The Cornell University Nutrient Management Planning System

THE NET CARBOHYDRATE AND PROTEIN SYSTEM FOR EVALUATING HERD NUTRITION AND NUTRIENT EXCRETION

CNCPS version 5.0
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MODEL DOCUMENTATION

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MODEL PURPOSE

Cattle are utilized to convert feed nutrients to human food under widely varying conditions around the world, and are a major source of human food nutrients (Beermann and Fox, 1998). The goals of improving cattle nutrition are to improve productivity, reduce resource use, and protect the environment. However, we extrapolate nutrient requirements and feed values developed under standardized, controlled research conditions to all combinations of cattle type, feeds, environmental and management conditions. Further improvements in cattle production efficiency will result from the use of models to predict nutritional requirements and feed utilization in a variety of production settings. Accurate predictions of nutrient requirements and supply, coupled with careful descriptions of the animal and the management environment, enable the nutritionist to identify the source of more of the variation in cattle performance than less comprehensive approaches to ration formulation. By knowing better what causes fluctuations in production, the need for expensive, and often environmentally detrimental, nutritional safety factors can be minimized. Our data (Wang et al., 1999; Hutson et al., 1998) indicate excess nutrient on dairy farms can impact water quality. The Cornell Net Carbohydrate and Protein System model (CNCPS) was developed to predict requirements, feed utilization and nutrient excretion for dairy and beef cattle in unique production settings. This model integrates our knowledge of cattle requirements as influenced by breed type and body size, production level and environment with our knowledge about feed composition, digestion and metabolism in supplying nutrients to meet requirements. There have been two versions that implemented the CNCPS model for diet evaluation on a single group basis only, and three versions designed to evaluate whole herd nutrient management and excretion (versions 3 to 5). Each new version contains changes that improve the accuracy of the CNCPS model and user friendliness of the computer software.

The profitability, competitiveness and sustainability of the New York dairy industry depends on minimizing feed costs per kg of milk produced while reducing nitrogen and phosphorus excretion to minimize environmental impacts. Feed costs account for more than 50% of the cost of producing milk, and are greatly influenced by nutritional management on each dairy farm. The CuNMPS is a set of integrated software tools developed for whole farm nutrient management planning. CNCPS 5.0 is the herd nutrition component of the Cornell Nutrient Management Planning System (CuNMPS). The other component of the CuNMPS is Cornell Cropware for the development of crops, soil, and manure nutrient management plans that meet NRCS standards. Cropware was developed and is supported by Dr. Quirine Ketterings and her group in the Department of Crop and Soil Sciences. All CuNMPS software is available through our Cornell College of Agriculture and Life Science (CALS) in the Nutrient Management Planning web site (www.nmp.cornell.edu).

This document describes a revision of the CNCPS version 4.0 which will predict nutrient requirements, annual feed requirements, and nutrient excretion on a whole herd basis**. Included is a complete list of all equations used in this version (Section 2), tutorials on how to use the computer program (Section 3) for four classes of cattle (dairy farm, beef feedlot, beef cow-calf, and dual purpose cow) that assist the user in learning how to use CNCPS 5.0, and the complete feed libraries (Section 4).** In addition to evaluating rations for each group in the herd, CNCPS v 5.0 is designed to predict whole herd annual feed requirements, nutrient excretion in total and from homegrown feeds. This information can be used to plan annual home grown crops and purchased feed requirements, and the impact of various combinations of home grown and purchased feeds, herd size, and milk production level on annual returns over feed costs and nutrient balances. The CuNMPS Cornell Cropware computer program can be used to develop a crops, soil, and manure nutrient management plan.

MODEL DEVELOPMENT

The definition of a model by Gill et al. (1989) describes the CNCPS: an integrated set of equations and transfer coefficients that describe the various physiological functions in cattle. Included are predictions of tissue requirements (maintenance, growth, pregnancy, lactation and tissue reserves), and supply of nutrients to meet requirements (dry matter intake, feed carbohydrate and protein fraction pool sizes, their characteristic digestion and passage rates, microbial growth, intestinal digestion and metabolism of absorbed nutrients). The purpose of a model is to describe mathematically the response of each compartment or several connected compartments to a variable or combination of variables. A model is considered to be mechanistic when it simulates behavior of a function through processes operating at a lower level (Gill et al. 1989). Most biological responses are integrated, nonlinear and change over time (dynamic) (Sauvant, 1991). A model that is totally mechanistic will accurately simulate whole animal metabolism under all conditions with little risk of use but such a model is beyond the capability of existing science (Gill et al. 1989). Further, ration formulation models are limited by the quality and availability of information about all of the model compartments, and by the amount of data and work needed to test and validate the functions of such a model. The knowledge of metabolism of nutrients is not as advanced as the prediction of ruminal fermentation, because of the almost infinite metabolic routes connecting various tissue and metabolic compartments, the multiple nutrient interactions, and the sophisticated metabolic regulations that determine the partitioning of absorbed nutrients (homeorhesis and homeostasis) (Sauvant, 1991). Therefore, the CNCPS uses a combination of mechanistic and empirical approaches, assumes steady state conditions, and uses statistical representations of data that describe the aggregated response of whole compartments (Fox and Barry, 1994, 1995).

A key challenge in modeling cattle nutrition is in determining the most appropriate level of aggregation (closeness to the cellular level). The most critical step is to describe the objective of the model, and then to determine the appropriate mix of empirical and mechanistic representations of physiological functions. These decisions are made based on the availability of development and validation data, whether the needed inputs are typically available, and a risk-benefit analysis of the increased sensitivity. Two of our most important self-imposed constraints in the development of the CNCPS are that the inputs needed by the model should be routinely available on most farms and that the output from the model should help producers improve their feeding programs. Another objective has been to develop a structure that can be readily updated and refined as new knowledge becomes available.

The CNCPS model contains a biologically based structure to evaluate diets for all classes of cattle (i.e. beef, dairy, and dual purpose) based on consideration of the existing animals, feeds, management and environmental conditions. The approach taken and level of aggregation of variables are based on our experience in working with farmers and consultants to diagnose performance problems, and to develop more accurate feeding programs. Since 1980, separate submodels that can be classified by physiological function have been developed and refined: (1) feed intake and composition, (2) rumen fermentation, (3) intestinal digestion, (4) metabolism, (5) maintenance, (6) growth, (7) pregnancy, (8) lactation, (9) reserves, and (10) nutrient excretion. New information has been periodically incorporated into these submodels. The user must have some nutritional knowledge to use the CNCPS because of the risks associated with not knowing how to choose inputs and interpret results. However, with training and experience, the CNCPS can be used to evaluate the interactions between animal type, production level, environment, feed composition and management. Changes in the ration needed to meet animal and rumen fermentation requirements under widely varying conditions can also be identified.

SUMMARY OF CNCPS PREDICTIONS

We have found that the ability of the CNCPS to predict requirements and supply needed in the diet to meet them depend on the accuracy with which these components are predicted:

1. Maintenance requirement for energy and amino acids

The maintenance energy requirement is determined by metabolic body size and rate with adjustments reflecting breed type, physiological state, previous nutritional treatment, activity, environment (temperature, wind velocity, and animal surface area and insulation) and heat gain or loss required to maintain normal body temperature. The proportion of the energy and protein intake needed for productive functions cannot be accurately determined until the proportion needed for maintenance is determined. The combined animal and diet heat production must thus be determined to assess energy balance in a particular environment, requiring the prediction of both Metabolizable and Net energy. The amino acid requirements for maintenance depend on the prediction of sloughed protein and net tissue turnover losses, as predicted from metabolic fecal nitrogen, urinary nitrogen loss, and scurf protein.

2. Energy and amino acid requirements for tissue deposition and milk synthesis

Growth requirements are based on empty body tissue composition of the gain expected, based on expected mature size for breeding herd replacements or expected weight at a particular final composition, considering body size, effect of dietary ingredients, and anabolic implants. Prediction of amino acid requirements will not be accurate without accurate predictions of empty body gain or milk composition. Pregnancy requirements are predicted from uterine and conceptus demand with varying expected birth weights and day of gestation. These become critical in accuracy of ration formulation during the last 60 days of pregnancy. Lactation requirements are computed for varying day of lactation, levels and composition of milk. Reserves are used to meet requirements when nutrient intake is inadequate. Reserves must be taken into account when evaluating ability to meet requirements, especially under environmental stress, feed shortage or early lactation conditions. Visual appraisal is used to assign a body condition score, which in turn is used to predict body fat and energy reserves. The cycle of reserve depletion and replenishment during lactation and the dry period is reflected by predicted condition score change.

3. Prediction of intake and ruminal degradation of feed carbohydrate and protein fractions, and microbial growth

The absorbed energy and amino acids available to meet requirements depend on accurate determination of dry matter intake (DMI), ingredient content of carbohydrate and protein fractions, microbial growth on the fiber and non fiber carbohydrates consumed, and the unique rates of digestion and passage of the individual feed carbohydrate and protein fractions that are being fed. First limiting in the CNCPS is accurate determination of DMI, and we typically insist on having actual DMI values to enter. Then we use predicted DMI as a benchmark for diagnostic purposes. The interactions of DMI, digestion and passage have several implications. First, the growth rate of each microbial pool that digests respective available carbohydrate fractions, and absorbable microbial amino acids produced, will depend on the special characteristics and intake of the feeds being fed, which in turn determines the demand for the nitrogen source required by each pool. Second, the percentage of cell wall that escapes digestion will change, depending on digestion and passage rates. Third, the site of digestion and, depending on the rate of whole tract passage, the extent of digestion will be altered. Variable rates of digestion and passage have similar implications for protein fractions in feeds. Those readily available will be degraded in the rumen, while those more slowly degraded will be partially degraded in the rumen and partially degraded postruminally, the proportion depending on rates of digestion and passage of the protein fractions in the feeds.

4. Prediction of intestinal digestion and excretion

Coefficients empirically derived are used to predict intestinal digestibilities and fecal losses based on summaries of data in the literature. A more mechanistic approach is needed to incorporate the integration of digestion and passage to predict intestinal digestion. However, the accuracy of prediction of pool sizes digested depends on the accuracy of prediction of ruminal flows, and therefore has second priority to the prediction of ruminal fermentation, particularly since, with most feeds, over 75% of total tract digestion occurs in the rumen. Until routine predictions of feed content of carbohydrate and protein fractions are available with accurate predicted digestion and passage rates, the use of a more complex intestinal submodel could result in a multiplication of errors. Overall, mineral excretion predicions needed for manure nutrient management planning (N and P) were nearly identical to that measured in manure applied to fields in a 500 cow dairy, when volatilization losses of N and bedding contributions are considered.

5. Prediction of metabolism of absorbed energy and amino acids

A metabolic submodel needs to be able to predict heat increment and efficiency of use of absorbed carbohydrate, volatile fatty acids, lipid and amino acids for various physiological functions with changes in productive states. However, we are currently limited to the use of transfer coefficients derived from equations for an application level model because of the limitations in predicting end products of ruminal fermentation, absorbed carbohydrate and amino acids, and the infinite metabolic routes connecting the numerous tissue and metabolic compartments, the multiple nutrient interactions, and the sophisticated metabolic regulations which drive the partioning of absorbed nutrients in various productive states. Pitt et al. (1996) have described the prediction of ruminal fermentation end products within the CNCPS structure as a first step. The equations used to predict Metabolizable Energy from Digestible Energy reflect the variation in methane produced across a wide range in diets. The equations used for lactating dairy cows to predict Net Energy for Lactation from Metabolizable Energy reflects the energetic efficiency associated with the typical mix of metabolites in the Metabolizable Energy, based on respiration chamber data (Moe, 1981), and validated on independent data (Roseler, 1994). The equations used for growing cattle to predict Net Energy for maintenance and Net Energy for gain reflect the wide variation in metabolites used in growing cattle and dry cows, and validated with little bias across a wide range of Metabolizable Energy contents (NRC, 2000).

APPLICATIONS OF THE CNCPS

There have been four previous releases of the CNCPS: Version 1.0 in 1991, Version 2.0 in 1993, Version 3.0 in 1994, and version 4.0 in 2000. CPM Dairy (a joint software development by scientists at Cornell University, University of Pennsylvania, and Miner Institute) was released in October 1998 as an implementation of a modified version of CNCPS 3.0. CPM versions 2.0 and 3.0 will be released in 2003, and will have implementations of CNCPS 5.0. In addition, CPM version 3.0 will contain a new fat model and additional feed fractions (organic acids and pectins).

CPM Dairy is intended for use by those wishing to use the CNCPS in a ration formulation program specific for dairy cattle. CNCPS 5.0 is intended for use by those who wish to evaluate and formulate rations for all classes of cattle and for nutrient management on a whole herd basis in developing whole farm nutrient management plans.

Information about the CNCPS model has been disseminated by: 1) publications in peer reviewed journals over the past ten years by Russell et al. (1992), Sniffen et al. (1992), Fox et al. (1992), O'Connor et al. (1993), Ainslie et al. (1993), Tylutki et al. (1994), Fox et al. (1995), Pitt et al. (1996), Tylutki and Fox (1997), Klausner et al. (1998), Fox and Tylutki (1998a), Fox et al. (1999), and Tedeschi et al. (2000a, b, c, 2001, 2002a, 2002b); 2) invited papers at most nutrition conferences in North America and at several international modeling conferences, 3) adoption as the structure for the first National Research Council model in revising the Nutrient Requirement recommendations for Beef Cattle (NRC, 2000), 4) use of the CNCPS growth and body reserves models and the structure for the CNCPS 4.0 computer program by the National Research Council model in revising the Nutrient Requirement recommendations for Dairy Cattle (NRC, 2001) and 5) incorporation of the growth equations in developing the Cornell Value Discovery System (CVDS) dynamic growth model for use in individual cattle management systems (Guiroy et al., 2001; Fox et al., 2001a,b, 2002; Tedeschi et al. 2003a).

In our experience, applications of the CNCPS (Fox, 1995; Fox et al., 1995) are:

- as a teaching tool to improve skills in evaluating the interactions of feed composition, feeding management and animal requirements in varying farm conditions;
- to design and interpret experiments;
- to apply experimental results;
- to develop tables of feed net energy and metabolizable protein values and adjustment factors that can extend and refine the use of conventional diet formulation programs;
- as a structure to estimate feed utilization for which no values have been determined and on which to design experiments to quantify those values;
- to predict requirements and balances for nutrients for which more detailed systems of accounting are needed, such as peptides, total rumen nitrogen, and amino acid balances;
- as a tool for extending research results to varying farm conditions;

- as a diagnostic tool to evaluate feeding programs and to account for more of the variation in performance in a specific production setting, and
- to provide information that can be used to improve whole farm nutrient management planning. Included are reduction of imported nutrients and reduction of manure nutrients, and crop production that matches herd and soil productivity (Tylutki and Fox, 1998).

Many graduate students have used the CNCPS to design experiments and to evaluate their results for their thesis research, and continue to use it in their work as nutritionists, primarily in North and Latin America. Many undergraduates at Cornell University and many feed consultants in New York have been trained to use the CNCPS, and they now use the model to improve feeding programs on NY dairy farms. To illustrate the model's potential, in one New York case study, changes made using the CNCPS were estimated to save $42,000 in feed costs the first year. Over three years the average milk production for this herd increased from 11,000 kg to over 12,000 kg per cow per year, while nitrogen excretion was reduced approximately 33% (Klausner et al., 1998). In initial tests, the ECM system based on the CNCPS doubled the profits of feedlot cattle (Fox and Perry, 1996).

In a 500 cow dairy case study described by Tylutki and Fox (1997), this new version was evaluated for its ability to predict the amount of N, P and K by comparing predicted amounts to that accounted for by manure amount and composition applied to the fields. The predicted amount of manure excreted was 16% lower than the measured value; the difference can be accounted for by the bedding in the manure hauled to the fields. The N predicted was 10% higher than measured values; in another case study with a similar manure handling system, 10% was lost in the barn by volatilization, accounting for this difference (Hutson et al., 1998). The predicted P excretion was 2% higher than measured values, which is within measurement error for feed and manure analysis and load weights. The predicted K excreted was 16% higher; the reason for this discrepancy is not obvious unless the variation in K in the ration was greater than measured by the feed analysis used in the case study. Given this accuracy in prediction of excretion, we believe the CNCPS 5.0 can be used to compute nutrient balances on dairy farms and to evaluate alternatives that will reduce N, P and K balances.

MODIFICATIONS OF CNCPS V. 3.0 IN DEVELOPING CNCPS V. 4.0

1. **Modifications based on the NRC (2000), including:**
   a. Adjustment to NEm requirements for body condition score (BCS) in growing cattle to replace the CNCPS system that adjusted both NEm requirement and diet NEg values.
   b. Changing the standard reference weight from 467 to 478 for all replacement heifers.
   c. Addition of standard reference weights for finishing cattle at 22, 25, and 28% body fat endpoints.
   d. Replacement of the Gompertz and Brody equations with the NRC (2000) model for predicting target weights and ADG for both beef and dairy replacement heifers.
   e. For all breeding females, replacement of the separate growth requirement equations for before and after calving with the NRC (2000) system for predicting energy and protein requirements from weaning until maturity. The validation of this model for use with all

heifers was presented by Tylutki et al. (1994). The application of this model and its validation for use with dairy replacement heifers was published by Fox et al. (1999).

f. A modified NRC (2000) energy and protein reserves model was developed, and is used for all cattle. This model and its validation are described by Fox et al. (1999).
g. Beef NRC equations to predict lactation requirements of beef cows.
h. Addition of the Beef NRC equations to predict pregnancy requirements, conceptus ADG and fetal weights for beef cattle. For dairy cattle, they are based on Bell et al. (1995).
i. Revision and expansion of the breed factors table from 17 to 34 breeds, including all dairy breeds used in North America, and dual purpose and beef breeds most commonly used in Latin America. Included are basal NEm requirement for lactating and non-lactating, peak milk and average birth weight for each breed.
j. Addition of the new NRC (2000) equations to predict DMI of growing cattle and beef cows.
k. Replacement of the adjustments for additives with the two used in the NRC (2000). All ionophores increase feed NEm 12% and non-use of an anabolic implant reduces DMI 6%.
l. Replacement of the feed library with a corrected and evaluated Beef NRC library that includes references for analytical values used for each feed (Section 3), and corrections of values based on a review of data sources used.

2. **Revised maintenance model based on Fox and Tylutki (1998a).**
   a. Separation of NEm requirements for activity from basal metabolism.
   b. Replacement of breed NEm adjustment factor with basal NEm requirement for each of 34 breeds.
   c. Ability to account for activity requirements under widely varying conditions.
   d. Ability to more accurately account for heat stress effects on NEm requirement and DMI intake.
   e. Adjustment to DMI for mud depth is made continuous with an equation.
   f. Set night cooling factor if minimum night temperature lower is than 20 ^{o}C.

3. **Addition of adjustments for tropical conditions, as described by Lanna et al. (1996), Fox et al. (1997), and Juarez Lagunes et al. (1999).**
   a. Standard reference weight of 400 kg for cattle finishing at 22% fat.
   b. NEm requirements and expected birth weights and peak milk for more tropical breeds, including dual-purpose breeds.
   c. Dry matter intake (DMI) equation of Traxler (1997) for dual-purpose cows.
   d. Addition of a tropical feed library (Tedeschi, 2002b).

4. **The addition of Schwab (1996) and Rulquin and Verite (1993) ratios to evaluate amino acid balances at the duodenum and absorbed, respectively.**

5. **Updated efficiencies of amino acids for pregnancy and lactation, based on a review by one of the authors (T. R.Overton).**

6. **Added a requirement for mammogenesis for close-up dry dairy cows, based on Bell et al. (2000) and VandeHaar and Donkin (1999).**

7. **The computation of mineral requirements for all cattle on a factorial basis as published by INRA (1989), to facilitate the prediction of minerals in animal products and manure.**

8. **Reduction of microbial growth and cell wall digestion for a ruminal N deficiency (Tedeschi et al, 2000a, b).**

9. **The addition of equations to predict herd annual nutrient excretion and urine and manure production as described by Tylutki and Fox (1997). The interface allows the user to save evaluations of all groups in the herd, and then computes annual herd feed requirements and costs, and nutrient excretion.**

10. **Output is part of the Cornell University Nutrient Management Planning System and can be used by crop and manure nutrient management planning programs as described by Bannon and Klausner (1997) and Kilcer (1997).**

11. **The capability to use linear optimization in ration formulation and home grown feed allocation based on best use of the feed nutrients, based on Tedeschi et al. (2000c) and Wang et al. (2000a).**

12. **Feed biological values predicted from feed analysis with two levels of solution (Weiss equations for energy, and level 2 developed UIP for level 1, and CNCPS rumen submodel for level 2).**

The mechanistic submodels as published by Russell et al. (1992); Sniffen et al. (1992), O'Connor et al. (1993) and Pitt et al. (1996) to predict microbial growth from feed carbohydrate and protein fractions and their digestion and passage rates were retained as in the CNCPS version 3.0 released in September 1994 and as released with the NRC (2000) level 2. The model provides variable ME, MP, and amino acid supplies from feeds, based on variations in DMI, feed composition and feed fiber characteristics. CPM Dairy contains the same sub-model to predict the supply of energy and protein for balancing with the CNCPS, but uses a modified and expanded feed library.

This version of the CNCPS allows data all groups of cattle in the herd to be saved. Two assumptions are made in the initial phases of developing a nutrient management plan: 1) the herd is in a steady-state condition (neither expanding nor reducing herd numbers), and 2) the rations being fed are representative of the whole year. Additional inputs are required by CNCPS version 5.0. These include: group name, number of animals in the group, level of refusals targeted, and number of days to feed (365 is the default to represent steady-state). In addition to the importance of nutrient management planning, the feed budgets calculated by the modified CNCPS can be used for other purposes including planning for expansion and commodity purchases for risk management programs.

MODIFICATIONS OF CNCPS V. 4.0 IN DEVELOPING CNCPS V. 5.0

CNCPS version 5.0 has had many new features, corrections, new biology, and user interface enhancements over CNCPS version 4.00.31. Many of the enhancements were in response to user requests to allow the CNCPS to be used for daily formulation.

The following is a list of changes made in developing version 5.0 from version 4.0:

1. We replaced the mineral requirements for dairy cattle with those of the NRC (2001); beef cattle mineral requirements continue to be those published by the NRC (2000).

2. A new phosphorus excretion model has been included based on Tylutki (2002) that predicts P excretion with a bias of -0.7% on individual animals. Details are provided in the ***model equations -excretion (Section 2).***

3. The CPM version 2.0 feed library has been included as a user option. This library is printed out in the ***feed libraries section (Section 4)***.

4. We have replaced effective NDF values in the feed library with numbers based on the physically effective NDF system published by Mertens (1997). An explanation of this system is given in ***CNCPS feed composition in this section***, and papers published by Mertens (1997, 2002) that fully explains the peNDF system are included on the CD.

5. Many changes were made in the software to correct errors and make it easier to use. These are summarized in the software help system and in an addendum on the CD. Included are:

    - Ability to import feed composition files from Dairy One (instructions are provided in the help system).

    - Ability to export inputs as files for using as inputs to the 2001 Dairy NRC software.

    - Ability to export ration information to the Cornell Value Discovery System.

    - Improved user friendly and correct component to make mixes.

    - Increased usability for international users (metric inputs and outputs, etc).

    - More user friendly reports, including:

        - One page summary report

        - Ability to create a custom batch feeding sheet based for any group, based on number of animals in the group, step size for the batch, dry matter range, etc.

OPTIMIZATION PROCEDURE FOR CNCPS 4.0 AND 5.0

A Linear optimization procedure was developed to formulate least cost diets with the CNCPS 5.0 by using biological values for feeds computed for a specific group of animals with their requirements and DMI defined. This is accomplished in the following steps as described by Tedeschi et al. (2000c):

Step 1. Enter all animal, environmental and feed inputs that describe the specific group being evaluated. Include all feeds to be considered in re-formulation.

Step 2. Compute the biological values (BV), such as ME, MP, microbial yields (Y_{1j}, Y_{2j}, Y_{3j}, g/g), passage rate (Kp), and CHO-B2 degradation rate, for each feed in the diet for this group with the CNCPS model by adding 0.01 lb. of each ingredient to the diet. Use the BV and feed composition and degradation rates to account for FC and NFC microbial growth and their requirement for NH_3 and peptide. We do not account for recycled nitrogen here because it is a nonlinear function.

Step 3. Gather animal requirements such as ME, MP, DMI, eNDF, Ca, and P from CNCPS model computations for the specific group described in the inputs.

Step 4. Use the feed values to meet the requirements at the least cost with the linear optimization, within the constraints set for nutrients and feeds.

Step 5. Return the optimized diet to the CNCPS and based on the CNCPS evaluation of the optimized diet decide to keep or re-evaluate the BV of each feed and re-optimize. This second optimization usually results in a more accurate ration balance due to using feed parameters in the second optimization computed from the optimized diet.

CNCPS FEED COMPOSITION VALUES

The CNCPS emphasizes mechanistic prediction of the supply of nutrients in each production situation, because animal requirements and diet are interactive. Variables computed for each situation include feed digestibility, heat increment to compute lower critical temperature, calculation of efficiency of ME use for maintenance, growth and lactation, and adjusting microbial protein production for diet effective NDF content. Therefore, accuracy of prediction of nutrient requirements and performance under specific conditions depends on accuracy of description of feedstuff composition and DMI.

The feed library developed for use with CNCPS 5.0 (Section 4) contains feed composition values that are needed to predict the supply of nutrients available to meet animal requirements. In this library, feeds are described by their chemical, physical and biological characteristics. Included are carbohydrate and protein fractions and their digestion and passage rates to predict net energy and metabolizable protein values for each feed based on the interaction of these variables. For ease of use, the feed composition table is organized to make it easy to find and compare feeds of the same type and to find all values for a feed in the same column. It is arranged with feed names listed alphabetically within feed classes of grass forages, legume forages, grain type forages, energy concentrates, protein concentrates, by-product feeds, and tropical feeds. All of the chemical, physical and biological values for each feed are in the row to the right of the feed name. The international feed number (IFN) is given for each feed where appropriate for comparison with previous feed composition tables.

The NRC (2000) model feed library was used as the base for CNCPS 4.0, which began with the CNCPS 3.0 library and modifications were made as described below. References for all feed analysis are provided in Section 4. It was evaluated and corrected for feed chemical analyses accuracy, and internal consistency between the tabular energy and protein degradability values used for the NRC (2000) level 1 and those predicted by level 2 from feed carbohydrate and protein fractions and their digestion rates (Tedeschi, 2001). The intent of these changes were to correct numerical errors and modify values based on new information since the NRC (1996) was released, and to delete odd feeds with little use or those that were inconsistent with others with a similar description. The following summarizes the changes made:

1. The following feeds were deleted; brome late bloom, fescue meadow and alta hay, fescue k31 mature, napiergrass fresh 60d, red top fresh, meadow spring, fall, and hay, 5 corn silages that were inconsistent or of limited use, 43% CP cottonseed meal, tapioca, wheat ground, coconut meal, corn gluten meal, beet pulp + Steffen's filter, and grape pomace.
2. Tropical feeds were moved to the new tropical feed library (Section 4).
3. The forage and concentrate contents of the grain type silages (corn, barley etc.) were adjusted to contain entirely forage (forage % = 100). This was to clarify the fact that any feed containing a forage % greater than zero is treated as a forage by Level 2.
4. The starch content (% NSC), noted as B1 CHO was increased for many of the forages to include the content of soluble fiber and decreased the calculated sugar content. Data for the ethanol insoluble carbohydrate content from the Pell laboratory and Doane et al. (1998b) were used as a general guide for the changes made. More specific data is needed to improve estimates of species differences.
5. For corn silages, the carbohydrate A fraction is 20% of the NFC with a 10%/h digestion rate to account for organic acids. For grass and legume silages, the carbohydrate A fraction is 10% of the NFC with 10%/h of digestion rate.
6. The lignin values for the cottonseed meals were included in the table incorrectly (double corrected to a % NDF basis).
7. Several feeds contained more mineral (the sum of Ca, Mg, etc.) than total ash. The ash content of these forages has been raised to account for the mineral content.

CHEMICAL COMPOSITION OF FEEDS IN THE FEED COMPOSITION LIBRARY

Chemical composition of feeds is described by feed carbohydrate and protein fractions that are used to predict microbial protein production, ruminal degradation and escape of carbohydrates and proteins and ME and MP. Feed library values for carbohydrate and protein fractions are based on Sniffen et al. (1992), Van Soest (1994) and NRC (2000). A tropical feed library was developed and published by Tedeschi et al. (2002b). The objectives of the tropical feed library development were 1) to provide nutritionists and producers from the tropical regions with accurate and updated feed composition, especially that needed for using the CNCPS in tropical regions, 2) to identify research priorities for tropical feed composition and feed analysis, and 3) to standardize tropical feed descriptions.

Feedstuffs are composed of chemically measurable carbohydrate, protein, fat, ash and water. The Weende system for proximate analysis has been used for more than 150 years to measure these components as crude fiber, ether extract, dry matter, and total nitrogen, with nitrogen free extract (NFE) being calculated by difference. However, this system cannot be used to mechanistically predict microbial growth because crude fiber does not represent all of the dietary fiber, NFE does not accurately represent the nonfiber carbohydrates, and protein must be described by fractions related to its ruminal degradation characteristics.

The rumen sub-model model was developed to mechanistically predict microbial growth and ruminal degradation and escape of carbohydrate and protein to more dynamically predict ME and MP feed values. To accomplish this objective, the detergent fiber system of feed analysis is used to compute carbohydrate (fiber carbohydrates, CHOFC and nonfiber carbohydrates, CHONFC) and protein fractions according to their fermentation characteristics (A = NPN, B_1 = fast, B_2 = intermediate, B_3 = slow and C = not fermented and unavailable to the animal), as described by Sniffen et al. (1992). Validations of the model for predicting feed biological values from feed analysis of carbohydrate and protein fractions have been published (Ainslie et al., 1993; O'Connor et al., 1993; Fox et al., 1995; and NRC, 2000). We recognize that considerable research is needed to refine this structure but it provides a system that will allow for implementing accumulated knowledge that can lead to accounting for more of the variation in performance. Research underway at Cornell University and elsewhere will result in refinement of sensitive coefficients to improve the accuracy of its use under specific conditions.

RECOMMENDED LABORATORY PROCEDURES

The procedures used to determine each fraction are described as follows (Sniffen et al., 1992); the methods of crude protein fractionation have been recently standardized (Licitra et al., 1996).

1. Residual from neutral detergent fiber (NDF) procedure is total insoluble matrix fiber (cellulose, hemicellulose and lignin) (Van Soest et al., 1991). A procedure for NDF analysis developed by Dr. David Mertens was recently approved by AOAC (method 2002.04), and we suggest using that procedure.

2. Lignin procedure is an indicator of indigestible fiber (Van Soest et al., 1991). The unavailable fiber is estimated as lignin × 2.4. The factor 2.4 is not constant across feeds. It may overestimate the CHO C fraction feeds that are of low lignification. However, it appears to be of sufficient accuracy for the current state of the model. The recommended lignin assay is 72% sulfuric acid hydrolysis of acid detergent residues (Van Soest et al., 1991). Permanganate lignin can be used but must be adjusted to sulfuric acid lignin content by multiplying by 0.82.

3. Available fiber (CHO fraction B2) is NDF - (NDFN × 6.25) - CHO fraction C, and is used to predict ruminal fiber digestion and microbial protein production on fiber. Intestinal digestibility of the B2 fraction that escapes the rumen is assumed to be 20%. Pectin and other soluble carbohydrates can be determined indirectly by assaying for total dietary fiber (TDF) and neutral detergent fiber, correcting both for ash and nitrogen and taking the difference. By

definition the difference is the soluble fiber content. The TDF assay we are using is a modification of Jeraci et al. (1989).

4. Total nitrogen is measured by Kjeldahl method (AOAC, 1980).

5. Soluble nitrogen (NPN + soluble true protein) is measured to identify total N rapidly degraded in the rumen (Krishnamoorthy et al., 1983).

6. True protein is precipitated from the soluble fraction to separate the NPN (protein fraction A) from true rapidly degraded protein (protein fraction B1). Protein fraction B1 typically contains albumin and globulin proteins and provides peptides for meeting NFC microbial requirements for maximum efficiency of growth. A small amount of this fraction escapes ruminal degradation and 100% is assumed to be digested intestinally. Protein fraction A provides ammonia for both FC and NFC growth.

7. The detergent analysis system (Van Soest et al., 1991) was designed to analyze for carbohydrate and protein fractions in forages. It has limitations in the analysis of other feedstuffs, particularly in the case of animal byproducts and treated plant protein sources. Nitrogen that is insoluble in neutral detergent (without sodium sulfite) and acid detergent (Van Soest et al., 1991) measures slowly degraded plus unavailable protein. Animal proteins do not contain fiber. However, because of filtering problems, analysis with this procedure will yield unrealistic values for ADF and NDF pools. To correct for this problem, all animal proteins have been assigned ADFIP values that reflect average unavailable protein due to heat damage and keratins. The residual protein fraction (B2) has been assigned rates reflecting their relatively slower rates.

8. Acid detergent insoluble protein (ADFIP) (Van Soest et al., 1991) is used to identify unavailable protein (protein fraction C), and is assumed to have zero ruminal and intestinal digestibility, realizing some studies have shown digestive disappearance of ADFIP. The levels of ADFIP can be adjusted where appropriate.

9. NDFIP minus ADFIP identifies slowly degraded available protein (protein fraction B3). This fraction typically contains prolamin and extensin type proteins and nearly all escapes degradation in the rumen, and is assumed to have an intestinal digestibility of 80 percent.

10. (Total nitrogen × 6.25) - A - B1 - B3 - C = protein intermediate in degradation rate (protein fraction B2), except for animal protein as described above. This fraction typically contains glutelin protein and extent of ruminal degradation and escape is variable, depending on individual feed characteristics and level of intake. The ruminally escaped B2 is assumed to have an intestinal digestibility of 100 percent.

11. Ash (AOAC, 1980).

12. Solvent-soluble fat (AOAC, 1980). All of this fraction is assumed to escape ruminal degradation and is assumed to have an intestinal digestibility of 95 percent. Only the glycerol and galactolipid are fermented and the fatty acids escape rumen digestion.

13. Non-fiber carbohydrates (sugar, starch, NFC) are computed as 100 – [CP + (NDF - NDF protein) + fat + ash]. Pectins are included in this fraction. Pectins are more rapidly degraded than starches but do not give rise to lactic acid.

14. CHO fraction A is nonfiber CHO minus starch. It is assumed that these nonstarch polysaccharides are more rapidly degradable than most starches. Nearly all of this fraction is degraded in the rumen, but the small amount that escapes is assumed to have an intestinal digestibility of 100 percent. For analysis of sugars, we are using either Phenol/Sulfuric reaction or the Anthrone Reaction. Both assays can be used on the 80% ethanol extract that results from rinsing the feed to remove sugars prior to assay for starch. These methods are described in Southgate (1976).

15. CHO fraction B1 is nonfiber CHO minus sugar. Starch is assayed for after washing the feed of interest with 80% ethanol to remove sugars. The starch method we are currently utilizing is the AOAC Method 996.11/AACC Method 76.13 with one modification: the first step is allowed to proceed for at least 30 minutes, not 6 as stated. This fraction has variable ruminal degradability, depending on level of intake, type of grain, degree of hydration and type of processing. Microbial protein production is most sensitive to ruminal starch degradation in the model level 2. The B1 fraction that escapes is assumed to have a variable digestibility, depending on type of grain and type of processing.

16. Feed physical characteristics are described as physically effective NDF (peNDF) as published by Mertens (1997, 2002). The diet peNDF is used to predict rumen pH, which is used to adjust microbial protein production and cell wall digestion. The analytical method suggested to measure peNDF uses a sieve with 1.18 mm openings. The quantity of a dried feed sample that remains on top of the sieve is multiplied by the feed NDF content to obtain the peNDF factor. The peNDF value for a feed with 50% NDF and 80% remaining on the top screen would be 40. An "estimate" of peNDF of an as-fed feed can be determined using a Penn State Forage Particle Separator. The proportion of the total feed weight remaining on the top 2 screens is an "index" of the % of the NDF that is physically effective.

The peNDF content of a feed is related to its physical characteristics that relate to chewing and rumination activity. This factor is a combination of both NDF content and a factor measuring physical effectiveness. Mertens (1997, 2002) used peNDF to predict daily chewing time. He reported an r^2 of > 0.76 between predicted and observed total daily chewing activity using this approach. The importance of chewing in stimulating salivary flow in buffering the rumen is well documented (Beauchemin, 1991).

There are a number of guidelines that can be used to assess the adequacy of the total ration peNDF. The two primary considerations are maintaining an adequate rumen pH or milk fat %. A minimum ration peNDF of about 22% is needed to maintain a rumen pH of 6.0; this should maintain milk fat in Holsteins at about 3.5% (Mertens, 1997, 2002). However, there are a number of other feed characteristics that can influence both rumen pH and milk fat%. These relate primarily to ration NFC content, sources and their rates of degradation. The peNDF value does not account for these. It is suggested that a reasonable minimum value for peNDF is dairy rations is 21-23%. We have increased this from our minimum of 20% with eNDF values, because many diets will have a 2 unit increase with the peNDF system. We recommend peNDF requirements of 7 to 10% in the ration DM for high energy rations (Fox and Tedeschi, 2002). This recommendation is based on the eNDF predicted by the equation of Pitt et al. (1996) required to keep rumen pH above 5.7, the threshold below which cattle typically reduce intake (Britton and Stock, 1989). Strasia and Gill (1990) concluded that finishing rations for cattle should contain at least 7% “high roughage” factor; the feedlot case study evaluation presented later in this paper supports this recommendation. If the goal is to maximize cell wall digestibility to optimize forage utilization, the requirement is a minimum of 20% peNDF in the diet DM.

Mertens (1997, 2002) differentiated between eNDF and peNDF, which he described as the physical characteristics of fiber (primarily particle size) that influence chewing and rumination activity; *thus the percentage of the NDF retained on a screen with 1.18 mm openings after dry sieving is the procedure for measuring peNDF*. Mertens (1997) found that 71% of the variation in rumen pH was accounted for by peNDF. Thus the CNCPS eNDF values used in past versions are more correctly defined as peNDF, since most are based on the % of NDF retained on a 1.18 mm screen as described by Mertens (1997). The peNDF values in the CNCPS version 5.0 feed libraries were assigned by Mertens, to correspond to the peNDF values he has published.

The data of Russell et al. (1992) and Pitt et al. (1996) showed that rumen pH below 6.2 results in linear reductions in microbial protein production and FC digestion rate. Using data in the literature, Pitt et al. (1996) evaluated several approaches to predict rumen pH: diet content of forage, NDF, a mechanistic model of rumen fermentation or the effective NDF values published by Sniffen et al. (1992). Effective NDF gave predictions of rumen pH similar to the mechanistic model, and has the advantage of simplicity and flexibility in application (Figure 1.1A).

In the CNCPS, microbial yield is reduced 2.5% for each percentage unit reduction in peNDF below 20 percent, and the equations of Pitt et al. (1996) are used to adjust FC digestion rate. Figure 1.1B shows the decline in digestion rate for four forages with different digestion rates (4, 6, 8 and 10%/hour when rumen pH is above 6.2). This figure shows that forages with high digestion rates under optimum rumen pH conditions (typically those low in lignin) are the most affected by this adjustment since this adjustment sets the NDF digestion rate to 2.2 to 2.4%/h at pH 5.7 independently of the optimum NDF digestion rate.

Mertens (1997) developed the following table to use as a guide in determining peNDF from his experimental data base. For example, a coarsely chopped grass hay with an NDF of 65% has a peNDF of 62% (65×0.95). These tabular values for eNDF can be used as a guide in estimating peNDF of a feed. Additional factors not accounted for in the peNDF system that can influence rumen pH are total grain intake and its digestion rate, and form of grain (whole, rolled, and flaked corn will stimulate rumination but corn meal may not; a higher proportion of the starch in whole corn will escape ruminal fermentation compared to processed corn and other grains). Also forages that are highly hydrated (fresh forage or low DM silage) may not stimulate chewing as much as the same forage in a dry form. Therefore adjustments to peNDF must be made in these cases to make the system reflect these conditions.

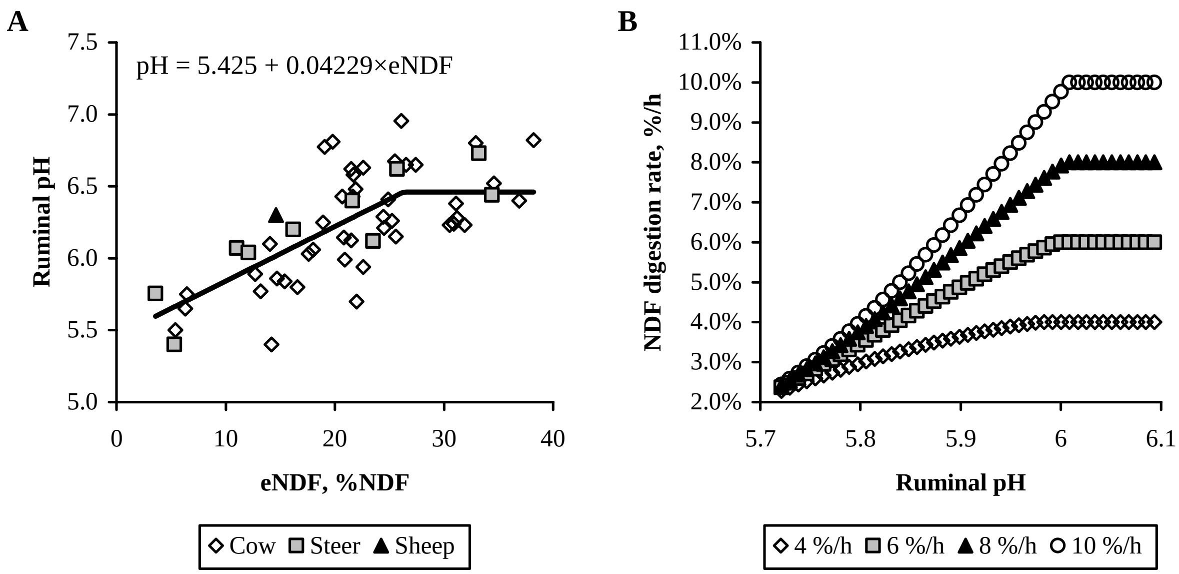


Figure 1.1. (A) Relationship of eNDF and ruminal pH. (B) effect of ruminal pH on NDF digestion rate for four forages with different FC degradation rates at optimal rumen pH (4, 6, 8 and 10%/h).

The effect of Ionophores on acidosis needs to be modeled; they inhibit the growth of *Streptococcus bovis*, which produces lactic acid, which is 10 times stronger than the normal volatile fatty acids produced in the rumen. Fermentation of highly digestible feeds that are high in pectin (soybean hulls, beet pulp, etc.) will not produce the drop in pH as grains do.

Table 1.1. Physical effectiveness factors (PEF) for feeds with different physical forms[1]

Physical form class	TLC[2] cm	PEF factor[3]	Grass hay	Grass silage	Corn silage	Alfalfa hay	Alfalfa silage	Conc.
Forage								
Long		1.00	Long					
Coarse chopped	4.8 to 8	0.95	Coarse	Coarse		Long		
Med. to coarse chopped	2.4 to 4	0.90	Med.	Med.	Coarse	Coarse		
Med chopped	1.2 to 2.0	0.85	Fine	Fine	Med.	Med.	Coarse	
Med. to fine chopped	0.6 to 1.0	0.80			Fine	Fine	Med.	
Fine chopped	0.3 to 0.5	0.70					Fine	
Ground	0.15 to 0.25	0.40						
Concentrates								
Rolled		0.80						HM corn
Rolled		0.70						Barley
Coarse		0.60						Cracked corn
Medium		0.40						Medium corn
Fine		0.30						Fine/Pellet

[1] Mertens (1997).
[2] Theoretical length of cut.
[3] Proportion of NDF effective in stimulating chewing and rumination.

PREDICTING FEED BIOLOGICAL VALUES FROM FEED ANALYSIS

The calculation of feed energy values in the most recently released systems are all based on TDN. That is, the other energy values, ME and NEl, are computed from TDN. The NRC (2000) model level 1, CPM Dairy level 1 (modified NRC; MNRC) and DALEX level 1 (www.dalex.com) uses the tabular TDN to predict ME, which is used to predict NEm, NEg, and NEl. The NRC (2000) model level 2, CPM Dairy level 2, CNCPS 5.0 level 2 and DALEX level 2 (www.dalex.com) use the feed carbohydrate and protein fractions (tabular if feed analysis data is not available) from their pool sizes and their predicted digestion and passage rates to predict TDN mechanistically, using the CNCPS model. This TDN value is sensitive to carbohydrate and protein fraction pool sizes and their digestion rates, and passage depends on level of intake and particle size as indicated by feed effective NDF value.

Feed consultants commonly use energy values on reports from feed testing laboratories for formulating diets. These values are predicted from feed carbohydrate and protein fractions, using regression equations similar to those described by Weiss et al. (1992) and Van Soest and Fox (1992). The Weiss et al. (1992) equation predicts a feed TDN, representing a maintenance level of intake (1x), from feed carbohydrate and protein fractions along with fat and ether extract. This or similar equations he has published have been used successfully by feed testing laboratories for several years (Paul Sirois, Dairy One Forage testing Laboratory; and Bill Weiss, personal communication). We developed a **CNCPS level one** solution using this approach so that the user can compare results computed from actual feed analysis by this approach with that predicted by the **CNCPS rumen model (level 2)**. We compared the values computed by both CNCPS levels 1 and 2 with the tabular values in our feed library (Section 4). We considered this feed composition table to be the best published database available for evaluating alternatives, for the following reasons.

1. The tabular TDN, ME, and net energy values used for the analysis (NRC, 2000) represent accumulated digestion trial data summarized in the NRC (1989), and have been successfully used over the past 10 years since its release. The tabular TDN represents a maintenance level of intake, which is adjusted for level of intake with the equations used to compute tabular NEl.

2. The carbohydrate and protein fractions are based on recent published data (Sniffen et al., 1992; and Van Soest, 1994) and the survey of nine feed laboratories conducted by the NRC (2000) committee which represents a cross section of composition of forages and concentrates now grown on farms.

The procedures used for this evaluation and the results of the evaluation of the Weiss et al. (1992) equation are described by Tedeschi (2001, Ch. 2). In that evaluation, a simple diet was formulated with the CNCPS to support a 650 kg dairy cow producing 31 kg of milk (3.5% fat and 3.4% protein) with intake set at 3 times maintenance (3x). The diet contained 42.9% DM of late bloom alfalfa hay, 38.1% DM of cracked corn grain, and 19% DM of whole extracted soybean. Intake of this same diet was reduced to meet the requirements of a dry dairy cow at 1x maintenance level of intake. Each feed contained in the library (excluding animal fat and minerals) were then substituted and then evaluated in these two base diets (100 g of each) to provide model estimates of the biological values at 3x, 2x, or 1x levels of intake.

Table 1.2 summarizes the results of the comparisons of tabular (Y) vs. level 2 (X), tabular (Y) vs. Weiss (X), and Weiss (Y) vs. level 2 (X) TDN values. Over all classes of feeds, both level 2 and Weiss agreed well with tabular values, with small biases. No bias of tabular vs. level 2 was observed and a relative high r^2 (83%) was obtained. However, in individual feed categories, much less of the variation in tabular values was accounted for by either level 2 or Weiss. Figure 1.2 shows the relationship between tabular vs. level 2 (A) and Weiss and level 2 (B) across all feed categories. Level 2 accounted for much more of the variation in Weiss than did the tabular values.

COMPUTING ME AND NE VALUES FROM TDN

Various approaches are used to compute ME and NE feed values from TDN. Those based on the NRC (1989, 2000) equations are as follows.

1. **Energy conversion.** The CNCPS level 2 (evaluation with the rumen submodel) adjusts the TDN for level of intake based on digestion and passage rate calculations, then uses the following NRC (1989, 2000) equations to predict Mcal/kg of ME and NE available to meet requirements.
   - DE, Mcal/kg = (%TDN/100) × 4.409
   - If dry or lactating dairy:
     ME = (DE × 1.01) - 0.45
   - If growing beef or dairy, or beef cows,
     ME = DE × 0.82
     NEm = 1.37 × ME – 0.138 × ME^2 + 0.0105 × ME^3 – 1.12, and
     NEg = 1.42 × ME – 0.174 × ME^2 + 0.0122 × ME^3 – 1.65
   - ME requirements for milk are computed as milk NEl/0.644

Table 1.2. Comparison of TDN predicted by model level 2 and Weiss et al. (1992) equation with tabular TDN values with DMI at maintenance[1]

	Tabular vs. Level 2			Tabular vs. Weiss			Weiss vs. Level 2		
	r^2 (%)	MSE	Bias	r^2 (%)	MSE	bias	r^2 (%)	MSE	bias
All classes	83	33.6	0.3	87	25.7	1.7	96	8.6	-1.3
Grass forages	48	23.7	-4.5	51	22.2	0.8	92	3	-5.3
Legume forages	77	11.8	5.9	76	12.3	4.1	98	0.9	1.7
Grain forages	82	24.6	-1.7	82	24.0	3.6	98	1.8	-4.6
Energy concentrates	66	17.0	1.2	62	19.1	0.7	96	1.6	0.5
Protein concentrates	56	44.5	2.9	63	36.4	1.6	93	8.5	1.7
Byproducts	80	41.2	-0.3	68	38.1	-0.2	98	5.9	-0.9

[1] MSE is Mean Square Error from regular regression. Bias (%) was calculated using the slope of regression, through the origin, minus one if the intercept of regular regression was not different from zero; otherwise bias was calculated dividing the mean of the Y–variate minus the mean of the X–variate by the mean of the X–variate. The first variable implies the Y–axis variable. A positive bias means that Y values are greater than X values.

2. **Net energy for lactation.** To adjust TDN (8% reduction) to a 3x level of intake for lactating dairy, the NRC (1989) uses a regression to compute NEl from a maintenance TDN intake with the following equation:
   - NEl = 0.0245 × maintenance TDN% - 0.12

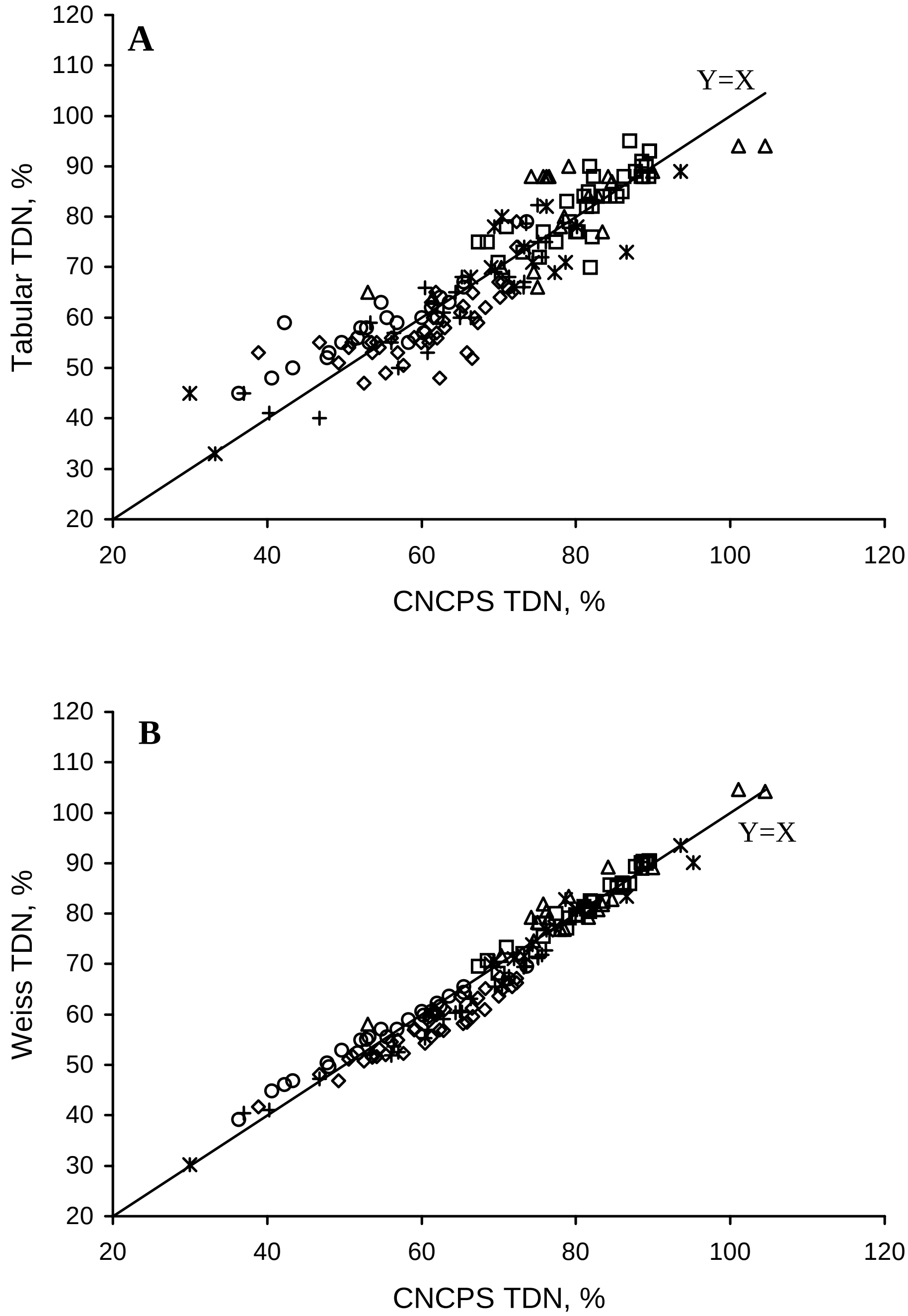


Figure 1.2. (A) Relationship between tabular TDN and TDN_{1x} predicted by the CNCPS 5.0 model for all classes of feeds evaluated. The equation is Y = 6.89 + 0.90X with an r^2 of 0.83, mean standard error (MSE) of 33.6, and bias of 0.25% ($P > 0.05$). Slope is different from one ($P < 0.05$). (B) Relationship between TDN_{1x} predicted by the Weiss et al. (1992) equation and by the CNCPS 5.0 model for all classes of feeds evaluated. The equation is Y = –0.64 + 1.0X with an r^2 of 0.96, MSE of 8.6, and bias of –1.3% ($P < 0.05$). Slope is not different from one ($P > 0.05$). Symbols are grass forages (◊), legume forages (o), grain–type forages (+), energy concentrates (□), protein concentrates (Δ), and by–product feeds (*). A positive bias means that Y values are greater than X values. (Tedeschi 2001, Ch. 2).

3. **Discounted TDN.** Since both tabular TDN and the Weiss predicted TDN represent a maintenance dry matter intake level, equations are needed to discount the Weiss equation or the tabular TDN to compute feed energy values for level 1 used in diet formulation for cattle consuming feed above maintenance. Van Soest and Fox (1992) summarized equations to discount TDN for different levels of intake. Based on their summary, the Mertens discount equation (Mertens, 1983) was selected for use in evaluating new equations to to discount TDN_{1x} for forages:

$$\text{TDN discount} = \text{DMIFactor} \times (0.033 + 0.132 \times \text{NDF} - 0.033 \times TDN_{1x})/100$$

Where:
DMIFactor is (actual DMI/maintenance DMI) – 1,
NDF is neutral detergent fiber (%DM), and
TDN_{1x} (%DM) is TDN at maintenance intake.

We developed new set of equations to discount TDN_{1x} using model level 2 predicted TDN_{1x} and TDN at 2x and 3x levels of dry matter intake for all concentrate and forage feeds in the library. Table 1.3 shows the regression coefficients to discount TDN_{1x} for growing and finishing steers as well as dairy cows. The discounted TDN is shown in the Section 3.

For example, using a concentrate with TDN_{1x} of 79.8% and 27.1% of NDF in the equation for a 550 kg growing animal (Table 1.3) results in a discount of 2.3% and 4.6% at two and three times the maintenance requirement, respectively, or an average discount for concentrates of 2.3% per multiple of maintenance. A forage with TDN_{1x} of 61% and NDF of 58% would have a TDN_{3x} of 55.8% (8.5% discount) for a 550 kg growing animal (Table 1.3).

Table 1.3. Equations to calculate a TDN discount factor (%) for concentrates and forages estimated using the Cornell Net Carbohydrate and Protein System[1]

	Concentrate			Forage		
	Growing		Cow	Growing		Cow
Variables[2]	250	550	650	250	550	650
Intercept	0.073	0.086	0.100	0.150	0.118*	0.209*
DMI_{Factor}	-4.051**	-4.653**	-4.853**	-17.371**	-15.809**	-20.370**
$TDN_{1x} \times DMI_{Factor}$	0.050**	0.055**	0.060**	0.210**	0.195**	0.249**
$NDF_{1x} \times DMI_{Factor}$	0.093**	0.101**	0.122**	0.341**	0.298**	0.398**
$TDN_{1x} \times DMI_{Factor} \times NDF$	-0.0002	-0.0001	-0.0005	-0.0031**	-0.0025**	-0.0036**
R^2	0.80	0.81	0.80	0.96	0.98	0.96
MSE	1.16	1.39	1.66	0.82	0.38	0.94

[1] The TDN discount factor (%) was calculated for 250 or 550 kg growing beef cattle or 650 kg cow using the Cornell Net Carbohydrate and Protein System. The symbols indicate whether the coefficient is different from zero at $P < 0.01$ (**) or $P < 0.05$ (*). MSE is the regression mean square error.
[2] The TDN_{1x} (% in DM) is the TDN at DMI to meet NEm requirements, NDF is neutral detergent fiber (% in DM), and DMIFactor is feed intake in units of maintenance – 1.

4. **Undegraded intake protein.** UIP was computed at different levels of dry matter intake by level 2 for each feed, and were compared with corresponding tabular UIP values.

Based on these results, the following equation (R^2 = 97.7% and MSE = 4.6) was developed to estimate UIP in concentrates and forages at any level of dry matter intake in level 1 given UIP_{1x}. It was generated using UIP values predicted for each feed in the model feed library by level 2 at a 1x, 2x, and 3x level of intake.

$$UIP_{DMIFactor} = (0.167 + a) + (1 + b) \times UIP_{1x} + (4.3 + c) \times DMIFactor + (-0.032 + d) \times UIP_{1x} \times DMIFactor$$

Where:
UIP_{1x} is UIP at maintenance dry matter intake,
DMIFactor is (actual DMI/DMI at maintenance) – 1 in which DMIFactor is greater than zero, and the value of coefficients a, b, c, and d for concentrates are -0.07, 0.01, 0.17, and 0.09 respectively; otherwise zero.

For example, a feed with UIP_{1x} of 50% would have UIP at 3x maintenance of 65.3% for a concentrate or 55.6% for a forage. The accuracy of this equation depends on the amount of soluble protein and the fraction of protein bound in the cell wall (NDF) of a feed given the high correlation between UIP and NDFIP of 85.1% and 94.4% for concentrates and forages, respectively. Thus, the use of level 2 to predict UIP will be more accurate than the use of this equation.

The application of the Weiss equation with these discount equations in feed testing laboratories was evaluated. The TDN was computed with the Weiss equation when used for animals fed at maintenance (typically dry cows), at 2x maintenance level of intake (typically growing cattle and lactating beef cows fed high forage diets), and 3x maintenance level of intake (usually feedlot finishing cattle). The database used included 28 forages and 47 concentrates analyzed at the Dairy One Forage Testing Laboratory provided by the manager Paul Sirois. The results summarized in Table 1.4, indicate feeds with the greatest discount are those with a high cell wall, and those with a low cell wall have a low discount, consistent with the level 2 predictions. This laboratory is using the Weiss equation along with discount equations to provide net energy values appropriate for the level of intake of the cattle being fed with the feed tested. Where possible, however the use of level 2 to predict feed energy values in specific production situations is preferred, to account for specific level of intake effects and to adjust for feed processing effects and the depression of cell wall digestibility as rumen pH drops below 6.2 (high grain diets).

EFFICIENCY OF USE OF ME

The relationships for converting ME to NEm and NEg were based on comparative slaughter studies involving 2766 animals fed complete, mixed diets at or near ad libitum intake for 100 to 200 days (NRC, 2000, pg. 4, which was based on Garrett, 1980). Digestion trials were conducted on most diets fed at about 1.1 times the maintenance amount to determine DE and ME, in which ME averaged 82% of DE. Table 1.5 shows the efficiency of use of ME to NEm and NEg computed with these equations. In these trials, 65% of the diets were within the range of 2.6 to 2.9 Mcal of ME/kg DM; 23 percent were below and 12% were above this range. Thus the database represents the range of ME concentrations in diets fed to dairy cattle. Data from respiration chamber studies with both dairy and beef cattle indicate the efficiency of use of ME for NEl is the same (NRC, 1989, 2000). The 64.4% efficiency used by the Dairy NRC to compute diet NEl from diet ME agrees with the efficiencies of 63.3 to 65.1 at 67 to 50% forage in Table 1.5, which is typical of most lactating dairy cow diets.

Table 1.4. Comparison of energy values predicted from chemical analysis of forage and concentrate feeds from Dairy One feed analysis laboratory database

	Forages[1]			Concentrates[2]		
	Low	Mean	High	Low	Mean	High
TDN_{1x}, % [3]	50	60	74	62	79	96
Average discount, % [4]	6.2	3.8	1.9	2.8	2.7	1.8
Animals fed at maintenance [5]						
NEm[8], Mcal/kg	0.97	1.31	1.76	1.38	1.91	2.41
Animals fed at 2x maintenance [6]						
NEm[8], Mcal/kg	0.86	1.23	1.70	1.32	1.85	2.36
NE_g[8], Mcal/kg	0.32	0.66	1.09	0.74	1.21	1.65
Animals fed at 3x maintenance [7]						
NEm[8], Mcal/kg	0.75	1.15	1.65	1.26	1.78	2.31
NE_g[8], Mcal/kg	0.21	0.59	1.04	0.69	1.16	1.61

[1] Mean value is from 28 forages, low is from straw, and high is from low fiber corn silage.
[2] Mean value is from 47 concentrates, low is from beet pulp, and high is from soybeans.
[3] TDN_{1x} is TDN at maintenance NEm. Values were predicted by the Weiss et al. (1992) equation.
[4] Discount per multiple of maintenance. Forages and concentrates were calculated with the equation developed with the CNCPS 5.0 model, assuming 70.0, 54.5, and 32.9% of NDF (%DM) for forages and 41.7, 31.5, and 12.0% of NDF (%DM) for concentrates, respectively for low, mean and high values.
[5] Typical of dry beef cows.
[6] Typical of backgrounding cattle.
[7] Typical of feedlot finishing cattle.
[8] NEm and NEg values are predicted with NRC (2000) equations from TDN_{1x} values.

Table 1.5. Efficiency of ME use for maintenance and gain

ME, Mcal/kg	Typical % forage	NEm/ME x 100	NEg/ME x 100	NEg/NEm
2.0	100	57.6	29.6	0.513
2.2	83	60.8	34.6	0.569
2.4	67	63.3	38.5	0.608
2.6	50	65.1	41.5	0.637
2.8	33	66.6	43.9	0.659
3.0	17	67.7	45.8	0.677
3.2	0	68.6	47.3	0.690

Table 1.5 indicates the following:

1. The ME efficiency for NEm ranges from 57.6% at an ME of 2.0 (typical of late bloom grasses), to 65.1% at an ME of 2.6 (typical corn silage) to 68.6 at an ME of 3.2 (corn grain). Therefore a constant to compute net energy values of individual feeds does not account for this effect.

2. Over this same range of ME, the efficiency of ME use for growth increases more rapidly than the ME efficiency for NEm (from 29.6 to 47.3, an increase of 17.7 percentage units or 17.7/29.6 is a 59.8% increase vs. (68.6-57.6)/57.6 = 19.1% increase). Fermentation of high starch feeds such as corn grain result in a large amount of propionate and lactate, while fermentation of high cell wall feeds will have a higher proportion of acetate. Acetate infusion increased milk fat synthesis and

decreased body fat synthesis, but the opposite occurred with propionate infusion (Moe, 1981). Other studies show diets producing large amounts of propionate and lactate are used more efficiently for fat deposition compared to those with lower proportions of propionate and lactate (Fox and Black, 1984). Moe (1981) concluded this is because acetate is used directly as a precursor for milk fat synthesis with less heat increment than when used for tissue deposition. Thus the variable NEm and NEg equations should be used to predict NEm and NEg. However, the use of the NEm equation to predict NEl might overpredict NEl values of high starch feeds, and underpredict NEl values for feeds high in cell wall. Therefore we continue to use the constant efficiency of 64.4% to compute NEl from ME for lactating dairy cows. The DE equation used to compute ME for lactating dairy cows gives a variable ME, while a constant is used by the beef NRC to compute NEm. This may offset the use of the constant of 64.4% to compute NEl from ME. This indicates that the two systems should be kept internally consistent (ie use their own k values for DE) when computing NEl for lactating dairy cows vs. when computing NEm for meeting maintenance requirements of other classes of cattle. Except for low quality forages, the ME/DE value from the Beltsville studies for dairy cows averages 5 to 6% higher than the ME/DE constant of 0.82 from the California studies used in the Beef NRC system. This accounts for most of the differences between feed NEl and NEm values computed with the Beef and Dairy NRC systems for feeds.

Diet NEm and NEg values determined in the body composition database described by Fox et al. (1992) were regressed against NEm and NEg predicted with the NRC equations. In this database, energy retained from the ME intake was measured in over 900 cattle primarily fed corn silage based diets widely varying in NDF. Diet NEg concentrations varied from approximately 0.90 to 1.50 Mcal/kg. These results were reported in the NRC (2000) page 130. There was no bias in either NEm or NEg predicted values, and the R^2 was 0.89 and 0.58, respectively. The lower R^2 for NEg prediction is the result of feed for gain reflecting all cumulative errors in predicting requirements in this system, because NEm requirement and feed for maintenance was computed using a fixed 0.077 Mcal/$BW^{0.75}$. Thus, it is likely that this is a "worst-case" scenario for predicted feed NEg because maintenance requirement can be highly variable (Fox et al., 1992).

The Van Soest equations for predicting NEm and NEg were compared with the NRC equations, using this same database (Van Soest and Fox, 1992). The NRC equations accounted for more of the variation in predicting NEg than did the Van Soest equations (58% vs. 43%), with no bias vs. a 3% bias. The primary problem is the use of a constant to predict NEg values from NEm does not account for the change in efficiency of use of NEg relative to NEm adequately as feed ME increases.

PREDICTING METABOLIZABLE PROTEIN SUPPLY WITH LEVELS 1 AND 2

The CNCPS level 2 provides a system in which microbial protein production and undegraded feed protein values are predicted mechanistically, based on the integration of feed carbohydrate and protein fraction pool sizes, microbial growth on fiber and non fiber fractions, and digestion and passage rates. However, most nutritionists use the NRC DIP/UIP system for ration formulation, so we developed a CNCPS level 1 to provide the capability to use either the "level 1" or "level 2" approach. For the CNCPS level 1 solution, we use the NRC (2000) level 1 equations to predict MP from microbial protein (13% of TDN; with 64% being metabolizable protein). Undegraded protein from feed is predicted from CP intake and the CP that is undegraded (%UIP), which is assumed to have an

80% intestinal digestibility. The discount equations as discussed previously are used to adjust level 2 generated UIP_{1x} values.

The level 1 NRC system was introduced in *Ruminant Nitrogen Usage* (NRC, 1985) and was implemented in the dairy and beef cattle revisions (NRC, 1989, 2000) to more accurately predict protein available to meet rumen microbial requirements and to supplement microbial protein in meeting animal requirements. The tabular values for use in the NRC (1989) and the NRC (2000) level 1, are from various sources and represent determinations by various methods. Analytically, DIP and UIP tabular values are determined by either in vitro or in situ methods, which have limitations in predicting ruminal degradation and escape of protein because of the limitations of the procedures and not accounting for variation in effects of digestion and passage rates. To evaluate this concern, we compared the NRC (2000) tabular UIP values with CNCPS generated UIP values at 1x and 3x, using the procedures described previously for the evaluation of tabular energy values. Across concentrate feeds (n = 50), tabular values accounted for 96% of the variation in CNCPS - 3x UIP values. The bias was a 1% under prediction for the CNCPS rumen simulation, suggesting the tabular concentrate values represent a 3x level of intake. This is an expected result, since the NRC (2000) feed library concentrate values are based on the 1989 Dairy NRC, and the laboratory survey results, which are mostly from the Northeast DHI Laboratory in Ithaca, and Van Soest (1994) tabular values. At a CNCPS - 1x level of intake, the tabular values accounted for 93% of the variation, with a 21% under prediction bias. Thus the 1x UIP values averaged 80% of the 3x UIP values. The results of our analysis of the forage UIP values is much less clear. The tabular values accounted for 51% of the variation in model level 2 predicted values; at 3x, the tabular values accounted for only 38% of the variation. The bias was inconsistent from class to class of forage, likely because the UIP values were assigned by the NRC committee to be consistent with how each forage is expected to be used. Those expected to be used by gestating beef cows were assigned UIP values appropriate for 1 x while those expected to be used by growing and finishing cattle were assigned appropriate for 2 to 3 x level of intake. Based on the results, we use the tabular UIP values generated by the CNCPS for a 1x level of intake then use the UIP discount equation to adjust for level of intake.

MODEL EVALUATIONS WITH ANIMAL PERFORMANCE DATA

LACTATING DAIRY COWS

Recent studies in which the CNCPS was evaluated with lactating dairy cows were published by Kolver et al. (1998) with TMR and grazing dairy cows and by ADAS (1998) with 10 dairy farms in England. In both of these studies, actual feed composition values were used along with actual animal and environmental factors to predict energy allowable milk production. In the Kolver studies, the CNCPS under predicted energy allowable milk by 2.5% in TMR fed groups and by 6.8% in pasture fed groups. In the ADAS study, the CNCPS over predicted energy allowable milk by 4.0% in the first period and by 1.6% in the second period, which were not statistically different from actual milk yields. A simple average over both of these validation studies indicates the CNCPS predicted energy allowable milk within 1% of actual milk production.

A more intensive challenge is to evaluate the ability of the CNCPS to predict animal performace with individual animals. A comparison of observed and predicted milk production with the CNCPS

4.0 were conducted with individual cow data from the PhD theses of Ruiz (2001) and Stone (1996), where nearly all of the inputs were measured. In general, cows in the dataset from Stone were energy limited while the datasets from Ruiz were protein limited. Across the entire data set with a wide range in milk production, the CNCPS accounted for 90% of the variation with a 1.7% bias. The model accounted for 56% of the variation with an 8.5% underprediction bias when energy was first limiting in high producing cows, and accounted for 77% of the bias with a 1.4% bias when protein was first limiting.

DAIRY REPLACEMENT HEIFERS

Van Amburgh et al. (1998a) evaluated the CNCPS and Dairy NRC (1989) models with 273 Holstein replacement heifers. The CNCPS ME allowable ADG, accounted for 86% of the variation in the actual ADG with a bias of 5.7%. They concluded the CNCPS has the advantage of improved accuracy in the prediction of nutrient requirements in each unique production situation.

GROWING AND FINISHING BEEF CATTLE

The NRC (2000) evaluated model levels 1 and 2 (CNCPS) with a 70 growth period data set that included both Holstein and beef breed steers. Actual feed composition data required by the level 2 model was used for the level 2 validation. The daily gain predicted by the first limiting of ME, MP or essential amino acids accounted for 92% of the actual daily gain with 0 bias when predicted with level 2 (CNCPS model). When the level 1 (tabular) system was used, 81% of the variation in daily gain was accounted for with a 12% bias (part of this bias was likely due to not using a discounted TDN to compute DE).

We evaluated the CNCPS model levels 1 and 2 with published studies, using animal growth as the response variable (Tedeschi, 2001, Ch. 2). These studies were chosen based on adequacy of information provided to characterize animal initial and final weights and body composition, and carbohydrate and protein fractions and their digestion rates for the dietary ingredients. Selection criteria were also based on the inclusion of treatments in which a growth response was obtained to the addition of energy or nitrogen supplements. Then treatment groups were divided into those in which ME or MP was first limiting, based on CNCPS model level 2 predictions. Table 1.6 summarizes the results of this evaluation. These results agree with the NRC evaluation. The NRC (2000) tabular system had an overprediction bias because it does not account for level of intake effects, and had a lower r^2 because the studies summarized to determine the tabular value likely differed in content of carbohydrate and protein fractions that those fed in the trials. Although it uses similar carbohydrate and protein fractions as level 1, the CNCPS level 2 accounted for more of the variation in animal performance because of accounting for the effects of additional variables, such as digestion rates, effects of level of intake, rumen pH, and ruminal nitrogen deficiency, on feed ME and MP values.

Guiroy et al. (2001) evaluated the ability of the CNCPS to predict individual animal performance, when nearly all model inputs were measured, including body composition. The CNCPS version 4.0 model was used to predict feed ME values, and the growth model was used to predict feed required for the observed ADG, body weight, and composition of gain. The CNCPS predicted feed required for the observed ADG accounted for 74% of the variation in feed actually consumed with no bias.

Table 1.6. Evaluation of the CNCPS levels 1 and 2 to predict ADG (kg/d) when ME or MP are first limiting [1]

	ADG, kg/d			Regression statistics[2]			RMSPE
	Min.	Mean ± SE	Max.	r^2	MSE	bias,%	
ME first limiting (n = 19)							
Observed	0.80	1.11 ± 0.04	1.44	-	-	-	-
Tabular	0.73	1.25 ± 0.06	1.78	0.61	0.01	-11.4*	0.23
CNCPS level 1	0.74	1.13 ± 0.06	1.62	0.73	0.01	-2.2	0.14
CNCPS level 2	0.79	1.10 ± 0.05	1.48	0.80	0.01	0.4	0.10
MP first limiting (n = 28)							
Observed	0.12	0.78 ± 0.07	1.36	-	-	-	-
Tabular	0.11	0.81 ± 0.09	1.78	0.80	0.03	-4.3	0.21
CNCPS level 1	0.13	0.78 ± 0.09	1.73	0.79	0.03	-0.5	0.22
CNCPS level 2	0.12	0.77 ± 0.07	1.45	0.92	0.01	1.9	0.11

[1] Analyses from Tedeschi (2001, Ch. 2).
[2] Observed values (Y) were regressed on predicted ADG (X) using tabular TDN or TDN predicted by CNCPS 5.0 level 1 (Weiss et al., 1992 equation) or CNCPS v. 4.0 level 2. Bias was calculated using the slope of linear regression, forced through the origin, minus one; otherwise, bias was calculated by dividing the mean of the Y-variate minus the mean of the X-variate by the mean of the X-variate. A positive bias means that Y values (observed) are greater than X values. MSE is the mean square error from the regular regression, SE is the standard error, and RMSPE is the root of the mean square prediction error.

TROPICAL BREEDS; GROWING AND FINISHING STEERS AND BULLS, AND DUAL-PURPOSE COWS

The CNCPS was evaluated by Lanna et al. (1996) for accuracy of predictions in tropical conditions with actual DM intake of tropical feeds fed to cattle types typical of those used in the tropics. Feeds were characterized for their content of carbohydrate and protein fractions and their digestion rates. The energy and protein content of empty body weight gain (growing animals) and milk production (dual purpose lactating cows) were measured. The growing cattle data set included 943 Nellore (the most common Zebu breed in Brazil) bulls and steers fed 96 different diets, with a subset of approximately 200 head used to determine composition of weight gain. Average live weight and live weight gain were 337 kg and 0.923 kg/d, respectively. The CNCPS accounted for 72% of the variation in live weight gain with a 2% bias. The lactating cow data set included 18 different diets fed to 178 Zebu crossbred cows representing the wide range in genotypes used for milk production in tropical conditions. The CNCPS accounted for 71% of the variation in milk production with a 10% bias. The 10% bias for the lactating cows is believed to be due to difficulty establishing the maintenance requirements of the animals because of the wide variation in their percentage of Holstein and Zebu. The authors observed that accounting for more of the variation in performance with the CNCPS would be difficult, because of the lack of uniformity in genotype within Zebu cattle. Lanna et al. (1996) concluded that the CNCPS was more accurate than the NRC under tropical conditions when the feeds and cattle types could be characterized adequately to provide accurate inputs into the CNCPS. The CNCPS then should provide for a more precise and dynamic estimate of nutrient requirements and animal performance.

In a recent evaluation of three comparative slaughter experiments with Nellore fed high forage diets, Tedeschi et al. (2002a) reported the energy requirement for maintenance of bulls (n = 31) and steers (n = 66) were similar; about 77.2 kcal/kg$^{0.75}$ EBW. However, the efficiency of conversion of ME to net energy for maintenance was greater for steers than bulls (68.8 and 65.6%, respectively), indicating that bulls had a greater ME requirement for maintenance than steers (5.4%; $P < 0.05$). They concluded the NRC (2000) recommendation of 10% lower energy requirement for *Bos indicus* compared to *Bos taurus* breeds, does not apply for Nellore fed high forage diets.

TROPICAL BREEDS; DUAL-PURPOSE COWS

Juarez Lagunes et al. (1999) conducted two experiments using the CNCPS to characterize the carbohydrate and protein fractions and corresponding rates of digestion of 15 tropical pasture grasses and to evaluate their ability to support milk production by dual purpose cows. In the first experiment, ranges in carbohydrate and protein fractions of 15 grasses at 35 to 42 d of regrowth were: NDF 63.5 to 74.9% of DM; permanganate lignin 4.7 to 7.8% of NDF; CP 5.5 to 11.9% of DM; and soluble protein 15.1 to 44.1 % of CP. The ranges of rates of digestion expressed as %/h were: neutral detergent solubles (7.5 to 27.4); NDF (3.8 to 8.4); and neutral detergent insoluble protein (2.9 to 9.5). Predictions of the amount of milk that could be produced based on the amount of metabolizable energy supplied by the diet decreased 35% when NDF increased from 60 to 80%, and increased 88% when the rate of digestion of NDF increased from 3 to 6%/h. The milk production that could be sustained based on metabolizable protein in the diet doubled as CP increased from 4 to 12%. In the second experiment, nitrogen fertilization reduced NDF 7.3% and increased CP 84% without changing protein solubility, resulting in increased rumen nitrogen and metabolizable protein balances. With all forages, the CNCPS predicted that availability of metabolizable protein would limit milk production. Predicted microbial growth was limited by ruminally available protein rather than by available carbohydrate. They concluded the CNCPS can be used to accurately describe animal requirements and the biological values of feeds if adequate forage analysis information is available to adequately characterize the forages.

THE EFFECTS OF A RUMINAL NITROGEN DEFICIENCY ON ANIMAL PERFORMANCE

The adjustment to the CNCPS prediction of fiber digestion and microbial mass production from ruminally-degraded carbohydrate for a ruminal N deficiency was evaluated with five published studies containing adequate information to evaluate the response of animals to added dietary N (Tedeschi et al., 2000a). These evaluations compared observed and CNCPS predicted average daily gain with and without this adjustment. The adjustment decreased the CNCPS overprediction of ADG in these nitrogen deficient diets from 19.2 to 4.7%, mean bias declined from 0.16 to 0.04 kg/d, and the r^2 of the regression between observed and metabolizable energy or metabolizable protein allowable ADG was increased from 0.83 to 0.88 with the adjustment. When the observed dry matter intake was regressed against CNCPS predicted DMI with an adjustment for reduction in cell wall digestibility, the r^2 was increased from 0.77 to 0.88. These results indicated the adjustment for ruminal nitrogen deficiency increased the accuracy of the CNCPS model in evaluating diets when ruminally degraded N is deficient. A prototype model to account for BCVFA deficiency in the rumen was developed by Tedeschi et al. (2000b).

CASE STUDIES

IMPORTANCE OF NUTRIENT MANAGEMENT TO PROTECT WATER QUALITY

Nutrients concentrate on livestock farms when more nutrients are imported as feed and fertilizer than are exported as products sold. Mass nutrient balances indicate more than two-thirds of the N, P and K imported on many dairy farms each year as purchased feed, fertilizer and N fixation remain on the farm (Klausner, 1993). However, data is lacking that relates this accumulation of nutrients to water quality.

We conducted two studies on dairy farms to address this question. The first was a dairy farm with 320 milking cows with 275 hectares in cultivated crops (primarily corn and alfalfa in rotation) selling 3,743,636 kg of milk/year. The soils are well drained silt loam and a nutrient management plan to minimize fertilizer purchases and hydrological risk developed by the farms crop advisor was being followed. Nutrient losses from surface run-off and groundwater leaching were predicted using complex models (Hutson et al. 1998). A groundwater-leaching model (LEACHN) predicted that the losses of N to the environment (volatilization from manure storage, leaching, and volatilization and denitrification) was 35,364 kg N/year. Thus, 67 - 75% of the retained N, i.e. the surplus between inputs and products sold, was projected to escape into the off-farm environment (Hutson et al., 1998). About 10% of this excess N would be expected to leach into the groundwater. Leaching is greater on the better-drained soils with 70 % of the leaching predicted to occur on 25% of the land area. The model predicted that the soil type was more critical to the amount of N leached than the crop. This study demonstrated the usefulness of this model for identifying the hydrologically sensitive areas on the farm.

A water monitoring program was conducted on this farm in which actual leaching and runoff of nutrients were measured by identifying an area drained by a single stream (drainage basin) and monitoring the concentrations of nitrate-nitrite Nitrogen (N), phosphorus (P) and total solids (Houser et al., 1996) in the stream draining that basin. The geohydrology of the area indicated that the small stream, which drains the sampling site selected, was not charged by any subsurface flows other than that which leaches through or runs off the delineated drainage basin. During the period measured (April 26 to November 22 in 1995), the concentration of N and P averaged 14.4 ppm nitrate N and 0.41 ppm of total P. These levels exceeded the federal water quality standard for groundwater (10 ppm N and 0.10 ppm). These data indictes nutrients can reach ground and surface water from the dairy farm through surface runoff and leaching.

The second study involved evaluating the long-term environmental impact of dairy farming on well water quality at the Cornell Animal Science Teaching and Research Farm (Wang et al., 1999). The farm had 321 lactating dairy cows that produced 2,501,818 kg of milk in 1979. By 1994, lactating cow numbers increased only 7.2% but milk production had increased 44% to 3,603,634 kg. During that period, cropland changed very little, with an average of 385 hectares, primarily corn and alfalfa in rotation, producing the forage for the dairy herd and nearly all of the concentrates used being imported as purchased feed. The farmland is typical of that used for dairy farming in New York, with the crops being grown and most of the manure applied on the valley floor, which contains well-drained soils. The steep valley sides are mostly medium to poorly drained soils in permanent grassland. A land divide runs through the farm with the area on the north side draining into the St. Lawrence River and the south draining into the Susquehana River. The majority of the drainage is as groundwater. Water in wells in the intensively farmed valley floor (four wells located in a 28 hectares field and one well located in a 10 hectares field; well drained sandy loam soil) were sampled from 1979 to 1994 to monitor nutrient concentrations during that period. Mass nutrient balances (N, P, and K) were constructed using baseline (1979) and current data and changes have been related to changes in well water quality (Wang et al., 1999).

The amount of imported N increased two fold during this period, as the result of increased imported feeds to support the 44% increase in milk production. The four wells in the 38 hectares field had an average increase of 54% in nitrate concentration in the water (3.24 ppm in 1979; 5.00 ppm in 1994). The well in the 10 hectares field contained 7 ppm in 1979 and had increased to 12 ppm by 1992, which exeeds the federal water quality standard of 10 ppm. During this time, the concentration of N in wells in the unfarmed hillside area remained small (0.6 ppm in 1992-1994). This has an important dilution effect, as 60% of the groundwater on this farm comes from seepage from the hillside area. Soil test P in the intensively cropped valley floor increased from 7 in 1979 to 30 kg/ha in 1994. One way of evaluating the potential for water quality risk is the concentration of manure nutrients applied per unit of land. In the first and second studies, manure application averaged 185 and 170 kg of N and 28 and 32 kg of P per hectare, respectively.

Based on these studies, we believe integrated whole farm nutrient management planning is needed to minimize the potential for increasing the concentration of nutrients in surface and ground water above acceptable limits. Three phases of nutrient management planning are required: 1) Minimize N and P used per kg of milk sold by integrating animal and crop nutrient management; 2) Develop manure management systems that maximize recycling of nutrients and minimize potential for leakage of nutrients and pathogens into surface and ground water; and 3) Develop viable alternatives for removing excess nutrients from the farm.

Development and application of computer tools for nutrient management on dairy farms

Five projects involving on farm case studies by a total of 25 Cornell scientists across several disciplines (soils and crops, animal nutrition, veterinary science, engineering, economics, integrated pest management) were conducted to develop and evaluate the processes for integration of scientific knowledge into computer software tools for use on farm to improve whole farm nutrient management.

In the first project, two dairy farms were used as case studies to develop a process for integrating scientific knowledge for whole farm nutrient management (Fox et al., 1996a,b; Klausner et al., 1996; Hutson et al., 1996; Rasmussen et al., 1996; Klausner et al., 1998; and Hutson et al., 1998). Animal and agronomic nutrient management plans that decrease the net excess of nutrients on the farm (Klausner et al., 1996; Hutson et al., 1996) increased predicted farm profitability (Rasmussen et al., 1996). Partial budgets predicted that net farm income would increase because of more efficient use of nutrients both by the animals and crops. To evaluate the sustainability of the case study farms, they found that a tremendous amount of data had to be collected and integrated. Most of the tools available to do this were workbooks or stand-alone software programs that were not linked or were incomplete. They concluded that making this type of analysis available to many farms in a timely fashion requires the development of a family of computerized decision aid tools, and that the use of these tools will promote animal and agronomic efficiency that will have the double benefit of decreasing nutrient excess on farms and increasing farm profitability.

The second project focused on developing a family of computerized tools needed to make dairy and beef farms more economically and environmentally sustainable by increasing efficiency of nutrient and resource use on each unique farm (Fox et al., 1996a). These tools were developed through a partnership between Cornell University, New York City Watershed Agricultural Council (WAC), and New York State agencies responsible for developing regulations to protect water quality (Natural Resource Conservation Service (NRCS), Department of Environmental Conservation (DEC) and The Department of Agriculture and Markets. This integrated system of nutrient management tools is called the Cornell University Nutrient Management Planning System The CuNMPS components developed for this project consisted of two specific computer tools developed in visual basic for windows: 1) Animal Nutrient Management, and 2) Crops, soils and manure nutrient management planning. The Animal Nutrient Management component is a whole herd version of the Cornell Net Carbohydrate and Protein System, which has been developed over a period of 20 years, with the biological basis and validation of the model being published in over 12 peer reviewed journal articles, as summarized by Fox et al. (2000). The CNCPS evaluates and balances least cost diets for each group based on farm specific animal nutrient requirements and feed nutrients available. It then computes returns over feed costs and predicts annual feed budgets and total herd N, P, and K excretion from home grown and purchased feed for each alternative nutrient management plan evaluated. The basis and approach for the Nutrient Management Planning for Crop Production program was published by Bannon and Klausner (1997) and Klausner et al. (1998). This program is now called Cornell Cropware (Rasmussen et al., 2001), which was programmed in Microsoft Visual Basic v. 6.0 and is being supported and distributed by Dr. Quirine Ketterings in the Department of Crop and Soil Sciences. Cropware contains decision making components regarding the distribution of manure and supplemental fertilizer recommendations that meet NRCS 590 standards, and includes the following.

- Inputs needed to develop a soils inventory and crop nutrient requirements for the farm (for each field, size, soil types and analyses, hydrological sensitivity, environmental risk factors including N and P leaching indexes, and crop rotations planned), and inputs needed to compute volume of manure, milk center waste, and silage leachate;
- Cornell recommendations for waste and fertilizer nutrient application (organic N, ammonium N, P_2O_5, and K_2O) for each field to meet crop requirements, considering nutrient priority and accounting for prior crop, soil available nutrients, previous manure and starter fertilizer applications;
- Manure allocation based on crop requirements (as calculated above) and estimate total manure, N, P_2O_5, and K_2O surplus or deficit for each year of rotation;
- P_2O_5 and K_2O recommendations based on soil P and K tests;
- N, P, and K mass balances based on manure nutrients available and crop needs, considering planned crop rotation, waste incorporation strategies and land acres to be spread on.
- Waste spreading schedules for each field (loads by spreader type), considering field restraints and requirements computed by program to meet crop needs of N, or P, or K;
- Waste and feed storage requirements by month, including estimation of storage sizing requirements;
- Easy to use format which facilitates analysis of “what-if” scenarios;
- User customized output, including the reports desired and ability to manipulate field environmental risk management factors;
- Program documentation and organization, and error trapping by alpha and beta testing.

A Crop Rotation component was developed as an Excel spreadsheet by Kilcer (1997), which can eventually be linked to provide a linkage between the animal and soil/crop components, and evaluates amounts produced with present and alternatives proposed. Optimizing herd nutrition, minimizing nutrient excretion per unit of production, and identifying crop rotations that best meet herd requirements while making the best use of soil resources are key steps in achieving the goals of the CuNMPS. In addition to the importance of nutrient management planning, the feed, crop and fertilizer budgets calculated by the CuNMPS can be used for other purposes including planning for expansion and developing risk management programs for commodity purchases. The software is written in visual basic for windows, which is an object oriented language that will allow integration of the components and provides a modular structure for ease of updating and revising. Included will be a system for common data entry that will provide farm data to all of the components, integration of all the software tools, and capability to interact with farm records.

The third project involved evaluating the CuNMPS software on a case study farm, a 500 cow dairy near Homer, NY over a period of 5 years (1997-2002). Complete results of this case study were published by Tylutki and Fox (1997), Kilcer (1997), Bannon and Klausner (1997), Tylutki et al. (1999), Tylutki and Fox (2000, 2002a, b), Tylutki et al. (2002) and McMahon and McMahon (2002). This farm has as a high priority the development and implementation of accurate, farm specific nutrient management plans, because it is situated over an aquifer that provides water for a nearby village and city, and has a protected trout stream running through the farm. They found that the first step in developing an integrated animal and plant nutrient management plan is to evaluate the current diets for each group of cattle on the farm, and accurately predict the current annual herd feed requirements and nutrient excretion. The next step is to develop alternative rations and feed budgets that will improve efficiency of use of nutrients and reduce excess nutrients on the farm, considering the resources available (soil, equipment, storage facilities, economics). The CNCPS version 4.0 (and 5.0 in 2002) were used to predict site-specific nutrient requirements, nutrient balances, feed budgets, manure production and N, P, and K excretion for each group of cattle on the farm with the current program. This result was then used by the crop rotation spreadsheet to evaluate the match of the current feeding program with current crop rotations and yields by field and in total. Then alternatives to improve nutrient use in the herd were developed with the CNCPS, and then were evaluated with the crop rotation software. The Nutrient Management Planning for Crop Production was used to predict mass nutrient balances, distribution of manure and supplemental fertilizer recommendations for the current program and each alternative considered.

The mass nutrient balance on this farm indicated that with the current (1997) crop production and feeding program, a high proportion of the nutrients imported remain on the farm (77.3% for N, 67.5% for P, and 64.7% for K). Only 36% of the N, 30% of the P, and 22% of the K fed are exported as milk or cattle sold, similar to other NY dairy farms (Klausner, 1993). The major source of excess nutrients on the farm is imported feed, since only 9.1% of the N, 12.7% of the P, and none of the K, respectively comes from purchased fertilizer because manure is managed to be used as the primary source of nutrients. Normally, purchased fertilizer accounts for about one third of the imported nutrients (Klausner, 1993). As various phases of the nutrient management plan have been implemented, the farm dramatically reduced use of commercial fertilizer to this level with no yield loss.

Of the sources of imported nutrients on this case study farm (nitrogen fixation, fertilizer, feed) the mass balance indicated purchased feeds accounted for 74% of the N, 77% of the P, and 50% of the K imported. The initial evaluation indicated that the current feeding program is based on 54% purchased feed, typical for many dairy farms, including those based on pasture. The largest expense typically is feed costs, and was $1,900/day for this farm, including both home-raised and purchased feeds. Manure production was predicted to be 39,090 kg daily, agreeing well with the manure production estimated in the crop nutrient management planning program (Bannon and Klausner, 1997), when wash water from the milking system and bedding are added. The crop rotation evaluation by Kilcer (1997) indicates a major factor causing importation of nutrients is this farm has not been able to produce all of the forage needs and much of the protein required by the cattle.

A new feeding and cropping program was designed in 1997 to minimize purchased feeds to minimize nutrient imports and reduce costs. The focus was on improving management of the hay crops to increase both yield and quality to allow for more homegrown forage to be fed while maintaining, or improving, milk production. Intensively managed grass was substituted for corn on the wet, erodable hillsides, and a feeding and management program was designed to provide and utilize high quality grass forage in the feeding program and more accurate ration balancing with the use of CNCPS 5.0 to reduce imported nutrients. Ration cost was predicted to decrease $110 per day ($40,150 annually) by this change. These changes were predicted to increase the percent of the ration that is home raised to 78%, reducing purchased N, P and K 55, 48, and 82%, respectively. In the new plan, only the flat valley land is rotated with corn and alfalfa, and acres seeded each year are reduced 22% by this change. However, an additional silo must be constructed to add this extra source of forage, and equipment changes must be made to permit rapid, early harvest of the grass forage.

Tylutki and Fox (2002b) and McMahon and McMahon (2002) described the impact on this farm over the 5 years of the case study. Critical to making the whole farm nutrient management plans that were designed in 1997 work was the development of a Total Quality Management Program for nutrients (Tylutki and Fox, 2002c). The feeding of diets based on high quality, home grown forages has resulted in improved herd health and milk sold per cow daily increasing 16 lb. to a farm high of 76 lb. Milk shipped has increased 45% due to improved forage yields and quality and reduced cull rate (from 44% to 23%) and improved heifer performance that have allowed the herd to grow from 408 to 544 cows milking over the 5 year period. Purchased feed cost has been reduced 52% (from $6.56 to $3.42/cwt milk) and manure N and P have been reduced 83 and 72%, respectively. The N and P loading/acre have been reduced by 79 and 68%, respectively.

<u>The fourth project</u> involved development and evaluation of a linear optimization component for the CNCPS 5.0 that can be used to optimize available feed resources by allocating them across the groups in the dairy herd based on best use of their content of nutrients (Tedeschi et al., 2000c, and Wang et al., 2000ab). After development, this model was applied to the Cornell Dairy Farm to determine the nutritionally and economically optimal dairy herd feeding and crop management strategies and to evaluate the environmental and economic consequences for different alternative available on this farm (Wang et al., 2000a). Feeding the lactating cows according to their production level vs. all fed one ration reduced annual N, P, and K mass balance by 14, 9, and 9%, respectively. Improving forage quality improved returns over feed costs by $28,634 per year. Improving forage yields to the maximum potential for the farm improved annual mass balance for N, P and K by 29, 49, and 105%, respectively and increased annual returns over feed costs by $70,579. Changing crop ha to

more grass and corn and less alfalfa reduced annual N and K mass balances by 19 and 31%, respectively and increased annual returns over feed costs by $39,383. By changing four alternatives together (grouping lactating cows by level of milk production, improving forage quality, optimizing crop yield and rotation), N, P and K mass balance was reduced 52, 55, and 97%, respectively. Increasing milk sold 10% by increasing production per cow production by 10% vs. expanding herd size at the same production level resulted in a lower mass balance for N, P, and K of 8, 12, and 24%, respectively with a $34,132 higher return over feed costs. These studies indicate optimizing forage production, quality, yield, and allocation across the herd to optimize nutrient use can reduce risk to water quality while improving farm profitability.

The fifth project involved evaluating the impact of implementation of precision feeding on dairy farms to reduce phosphorus accumulation in a P restricted watershed. In 2000 and 2001, the Cornell Net Carbohydrate and Protein System was used in a research and demonstration project to examine reducing purchased feed phosphorus (P) in dairy diets on four commercial dairy farms in the Cannonsville reservoir basin (Cerosaletti et al., 2002). This reservoir, the largest single reservoir source of water for the New York City region, is under regulatory P restriction. In two of the four herds, diets were adjusted to reduce dietary P levels in the lactating dairy cattle, resulting in a reduction of 30% or more in P intake (and feed P imports) and a 33% reduction in manure P (nearly identical to the CNCPS predicted reduction in P excretion). The These reductions in P from the feeds translated into an average decrease of 50 % in the amount of P remaining on the farm, bringing these farms much closer to a zero P balance. If the reductions achieved on the pilot farms were able to be applied to all lactating dairy cattle in the Cannonsville basin, the amount of P imported into the basin and excreted in the dairy manure produced in the basin each year could be reduced by 140,000-160,000 lb; the total P loading in the reservoir each year is approximately 110,000 lb. If only 10% of the manure P reaches the reservoir this would result in 14,000 to 16,000 lb less P entering the reservoir each year, having a large impact on the P restriction problem.

APPLICATION OF THE CNCPS ON A BEEF CATTLE FEEDING AND FARMING OPERATION

A case study was conducted on a 630-acre farmer feeding operation marketing 950 Holstein steers each year (M. Baker, unpublished data). The farm receives 300 lb. calves every seven weeks, which are integrated into a continuous flow operation. The cattle are fed and managed in three weight groups: light (avg. BW of 550 lb.), medium (avg. BW of 900 lb.), and heavy (avg. BW of 1175 lb.). The goal is to market the crops they can grow to best advantage, which is primarily a rotation of Alfalfa and Corn. All of the forage and most of the corn is home grown. Byproduct feeds such as brewer's grains provide protein and additional energy.

The following approach was taken to design a feeding management plan for this farm:

1. Design a feeding program that maximizes use of home grown feeds, using purchased feeds only as needed to provide supplemental nutrients as needed to support nutrient requirements to meet the farm's production goals.
2 Modify crop rotations to provide a mix of home grown feeds that better match herd requirements while minimizing excess nutrients in the ration, as well as to best match soil resources and soil conservation goals.
3 Develop a crop and manure nutrient management plan that best allocates the manure to match crop requirements while minimizing risk of leakage into surface and ground water.

Data collected over a 12 months period on feed intake, feed analysis, cattle weights, and barn temperatures were used as inputs to the CNCPS. The actual and predicted daily gains were identical for the light and medium groups (3.0 vs. 3.03 for light and 2.8 vs. 2.83 for medium); daily gain was over-predicted 5.9% for the heavy group. The only major difference in feeding program for the heavy and other two groups is approximately 40% of the high moisture corn is replaced with dry whole corn in the heavy group to help control acidosis. Predicted and observed ADG agreed for this group (2.7 vs. 2.72 lb/day) when the ruminal and intestinal digestion rates were reduced to the low end of the range for dry whole corn given in the CNCPS guidelines. A proposed plan developed with the CNCPS increases animal performance and uses a mix of crops that best match both animal requirements and soil management requirements to control soil erosion and productivity. This plan reduces feed costs about $126,000 while reducing N, P, and K excretion.

2. MODEL EQUATIONS

ANIMAL REQUIREMENTS

The requirement section is subdivided into four main sections: maintenance, growth, lactation and pregnancy. Each section begins with an overview of how the model computes that requirement, followed by a summary of the equations in psuedo code.

MAINTENANCE

Maintenance requirements are computed by adjusting the basal metabolism NEm requirement for breed, physiological state, activity, urea excretion, acclimitization and heat or cold stress. Current temperature, animal insulation, and heat loss vs heat production, which is computed as ME intake - retained energy, are used to predict the effects of the current environment on NEm requirement. Heat loss is affected by animal insulation factors and environmental conditions.

The maintenance energy requirement is determined by metabolic body size and rate with adjustments reflecting physiological state, previous nutritional treatment, activity, and heat gain or loss required to maintain normal body temperature, based on data published by Fox et al. (1992), Fox and Tylutki (1998a) and NRC (2000). The proportion of the energy available for productive functions depends on the proportion needed for maintenance. Basal maintenance requirements (kcal/kg metabolic body size, which is the ¾ power of shrunk body weight) were developed for each breed type. In growing cattle, this basal requirement is adjusted 5% per condition score below (decreased) or above (increased) a 5 (1-9 scale), for the effect of previous plane of nutrition on organ size. Requirements are added for activity and for body temperature maintenance. To compute the energy required to maintain a normal body temperature, the combined animal and diet heat production is computed as metabolizable minus net energy to assess heat production vs. heat loss in a particular environment. The temperature and wind velocity the animals are exposed to, and animal insulation as influenced by body condition score, hair coat depth and condition of the hair coat are used to predict heat loss. Relative humidity changes the temperature that is effective in determining the animal's lower or upper critical temperature. The lower critical temperature is the point at which the animal no longer produces enough heat from fermentation and metabolism to maintain body temperature and must use absorbed dietary energy for this purpose. The upper critical temperature is the point at which the animal must reduce heat load by reducing intake and use energy to get rid of the excess heat in the body. A complete description of the model used to account for these effects has been published by Fox and Tylutki (1998a). An index called the current effective temperature index (CETI) is computed from current temperature and relative humidity, which is used for temperature in the model to make adjustments for cold or heat stress, and to adjust predicted intake for temperature effects. At temperatures below 20 degrees C (68 F) and relative humidity's above 50% the CETI will be reduced. At temperatures above 20 degrees C (68 F) the CETI will be increased. Effects on maintenance requirement and intake will be small within the range of CETI of 16 to 25 (Fox and Tylutki, 1998a). Heat stress is the greatest environmental effect in lactating dairy cows; under normal housing, management and feeding conditions in North America, they are not likely to experience cold stress. Performance can be expected to be reduced at or above a current monthly CETI of 25 degrees C (Fox and Tylukti, 1998a).

Dry matter intake is adjusted for the effect of temperature, which reflects the demand to produce more heat and support a higher metabolic rate in cold weather and to reduce heat production in hot weather. DMI is adjusted for lot mud depth; animals become increasingly reluctant to go the feedbunk as mud depth increases.

Recommendations on choosing inputs are summarized below:

- Enter an accurate estimate of the average shrunk body weight for the group the ration is being formulated for. Shrunk weight is computed as 96% of full weight. If scale weights are not available, use tape weights.

- Be sure entered body condition score accurately reflects the group, especially in heifers. It is used to compute insulation in all cattle as well as adjusts basal maintenance in growing cattle. For heifers limit fed high energy rations that support target growth rates and weights, we recommend entering a body condition score of 2, based on an analysis of the studies of Van Amburgh et al. (1998a, b).

- Enter a wind velocity that reflects the wind the animals are exposed to. It has no effect except when animals are near their lower critical temperature, which is a function of current environmental temperature, metabolizable energy intake and animal insulation.

- For previous temperature, use average temperature the animals are exposed to for the previous month. Maintenance requirement will increase above or below 68 degrees F (20 degrees C); use this temperature for previous temperature if you do not wish to have maintenance requirement adjusted for this effect, which is an increase in basal metabolism requirement with colder or warmer temperatures above thermal neutral (20 degrees C). Recent research suggests this adjustment may not be needed as long as the environmental temperature the animal is exposed to is between their upper and lower critical temperature. When outside of that range, increases or decreases in an animal's metabolic rate may be accounted for by the changes in maintenance energy the model computes to be needed for combating cold or heat stress.

- For current temperature, use average temperature the animals are being exposed to during the period beng evaluated. Maintenance requirement will not be affected unless the animals are below the temperature needed to generate more heat than the diet provides during fermentation and metabolism to keep warm (lower critical temperature). Housed lactating dairy cows will rarely be below their critical temperature, but often dairy heifers will be. Use 68 degrees F (20 degrees C) for current temperature if you do not wish to have maintenance requirement adjusted for this effect, including increased DMI below this temperature or decreased DMI above this temperature.

- Use a hair depth of 0.5 inches (1.27 cm) in winter and 0.25 in summer to reflect a hair coat depth when clean and dry.

- When choosing hair coat condition code, consider degree of matting of the hair coat with mud and/or manure. Coat condition will not have an effect unless the animal is near their lower critical temperature.

- Choose the appropriate panting index code to reflect the energy cost of getting rid of excess heat.

Summary of equations to predict maintenance requirements

Maintenance energy requirement

$NEm = ((SBW^{0.75} \times ((a1 \times COMP) + a2)) + ACT + NEmcs) \times NEmhs$

Basal metabolism requirement for different breeds is in Table 2.1:

Where: a1= 0.070 if beef *Bos taurus*; 0.073 if dairy cows; 0.078 if dairy heifers or steers; 0.064 if *Bos indicus*; 0.069 if tropical dual purpose breeds (see Table 2.1).

These and adjustments for L (lactation effect) are entered separately for each of 35 breeds (Table 2.1). No adjustment for L is made for dairy breeds, as the values are based on actual respiration calorimetry values (Moe, 1981). The adjustments for beef cows are based on the NRC (2000).

Adjustment for previous plane of nutrition (growing cattle only)

$COMP = 0.8 + (BCS - 1) \times 0.05$

Model equations were developed with the 1-9 BCS scale; if dairy, the 1-5 scale value is entered and the model 1-9 BCS = (dairy BCS - 1) × 2 + 1

Adjustment for previous temperature

$a2 = ((88.426 - (0.785 \times Tp) + (0.0116 \times Tp^2)) - 77)/1000$

When environmental temperature is above 20°C, a Tp adjusted for the combined effects of temperature, humidity, and sunlight exposure is computed as follows, based on Baeta et al. (1987) and Furukawa et al. (1984).

$Adjusted\ Tp = 27.88 - (0.456 \times Tp) + (0.010754 \times Tp^2) - (0.4905 \times RHP) + (0.00088 \times RHP^2) + (1.1507 \times WS) - (0.126447 \times WS^2) + (0.019876 \times Tp \times RHP) - (0.046313 \times Tp \times WS) + (0.4167 \times HRS)$

Adjustment for activity

ACT (Mcal/day) = (STAND + POSITION CHANGE + DISTANCE F + DISTANCE S)/1000
STAND (kcal/day) = (hours standing × 0.1) × FBW
POSITION CHANGE (kcal/day) = (standing/lying changes × 0.062) × FBW
DISTANCE FLAT (kcal/day) = (km traveled daily × 0.621) × FBW
DISTANCE SLOPE (kcal/day) = (km traveled daily × 6.69) × FBW

Default values used in the model for various conditions are summarized in Table 2.2.

Predicting heat increment

No stress intake is computed for use in predicting heat increment;

$I_m = NEm / (NEma \times IonophoreFactor)$

Ionophores do not improve feed NEma in diets containing added fat (Tedeschi et al., 2003b).

NE required for growing cattle (used to compute heat increment):

$RE = (DMI - I_m) \times NEga$

NE required for lactating cattle (used to compute heat increment):

$(RE + YE + LE) = (DMI - I_m) \times NEma$; assumes $NEma = NE_{lactation}$

Adjustment for cold stress

$SA = 0.09\ BW^{0.67}$
$HE = (MEI - (RE + YE + LE))/SA$
$EI = (7.36 - (0.296 \times WIND) + (2.55 \times HAIR)) \times MUD2 \times HIDE$

If EI < 0 then $EI = 0$
If body mud code < = 2, $Mud2 = 1 - (\text{body mud code} - 1) \times 0.2$
Otherwise: $Mud2 = 0.8 - (\text{body mud code} - 2) \times 0.3)$

HIDE is 0.8, 1, and 1.2 for Hide codes 1 (thin), 2 (average), and 3 (thick), respectively.

If $t \leq 30$ then $TI = 2.5$
If $t > 30$ and ≤ 183 then $TI = 6.5$
If $t > 183$ and ≤ 363 then $TI = 5.1875 + (0.3125 \times BCS)$
If $t > 363$ then $TI = 5.25 + (0.75 \times BCS)$

$IN = EI + TI$
$LCT = 39 - (IN \times (HE \times 0.85))$

If $LCT > T_c$ then $ME_{cs} = SA \times (LCT - T_c)/IN$
Otherwise, $ME_{cs} = 0$

$NEmcs = k_m \times ME_{cs}$
$NEm = NEm + NEmcs$

Adjustment for heat stress

$CETI = 27.88 - (0.456 \times Tc) + (0.010754 \times Tc^2) - (0.4905 \times RHC) + (0.00088 \times RHC^{2)} + (1.1507 \times WS) - (0.126447 \times WS^2) + (0.019876 \times Tc \times RHC) - (0.046313 \times Tc \times WS) + (0.4167 \times HRS)$

For *Bos taurus:*
If CETI > 20 ^{o}C then $NEmhs = 1.09857 - (0.01343 \times CETI) + (0.000457 \times CETI^2)$
Otherwise $NEmhs = 1$

For *Bos indicus* (Table 2.1 identifies *B. indicus* breeds with a "b" superscript in the breed name):
NEmhs = 1.07 if rapid shallow panting and 1.18 if open mouth panting.

$NEm = NEm \times NEmhs$

Intake for maintenance adjusted for environmental effects

I_m = NEm / (NEma $\times$ IonophoreFactor)

The cost of excreting excess N (UREA cost) is added to the ME required for maintenance, which is subtracted from ME intake to compute ME intake available for production:

UREA (Mcal ME) = (g rumen N balance - g recycled N) + (g excess N from MP) × 0.0073

Where:

a1 is thermal neutral maintenance requirement for fasting metabolism (Mcal/day/kg $SBW^{0.75}$).
a2 is maintenance adjustment for previous temperature effect (Mcal/day/kg $SBW^{0.75}$).
ACT is activity requirement for standing, changing position, horizontal and slope walking.
IonophoreFactor is 1.12 using ionophore without fat supplement added in the diet; otherwise is 1.
BCS is body condition score.
BE is breed effect on NEm requirement.
CETI is current month’s effective temperature index (°C).
COMP is compensation effect for previous plane of nutrition.
DMI is dry matter intake, kg/day.
DMIAFN is DMI adjustment factor with no night cooling (%).
DMIAFC is DMI adjustment factor with night cooling (%).
Distance flat is distance traveled daily on flat surface (m).
Distance sloped is distance traveled daily on sloped surface (m).
EI is external insulation value (°C/Mcal/m^2 /day).
GU is grazing unit (ha).
HAIR is effective hair depth (cm).
HE is heat production (Mcal/m^2/day).
HIDE is hide adjustment factor for external insulation.
HRS is hours per day exposed to direct sunlight.
FBW is full body weight.
I is insulation value (°C/Mcal /m^2/day).
I_m is DMI for maintenance (no stress).
k_m is diet NEm/diet ME.
LE is Net energy required for lactation (Mcal/day).
LCT is animal’s lower critical temperature (°C).
Mcal is megacalorie.
ME is metabolizable energy.
ME_{cs} is metabolizable energy required for cold stress (Mcal/day).
MEI is metabolizable energy intake (Mcal/day).
MUD2 is mud adjustment factor for external insulation.
NEga is net energy content of diet for gain, Mcal/kg.
NEm is net energy required for maintenance adjusted for acclimatization, activity, and excess N.
$NEma_{ct}$ is activity effect on NEm requirement (Mcal/day).
NEm_{cs} is net energy required for cold stress (Mcal/day).
NEma is net energy value of diet for maintenance (Mcal/kg).
NEm_{hs} is NEm adjustment for heat stress (%).
Position changes is number of changes between lying and standing.

RE is net energy retained (Mcal/day).
RHP is previous month's average relative humidity (%).
RHC is current month's average relative humidity (%).
SA is surface area (m^2).
SBW is shrunk body weight, which is defined as 96% of full weight.
Standing is time spent standing (h/day).
t is time in days.
Tc is current mean daily (24 h) temperature (°C).
TI is tissue (internal) insulation value (°C /Mcal/m^2/day).
Tp is previous month's average temperature (°C).
Tc is current month's average temperature (°C).
UREA is cost of excreting excess nitrogen (Mcal ME).
WIND is wind speed (kph); maximum wind input is 32 kph.
WS is speed (m/s); maximum wind input is 32 kph.
YE is net energy required for pregnancy (Mcal/day).

Table 2.1. Breed maintenance requirement multipliers, birth weights, and peak milk production[1]

Breed	NEm (factor a1)	Birth weight, kg	Peak[a] Milk, kg/d	Fat, %	Protein, %	First conception weight[c]
Angus	0.070	31	8.0	4.0	3.8	0.60
Aryshire	0.073	32	36.0	4.0	3.4	0.55
BrownSwiss	0.073	39	37.0	3.5	3.3	0.55
Braford[b]	0.067	36	7.0	4.0	3.8	0.62
Brahman[b]	0.064	31	8.0	4.0	3.8	0.62
Brangus[b]	0.067	33	8.0	4.0	3.8	0.62
Braunvieh	0.084	39	12.0	4.0	3.8	0.57
Canchin[b]	0.067	35	8.0	4.0	3.8	0.65
Charolais	0.070	39	9.0	4.0	3.8	0.60
Chianina	0.070	41	6.0	4.0	3.8	0.60
Friesian	0.073	35	37.0	3.5	3.3	0.55
Galloway	0.070	36	8.0	4.0	3.8	0.60
Gelbvieh	0.074	39	11.5	4.0	3.8	0.57
Guernsey	0.073	32	35.0	4.7	3.7	0.55
Gir[b]	0.064	29	10.0	4.0	3.8	0.65
Guzerat[b]	0.064	32	7.0	4.0	3.8	0.65
Hereford	0.070	36	7.0	4.0	3.8	0.60
Holstein	0.073	43	43.0	3.5	3.3	0.55
Jersey	0.073	32	34.0	5.2	3.9	0.55
Limousin	0.070	37	9.0	4.0	3.8	0.55
Longhorn	0.070	33	5.0	4.0	3.8	0.60
MaineAnjou	0.070	40	9.0	4.0	3.8	0.60
Nellore[b]	0.064	32	7.0	4.0	3.8	0.65
Piedmontese	0.070	38	7.0	4.0	3.8	0.60
Pinzgauer	0.070	38	11.0	4.0	3.8	0.60
Polled Hereford	0.070	33	7.0	4.0	3.8	0.60
RedPoll	0.070	36	10.0	4.0	3.8	0.60
Sahiwal[b]	0.064	38	8.0	4.0	3.8	0.65
Salers	0.070	35	9.0	4.0	3.8	0.60
Santa Gertudis[b]	0.067	33	8.0	4.0	3.8	0.62
Shorthorn	0.070	37	8.5	4.0	3.8	0.60
Simmental	0.084	39	12.0	4.0	3.8	0.57
SouthDevon	0.070	33	8.0	4.0	3.8	0.60
Tarentaise	0.070	33	9.0	4.0	3.8	0.60

[1] Based on NRC (2000); Lanna et al. (1996); and Fox et al. (1992, 1998); a1= 0.070 if beef *Bos taurus*; 0.073 if dairy cows; 0.078 if dairy heifers or steers; 0.064 if *Bos indicus*; 0.069 if tropical dual purpose breeds

[a] a1, birth weight (CBW) and peak milk yield (PKYD) are used to predict cow requirements. Adjustments for lactation in beef breeds are the same as in the NRC (2000) (increased 20%) except high milk breeds (Simmental and Braunvieh), which are made the same as other *Bos taurus* beef breeds (0.084).

[b] Breeds assumed to be tropical breeds (*Bos indicus*). When cows are identified as dairy, tropical cow DMI equation is used, based on Traxler (1997) and Juarez Lagunes (1998) for these breeds.

[c] Factor applied to mature weight to compute target weight at first conception.

Table 2.2. Default inputs for evaluating activity

Parameter	Environment: Dairy	Environment: Beef	Value
Time Spent Standing[a] (hours/day)	Tie-Stall Barn	Confinement barn	12
	Small free-stalls (<200 cows)	Conventional barn (30-50 sq ft/hd)	12
	Large free-stalls, close parlor	Dry lot (50-100 sq ft/hd)	15
	Large free-stalls, far parlor	Dry lot (100-200 sq ft/hd)	15
	Dry lots	Dry lot (> 200 sq ft/hd)	18
	Intensive Grazing	Intensive Grazing	16
	Continuous Grazing	Continuous Grazing	18
Position Changes (number/day)	Tie-Stall Barns	Confinement barn	6
	Small free-stalls (<200 cows)	Conventional barn (30-50 sq ft/hd)	9
	Large free-stalls, close parlor	Dry lot (50-100 sq ft/hd)	9
	Large free-stalls, far parlor	Dry lot (100-200 sq ft/hd)	9
	Dry lots	Dry lot (> 200 sq ft/hd)	6
	Intensive Grazing	Intensive Grazing	6
	Continuous Grazing	Continuous Grazing	6
Walking Flat[b] (meters/day)	Tie-Stall Barns	Confinement barn	0
	Small free-stalls (<200 cows)	Conventional barn (30-50 sq ft/hd)	500
	Large free-stalls, close parlor	Dry lot (50-100 sq ft/hd)	1000
	Large free-stalls, far parlor	Dry lot (100-200 sq ft/hd)	1500
	Dry lots	Dry lot (> 200 sq ft/hd)	1500
	Intensive Grazing	Intensive Grazing	1000
	Continuous Grazing	Continuous Grazing	2000
Walking Sloped[c] (meters/day)	Tie-Stall Barns	Confinement barn	0
	Small free-stalls (<200 cows)	Conventional barn (30-50 sq ft/hd)	1
	Large free-stalls, close parlor	Dry lot (50-100 sq ft/hd)	1
	Large free-stalls, far parlor	Dry lot (100-200 sq ft/hd)	1
	Dry lots	Dry lot (> 200 sq ft/hd)	1
	Intensive Grazing[d]	Intensive Grazing	0
	Continuous Grazing[d]	Continuous Grazing	0

[a] Values vary by cow comfort, overcrowding, number of times milked per day, average time spent in holding areas, and others. Values given are minimum estimates.
[b] Values vary dependent upon distance from milking center, number of times milked per day and size of facility. Values given are minimum estimates.
[c] Defined as any vertical movement.
[d] Ranges are those used in this evaluation and are dependent upon the pastures.

Maintenance Protein Requirement

Protein requirements for maintenance are the sum of scurf protein, urinary protein, and metabolic fecal protein (NRC, 1984). In the NRC (1984, 1985, 1989), metabolic fecal nitrogen is a function of indigestible DM. The CNCPS assumes that metabolic fecal protein is 9% of indigestible DM (100 - digestible DM) as does NRC (1985).

MP_{maint} (XP)= SPA + UPA + FPN
UPA = 2.75 × $SBW^{0.5}$ / 0.67
SPA = 0.20 × $SBW^{0.6}$ / 0.67
FPN = 0.09 × IDM

Where:
FPN is metabolic fecal protein, g/day.
IDM is indigestible dry matter, g/day.
MP_{maint} (XP) is metabolizable protein requirement for maintenance, g/day.
SBW is shrunk body weight, kg.
SPA is scurf protein, g/day.
UPA is urinary protein, g/day.

GROWTH

Requirements for growth are calculated using body weight, shrunk weight gain, body composition, and relative body size. Accurate prediction of daily gain that can be expected for the metabolizble energy and protein consumed depends on accurate prediction of energy required for maintenance and composition of gain, which is related to proportion of mature weight at a particular weight (Fox et al., 1992; Tylutki et al., 1994). A size scaling system is used to adjust shrunk body weight (SBW) to a weight equivalent to a standard reference animal at the same stage of growth (Tylutki et al., 1994; NRC, 2000). This equivalent shrunk body weight (EQSBW) = SBW x (SRW/MSBW), where SRW is mature weight of the standard reference animal and MSBW is expected mature shrunk body weight if replacement heifers and is expected finished weight at the target body fat if growing and finishing steers, heifers, or bulls. For herd replacement heifers, SRW is 478 kg. For growing and finishing steers, heifers, or bulls, SRW is 400, 435, 462, or 478 kg if the target is to market at 22, 25, 27, or 28% body fat, respectively. These body fat endpoints are associated with devoid, traces, slight, and small degrees of marbling, respectively. This system requires accurate estimation of mature weight if breeding herd replacements or target finished weight if growing and finishing for beef. ***Representative weights of mature cull cows sold in average body condition score can be used as a starting point for estimating mature weight for breeding herd replacements.*** Most cattle feeders are experienced with finished weights expected with feedlot finishing on a high grain diet with backgrounded calves or yearlings that have received an estrogenic implant. Guidelines for other conditions are: ***1) reduce finished weight 25 to 45 kg for non use of an estrogenic implant; 2) increase finished weight for an aggressive implant program, which usually involves use of an implant containing trenbolone acetate (TBA) plus estrogen; 3) increase finished weight 25 to 45 kg for extended periods at slow rates of gain; and 4) decrease finished weight 25 to 45 kg for continuous use of a high energy diet from weaning.***

Equivalent empty body weight (EQEBW) is 0.891 x EQSBW and empty body gain (EBG) is 0.956 × shrunk body gain (SBG). These variables are used to predict required net energy for gain (NEg) to formulate least cost diets to support a target daily gain; NEg, mcal/d = 0.0635 x $EQEBW^{0.75}$ × $EBG^{1.097}$. Across all cattle types, these equations accounted for 94% of the variation in energy and 91% of the protein retained measured in body composition studies, with only a 2% bias. Similar results were obtained with Holstein heifers only (Fox et al., 1999).

In evaluating if the current ration meets or exceeds the target daily gain, daily net energy available for gain (NEFG) from the diet after maintenance requirements are met is used along with the body weight adjusted to the weight of the standard reference animal to predict daily gain the diet will allow with the following equation; SWG, Mcal/d = $13.91 \times NEFG^{0.9116} \times EQSBW^{-0.6837}$. Net protein required for gain (NPg, g/d) = SWG×(268 - (29.4×(NEg/SWG))).

Target rates for herd replacement heifers

Recent research has identified optimum growth rates for herd replacement heifers for minimizing replacement costs while maximizing first lactation milk production (Van Amburgh et al., 1998b; Fox et al., 1999). After reaching maturity, body weight changes reflect use of energy reserves to either supplement ration deficiencies or to store energy consumed above requirements. Most beef and dairy producers monitor body condition score changes in cows to manage energy reserves. The National Research Council Nutrient Requirements of Beef Cattle model (NRC, 2000) is used to compute target weights and daily gains for replacement heifers; the equations in the growth section are used to compute requirements for all target ADG for growth. This model was modified and evaluated for computing growth requirements, target weights and energy reserves for any body size of dairy cattle, as described by Fox et al. (1999), which was adopted by the Dairy NRC (2001). Coefficients for computing target breeding weights after first calving are based on USMARC data summarized by Gregory et al. (1992) and used in the NRC (2000), and the data of Van Amburgh et al. (1998b). Target first conception weights are 55%, 60%, and 65% of mature weight for dual purpose and dairy, *Bos taurus* beef, and *Bos indicus* beef, respectively. Target post first calving weight is 85% of mature weight if dairy and is 80% of mature weight for all other types. Target post second and third calving weights are 92 and 96% of expected mature weight for all cattle types. These target weights are used with current age and weight, age at first calving and calving interval to compute daily gain required to reach the next target weight, as described next using dairy heifers as an example. For heifers before first pregnant, target weight gain to target first pregnant weight is ((mature weight×0.55) – current weight) / ((days of age at first calving - 280) – current age). For first bred heifers, daily gain required is ((mature weight×0.85) – current weight) / (280 – days pregnant); conceptus daily gain is added to get measured weight gain required. To avoid confusion of growth requirements with body reserves changes, after first calving, target calving weights and calving interval rather than current weight and current age are used to compute ADG required. If calving interval is extended or compensatory growth is needed, the user can increase ADG requirement by entering a shorter calving interval. Daily gain required during the first lactation (including the dry period) is ((mature weight×0.92) – current weight) / (calving interval days – days since calving). Daily gain for the second and third lactations are computed the same way, using 0.96 or 1 to compute the next target weight for the second and third lactations, respectively. The predicted target weights and daily gains required to minimize cost of growing replacement heifers while not affecting first lactation milk production agree with those reported for Holstein heifers in recent published studies (Van Amburgh et al., 1998b). In that study, the daily gain before first calving averaged 0.82 kg/d vs. model target of 0.87 kg/d; weight at first pregnancy was 370 kg vs. model target of 352 kg; the daily gain during first pregnancy averaged 0.63 kg/d vs. model target of 0.69 kg/d; weight at post first calving averaged 533 kg vs. target of 545 kg ; first lactation daily gain averaged 0.136 kg/d vs. target of 0.104; and second post calving weight was 592 kg vs. target of 590 kg.

Summary of equations to predict growth requirements

Energy and protein requirements

$EBW = 0.891\ SBW$
$EBG = 0.956\ SWG$
$EQSBW = SBW \times (SRW) / (FSBW)$
$EQEBW = 0.891 \times EQSBW$
$RE = 0.0635 \times EQEBW^{0.75} \times EBG^{1.097}$
$NP_g = SWG \times (268 - (29.4\ (RE / SWG)))$
$MEgrowth = NEg \times (TotalME / NEga)$

For NPg/MPg conversion only:
If $EQSBW \geq 478$ kg then $EQSBW = 478$
$MPg = NPg / (0.834 – (EQSBW \times 0.00114))$

Mammogenesis requirement

The energy and protein requirements for mammogenesis are calculated for dairy either dry cow or replacement heifer with more than 259 days pregnant based on Bell et al. (2000) and VandeHaar and Donkin (1999).

MP_{mm} (g/day) = 80 / 0.28908 = 276.7
ME_{mm} (Mcal/day) = 1 / NEga

Where:
EBG is empty body gain, kg.
EBW is empty body weight, kg.
EQEBW is equivalent empty body weight, kg.
EQSBW is kg equivalent shrunk body weight.
FSBW is actual final shrunk body weight at the body fat endpoint selected for feedlot steers and heifers, at maturity for breeding heifers or at mature weight × 0.6 for breeding bulls.
MP_g is metabolizable protein requirement, g/day.
MP_{me} is metabolizable energy requirement for mammogenesis, g/day.
MP_{mm} is metabolizable protein requirement for mammogenesis, g/day.
NEga is net energy for gain content of the diet, Mcal/kg.
NP_g is net protein requirement, g/day.
RE is retained energy, Mcal/day.
SBW is shrunk body weight, kg (typically 0.96 × full weight).
SRW is standard reference weight and is 478, 462, 435, and 400 for 28% fat finished weight or breeding herd replacements, or 27, 25, or 22% fat finished weight, respectively.
SWG is shrunk weight gain, kg.

Prediction of average daily gain (ADG) when net energy available for gain (RE) is known:

$EBG = 12.341 \times EQEBW^{-0.6837} \times RE^{0.9116}$
$SWG = 13.91 \times EQSBW^{-0.6837} \times RE^{0.9116}$

Predicting target weights (SBW) and rates of gain for herd replacement heifers

TPW = MW × (0.55 for dual purpose and dairy, 0.60 for *Bos taurus* and 0.65 for *Bos indicus*)
TPA = TCA - 280
BPADG = (TPW - SBW) / (TPA - T_{AGE})
If dairy: TCW1 = MW × 0.85; otherwise TCW1 = MW × 0.80
TCW2 = MW × 0.92
TCW3 = MW × 0.96
TCW4 = MW × 1.0
APADG = (TCW1 - SBW) / (280 - t)
ACADG = (TCW_{xx} - SBW) / (280 – (CI×30.4 – t))

where:

- ACADG is after calving target ADG, kg/day.
- APADG is postpregnant target ADG, kg/day.
- BPADG is prepregnant target ADG, kg/day.
- CI is calving interval, days.
- MW is mature weight, kg.
- SBW is shrunk body weight, kg.
- t is days pregnant.
- T_{age} is heifer age, days.
- TCA is target calving age in days.
- TCW1 is target first calving weight, kg.
- TCW2 is target second calving weight, kg.
- TCW3 is target third calving weight, kg.
- TCW4 is target fourth calving weight, kg.
- TCWx is current target calving weight, kg.
- TCWxx is next target calving weight, kg.
- TPA is target pregnant age in days.
- TPW is target pregnant weight, kg.

AVERAGE DAILY GAIN DUE TO PREGNANCY

For pregnant animals, ADG due to gravid uterus growth is added to target and ME, MP, and EAA allowable daily gain (SWG), as follows:

If dairy:
ADGpreg, g/day = (If t < 190 then 100 otherwise 664) × CBW/45); based on Bell et al. (1995)

Otherwise:
ADG_{preg} = CBW × (18.28 × (0.02-0.0000286 × t) × exp(0.02 × t-0.0000143 × t × t)); based on NRC (2000)

For pregnant heifers, weight of fetal and associated uterine tissue is deducted from EQEBW to compute growth requirements. The conceptus weight (CW) is predicted as follows:

If dairy:
If t > 190, CW = (18 + ((t - 190) × 0.665)) × (CBW/45); based on Bell et al. (1995)

Otherwise:
$CW = (CBW \times 0.01828) \times \exp(0.02 \times t - 0.0000143 \times t \times t)$; based on NRC (2000)

Where:
CBW is expected calf birth weight, kg,
CW is conceptus weight, g
e is the base of the natural logarithms.
t is days pregnant

PREGNANCY REQUIREMENTS

Calf birthweight and day of gestation are used to calculate pregnancy requirements.

If dairy and days pregnant > 190 then (based on Bell et al. (1995)):
$MEpreg = ((2 \times 0.00159 \times t) - 0.0352) \times (CBW / 45) / 0.14$,
$MPpreg = ((0.69 \times t) - 69.2) \times (CBW / 45) / 0.33$

Otherwise (based on NRC (2000)):
$MEpreg, Mcal/day = ((CBW \times (0.05855 - 0.0000996 \times t) \times \exp((0.03233 - .0000275 \times t) \times t)) / 1000) / 0.13$
$MPpreg, g/day = (((CBW \times (0.001669 - (0.00000211 \times t)) \times \exp((0.0278 - 0.0000176 \times t) \times t))) \times 6.25)/0.50$

Note: for beef cows, the efficiency of use of MP for pregnancy is 50% as in the NRC (1985) compared to 65% for NRC (2000).

Where:
CBW is expected calf birth weight, kg.
e is the base of the natural logarithms.
MP_{preg} is MP for pregnancy, g/day.
t is day of pregnancy.

Note: ME can be converted to an NEm requirement with an efficiency of 0.576 (NRC, 2000).

ENERGY AND PROTEIN RESERVES

After reaching maturity, body weight changes reflect use of energy reserves to either supplement ration deficiencies or to store energy consumed above requirements. Available data indicates weight gain and loss after maturity is similar in composition to weight gain during growth. Most dairy and beef producers monitor body condition score changes in cows to manage energy reserves. Body condition score is highly related to body fat in cows (NRC, 2000; Fox et al., 1999; Otto et al., 1991). After maturity, body reserves are computed from body weight and body condition score (BCS). The CNCPS uses the NRC (2000) body reserves model, which was developed from data on chemical body composition and body condition scores from 106 mature cows of diverse breed types, mature weights and body condition scores and was validated with an independent data set of 65 matuure cows. The mean SBW was 642 kg (BCS 5 on the 1-9 scale), the average weight change per BCS change was 44 kg (6.85% of the mean weight), and EBW was 85.1 % of SBW. The NRC (2000) model used to compute weight for a given condition score was modified to compute weight change per condition score as 6.85% for each BCS on either side of the weight at BCS 5. Modifications made for dairy cattle include using the 1-5 dairy condition scoring system (the dairy score is converted to the 1-9 score, which is used in both models; BCS = (dairy BCS - 1) × 2 + 1) and using the SBW change of 13.7% per dairy condition score for computing the weight change associated with any body weight and BCS (Fox et al., 1999). Body fat and body protein change 7.54 and 1.33 percentage units per dairy condition score, respectively. Body fat, protein and weight are used to compute body energy at each condition score. Energy reserves for the next lower and higher BCS is subtracted from the current BCS to compute energy and protein gain or loss to reach the next BCS. During mobilization, 1 Mcal of energy reserves substitutes for 0.82 Mcal of diet NEl; 1 Mcal diet NEl will provide 0.75/0.644 = 1.16 Mcal of energy reserves. In this equation, 0.75 is the efficiency of use of ME for reserves in lactating cows and 0.644 is the efficiency of use of ME for lactation (Fox et al., 1999). Then days to change 1 BCS = NEl required or provided for 1 BCS change/NEL balance. For example, a 600 kg cow at BCS 3 will mobilize 246 Mcal NE in declining to a BCS 2.5. If NEl intake is deficient 3 Mcal/day, this cow will lose 1 BCS in (246 × 0.82) / 3 = 67 days. If consuming 3 Mcal NEl above daily requirements, this cow will move back to a BCS 3 in 246 / ((3 / 0.644) × 0.75) = 70 days.

We used the independent data of Otto et al. (1991) to validate this model for dairy cattle. The revised model accounted for 96% of the variation in body fat with only a 1.6% bias and predicted 80 kg BW change per BCS compared to 84.6 kg observed in Holstein cows slaughtered over the range of dairy BCS. The CNCPS reserves model was adapted by the NRC (2001), as described by Fox et al. (1999).

Summary of equations to predict body reserves

For all breed types, based on NRC (2000), body composition and energy is computed for all BCS with the following:

$BCS_{1-9} = (BCS_{1-5} - 1) \times 2 + 1$
$AF = 0.037683 \times BCS_{1-9}$
$AP = 0.200886 - 0.0066762 \times BCS_{1-9}$
$EBW = 0.851 \times SBW$
$TF = AF \times EBW$
$TP = AP \times EBW$
$TE = 9.4 \times TF + 5.7 \times TP$
EBW@BCS5 = (Current EBW/ adjustment factor); then EBW and TE is computed for all other BCS, using the weight adjustment factors.

If to gain BCS: ER = next BCS TE - current BCS TE
If to lose BCS: ER = current BCS TE - next BCS TE

Where:
AF is proportion of empty body fat.
AP is proportion of empty body protein.
EBW is empty body weight, kg.
ER is energy reserves, Mcal.
SBW is shrunk body weight, kg.
TE is total body energy, Mcal.
TF is total body fat, kg.
TP is total body protein, kg.

Weight adjustment factor for BCS 1-9 is 0.726, 0.794, 0.863, 0.931, 1, 1.069, 1.137, 1.206, 1.274, respectively, based on the 6.85% of BCS 5 BW change per condition score.

Efficiency factors for converting NE reserves from ME balance ($Efficiency_{DLM}$) are:
If lactating dairy cow and energy balance is positive = 0.75
If lactating dairy cow and energy balance is negative = 0.644 / 0.82
Otherwise = 0.60

The net energy for daily live weight change (NE_{DLM}, Mcal/kg) is calculated using the body condition score (BCS: 1 to 9) as:

$$NE_{DLW} = 0.5381 \times BCS + 3.2855$$

Then, the daily live weight change (DLW, kg/d) is calculated as:

$$DLW = (ME\ Balance \times Efficiency_{DLM}) / NE_{DLM}$$

LACTATION FOR BEEF

Lactation requirements are calculated using age of cow, time of lactation peak, peak milk yield, day of lactation, duration of lactation, milk fat content, milk solids not fat, and protein:

If beef cows (based on NRC, 2000):

$$T = 8.5$$
$$k = 1 / T$$
$$PKYD_{adj} = (0.125 \times RelMilkProd + 0.375) \times PKYD$$
$$A = 1 / (PKYD_{adj} \times k \times e)$$
$$Milk = n / (A \times \exp(k \times n))$$

If age = 2

$$Milk = 0.74 \times Milk$$

If age = 3

$$Milk = 0.88 \times Milk$$

Using the predicted milk production, metabolizable energy required for lactation is computed, assuming an efficiency of 64.4% (NRC, 1989). Metabolizable protein requirements are computed from milk yield, milk protein content, and an efficiency of 65% (NRC, 1985):

$$LE = Milk \times ((0.3512 + (0.0962 \times MF)) / 0.644)$$
$$LP = 10\ Milk \times (PP) / 0.65$$

Where:
- a is intermediate rate constant.
- age is age of cow, years.
- e is the base of the natural logarithms.
- k is intermediate rate constant.

LE is metabolizable energy required for lactation, Mcal/day.
LP is metabolizable protein required for lactation, g/day.
MF is milk fat, %.
Milk is daily milk (Milk) for beef.
Milk is daily milk yield at week of lactation, kg/day.
n is week of lactation.
PKYD is peak milk yield, kg/day (Table 2.1).
PKYDadj is the peak milk yield, kg/day, adjusted for relative milk production factor (1-9).
RelMilkProd is the used defined relative milk production ranging from 1 (low) to 9 (high).
T is week of peak lactation.

LACTATION FOR DAIRY

If dairy, the LE and LP is calculated from actual user entered milk production and component values. If milk protein is entered as crude milk protein, it is adjusted to true milk protein (crude protein % × 0.93) in the program. If protein and fat are not entered or are entered as zero for a lactating dairy cow, program predicted values, described below, are used to calculate LE and LP.

Using actual milk production, metabolizable energy required for lactation is computed, assuming an efficiency of 64.4% (NRC, 1989). Metabolizable protein requirements are computed from milk yield, milk protein content, and an efficiency of 65% (NRC, 1985):

$$LE = Milk \times (0.3512 + 0.0962 \times MF) / 0.644$$
$$LP = 10 \times Milk \times PP / 0.65$$

Where:
LE is metabolizable energy required for lactation, Mcal/day.
LP is metabolizable protein required for lactation.
MF is actual entered milk fat, %.
Milk is actual entered milk production.
PP is true milk protein (entered crude protein % × 0.93).

PREDICTED DAIRY MILK PRODUCTION, PROTEIN, AND FAT

In the program, a predicted milk production, milk protein and fat % are calculated and displayed to provide the users with a check for entered values. The predicted milk yield for the entered days in milk, lactation number and herd average is computed as follows, based on Oltenacu et al. (1981) and Marsh et al. (1988), and the Wood (1967) equation coefficients for lactation number.

For first lactation dairy cows, the A coefficient is determined from the following equation:
$$A = (GNRHA \times 0.01 - 20) / 2.96$$

For multiparous dairy cows, the A coefficient is determined from the following equation:
$$A = (14 + GNRHA \times 0.01) / 2.96$$

Using the Woods coefficients b, c and d (Table 2.3), expected daily milk production of dairy cows is:

$$MM = A \times TL^{b} \times \exp(c \times TL) \times \exp(d \times t)$$

Where:

GNRHA = rolling herd lactation average, lb milk/yr.
t is day of gestation, days.
TL is day of lactation.

The terms PQ and PP below are used to represent predicted milk fat and milk protein, respectively (George, 1984).

$$PQ = 1.01 \times PMF \times (((TL + 1) / 7)^{-0.13}) \times (\exp(0.02 \times ((TL + 1) / 7)))$$
$$PP = 1.14 \times PMP \times (((TL + 1) / 7)^{-0.12}) \times (\exp(0.01 \times ((TL + 1) / 7)))$$

Where:

exp() is exponential function.
PMF is peak milk fat, % (Table 2.1).
PMP is peak milk protein, % (Table 2.1).
PP is milk protein on a particular day of lactation, %.
PQ is milk fat for a particular day of lactation, %.

Table 2.3. Wood's coefficients for dairy cows[1]

Lactation	Coefficients			
	A	B	C	D
1	67.568	0.08	-0.002	-0.001
2	79.054	0.12	-0.004	-0.002
3	79.054	0.16	-0.005	-0.002

[1] Based on Wood (1967).

AMINO ACID REQUIREMENTS

The CNCPS computes amino acid requirements and predicts energy and protein supply from feed physical and chemical properties, based on O'Connor et al., with modifications as described by NRC (2000) and a recent review of the literature (T. R. Overton, personal communication).

Maintenance

$$MPAA_i = AATISS_i \times 0.01 \times (FPN + ((UPA + SPA) \times 0.67) / EAAM_i)$$

Where:

$AATISS_i$ is amino acid composition of tissue (Table 2.4).
$MPAA_i$ is metabolizable requirement for the i^{th} absorbed amino acid, g/day.
$EAAM_i$ is efficiency of use of the i^{th} amino acid for maintenance (Table 2.5), g/g.

Growth

$$RPAA_i = AATISS_i \times 0.01 \times (NPg + MP_{mm} \times 0.28908) / EAAG_i$$

Where:

$AATISS_i$ is amino acid composition of tissue (Table 2.4).
$EAAG_i$ is efficiency of use of the i^{th} amino acid for growth (Table 2.5), g/g.
$RPAA_i$ is growth requirement for the i^{th} absorbed amino acid, g/day.
NPg is net protein required for growth, g/day.

Lactation

$$LPAA_i = (AALACT_i \times 0.01 \times (LP \times 0.65)) / EAAL_i$$

Where:

$AALACT_i$ is the i^{th} amino acid content of milk true protein, g/100g (Table 2.4).
$EAAL_i$ is efficiency of use of the i^{th} amino acid for milk protein formation, g/g (Table 2.5).
$LPAA_i$ is metabolizable requirement for lactation for the i^{th} absorbed amino acid, g/day.

Pregnancy

$$YPAA_i = (AATISS_i \times 0.01 \times (MPpreg \times Efficiency)) / EAAP_i$$

if Dairy then Efficiency=0.33, Otherwise Efficiency=0.50

Where:

$AATISS_i$ is amino acid composition of tissue (Table 2.4).
$EAAP_i$ is efficiency of use of the i^{th} amino acid for gestation, g/g (Table 2.5).
$PPAA_i$ is metabolizable requirement for gestation for the i^{th} absorbed amino acid, g/day.

Table 2.4. Amino acid composition of tissue and milk protein[1]

Amino acid	Tissue[2]	Milk[3]	Ratios for milk production		
			CNCPS[4]	Schwab[5]	Rulquin[6]
Methionine	1.97	2.71	5.3	5.5	2.5
Lysine	6.37	7.62	16.9	16.0	7.3
Histidine	2.47	2.74	6.2	5.5	-
Phenylalanine	3.53	4.75	9.4	10.0	-
Tryptophan	0.49	1.51	2.5	3.0	-
Threonine	3.90	3.72	9.4	8.9	-
Leucine	6.70	9.18	18.1	19.5	-
Isoleucine	2.84	5.79	11.5	11.4	-
Valine	4.03	5.89	12.5	13.0	-
Arginine	3.30	3.40	8.2	7.2	-

[1] Amino acid composition as g/100 g of protein. [2] Average of three studies summarized by whole empty body values of Ainslie et al. (1993). [3] Waghorn and Baldwin (1984). [4] Percent of essential amino acids. [5] Percent of essential amino acids of the duodenum (Schwab, 1996). [6] Percent of metabolizable protein.

Table 2.5. Utilization of individual absorbed amino acids for physiological functions[1]

Amino acid	Maintenance (EAAM)	Pregnancy (EAAP)	Lactation (EAAL)
Methionine	0.85	0.35	1.00
Lysine	0.85	0.53	0.82
Histidine	0.85	0.32	0.96
Phenylalanine	0.85	0.48	0.98
Tryptophan	0.85	0.85	0.85
Threonine	0.85	0.57	0.78
Leucine	0.66	0.42	0.72
Isoleucine	0.66	0.32	0.66
Valine	0.66	0.32	0.62
Arginine	0.85	0.38	0.35

[1] Requirement for growth varies with stage of growth as determined by Ainslie et al. (1993). If EQSBW < 478 kg then EAAG = 0.834 - (0.00114 × EQSBW), where EAAG is the efficiency of amino acid for growth factor and EQSBW is equivalent shrunk body weight as described by Fox et al. (1992). Other values have been updated from O'Conner et al. (1993) by Overton (personal communication). Values are expressed as g/g.

Predicting dry matter intake

The following equations are used to predict intake for various cattle types; adjustments for various factors are given in Table 2.6 and can be used with these or other intake estimates. If using monensin at 28 mg/kg of ration DM or higher, the DMI is decreased by 4% (Tedeschi et al., 2003b).

GROWING CALVES

This equation is used for beef calves (NRC, 2000) and all dairy replacement heifers (NRC, 2001) without the adjustment factors: BFAF, BI, and ADTV. For diets with a NEm < 1.0 Mcal/kg then NEma (divisor) = 0.95.

$$DMI = ((SBW^{0.75} \times (0.2435 \times NEm - 0.0466 \times NEma^2 - 0.1128)) / NEma) \times BFAF \times BI \times ADTV \times TEMP1 \times MUD1$$

GROWING YEARLINGS

For diets with a NEm < 1.0 Mcal/kg then NEma (divisor) = 0.95. If pregnant heifers, use SBW minus CW. If days pregnant > 259 then C = 0.8, otherwise C = 1

$$DMI = ((SBW^{0.75} \times (0.2435 \times NEma - 0.0466 \times NEma^2 - 0.0869)) / NEma) \times BFAF \times BI \times ADTV \times TEMP1 \times MUD1 \times C$$

NON-PREGNANT BEEF COWS OR FIRST 1/3 OF PREGNANCY

$$DMI = (((SBW^{0.75} \times (0.04997 \times NEma^2 + 0.03840) / NEma) \times TEMP1 \times MUD1 + 0.2 \times Milk$$

For diets with a NEm < 1.0 Mcal/kg then NEma (divisor) = 0.95.

PREGNANT BEEF COWS (LAST 2/3 OF PREGNANCY)

$DMI = ((SBW^{0.75} \times (0.04997 \times NEm^2 + .04631) / NEma) \times TEMP1 \times MUD1 + 0.2 \times Milk$

For diets with a NEm < 1.0 Mcal/kg then NEma (divisor) = 0.95.

Where:

- ADTV is feed additive adjustment factor for DMI (Table 2.6).
- BFAF is body fat adjustment factor (Table 2.6).
- BI is breed adjustment factor for DMI (Table 2.6).
- DMI is dry matter intake, kg/day.
- Milk is milk production, kg/day.
- MUD1 is mud adjustment factor for DMI.
- NEma is net energy value of diet for maintenance, Mcal/kg.
- SBW is shrunk body weight, kg.
- TEMP1 is temperature adjustment factor for DMI.

LACTATING DAIRY CATTLE

Based on Milligan et al. (1981) with lag from Roseler et al. (1997). If week in milk ≤ 16 then: $Lag = 1 - \exp(-(0.564 - 0.124 \times PKMK) \times (\text{Week in milk} + P))$ otherwise $Lag = 1$. P = 2.36 for PKMK = 1 or 2, and P = 3.67 for PKMK = 3. Note that CNCPS 5.0 assumes PKMK=2, since it is not an input variable.

$FCM = 0.4 \times Milk + 15 \times Milk \times MF$

$DMI = ((0.0185 \times FBW + 0.305 \times FCM \times TEMP1 \times MUD1) \times Lag$

LACTATING DAIRY CROSSED WITH *BOS INDICUS*

Based on Traxler (1997):

$DMI = (FBW^{0.75} \times (0.1462 \times NEm - 0.0517 \times NEm^2 - 0.0074) + 0.305 \times FCM) + C$

If Milk (kg) > 15 then $C = 1.7$, otherwise $C = 0$

DRY DAIRY CATTLE

Based on Milligan et al. (1981):

$DMI = (0.02 \times SBW \times TEMP1 \times MUD1) \times C$

If t > 259 then $C = 0.8$, otherwise $C = 1$

TEMPERATURE AND MUD FACTORS

Temperature < 20°C

If *Temperature* < -20 °C: $DMIAF = 1.16$

otherwise: $DMIAF = 1.0433 - .0044 \times Tc + .0001 \times Tc^2$

TEMP1=DMIAF

Temperature > 20°C without night cooling

DMIAFN = (119.62 × (-0.9708 × CETI)) / 100
TEMP1=DMIAFN

Temperature > 20°C with night cooling

DMIAFC = ((1 - DMIAFN) × 0.75) + DMIAFN
TEMP1=DMIAFC

Mud

MUD1 = 1 - 0.01 × (mud depth, cm)

Where:

CETI is Current Months Effective Temperature Index (°C).
DMIAF is dry matter intake adjustment factor for temperature <-20^0 C.
DMIAFC is dry matter intake adjustment factor with night cooling (%).
DMIAFN is dry matter intake adjustment factor with no night cooling (%).
FCM is fat corrected milk.
Milk is daily milk production, kg/day.
PKMK is month post-calving when peak milk yield occurs.
PQ is milk fat %.

Table 2.6. Adjustment factors for dry matter intake of beef cattle[1,2]

Adjustment factor	Multiplier
Breed (BI)	
Holstein	1.08
Holstein x Beef	1.04
Empty body fat (BFAT) (***not used for herd replacement heifers***)	
If EqSBW ≥ 350 kg then BFAF = 0.7714 + 0.00196×EqSBW – 0.00000371×EqSBW^2	
Anabolic implant (ADTV)	
Anabolic implant	1.00
No anabolic implant	0.94

[1] NRC (2000).
[2]The "growing calves" equation is used for all classes of dairy replacement heifers, with none of the above adjustments, based on NRC (2001).

SUPPLY OF NUTRIENTS

LEVEL 1 SUPPLY OF ENERGY AND PROTEIN

Total digestible nutrients (TDN) at maintenance

TDN_{1x} (% of DM) is computed with the Weiss et al. (1992) equation. Then one (growing beef or dairy, or lactating beef) or two (lactating dairy) discounts (dTDN) are applied to adjust to 2x or 3x level of intake, respectively. The NRC systems are then used to compute DE, ME, NEm, NEg, and NEl, and MP.

$$TDN_{1x}\ \% = 0.98 \times (100 - NDFn - CP - Ash - EE + IADICP) + (KDcp \times CP) + 2.70 \times (EE - 1) + 0.75 \times (NDFn - Lig) \times (1 - (Lig / NDFn)^{2/3}) - 7$$

Note: all values are as a percent of DM except ADFIP and NDFIP (% of CP).

Where:

ADICP is ADF indigestible crude protein: (ADFIP / 100) × CP;
EE is ether extract, assumed to be equal to total fat;
IADICP is indigestible acid detergent insoluble crude protein, and is computed as
For forages: (0.7 × ADICP);
For concentrates: (0.4 × ADICP);
KDcp is calculated factor for the digestibility of the CP, and is computed as
For forages: exp(-0.0012 × ADFIP);
For concentrates: 1 - (0.004 × ADFIP);
Lig is Lignin (% of DM) and is computed as (Lignin / 100) × NDF;
NDFn is NDF corrected for nitrogen: NDF - NDFICP + IADICP;
NDICP is NDF indigestible crude protein: (NDFIP / 100) × CP;

TDN at different levels of dry matter intake

The discount equation of TDN_{1x} is used to adjust the effect of levels of intake on the digestibility of the feed using the following equations:

For forages, based on Tedeschi (2001, Ch. 2):

$$dTDN = 0.53 + 0.99 \times TDN_{1x} - 0.009 \times NDF + 0.00005 \times TDN_{1x} \times NDF + 8.96 \times DMIFactor - 0.1 \times TDN_{1x} \times DMIFactor - 0.13 \times NDF \times DMIFactor + 0.0005 \times TDN_{1x} \times NDF \times DMIFactor$$

For concentrates, based on Tedeschi (2001, Ch. 2):

$$dTDN = 1.01 \times TDN_{1x} - 1.77 \times DMIFactor - 0.99$$

The following equations are used to convert dTDN to DE, ME, and NE for different classes:

DE, Mcal/kg = (dTDN/100) × 4.409 (all classes)
ME, Mcal/kg = (DE × 1.01) - 0.45 (dry and lactating dairy)
ME, Mcal/kg = 0.82 × DE (all beef cattle and growing dairy)
NEm, Mcal/kg = $1.37 \times ME - 0.138 \times ME^2 + 0.0105 \times ME^3 - 1.12$ (all classes)
NEg, Mcal/kg = $1.42 \times ME - 0.174 \times ME^2 + 0.0122 \times ME^3 - 1.65$ (all classes)

NEl, Mcal/kg = ME × 0.644 (all classes)

Undegraded intake protein (UIP)

The following equations are used to predict UIP at any level of dry matter intake based on UIP_{1x} (Tedeschi, 2001, Ch. 2):

$$UIP = (0.167 + a) + (1 + b) \times UIP_{1x} + (4.3 + c) \times DMIFactor + (-0.032 + d) \times UIP_{1x} \times DMIFactor$$

Where:

UIP_{1x} is UIP at mantenance dry matter intake (% CP).

Coefficients a, b, c, and d are –0.07, 0.01, 0.17, and 0.09 for concentrates, otherwise zero.

If peNDF < 20% then peNDF factor = (1- (20 - diet peNDF) × 0.025) otherwise peNDF factor = 1

MP (g/day) = (dTDN × DMIg × 0.13 × 0.64 × peNDF factor) + UIP × CP × DMIg × 0.8

Nitrogen Balance (g/day) = ((1 - UIP) × DMIg × CP)/6.25 + RecycledN - (dTDN × DMIg × 0.13 × peNDF factor × 0.16)

Where:

DMI factor is (DMI / maintenance DMI) – 1: 0 at maintenance intake, 1 for 2X maintenance intake, and 2 for 3X maintenance intake;

UIP is undegraded intake protein. UIP3x is used for lactating dairy cows. All other classes of animals use UIP1x/2x.

LEVEL 2 SUPPLY OF ENERGY, PROTEIN, AND AMINO ACIDS

Predicting the energy content of the ration is accomplished by estimating apparent TDN of each feed and for the total ration as described by Russell et al. (1992), Sniffen et al. (1992), and NRC (2000), and utilizing equations and conversion factors to estimate ME, NEm, NEg, and NEl values, as described by Fox et al. (1992) and NRC (2000). To calculate apparent TDN, apparent digestibilities for carbohydrates, proteins and fats are estimated. These apparent digestibilities are determined by simulating the degradation, passage, and digestion of feedstuffs in the rumen and small intestine. Also, microbial yields and fecal composition are estimated. Feed composition values used include: NDF, lignin, CP, Fat, Ash, NDFIP, as a percent of the diet DM and starch and sugar expressed as a percentage of non-fiber carbohydrates.

Rumen microorganisms can be categorized according to the types of carbohydrate they ferment. In the CNCPS, they are categorized into those that ferment fiber carbohydrates (FC) and nonfiber carbohydrate (NFC), as described by Russell et al. (1992) and the NRC (2000). Generally, FC microorganisms ferment cellulose and hemicellulose and grow more slowly, and utilize ammonia as their primary nitrogen source for microbial protein synthesis. NFC microorganisms in contrast ferment starch, pectin and sugars, grow more rapidly and can utilize ammonia and amino acids as nitrogen sources. The FC and NFC microorganisms have different maintenance requirements (the CNCPS uses 0.05 and 0.15 g of carbohydrate per g of microorganism per hour, respectively) and efficiency of growth of NFC digesting bacteria is optimized at 14% peptides as a percentage of NFC. Thus the degradable protein requirement is for supporting optimal utilization of NFC and FC to meet respective microbial growth requirements. The rate of microbial growth of each category is directly proportional to the rate of carbohydrate digestion, so long as a suitable nitrogen source is available. The extent of digestion in the rumen depends on digestion of FC and NFC feed fractions and how rapidly the feed passes out of the rumen. The extent of digestion thus depends on factors such as level of intake, particle size, rate of hydration, lignification, and characteristics of each carbohydrate and protein fraction.

The ME and MP derived in each situation will primarily depend on the unique rates of digestion and passage of the individual feed carbohydrate and protein fractions that are being fed. Digestion rates are feed specific, and depend primarily on type of starch and protein, degree of lignification, and degree of processing. Extent of ruminal digestion is a function of competition between digestion and passage, and varies with feed type (forage vs. grain) and particle size (peNDF). There are four nitrogen fraction requirements that must be met in evaluating a ration with the CNCPS; two microbial categories (ammonia for the SC and peptides and ammonia for the NSC microbial pools), and two animal pools (MP and essential amino acids). In evaluating a diet, one must be able to determine how well all four requirements are being met.

One of the critical factors affecting microbial growth is rumen pH. The CNCPS describes physical characteristics of feeds as related to their effectiveness in stimulating chewing, rumination and increased rumen motility based on their total cell wall content and particle size within classes of feeds (effective NDF; peNDF). The peNDF value in the CNCPS is defined as the percent of the NDF retained on a 1.18 mm screen as described by Mertens (1997). Factors other than particle size that influence the peNDF value are degree of lignification of the NDF, degree of hydration, and bulk density. Pitt et al. (1996) described the relationship between CNCPS peNDF values, rumen pH and SC digestion. Total microbial yield and SC growth rate rapidly declines below a pH of 6.2, which relates to a diet peNDF content of 20%. The CNCPS reduces microbial yield 2.5 percentage units for each percentage drop in diet peNDF below 20%. Thus the diet peNDF must be accurately predicted to accurately predict microbial amino acid production and cell wall digestion.

Additionally, a rumen nitrogen deficiency reduces microbial growth and cell wall digestion (Tedeschi et al., 2000a). The CNCPS rumen model accounts for the effects of a ruminal nitrogen deficiency on forage digestion rates, based on the model published by Tedeschi et al. (2000a). Fiber digestion rate and microbial yield are reduced proportional to the ammonia deficiency.

Feed composition in the CNCPS is described by carbohydrate and protein fractions and their digestion rates, which are used to compute the amount of SC and NSC available for each of the two microbial pools (Sniffen et al., 1992). Digestion and passage rates have been developed for common feeds, based on data in the literature, as described by Sniffen et al. (1992). All of the carbohydrate and protein fractions needed to predict the amounts of degradable carbohydrate and protein fractions available to support rumen fermentation can be determined in feed testing laboratories, using the Van Soest et al. (1991) system of feed analysis and proximate analysis. Included are NDF, CP, soluble protein, neutral and acid detergent insoluble protein, fat and ash. The CNCPS feed library contains over 150 feeds that are described by these analyses, as described by Sniffen et al. (1992). Included are digestion rates for sugars (CHO A), starch and pectin (CHO B1), available NDF (CHO B2) and fast (B1), intermediate (B2) and slow (B3) protein. Total carbohydrates are computed as 100-(protein + fat + ash), using tabular or analytical values. Then carbohydrates are partitioned into structural (SC) and nonstructural (NSC) by subtracting NDF from total carbohydrates, with the available fiber being

NDF - NDF_N - (Lignin × 2.4). Data from the literature is used to establish the distribution of sugars and starch in the NSC fraction. The growth of two microbial pools (SC and NSC) is then predicted, based on the integration of rates of digestion and passage, which in turn determines the nitrogen requirements of each pool, microbial protein produced and MP available from this source, carbohydrates escaping digestion and digested postruminally and ME derived from the diet. Passage rates are a function of level of intake, percent forage, and effective NDF value. Simultaneously, the degraded and undegraded protein pools are predicted, which are used to determine nitrogen balance for each of the microbial pools, feed protein escaping undegraded and digested postruminally, and MP derived from undegraded feed protein. The protein fractions are expressed as a percentage of the CP. The "A" protein fraction is NPN and the "B1" fraction is true protein that is nearly all degraded in the rumen; these pools are measured as soluble protein. The "C" protein fraction is measured as acid detergent insoluble protein (ADIP) and is assumed to be unavailable. The "B3" or slowly degraded protein fraction can be determined by subtracting the value determined for ADIP from the value determined for neutral detergent insoluble protein (NDIP). The "B2" fraction, which is partly degraded in the rumen, depending on digestion and passage rates, can be then estimated as the difference between CP and the sum of soluble + B3 + C. Feed amino acid content is described by their concentration in the undegraded protein, as described by O'Connor et al. (1993) Intestinal digestibility of the amino acids is assumed to be 100% in the B1 and B2 and 80% in the B3 protein escaping ruminal degradation.

Summary of equations to predict supply of nutrients

Intake carbohydrate

Based upon feed chemical analyses (as described in section 3), equations used to calculate carbohydrate composition of the j^{th} feedstuff are listed below:

CHO_j (%DM)= 100 - CP_j - FAT_j - ASH_j
CC_j (%DM) = NDF_j × 0.01 × $LIGNIN_j$ × 2.4
$CB2_j$ (%DM) = NDF_j - ($NDFIP_j$ × 0.01 × CP_j) - CC_j
NFC_j (%DM) = CHO - $CB2_j$ - CC_j
$CB1_j$ (%DM) = $STARCH_j$ × NFC_j / 100
CA_j (%DM) = NFC_j - $CB1_j$

Where:
- ASH_j(%DM) is percentage of ash of the j^{th} feedstuff.
- CA_j(%DM) is percentage of DM of the j^{th} feedstuff that is sugar.
- $CB1_j$(%DM) is percentage of DM of the j^{th} feedstuff that is starch.
- $CB2_j$(%DM) is percentage of DM of the j^{th} feedstuff that is available fiber.
- CC_j(%DM) is percentage of DM in the j^{th} feedstuff that is unavailable fiber.
- CHO_j(%DM) is percentage of carbohydrate of the j^{th} feedstuff.
- CP_j(%DM) is percentage of crude protein of the j^{th} feedstuff.
- FAT_j(%DM) is percentage of fat of the j^{th} feedstuff.
- FC_j(%DM) is percentage of the DM in the j^{th} feedstuff that is nonfiber carbohydrates.
- $LIGNIN_j$(%NDF) is percentage of lignin of the j^{th} feedstuff's NDF.
- $NDFIP_j$(%CP) is the percentage of neutral detergent insoluble protein in the crude protein of the j^{th} feedstuff.

NDF_j(%DM) is percentage of the j^th^ feedstuff that is neutral detergent fiber.
$STARCH_j$(%NFC) is percentage of starch in the non-structural carbohydrate of the j^{th} feedstuff.

Intake protein

The Ruminant Nitrogen Usage (NRC, 1985) equation is used to predict recycled nitrogen:

$$U = 121.7 - 12.01 \times X + 0.3235 \times X^2$$

Where:
U is urea N recycled (percent of N intake).
X is diet CP, as a percent of diet dry matter.

The following equations are be used to calculate the five protein fractions contained in the j^{th} feedstuff from percent of crude protein, percent of protein solubility, percent of NDFIP, and percent of ADFIP:

$$PA_j\ (\%DM) = NPN_j \times 0.0001 \times SOLP_j \times CP_j$$
$$PB1_j(\%DM) = SOLP_j \times CP_j \times 0.01 - PA_j$$
$$PC_j(\%DM) = ADFIP_j \times CP_j \times 0.01$$
$$PB3_j(\%DM) = (NDFIP_j - ADFIP_j) \times CP_j \times 0.01$$
$$PB2_j(\%DM) = CP_j - PA_j - PB1_j - PB3_j - PC_j$$

Where:
$ADFIP_j$(%CP) is percentage of the j^{th} feedstuff that is acid detergent insoluble protein.
CP_j(%DM) is percentage of crude protein of the j^{th} feedstuff.
$NDFIP_j$(%CP) is percentage of the crude protein of the j^{th} feedstuff that is neutral detergent insoluble protein.
NPN_j(%soluble protein) is percentage of soluble protein in the crude protein of the j^{th} feedstuff that is non-protein nitrogen times 6.25.
PA_j(%DM) is percentage of crude protein in the j^{th} feedstuff that is non-protein nitrogen.
$PB1_j$(%DM) is percentage of crude protein in the j^{th} feedstuff that is rapidly degraded protein.
$PB2_j$(%DM) is percentage of crude protein in the j^{th} feedstuff that is intermediately degraded protein.
$PB3_j$(%DM) is percentage of crude protein in the j^{th} feedstuff that is slowly degraded protein.
PC_j(%DM) is percentage of crude protein in the j^{th} feedstuff that is bound protein.
$SOLP_j$(%CP) is percentage of the crude protein of the j^{th} feedstuff that is soluble protein.

ADJUSTMENT OF CHO-B2 FRACTION FOR THE EFFECT OF DIET PH

If peNDF < 24.5%: $pH = 5.425 + 0.04229 \times peNDF$
Otherwise: $pH = 6.46$

$$Y_{1j} = 1 / (KM1 / (kd_{6j} - KM1 \times YG1) + 1 / YG1)$$
$$KM1' = 0.1409 - 0.0135 \times pH$$
$$YG1' = -0.1058 + 0.0752 \times pH$$

If pH> 5.7:

$$RelY = (1 - \exp(-5.624 \times (pH - 5.7)^{0.909})) / 0.9968$$
$$Y'_{1j} = RelY \times Y_{1j}$$
$$Kd'_{6j} = (KM1' \times Y'_{1j} \times YG1') / (YG1' - Y'_{1j}) + KM1' \times YG1'$$

Otherwise:

$$RelY = 0$$
$$Y'_{1j} = 0$$
$$Kd'_{6j} = 0$$

$$Kd_{6j} = Min(Kd'_{6j} , Kd_{6j})$$

Where:

peNDF is % effective NDF in ration.
Kd_{6j} is feed specific degradation rate of available NDF (decimal form), which must be ≥ $0.02h^{-1}$.
Kd'_{6j} is pH adjusted feed specific degradation rate of available fiber fraction (decimal form).

COMPUTING RUMINAL ESCAPE OF CARBOHYDRATE AND PROTEIN

Ruminal degradation and escape of carbohydrate and protein fractions are determined by the following formulas, using digestion rates for each carbohydrate and protein fraction, and the passage rate equation which uses % forage and % physically effective NDF:

$$RD = Kd / (Kd + Kp)$$
$$RESC = Kp / (Kd + Kp)$$

Where:

Kd is degradation rate of feedstuff component.
Kp is passage rate of feedstuff.
RD is a proportion of component of a feedstuff degraded in the rumen.
RESC is a proportion of component of feedstuff escaping ruminal degradation.

CALCULATION OF PASSAGE RATES

$$kpf = (0.38 + (0.022 \times DMI \times 1000 / FBW^{0.75}) + 2.0 \times FORAGE^{2}) / 100$$
$$kpc = (-0.424 + (1.45 \times Kpf)) / 100$$
$$kpl = (4.413 + 0.191 \times DMI \times 1000 / FBW) / 100$$

where:

FORAGE is forage concentration in the diet, g/g.
kpc is concentrate passage rate.
kpf is forage passage rate.
kpl is liquid passage rate.
FBW is full body weight, kg.

kp is adjusted for individual feeds using a multiplicative adjustment factor (Af) for particle size using diet physically effective NDF (peNDF):

For forages:

$$Af_{j} = 100 / (NDF_{j} \times peNDF_{j} /100 + 70)$$

$Kp_j = kpf \times Af_j$

For concentrates:

$Af_j = 100 / (NDF_j \times peNDF_j + 90)$
$kp_j = kpc \times Af_j$

Where:

$peNDF_i$ is effective NDF concentration of individual feedstuff, percent (decimal form).

The peNDF requirement is computed as:

If growing/finishing then $peNDFr = 0.1 \times DMI$
Otherwise, $peNDFr = 0.23 \times DMI$

The following equations calculate the amounts of protein that are ruminally degraded.

$RDPA_j = I_j \times Pa_j$
$RDPB1_j = I_j \times PB1_j \times (Kd_{1j} / (Kd_{1j} + Kp_j))$
$RDPB2_j = I_j \times PB2_j \times (Kd_{2j} / (Kd_{2j} + Kp_j))$
$RDPB3_j = I_j \times PB3_j \times (Kd_{3j} / (Kd_{3j} + Kp_j))$
$RDPEP_j = RDPB1_j + RDPB2_j + RDPB3_j$

Where:

I_j is intake of the j^{th} feedstuff g/day.
Kd_{1j} is the rumen rate of digestion of the rapidly degraded protein fraction of the j^{th} feedstuff, h^{-1}.
Kd_{2j} is the rumen rate of digestion of the intermediately degraded protein fraction of the j^{th} feedstuff, h^{-1}.
Kd_{3j} is the rumen rate of digestion of the slowly degraded protein fraction of the j^{th} feedstuff, h^{-1}.
Kp_j is the rate of passage from the rumen of the j^{th} feedstuff, h^{-1}.
$RDPA_j$ is the amount of ruminally degraded NPN in the j^{th} feedstuff, g/day.
$RDPB1_j$ is the amount of ruminally degraded B1 true protein in the j^{th} feedstuff, g/day.
$RDPB2_j$ is the amount of ruminally degraded B2 true protein in the j^{th} feedstuff, g/day.
$RDPB3_j$ is the amount of ruminally degraded B3 true protein in the j^{th} feedstuff, g/day.
$RDPEP_j$ is the amount of ruminally degraded peptides from the j^{th} feedstuff, g/day.

The undegraded protein is passed to the small intestine and the following equations calculate the amount of each protein fraction that escapes rumen degradation:

$REPB1_j = I_j \times PB1_j \times (Kp_j / (Kd_{1j} + Kp_j))$
$REPB2_j = I_j \times PB2_j \times (Kp_j / (Kd_{2j} + Kp_j))$
$REPB3_j = I_j \times PB3_j \times (Kp_j / (Kd_{3j} + Kp_j))$
$REPC_j = I_j \times PC_j$

Where:

$REPB1_j$ is the amount of ruminally escaped B1 true protein in the j^{th} feedstuff, g/day.
$REPB2_j$ is the amount of ruminally escaped B2 true protein in the j^{th} feedstuff, g/day.
$REPB3_j$ is the amount of ruminally escaped B3 true protein in the j^{th} feedstuff, g/day.
$REPC_j$ is the amount of rumen escaped bound C protein from the j^{th} feedstuff, g/day.

The following equations are used to calculate the amounts of each of the carbohydrate fractions of the jth feedstuff that are ruminally digested:

$RDCA_j = I_j \times CA_j \times (Kd_{4j} / (Kd_{4j} + Kp_j))$
$RDCB1_j = I_j \times CB1_j \times (Kd_{5j} / (Kd_{5j} + Kp_j))$
$RDCB2_j = I_j \times CB2_j \times (Kd_{6j} / (Kd_{6j} + Kp_j))$

Where:
Kd_{4j} is the rumen rate of sugar digestion of the jth feedstuff, h^{-1}.
Kd_{5j} is the rumen rate of starch digestion of the jth feedstuff, h^{-1}.
Kd_{6j} is the rumen rate of available fiber digestion of the jth feedstuff, h^{-1}.
$RDCA_j$ is the amount of ruminally degraded sugar from the jth feedstuff, g/day.
$RDCB1_j$ is the amount of ruminally degraded starch from the jth feedstuff, g/day.
$RDCB2_j$ is the amount of ruminally degraded available fiber from the jth feedstuff, g/day.

The following equations are used to calculate the amounts of each of the carbohydrate fractions of the jth feedstuff that escape the rumen:

$RECA_j = I_j \times CA_j \times (Kp_j / (Kd_{4j} + Kp_j))$
$RECB1_j = I_j \times CB1_j \times (Kp_j / (Kd_{5j} + Kp_j))$
$RECB2_j = I_j \times CB2_j \times (Kp_j / (Kd_{6j} + Kp_j))$
$RECC_j = I_j \times CC_j$

Where:
$RECA_j$ is the amount of ruminally escaped sugar from the jth feedstuff, g/day.
$RECB1_j$ is the amount of ruminally escaped starch from the jth feedstuff, g/day.
$RECB2_j$ is the amount of ruminally escaped available fiber from the jth feedstuff, g/day.
$RECC_j$ is the amount of ruminally escaped unavailable fiber from the jth feedstuff, g/day.

CALCULATION OF MICROBIAL YIELD

Bacterial yields for structural and non-structural carbohydrate fermenting bacteria are given by the following:

If peNDF < 20: $YG_1 = YG_1 \times (1 - ((20 - peNDF) \times 0.025))$
If peNDF < 20: $YG_2 = YG_2 \times (1 - ((20 - peNDF) \times 0.025))$
$1 / Y_{1j} = (KM_1 / Kd_{6j}) + (1 / YG_1)$
$1 / Y_{2j} = (KM_2 / Kd_{4j}) + (1 / YG_2)$
$1 / Y_{3j} = (KM_2 / Kd_{5j}) + (1 / YG_2)$
$RDPEP = \sum_{j=1}^{n} (RDPEP_j)$

If Ionophore: PepUptakeRate (%/h) = $7 \times 2/3$
Otherwise: PepUptakeRate (%/h) = 7

RATIO = RDPEP/(RDCA + RDCB1 + RDPEP)
If RATIO > 0.18: RATIO = 0.18

$IMP = \exp(0.404 \times \ln(RATIO \times 100) + 1.942)$

$FCBACT_j = Y_{1j} \times RDCB2_j$
$Y_{2j} = Y_{2j} \times (1 + IMP \times 0.01)$
$Y_{3j} = Y_{3j} \times (1 + IMP \times 0.01)$
$NFCBACT_j = (Y_{2j} \times RDCA_j) + (Y_{3j} \times RDCB1_j)$

$$\text{Total\_FCBACT (g/d)} = \sum_{j=1}^{n} (FCBACT_j)$$

$$\text{Total\_NFCBACT (g/d)} = \sum_{j=1}^{n} (NFCBACT_j)$$

Total_NFCBACTMass (g) = Total_NFCBACT / (kpf × 24)
Total_NFCBACTPepUptake (g/h) = Total_NFCBACTMass × PepUptakeRate / 100
Total_RDPEPh (g/h) = RDPEP / 24
GrowthRate = 1 / (1 - kpl)

$$\text{DisappearanceTime} = \frac{\log\left(\frac{((\text{GrowthRate} - 1)/3600) * \text{Total\_RDPEPh}}{(\text{Total\_NFCBactPepUptake}/3600)} + 1\right)}{\log(1 + (\text{GrowthRate} - 1)/3600)} / 3600$$

If Total_NFCBACTPepUptake × DisappearanceTime > Total_RDPEPh:
PeptideUptake (g/d) = Total_RDPEPh × 24
Otherwise:
PeptideUptake (g/d) = Total_NFCBactPepUptake × DisappearanceTime × 24

PeptidePassing (g/d) = RDPEP - PeptideUptake
PeptideAccount (g/d) = PeptideUptake + PeptidePassing

BACTERIA N BALANCE

NFC bacteria

PeptideUptakeN = PeptideUptake/6.25
PeptideRequiredN = 0.66 × Total_NFCBACT × 0.625 / 6.25
PEPBAL = PeptideUptakeN - PeptideRequiredN
NFC_NH3_RequiredN = 0.34 × Total_NFCBACT × 0.625 / 6.25
NH3_Bacteria = Max(0, PeptideUptakeN - PeptideRequiredN)

$$\text{NH3\_Diet} = \sum_{j=1}^{n} (RDPA_i) / 6.25$$

$$\text{NH3\_Recycled} = ((121.7 - 12.01 \times (CP,\%) + 0.3235 \times (CP,\%)^2)/100) \times (\text{Total\_CP}/6.25)$$

FC bacteria

FC_NH3_AvailableN = Max(0, (NH3_Bacteria + NH3_Diet + NH3_Recycled) - NFC_NH3_RequiredN)
FC_NH3_RequiredN = Total_FCBACT × 0.625 / 6.25

BactNBalance = (PeptideUptakeN + NH3_Diet + NH3_Recycled) - (PeptideRequiredN + NFC_NH3_RequiredN + FC_NH3_RequiredN)

ADJUSTMENT OF MICROBIAL YIELD AND RUMEN ESCAPED CHO-B2 FOR A RUMINAL N DEFICIENCY

If the rumen N balance is less than 0, the following steps adjust microbial yield and FC escaping the rumen: 1) the sum of rumen available peptide and ammonia is divided by microbial N content to determine the N allowable microbial growth, 2) this value is subtracted from the energy allowable total microbial growth to obtain the reduction in yield, 3) This yield reduction is allocated between FC and NFC bacteria by their proportions in the energy allowable total bacterial growth, and 4) the loss in FC digested is computed as the loss in FC yield divided by its growth rate (y_{ij}), which is added to the FC escaping the rumen. Figure 2.1 summarizes the submodel developed to account for the effect of a ruminal N deficiency on cell wall digestion and microbial yield. The equations below describe this submodel using the CNCPS structure based on Tedeschi et al. (2000a):

If BactNBalance < 0 (ruminal N deficiency) then

$EFCBact_j = FCBact_j$
$ENFCBact_j = NFCBact_j$
$NAllowableBact = (PeptideUptakeN + NH3\_Diet + NH3\_Recycled) / 0.625 / 6.25$
$EBactRatio_j = (EFCBact_j + ENFCBact_j) / (Total\_FCBact + Total\_NFCBact)$
$NAllowableBact_j = NAllowableBact \times EBactRatio_j$
$BactRed_j = (EFCBact_j + ENFCBact_j) - NAllowableBact_j$
$EFCBactRatio_j = FCBact_j / (EFCBact_j + ENFCBact_j)$
$FCBactRed_j = BactRed_j \times EFCBactRatio_j$
$NFCBact_j = NFCBact_j - BactRed_j \times (1 - EFCBactRatio_j)$
$FCRed_j = FCBactRed_j / Y1_j$
$RDCB2_j = RDCB2_j - FCRed_j$

$$FCRedRatio = (100 \times \sum_{j=1}^{n} FCRed_j) / \sum_{j=1}^{n} RDCB2_j$$

$$NFCBact = \sum_{j=1}^{n} NFCBact_j$$

The amount of protein escaping in the non-degraded B2 fraction can be estimated in the following way:

$ProtB3Red_j = FCRed_j \times (NDFIP_j - ADFIP_j) \times CP_j$
$RDPB3_j = Max(0, RDPB3_j - ProtB3Red_j)$

The new microbial yield adjusted for ruminal N deficiency to estimate the new peptide uptake and peptide escaping the rumen degradation is calculated.

ADJUSTED RUMINAL FEED DEGRADATION FOR ESCAPING PEPTIDES

$RDPB1_j = Max(0, RDPB1_j - (PeptidePassing \times (RDPB1_j/(RDPB1 + RDPB2 + RDPB3))))$
$RDPB2_j = Max(0, RDPB2_j - (PeptidePassing \times (RDPB2_j/(RDPB1 + RDPB2 + RDPB3))))$
$RDPB3_j = Max(0, RDPB3_j - (PeptidePassing \times (RDPB3_j/(RDPB1 + RDPB2 + RDPB3))))$

RUMINAL FEED ESCAPING

$REPA_j = I_j \times ProtA_j \times (kp_j/(\infty + kp_j))$
$REPB1_j = I_j \times ProtB1_j \times (kp_j/(ProtB1\_kd_j + kp_j)) + (PeptidePassing \times (RDPB1_j/(RDPB1 + RDPB2 + RDPB3)))$
$REPB2_j = I_j \times ProtB2_j \times (kp_j/(ProtB2\_kd_j + kp_j)) + (PeptidePassing \times (RDPB2_j/(RDPB1 + RDPB2 + RDPB3)))$
$REPB3_j = I_j \times ProtB3_j \times (kp_j/(ProtB3\_kd_j + kp_j)) + (PeptidePassing \times (RDPB3_j/(RDPB1 + RDPB2 + RDPB3))) + ProtB3Red_j$
$RECA_j = I_j \times CHOA_j \times (kp_j/(CHOA\_kd_j + kp_j))$
$RECB1_j = I_j \times CHOB1_j \times (kp_j/(CHOB1\_kd_j + kp_j))$
$RECB2_j = I_j \times CHOB2_j \times (kp_j/(CHOB2\_kd_j + kp_j)) + FCRed_j$
$RECC_j = I_j \times CHOC_j \times (kp_j/(0 + kp_j))$

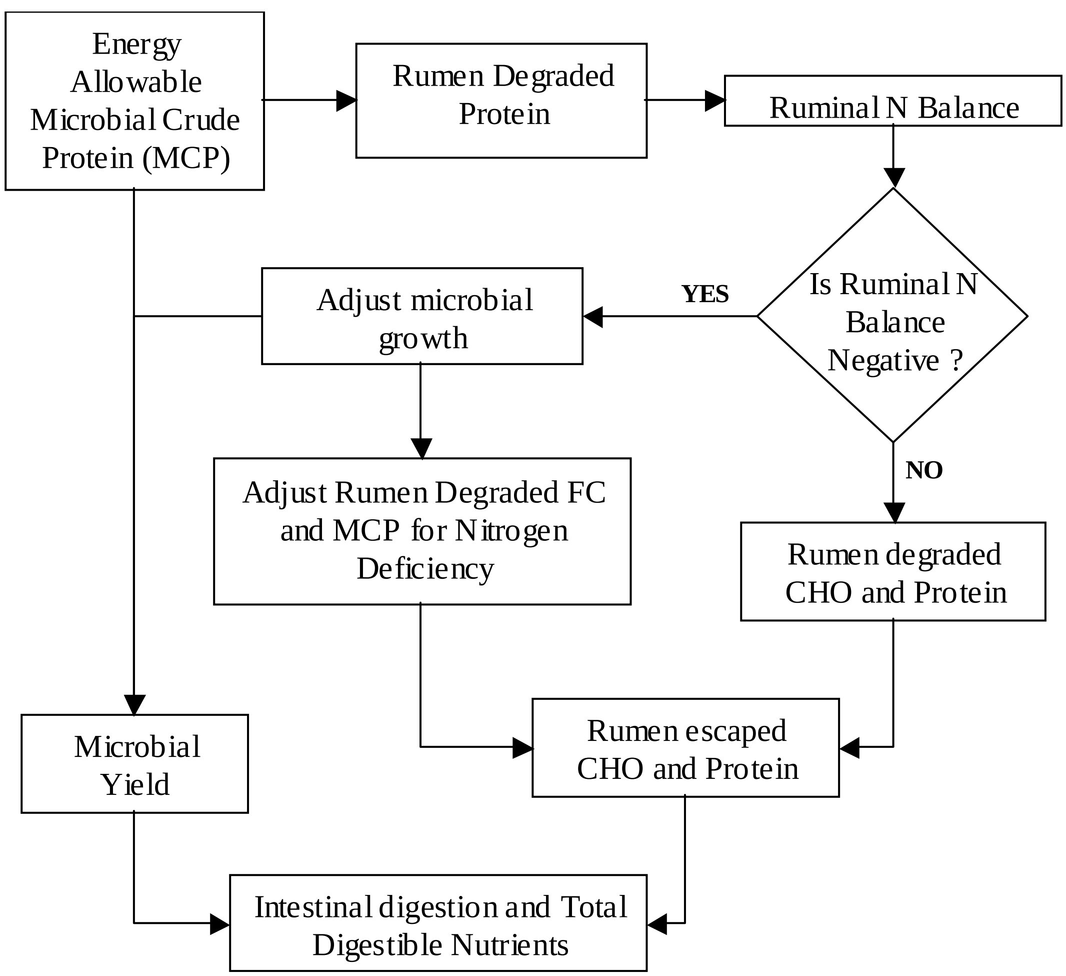
MICROBIAL COMPOSITION

$REBTP_j$ = 62.5% × 60% × Min($NAllowableBact_j$, $ENFCBact_j$ + $EFCBact_j$)
$REBCW_j$ = 62.5% × 25% × Min($NAllowableBact_j$, $ENFCBact_j$ + $EFCBact_j$)
$REBNA_j$ = 62.5% × 15% × Min($NAllowableBact_j$, $ENFCBact_j$ + $EFCBact_j$)
$REBCA_j$ = 21.1% × 80% × Min($NAllowableBact_j$, $ENFCBact_j$ + $EFCBact_j$)
$REBCB1_j$ = 21.1% × 20% × Min($NAllowableBact_j$,$ENFCBact_j$ + $EFCBact_j$)
$REBCHO_j$ = $REBCA_j$ + $REBCB1_j$
$REBFAT_j$ = 12% × Min($NAllowableBact_j$, $ENFCBact_j$ + $EFCBact_j$)
$REBASH_j$ = 4.4% × Min($NAllowableBact_j$, $ENFCBact_j$ + $EFCBact_j$)

EXCESS NITROGEN TO BE EXCRETED

BACTN = (Total_FCBACT + Total_NFCBACT) × 0.625/6.25
EN = (PeptideUptakeN + NH3_Diet + NH3_Recycled – BACTN) + (MP_a – MP_g)/6.25

Figure 2.1. Flowchart of ruminal degradation of CHO-B2 fraction adjusted for ruminal N deficiency and peptide uptake (Tedeschi et al., 2000a).



Where:

BACTj is yield of bacteria from the j^{th} feedstuff g/day.
BACTNBAL is bacterial nitrogen balance, g/day.
BACTNj is bacterial nitrogen, g/day.
BactRedj is the reduction in bacteria due to N deficiency from j^{th} feedstuff, g/day.
e is the base of the natural logarithms.
EBactRatioj is the percentage of bacteria from the j^{th} feedstuff, %.
EFCBactRatioj is the percentage of FC bacteria from the j^{th} feedstuff, %.
EN is nitrogen in excess of rumen bacterial nitrogen and tissue needs, g/day.
FCBACTj is yield of fiber carbohydrate bacteria from the j^{th} feedstuff g/day.
FCBACTNj is fiber carbohydrate bacterial nitrogen, g/day.
FCBactRedj is the amount of FC bacteria in the bacteria difference from j^{th} feedstuff, g/day.
FCRedj is the amount of CHO B2 not degraded by FC bacteria, g/day.
IMP is percent improvement in bacterial yield, %, due to the ratio of peptides to peptides plus non-structural CHO in j^{th} feedstuff.
Kd_{4j} is growth rate of the sugar fermenting carbohydrate bacteria, h^{-1}.
Kd_{5j} is growth rate of the starch fermenting carbohydrate bacteria,h^{-1}.
Kd_{6j} is growth rate of the fiber carbohydrate bacteria, h^{-1}.
KM1 is the maintenance rate of the fiber carbohydrate bacteria, 0.05 g FC/g bacteria/h.
KM1' is the pH adjusted KM1, 0.05 g FC/g bacteria/h.
KM2 is the maintenance rate of the non-fiber carbohydrate bacteria, 0.15 g NFC/g bacteria/h.
KM2' is the pH adjusted KM2, 0.15 g NFC/g bacteria/h.
Ln is the natural logarithm.
MPa is metabolizable protein supplied, g/day.
MPg is metabolizable protein required, g/day.
NAllowablej is the nitrogen allowable bacterial growth from the j^{th} feedstuff, g/day.
NewBacteria is the total bacterial growth allowable by the ruminal nitrogen available, g/day.
NFCBACTj is yield of non-fiber carbohydrate bacteria from the j^{th} feedstuff, g/day.
NFCBACTNj is non-fiber carbohydrate bacterial nitrogen, g/day.
PEPBAL is peptide balance, g nitrogen/day.
ProtB3Redj is the reduction in protein fraction B3 that is associated with the CHO B2 fraction not degraded of the j^{th} feedstuff, g/day.
Ratio is the ratio of peptides to peptide plus NFC in the j^{th} feedstuff.
RDCAj is the g NFC in the A (sugar) fraction of the j^{th} feedstuff ruminally degraded.
RDCB1j is the g NFC in the B1 (starch and pectins) fraction of the j^{th} feedstuff ruminally degraded.
RDCB2j is the g FC in the B2 (available fiber) fraction in the j^{th} feedstuff ruminally degraded.
RDPEPj is the peptides in the j^{th} feedstuff.
REBASHj is the amount of bacterial ash passed to the intestine by the j^{th} feedstuff, g/day.
REBCHOj is the amount of bacterial carbohydrate passed to the intestine by the j^{th} feedstuff, g/day.
REBCWj is the amount of bacterial cell wall protein passed to the intestine by the j^{th} feedstuff, g/day.
REBFATj is the amount of bacterial fat passed to the intestine by the j^{th} feedstuff, g/day.
REBNAj is the amount of bacterial nucleic acids passed to the intestine by the j^{th} feedstuff, g/day.
REBTPj is the amount of bacterial true protein passed to the intestine by the j^{th} feedstuff, g/day.
Y_{1j} is yield efficiency of FC bacteria from the available fiber fraction of the j^{th} feedstuff, g FC bacteria/g FC digested.

Y'_{1j} is the pH adjusted Y_{1j}, g FC bacteria/g FC digested.
Y_{2j} is yield efficiency of NFC bacteria from the sugar fraction of the j^{th} feedstuff, g NFC bacteria/g NFC digested.
Y_{3j} is yield efficiency of NFC bacteria from the starch fraction of the j^{th} feedstuff, g NFC bacteria/g NFC digested.
YG1 is the theoretical maximum yield of the fiber carbohydrate bacteria, 0.4 g bacteria/g FC/h.
YG1' is the pH adjusted YG1, 0.4 g bacteria/g FC/h.
YG2 is the theoretical maximum yield of the non-fiber carbohydrate bacteria, 0.4 g bacteria/g NFC/h.

INTESTINAL DIGESTIBILITIES AND ABSORPTION

Experimentally measured digestibility coefficients are used to predict intestinal digestibilities and fecal losses based on summaries of data in the literature (Sniffen et al., 1992; Knowlton et al., 1998). NDF escaping the rumen is assumed to have an intestinal digestibility of only 20% because the small intestine lacks the enzymes to digest cellulose and hemicellulose. Intestinal digestibilities for protein fractions that escape the rumen are: PROT A, B1, and B2, 100%; PROT B3, 80%, and PROT C, 0%. Intestinal starch digestibility depends on type of grain, degree of processing, and level of intake above maintenance (Sniffen et al., 1992; Knowlton et al., 1998). Ranges are provided for the user to adjust intestinal starch digestion for the situation, based on observation of the feces, and in adjusting inputs to account for differences between actual and model predicted performance. For most conditions, the ranges suggested are based on studies with growing beef steers and lactating dairy cows consuming feed at two to three times maintenance level of intake (Sniffen et al., 1992): whole corn, 30 to 50%; cracked corn, 50 to 70%; dry rolled corn, 70 to 80%; corn meal, 80 to 90%; whole high moisture corn, 80 to 90%; high moisture ground corn, 85 to 95%; steam flaked corn, 92 to 97%; dry rolled sorghum, 60 to 70%; dry ground sorghum, 70 to 80%; and steam flaked Sorghum, 90 to 95%. Based on recent studies and a review of the literature (Knowlton et al., 1998), modifications of the above for high producing dairy cows (above 45 kg millk) fed corn are: whole corn, 30 to 40%; cracked corn, 40 to 60%; corn meal, 70 to 90%; and rolled high moisture corn, 75 to 85%. Although little escapes digestion in the rumen, starch from processed small grains (wheat, barley, oats) has a high intestinal digestibility (over 90%).

A more mechanistic approach is needed that incorporates the integration of digestion and passage to predict intestinal digestion. However, the accuracy of prediction of pool sizes digested depends on the accuracy of prediction of ruminal flows, and therefore has second priority to prediction of ruminal fermentation, particularly since, with most feeds, over 75% of total tract digestion occurs in the rumen.

Summary of equations to predict intestinal digestion

Equations for calculating digested protein from feed and bacterial sources are listed below:

$DIGPB1_j = IntDigPB1_j \times REPB1_j$
$DIGPB2_j = IntDigPB2_j \times REPB2_j$
$DIGPB3_j = IntDigPB3_j \times REPB3_j$
$DIGFP_j = DIGPB1_j + DIGPB2_j + DIGPB3_j$
$DIGBTP_j = REBTP_j$

$DIGBNA_j = REBNA_j$
$DIGP_j = DIGFP_j + DIGBTP_j + DIGBNA_j$

Where:
$DIGBNA_j$ is the digestible bacterial nucleic acids produced from the j^{th} feedstuff, g/day.
$DIGBTP_j$ is the digestible bacterial true protein produced from the j^{th} feedstuff, g/day.
$DIGFP_j$ is the digestible feed protein from the j^{th} feedstuff, g/day.
$DIGPB1_j$ is the digestible B1 protein from the j^{th} feedstuff, g/day.
$DIGPB2_j$ is the digestible B2 protein from the j^{th} feedstuff, g/day.
$DIGPB3_j$ is the digestible B3 protein from the j^{th} feedstuff, g/day.
$DIGP_j$ is the digestible protein from the j^{th} feedstuff, g/day.
IntDigPB1 is the B1 protein intestinal digestibility of the j^{th} feedstuff (default = 100%).
IntDigPB2 is the B2 protein intestinal digestibility of the j^{th} feedstuff (default = 100%).
IntDigPB3 is the B3 protein intestinal digestibility of the j^{th} feedstuff (default = 80%).

The equations for calculating digested carbohydrate due to the j^{th} feedstuff are listed below:
$DIGFC_j = IntDigCA_j \times RECAj + IntDigCB1_j \times RECB1_j + IntDigCB2_j \times RECB2_j$
$DIGBC_j = 0.95 \times REBCHO_j$
$DIGC_j = DIGFC_j + DIGBC_j$

Where:
$DIGBC_j$ is digested bacterial carbohydrate produced from the j^{th} feedstuff, g/day.
$DIGC_j$ is digestible carbohydrate from the j^{th} feedstuff, g/day.
$DIGFC_j$ is intestinally digested feed carbohydrate from the j^{th} feedstuff, g/day.
$IntDigCA_j$ is the A carbohydrate intestinal digestibility of the j^{th} feedstuff (default = 100%).
$IntDigCB1_j$ is the B1 carbohydrate intestinal digestibility of the j^{th} feedstuff (default = 75%).
$IntDigCB2_j$ is the B2 carbohydrate intestinal digestibility of the j^{th} feedstuff (default = 20%).

The following equation is used to calculate ruminally escaped fat from the j^{th} feedstuff:
$REFAT_j = I_j \times FAT_j$

Where:
FAT is fat composition of the j^{th} feedstuff, g/day.
$REFAT_j$ is the amount of ruminally escaped fat from the j^{th} feedstuff, g/day.

Equations for calculating digestible fat from feed and bacterial sources are listed below:
$DIGFF_j = IntDigFAT_j \times REFAT_j$
$DIGBF_j = 0.95 \times REBFAT_j$
$DIGF_j = DIGFF_j + DIGBF_j$

Where:
$DIGBF_j$ is digestible bacterial fat from the j^{th} feedstuff, g/day.
$DIGFF_j$ is digestible feed fat from the j^{th} feedstuff, g/day.
$DIGF_j$ is digestible fat from the j^{th} feedstuff, g/day.
$IntDigFAT_j$ is the fat intestinal digestibility of the j^{th} feedstuff (default=95%).

FECAL OUTPUT

The following equations calculate undigested feed residues appearing in the feces from NDFIP, ADFIP, starch, fiber, fat, and ash fractions, based on Van Soest (1994):

$FEPB3_j = (1 - IntDigPB3_j) \times REPB3_j$

$FEPC_j = REPC_j$

$FEFP_j = FEPB3_j + FEPC_j$

$FECB1_j = (1 - IntDigCB1_j) \times RECB1_j$

$FECB2_j = (1 - IntDigCB2_j) \times RECB2_j$

$FECC_j = RECC_j$

$FEFC_j = FECB1_j + FECB2_j + FECC_j$

$FEFA_j = I_j \times ASH_j \times (1 - IntDigAsh_j)$

$FEFF_j = REFAT_j \times (1 - IntDigFAT_j)$

Where:

ASHj is the ash composition of the j^{th} feedstuff, g/day.
$FECB1_j$ is the amount of feed starch in feces from the j^{th} feedstuff, g/day.
$FECB2_j$ is the amount of feed available fiber in feces from the j^{th} feedstuff, g/day.
$FECC_j$ is the amount of feed unavailable fiber in feces from the j^{th} feedstuff, g/day.
$FEFA_j$ is the amount of undigested feed ash in feces from the j^{th} feedstuff, g/day.
$FEFC_j$ is the amount of feed carbohydrate in feces from the j^{th} feedstuff, g/day.
FEFF is the amount of undigested feed fat in feces from the j^{th} feedstuff, g/day.
$FEFP_j$ is the amount of feed protein in feces from the j^{th} feedstuff, g/day.
$FEPB3_j$ is the amount of feed B3 protein fraction in feces from the j^{th} feedstuff, g/day.
$FEPC_j$ is the amount of feed C protein fraction in feces from the j^{th} feedstuff, g/day.
$IntDigAsh_j$ is the ash intestinal digestibility of the j^{th} feedstuff (default = 50%).
$REFAT_j$ is the amount of ruminally escaped fat form the j^{th} feedstuff, g/day.

Microbial matter in the feces is composed of indigestible bacterial cell walls, bacterial carbohydrate, fat and ash (Van Soest, 1994):

$FEBCW_j = REBCW_j$

$FEBCP_j = FEBCW_j$

$FEBC_j = (1 - 0.95) \times REBCHO_j$

$FEBF_j = (1 - 0.95) \times REBFAT_j$

$FEBASH_j = (1 - 0.50) \times REBASH_j$

$FEBACT_j = FEBCP_j + FEBC_j + FEBF_j + FEBASH_j$

Where:

$FEBACT_j$ is the amount of bacteria in feces from the j^{th} feedstuff, g/day.
$FEBASH_j$ is the amount of bacterial ash in feces from the j^{th} feedstuff, g/day.
$FEBC_j$ is the amount of bacterial carbohydrate in feces from the j^{th} feedstuff, g/day.
$FEBCP_j$ is the amount of fecal bacterial protein from the j^{th} feedstuff, g/day.
$FEBCW_j$ is the amount of fecal bacterial cell wall protein from the j^{th} feedstuff, g/day.
$FEBF_j$ is the amount of bacterial fat in feces from the j^{th} feedstuff, g/day.

Endogenous protein, carbohydrate and ash are:

$FEENGP_j = 0.09 \times IDM_j$ (NRC, 1989)

$FEENGF_j = 0.0119 \times DMI_{gj}$ (Lucas et al., 1961)

$FEENGA_j = 0.017 \times DMI_{gj}$ (Lucas et al., 1961)

Where:

DMI_{gj} is amount of DM consumed of the j^{th} feedstuff, g/day.
$FEENGA_j$ is the amount of endogenous ash in feces from the j^{th} feedstuff, g/day.
$FEENGF_j$ is the amount of endogenous fat in feces from the j^{th} feedstuff, g/day.
$FEENGP_j$ is the amount of endogenous protein in feces from the j^{th} feedstuff, g/day.
IDM_j is the indigestible dry matter from the j^{th} feedstuff, g/day.

Total fecal DM is calculated by summing protein, carbohydrate, fat and ash DM contributions from undigested feed residues, microbial matter, and endogenous matter:

$$FEPROT_j = FEFP_j + FEBCP_j + FEENGP_j$$
$$FECHO_j = FEFC_j + FEBC_j$$
$$FEFAT_j = FEBF_j + FEFF_j + FEENGF_j$$
$$FEASH_j = FEFA_j + FEBASH_j + FEENGA_j$$
$$IDM_j = (FEFP_j + FEBCP_j + FECHO_j + FEFAT_j + FEASH_j) / 0.91$$

Where:

$FEASH_j$ is the amount of ash in feces from the j^{th} feedstuff, g/day.
$FECHO_j$ is the amount of carbohydrate in feces from the j^{th} feedstuff, g/day.
$FEFAT_j$ is the amount of fat in feces from the j^{th} feedstuff, g/day.
$FEPROT_j$ is the amount of fecal protein from the j^{th} feedstuff, g/day.

TOTAL DIGESTIBLE NUTRIENTS AND ENERGY VALUES OF FEEDSTUFFS

Apparent TDN is potentially digestible nutrient intake minus indigestible bacterial and feed components appearing in the feces:

$$TDNAPP_j = (DIET\ PROT_j - FEPROT_j) + (DIET\ CHO_j - FECHO_j) + (2.25 \times (DIET\ FAT_j - FEFAT_j))$$

Where:

$TDNAPP_j$ is apparent TDN from the j^{th} feedstuff, g/day.

The DE values for each feed are based on assuming 1 kg of TDN is equal to 4.409 Mcal of DE.

For lactating dairy: $ME_{aj} = (0.001 \times TDNAPP_j \times 4.409 \times 1.01) - 0.45$
Otherwise: $ME_{aj} = 0.001 \times TDNAPP_j \times 4.409 \times 0.82$

$$MEC_j = ME_{aj} / I_j$$
$$MEI = \sum_{j=1}^{n} ME_{aj}$$
$$MEC = MEI / DMI$$

Where:

ME_{aj} is metabolizable energy available from the j^{th} feedstuff, Mcal/day.
MEC is metabolizable energy concentration of the diet, Mcal/kg.
MEC_j is metabolizable energy concentration of the j^{th} feedstuff, Mcal/kg.
MEI is metabolizable energy supplied by the diet, Mcal/day.

CALCULATION OF NET ENERGY VALUES

$NEla_j = MECj \times 0.644$ (Moe and Tyrrell, 1976)
$NEga_j = (1.42 \times MEC_j - 0.174 \times MEC_j^2 + 0.0122 \times MEC_j^3 - 1.65)$ (NRC, 1984)
$NEma_j = (1.37 \times MEC_j - 0.138 \times MEC_j^2 + .0105 \times MEC_j^3 - 1.12)$ (NRC, 1984)

Where:
$NEga_j$ is net energy for gain content of the j^{th} feedstuff, Mcal/kg.
$NEla_j$ is net energy for lactation content of the j^{th} feedstuff, Mcal/kg.
$NEma_j$ is net energy for maintenance content of the j^{th} feedstuff, Mcal/kg.

METABOLIZABLE PROTEIN

Total feed MP is the sum of each feed MP:

$$MP_{aj} = DIGP_j - DIGBNA_j$$

$$MP_a = \sum_{j=1}^{n} MP_{aj}$$

Where:
MP_a is metabolizable protein available in the diet, g/day.
MP_{aj} is metabolizable protein from the j^{th} feedstuff, g/day.

AMINO ACID SUPPLY

Essential amino acid composition of the undegradable protein of each feedstuff is used to calculate supply of amino acids from the feeds. Microbial composition of essential amino acids is used to calculate the supply of amino acids from bacteria.

Bacterial amino acid supply to the duodenum

$$REBAAi = \sum_{j=1}^{n} (AABCW_i \times 0.01 \times REBCW_j) + (AABNCW_i \times 0.01 \times REBTP_j)$$

Where:
$AABCW_i$ is the i^{th} aa content of rumen bacteria cell wall protein, g/100g (Table 2.7).
$AABNCW_i$ is the i^{th} aa content of rumen bacteria non-cell wall protein, g/100g (Table 2.7).
$REBAA_i$ is the amount of the i^{th} bacterial amino acid appearing at the duodenum, g/day.
$REBCW_j$ is the bacterial cell wall protein appearing at the duodenum as a result of fermentation of the j^{th} feedstuff, g/day.
$REBTP_j$ is the bacterial non-cell wall protein appearing at the duodenum as a result of fermentation of the j^{th} feedstuff, g/day.

Bacterial amino acid digestion

$$DIGBAA_i = \sum_{j=1}^{n} AABNCWi \times 0.01 \times REBTP_j$$

Where:
$DIGBAA_i$ is the amount of the i^{th} absorbed bacterial amino acid, g/day.

Feed amino acid supply

$$REFAA_i = \sum_{j=1}^{n} AAINSP_{ij} \times 0.01 \times (REPB1_j + REPB2_j + REPB3_j + REPC_j)$$

Where:
$AAINSP_{ij}$ is the i^{th} amino acid content of the insoluble protein for the j^{th} feedstuff, g/100g.
$REFAA_i$ is the amount of i^{th} dietary amino acid appearing at the duodenum, g/day.
$REPB1_j$ is the rumen escaped B1 protein from the j^{th} feedstuff, g/day.
$REPB2_j$ is the rumen escaped B2 protein from the j^{th} feedstuff, g/day.
$REPB3_j$ is the rumen escaped B3 protein from the j^{th} feedstuff, g/day.
$REPC_j$ is the rumen escaped C protein from the j^{th} feedstuff, g/day.

Total duodenal amino acid supply

$$REAA_i = REBAA_i + REFAA_i$$

Where:
$REAA_i$ is the total amount of the i^{th} amino acid appearing at the duodenum, g/day.

Feed amino acid digestion

$$DIGFAA_i = \sum_{j=1}^{n} AAINSP_{ij} \times 0.01 \times (IDPB1 \times REPB1_j + IDPB2 \times REPB2_j + IDPB3 \times REPB3_j)$$

Where:
$DIGFAA_i$ is the amount of the i^{th} absorbed amino acid from dietary protein escaping rumen degradation, g/day.
IDPB1, IDPB2, and IDPB3 are intestinal digestibility of protein fractions B1, B2, and B3, respectively. By default they are 100, 100, and 80%, respectively.

Total metabolizable amino acid supply

$$AAA_{si} = DIGBAA_i + DIGFAA_i$$

Where:
AAA_{si} is the total amount of the i^{th} absorbed amino acid supplied by dietary and bacterial sources, g/day.

Amino acid ratio

To maximize milk protein production in lactating dairy cows, Rulquin (1993) reported that the Lysine ratio should be 7.3% MP and Methionine should be 2.5% of MP. However, these ratios cannot be achieved economically in most diets. Thus, a Lysine ratio exceeding 6.5% MP is acceptable with the Methonine ratio being 2.1 to 2.2% of MP with LYS:MET being 3:1. These values are different than the NRC (2001), which recommends LYS of 7.2% and MET of 2.4% and represents differences in the models. These ratios have not been evaluated, or developed, for other classes of cattle.

MET %MP = MET Supply / Total MP Supply

LYS %MP = LYS Supply / Total MP Supply

Table 2.7. Amino acid composition of rumen microbial cell wall and noncell wall protein[1]

Amino acids			Ruminal Bacteria[a]	
	Cell wall	Noncell wall	Mean	SD
Methionine	2.40	2.68	2.60	0.7
Lysine	5.60	8.20	7.90	0.9
Histidine	1.74	2.69	2.00	0.4
Phenylalanine	4.20	5.16	5.10	0.3
Tryptophan	1.63[b]	1.63	-	-
Threonine	3.30	5.59	5.80	0.5
Leucine	5.90	7.51	8.10	0.8
Isoleucine	4.00	5.88	5.70	0.4
Valine	4.70	6.16	6.20	0.6
Arginine	3.82	6.96	5.10	0.7

[1] Amino acid composition as g/100 g of protein.

[a] Average composition and SD (standard deviation) of 441 bacterial samples from animals fed 61 dietary treatments in 35 experiments (Clark et al., 1992). Included for comparison to the cell wall and noncell wall values used in this model.

[b] Data were not available, therefore, content of cell wall protein was assumed to be same as noncell wall protein (O'Connor et al., 1993).

PREDICTING MANURE PRODUCTION AND NITROGEN AND PHOSPHORUS EXCRETION

This section describes a submodel added to the CNCPS to predict manure production, mineral balances, and excretion of nitrogen and potassium as described and evaluated by Tylutki and Fox (1997) and excretion of phosphorus as described by Tylutki et al. (2002). Although results from the nitrogen balance calculations agree well with published experiments and annual nitrogen in manure hauled to the fields in the case study (Tylutki and Fox, 1997), a more complete validation of this component is needed.

MANURE PRODUCTION

Manure production is calculated as the sum of fecal and urinary production, using values predicted by the CNCPS. Fecal production (kg/d) is calculated as:

TFDM = IDM / FDM

If milk ≤ 45.4 kg/d: FDM = (-0.102 × milk production (kg/d) + 21.487) / 100; otherwise: FDM = 0.1685

Where:

FDM is % dry matter of feces.

IDM is indigestible dry matter, g/day.
TFDM is total fecal dry matter from indigestible feed, g/day.

Using the data of Mertens et al. (1994), Morse (1994), and Stone (1996), an equation to predict urine production (kg/d) of dairy cattle was developed:

$$Urine = (3.55 + 0.16 \times DMIA + 6.73 \times CPIA - 0.35 \times MILKA) \times AU$$

Where:
AU is animal units (Body weight, kg / 454).
CPIA is crude protein intake per animal unit, kg/day.
DMIA is dry matter intake per animal unit, kg/day.
MILKA is milk production per animal unit, kg/day.

PREDICTING NITROGEN EXCRETION

Nitrogen excretion is predicted by partitioning N excretion from the predicted N balance into feces and urine. Fecal nitrogen (g/d) and urinary nitrogen (g/d) are calculated as:

$$Fecal\ N = (FFN + BFN + MFN)$$
$$Urinary\ nitrogen = (BEN + BNA + NEU + TN)$$

Where:
BEN is excess bacterial nitrogen.
BFN is bacterial fecal nitrogen, primarily bacterial cell wall.
BNA is bacterial nucleic acids.
FFN is fecal nitrogen from indigestible feed.
MFN is metabolic fecal nitrogen.
NEU is metabolizable nitrogen supply - net nitrogen use (i.e., inefficiency of use).
TN is degraded tissue nitrogen.

PREDICTING PHOSPHORUS EXCRETION

Development of equations to predict P excretion is based on input minus output concepts, as described by Tylutki (2002) and Tylutki et al. (2002). This model assumes that an animal is in long-term P balance, and manure P is residual P after excretion via products (milk, tissue, and pregnancy) are accounted for. Urinary, pregnancy, and growth P are calculated utilizing the NRC system. Three milk P equations were tested (INRA, NRC, and German (Kirchgebner, 1993)) for their ability to predict milk P and their impact on model behavior in predicting total manure P. The final model adopted utilizes the German milk P requirement.

$$Urinary = ((2 \times FBW) / 1000)$$
$$Lactation = (1.0 \times Milk)$$

if Days Pregnant > 190 then

$Pregnancy = 0.02743 \times Exp(((0.05527 - (0.000075 \times DaysPreg)) \times DaysPreg)) - 0.02743 \times Exp(((0.05527 - (0.000075 \times (DaysPreg - 1))) \times (DaysPreg - 1)))$

Otherwise: Pregnancy = 0

$Growth = (1.2 + (4.635 * (MW ^ 0.22) * (FBW ^ -0.22))) * (ADG / 0.96)$

Net Required P = (Lactation + Pregnancy + Growth)
Total Fecal P = P_intake – (Urinary + Lactation + Pregnancy + Growth)
Manure P = Total Fecal P + Urinary P

Where:

FBW = full body weight, kg
Milk = milk production, kg/d
Exp = natural log base
DaysPreg = days pregnant
MW = mature weight, kg
ADG = average daily gain, kg/d
P_intake = dietary P intake, g/d

MINERAL REQUIREMENTS

The NRC recommendations are used for all mineral requirements: NRC (2000) is used for beef cattle and NRC (2001) is used for dairy cattle.

CALCULATION OF DIETARY CATION:ANION BALANCE (DCAB)

Two equations are provided to calculate the DCAB (or CAD, Cation: Anion Difference) as milliequivalents per kg of dry matter (mEq/kg DM) from dietary mineral intake (%DM) as follows (Jesse Goff, personal communication):

$DCAB1 = (435 \times Na + 256 \times K) – (282 \times Cl + 624 \times S)$
$DCAB2 = (0.15 \times 500 \times Ca + 0.15 \times 823 \times Mg + 435 \times Na + 256 \times K) – (282 \times Cl + 0.25 \times 624 \times S + 0.5 \times 968 \times P)$

3. MODEL TUTORIALS

TUTORIAL 1 - CREATING YOUR FIRST SIMULATION

In this tutorial, you will learn how to create a new simulation from scratch. The objective is to learn the mechanics of using CNCPSv5. Using the model to evaluate a herd evaluation is covered in the other tutorials.

First a few words about the terminology used in CNCPSv5.

This version of the CNCPS was designed to work with multiple groups within a single file to allow for evaluations of herd nutrient excretion and herd feed requirements. All information about a farm is stored in one file. These files are called *Simulation Data Files*. They can be found on your hard drive in the CNCPS ver. 5 folder and have the file extension *.cns*. Simulation data files contain all the groups (and their inputs), all the feeds (and composition) used on the farm, and rations fed to each group.

The main feed library included with the CNCPS is a read only file. Feeds that the user creates are stored in the User-Created Feed Library. Feeds used on the farm, while stored as part of the simulation data file, are part of the *Feeds Collection* and can be exported as a file for use in other simulations. A component of the feeds collection is mixes. Feeds that are included in mixes can be identified in the feeds collection by the M in parenthesis at the end of their name. When a mix is created, the percentage of each feed in the mix is calculated (for example 50% corn meal, 50% soy hulls). When the mix is fed to a group, the model decomposes the mix to run the calculations. For example, if 10 pounds of the corn/soy mix is fed, the model performs the calculations based on 5 pounds of corn meal and 5 pounds of soy hulls.

There are three ways to move around in the program: the menus, the buttons on the tool-bar, and the tree (found on the left side of the screen). This tutorial will focus primarily on using the tree and the tool-bar as these are the fastest way to move around the program. As you work through this tutorial, experiment with different ways to move around and use the method that works best for you.

NOW TO GET STARTED

In this tutorial, we are going to use the actual data from a 40-cow herd in central New York.

Step	Description
1	*Create the simulation.* Click on the file menu, then click on New Simulation. You will be asked if you want to save your current simulation, click on No. You will then be asked to name the simulation. Name the simulation “Tutorial 1” and click on Save.
2	*Create the groups.* The model must always have data in it to function properly. When a simulation is created, it loads default data. After creating your simulation, you will be taken to the Simulation Parameters screen. On this screen you will create your groups, enter how many animals are in each group, how many days to feed the group, what units you wish to work in, whether to enter feed amounts in dry matter or as fed basis, and what level of

Step	Description
	solution you wish. Both levels calculate animal requirements the same. Level 2 uses the rumen sub-model where-as level 1 uses the Weiss system. Comments about the simulation can also be added. For this simulation, we will work with five animal groups. For this tutorial, we will be working in Metric Units, Dry Matter Basis, Level 2 solution, and Calories for the energy units.

Do the following:

Group	**Click on**	**Enter the following**
Lactating cows	Create Animal Group Create Group OK	Lactating Cow
Name the group:	Lactating cows 35 animals 365 days to feed	
Dry cows	Create Animal Group Create Group OK	Dry Cow
Name the group:	Dry cows 3 animals 365 days to feed	
Bred heifers	Create Animal Group Create Group OK	Replacement Heifer
Name the group:	Bred heifers 12 animals 365 days to feed	
Open heifers	Create Animal Group Create Group OK	Replacement Heifer
Name the group:	Open heifers 19 animals 365 days to feed	
Less than 6 mo. old	Create Animal Group Create Group OK	Replacement Heifer
Name the group:	Less than 6 mo	

Step	Description
	10 animals 365 days to feed
	After you create all of your groups, click on the group named Default Animal Group. Now click on the Delete Selected Group button. When the program warns you that you are about to delete a group, click on Ok.
3	*Adding the feeds to the Feeds Collection.* Click on Feeds in the tree (or click on the Feeds button on the toolbar.). You will be taken to the Feeds Collection screen. This is the only place you can add feeds or rename a feed. For this simulation, we will be working with six feeds. To add them, click on the Add Feed(s) button. As you now see on your screen, feeds are listed by category. Select feeds by finding the feed you want and single clicking on it with your mouse. You will see that the feed moves to the bottom of the screen so you can view its composition. If you select a feed mistakenly, click on its name again. It will remove it from the list.

Select the following feeds:

Category	**Feed name**
Grass Forages	Mixedsil 15Cp52Ndf12LNdf Medium Chop
Grass Forages	Orchardgrass – Hay, E. Bloom (106) Long
Legume Forages	Alfalfa Hay – L. Veg (202) Long Hay
Grain Type Forages	Corn Sil. 40% GR – Medium grnd (308)
Energy Concentrates	Corn HM – Grain56 (412) Finely Ground
Protein Concentrates	Soybean – Meal – 47.5 (525) Finely Ground

Click on the Add Feed button found on the lower left corner of the screen.

You are now returned to the Feeds Collection screen. The first feed listed in the feeds collection list is Corn Silage 45% Grain. This is the default feed that was loaded when the simulation was created. Click on it once and then click on the Remove Feed button.

Click on the Corn HM –Grain56 (412). Click on the up arrow next to the Feeds Collection List box. This will move the feed up. Move this feed to the very top. On the right of the screen is the Feed Components section. This is one way to change feed composition and it is the only place to change the feed name. Click on the Corn HM Grain – 56 (412) line under Feed Components. Now type High moisture corn. You have just renamed the feed.

Now move the Soybean – Meal –49 (525) up to be the second feed. Do not rename it.

Now move the Mixedsil 15Cp52Ndf12LNdf up to be the third feed. Rename it Hay silage.

Now move the Corn Sil. 40% GR – Medium grnd (308) up to be the fourth feed. Rename it Corn silage.

Now move the Alfalfa Hay – L. Veg (202) up to be the fifth feed. Rename it Dry hay.

Step	Description
	The Orchardgrass – Hay, E. Bloom (106) should be the last feed. Rename it Round bales.
4	*Save the simulation.* Click on File, Save. At this point all of the groups are named and feeds are loaded. It is a recommended practice to save the file at this point.
5	*Edit the feed composition.* There are two ways to edit the feed composition. One way is to work with each feed individually on the Feeds Collection screen. If only one feed is going to be edited, this is the recommended procedure. To change the composition of more than one feed, click on the Edit Inputs button on the tool bar. On the top of this screen you will find a listing of all of your groups in the simulation. Ignore this for now. On the bottom of this screen is the Feed Data section. You can change all of the feed composition here except for the feed name. To edit a feed composition, click on the cell you wish to edit first (e.g. click on Cost). Enter the value and then either click on the next cell or use the arrow keys to move between cells. Be sure to watch your units! Most labs report ADICP and NDICP as percent of dry matter where the model uses percent of crude protein. A similar issue exists with lignin where labs report it as percent dry matter and the model uses lignin as a percent of NDF. Make sure you check the way your lab reports these values.

The following is the feed analysis for this farm (in model format):

	HMSC	Soy47.5	HCS	CS	Dry hay	Round bales
Cost $/ton	$80	$170	$35	$25	$140	$60
Homegrown	True	False	True	True	True	True
Dry matter	72	90	36	42	91	89
NDF	9.00	7.79	56.1	44.1	42.4	62.5
Lignin	2.22	2.50	10.85	7.75	17.00	8.50
CP	9.80	54.00	14.87	9.20	20.40	11.40
Fat	4.30	1.10	3.20	3.00	2.75	3.00
Ash	1.60	6.70	8.11	4.00	12.22	11.00
Sol-P	40	20	52	47	28	22
NDFIP	15.90	5.00	21.19	15.45	16.10	30.10
ADFIP	5.30	2.00	11.15	7.05	12.24	6.25
Ca	.03	.29	1.20	.27	1.35	.31
P	.31	.71	.42	.22	.60	.31

For all other analysis, use book values.

Click on return. You will be back to the Feeds Collection screen.

6 *Save the simulation.*

7 *Enter the description inputs for the group.* The first group we will work with is the lactating cows. To get to their inputs, either click on the Lactating cows branch in the tree or click on the Inputs button on the tool bar. The first tab we will work on is the Description Inputs. Enter the following inputs:

Animal Type: Lactating Cow (should already say this), press Tab

Age: 55 months (don't type in the word months), press Tab

Sex: Cow (should already say this), press Tab

Step **Description**

Body Weight inputs: First click on SBW (shrunk body weight—for more details on body weight, see on-line help) now click on the box labeled Current. Enter 635 kg (bodyweight for this group), press Tab to go to the Mature input. Enter 635 kg, press Tab
Breed Type: Dairy (should already say this) press Tab
Days Pregnant: 70, press Tab
Days Since Calving: 130, press Tab
Lactation Number: 4, press Tab
Calving Interval: 12.5, press Tab
Exp. Calf Birth Weight: 43, press Tab
Age At First Calving: 24
Now click on the Production Tab

8 *Enter the production inputs for the group.* Production inputs describe the performance of the animal. Enter the following inputs:
Click on the input box Rolling Herd Average: 8,845, press Tab
Milk Production: 29.8 kg, press Tab
Milk Fat: 4.10 (enter as a whole number), press Tab
Now click on True Protein then click on the input box for milk protein and enter 3.30, press Tab
Milk Price: 0.2646 $/L, press Tab
Body Condition Score: 2.80 (on a Dairy Scale), press Tab
Breeding System: Straightbred (should already say this), press Tab
Breed: Holstein (should already say this)

Now click on the Management/Environment Tab

9 *Enter the management/environment inputs for the group.* These inputs describe the environment that the animals are housed in. Enter the following inputs:

Click on the Additive input: None, press Tab twice
Added Fat should not be checked. *This applies only to finishing cattle fed high-energy diets with ionophores.*
Wind Speed: 1.6 kph, press Tab
Prev. Temperature: 15.6 C
Prev. Rel. Humidity: 40, press Tab
Temperature: 15.6 C, press Tab
Relative Humidity: 40, press Tab
Hours in Sunlight: 0, press Tab
Storm Exposure: should not be checked, press Tab
Hair Depth: 0.64 cm, press Tab
Mud Depth: 0, press Tab
Hide: Thin, press Tab
Hair coat: No Mud, press Tab
Cattle panting: None, press Tab
Minimum Night Temperature: 10 C, press Tab
Activity: click on the down arrow on the right side of the input box. Choose Tie-Stall Barns. For this simulation, all inputs under Activity will remain as the defaults.

Step	Description
	Click on the Ration Tab.
10	*Enter the ration for the group.* The first time you go to this screen, no results will appear on the right side of the screen. This is because the group is not fed and therefore the computations cannot be made. As soon as the feed amount for the first feed is entered, results will appear. Enter the following ration: Click on the input cell for lbs/day of the first feed. The amounts entered in this simulation are pounds Dry Matter per day. High moisture corn: 5.557 kg/day, press your down-arrow on your keyboard Soybean – Meal –49: 2.778, press your down-arrow on your keyboard Hay silage: 6.752, press your down-arrow on your keyboard Corn silage: 3.818, press your down-arrow on your keyboard Dry hay: 1.054, press your down-arrow on your keyboard Round bales: 0, press your down-arrow on your keyboard. The total should be 19.959 kg/day. The Total Intake box will still read 0. To update this box, click on the Management/Environment Tab, now click on the Ration Tab. The Total Intake box should now read 19.959 kg/day. Summary results should look like this: Entered Milk: 29.8 kg/day ME allowable milk: 32.3 MP allowable milk: 30.1 MET allowable milk: 34.2 Days to gain 1 condition score: 268 Rumen N balance: 99 g/d Peptide balance: 36 g/day eNDF balance: 1.2 kg/day Pred. DMI: 21.41 kg/day To view a report for this group, click on the down arrow in the input box for Quick Report. Select the Diet Evaluation Report and then click on the view button. After viewing the report, click on the Return button to return to the Ration Tab.
11	*Save the simulation.*
12	*Evaluate and print reports.* You can print reports for each group as you evaluate the group or you can wait until all the groups are entered and then print all the reports for all the groups by clicking on the Reports button on the tool bar. Select the reports and groups you want to print and click on the Print button. Only groups that have rations entered can be printed.
13	Now enter the inputs for the Dry cows. Click on Dry Cows in the tree. You will be taken to the Ration tab for that group. Now click on the Description Tab.
14	Here are the inputs for the Dry cows, Bred heifs, Open heifs, and Less than 6 mo heifs groups:

Step Description

	Dry Cows	*Bred heifs*	*Open heifs*	*Heifers < 6 mo*
Animal Type:	Dry Cow	Replacement Heifer	Replacement Heifer	Replacement Heifer
Age:	45	17	12	4
Sex:	Cow	Heifer	Heifer	Heifer
Current Body Weight:	635	454	340	181
Mature Weight:	635	635	635	635
Breed Type:	Dairy	Dairy	Dairy	Dairy
Days Pregnant:	276	160	0	0
Days Since Calving:	333	0 (can't change)	0 (can't change)	0 (can't change)
Lactation Number:	4.0	0 (can't change)	0 (can't change)	0 (can't change)
Calving Interval:	12.5	12.5	12.5	12.5
Exp. Calf Birth Weight:	43	43	43	43
Age At First Calving:	22	24	24	24
Rolling Herd Average:				
Milk Production:				
Milk Fat:				
True Protein:				
Milk Price:				
Body Condition Score:	3.00	3.00	3.00	3.00
Breeding System:	Straightbred	Straightbred	Straightbred	Straightbred
Breed:	Holstein	Holstein	Holstein	Holstein
Additive	None	None	None	None
Added fat in ration	No	No	No	No
Wind Speed:	1	1	1	1
Prev. Temperature:	15.6	15.6	15.6	15.6
Prev. Rel. Humidity:	40	40	40	40
Temperature:	15.6	15.6	15.6	15.6
Relative Humidity:	40	40	40	40
Hours in Sunlight:	0	0	0	0
Hair Depth:	0.64	0.64	0.64	0.64
Mud Depth:	0	0	0	0
Hide:	Thin	Thin	Thin	Thin
Min Night Temp:	10	10	10	10
Activity:	Dry Lots	Dry Lots	Dry Lots	Tie-Stall Barns
High moisture corn:	0	1.896	1.261	0.758
Soybean – Meal –49:	0	0.948	0.630	0.376
Hay silage:	0	2.304	1.533	0.921
Corn silage:	0	1.302	0.866	0.522
Dry hay:	0	0.358	0.240	1.960
Round bales:	10.151	3.175	3.175	0

15 *Save the simulation.*

16 *Evaluate and print reports.*

17 All the reports for this tutorial are included on the cd or on the web. The file name is: Tut1 reps.pdf. DO NOT PRINT THE pdf FILE. IT INCLUDES ALL POSSIBLE REPORTS AND IS 150 PAGES LONG.

TUTORIAL 2 - USING THE CNCPS ON A DAIRY FARM

MODEL OBJECTIVES

The Cornell Net Carbohydrate and Protein System (CNCPS) has been developed to account for more of the variation in nutrient requirements of cattle and feed utilization by different types of animals with diverse environmental and management conditions and feeds. The goal is to more accurately formulate rations to improve animal performance, and to reduce overfeeding, feed costs and nutrient excretion. To accomplish this, a modeling approach is used.

Metabolizable energy (ME) and metabolizable protein (MP) requirements vary according to breed, physiological state, environment, animal characteristics, management, and dietary factors. ME and MP supplied by the diet are based on quality and quantity of feed intake, ruminal carbohydrate fermentation and protein degradation, rumen microbial growth, nutrient passage to and absorption in the intestines, and nutrient partition for physiological functions. Rate of gain and milk production are predicted based on ME available for productive purposes after maintenance and gestation requirements have been satisfied. The underlying biological concepts to accomplish this are described for each component in the Model Biology help section of the software. Equations used are described in the Model Documentation help.

In on farm evaluations, it has reduced feed costs, N, and P excretion. On a 500 cow dairy, model predicted N and P excretion was within 2% of that hauled to the fields in manure over a 12 month period. This allows the user to accurately evaluate the effect of alternative feeding strategies on annual feed requirements and N, P and K excreted compared to that removed from the fields by home grown feeds fed.

The model can be used for the following:

- → Diagnose and solve feeding problems
- → Formulate rations for each group in the herd
- → Project herd feed requirements and nutrient excretion
- → Optimize use of home grown forages across groups in the herd
- → Match the herd-feeding program with crop production
- → Minimize nutrient excretion into the environment per unit of product produced
- → Minimize whole farm nutrient balance/unit of land
- → Set research priorities
- → Design sensitive experiments
- → Interpret experimental results
- → Teach application of the biological principles upon which the model is based

Since the release of version 3 of the CNCPS, much advancement in our understanding of ruminant nutrition, environmental regulation, hardware, and software have occurred. We have attempted to capture these advancements. The previous release (CNCPSv4) was developed in Microsoft Visual Basic and represented much needed improvements in ease of use, flexibility, and current research results. It was designed to evaluate and formulate rations for individual cattle groups and the whole herd.

The current release (CNCPSv5) continues this trend of increasing ease of use and incorporating new biology. Enhancements to the mix routines and reports were made at the request of our users. Several additions have been made including: an energy units switch (Calories or Joules) for our international users, ability to import feed analysis from DairyOne, exporting groups as 2001 Dairy NRC files, and linking the CNCPSv5 with the Cornell Value Discovery System (CVDS). The CVDS is a growth and economic projection tool for feedlot animals. It also has the ability to allocate feed to individual animals based on close-out data. Future versions of the CVDS for beef cow/calf, replacement heifers, and dairy cattle are planned. Biology changes have been primarily in the mineral nutrition arena. Beef and dual purpose mineral requirements are calculated using the 2000 Beef NRC update. Dairy cattle mineral requirements are calculated using the 2001 Dairy NRC. Phosphorus excretion has been modified using the excretion model of Tylutki (2002 PhD dissertation) where total P in manure was predicted for individual animals with less than 4% bias. The feed libraries have also been changed as follows: A protein ruminal degradation rate can be modified, sugar and starch have been added as inputs, and VFAs have been added as inputs. While the CNCPSv5 does not use sugar, starch, or VFAs for microbial growth predictions, they do appear on the reports as dietary concentrations. They were added so that users can use these values as additional diagnostic tools and begin populating their databases with values as the next version (CNCPSv6) will include a ruminal VFA model.

The CNCPSv5 is a component of the Cornell University Nutrient Management Planning System (CuNMPS). The CuNMPS integrates crop production and cattle nutrition with the goals of: maintaining or enhancing dairy farm sustainability, minimizing nutrient excretion, and protecting water quality.

The purpose of this tutorial is to walk you through a complete dairy herd analysis utilizing the CNCPSv5. Estimated time to complete this complete tutorial is five to eight hours. Questions or comments about this tutorial are welcome and can be emailed to Tom Tylutki at tpt1@cornell.edu.

This tutorial uses data from a 500-cow herd that has been cooperating with the CuNMPS group since 1997. The tutorial analyzes three groups of cows (Fresh (<40 DIM), First-calf heifers, and Mature cows), two groups of dry cows (far-off and close-ups), and four groups of replacement heifers. For each animal class, one group is fully analyzed and selected outputs from the remaining groups are given. At the end of the tutorial is a series of what-if questions that highlight different areas of the tutorial.

MODEL INFORMATION REGARDING EACH ANIMAL CLASS

Lactating Cows

In the CNCPSv5, lactation requirements are calculated independently from maintenance requirements. Lactation requirements are ranked third in nutrient priority for the animal (maintenance, pregnancy, lactation and growth). They are calculated as:

ME required (Mcals/d) = Milk Production * (((Milk Fat * 0.0962) + 0.3512) / 0.644)
MP required (gms/d) = (10 * Milk Production * Milk Protein) / 0.65

Where: milk production is kg/d
Milk fat is %
Milk protein is % True protein

The 0.644 coefficient in the ME equation is the efficiency of use of ME to NE for lactation based upon the work of Moe et al (1981). The 0.65 coefficient in the MP equation is the efficiency of use of MP to net protein from the 1985 NRC. In other words, the model calculates the net energy and net protein required for the inputted milk production (and composition) and converts it to a metabolizable basis using these efficiency factors.

Diet evaluation with the CNCPSv5 is accomplished by comparing required and supplied Mcals or grams rather than with concentrations of nutrients. The same is true when evaluating the amino acid adequacy of a diet. Amino acid content of tissue and milk protein used in the CNCPSv5 are as follows:

	Amino Acid Composition (g/100g)	
Amino Acid	Tissue	Milk protein
Methionine	1.97	2.71
Lysine	6.37	7.62
Arginine	6.60	3.40
Threonine	3.90	3.72
Leucine	6.70	9.18
Isoleucine	2.84	5.79
Valine	4.03	5.89
Histidine	2.47	2.74
Phenylalanine	3.53	4.75
Tryptophan	0.49	1.51

For each amino acid, the following calculations are performed:

First, maintenance AA requirements are calculated as:

MPAAi = ((AATISSi * 0.01) * (FPN + ((SPA + UPA) * 0.65))) / EAAMi

Then pregnancy requirements:

PPAAi = (AATISSi * 0.01 * MPPreg * MPtoNPFactor) / EAAPI

Then lacatation

LPAAi = (AALACTi * 0.01 * (MPLact * 0.65)) / EAALI

And finally, gain

GPAAi = ((SWG * 1000) * (ProteinInGain / 100) * AATISSi * 0.01) / EAAGi

Where: MPAAi is maintenance amino acid required (gms/d) for the ith AA
AATISSi is the amino acid composition of tissue for the ith AA
FPN is metabolic fecal nitrogen (gms/d)
SPA is scurf protein (gms/d)
UPN is urinary protein (gms/d)
EAAMi is the efficiency of use of the ith AA for maintenance
PPAAi is pregnancy amino acid required (gms/d) for the ith AA

MPPreg is the metabolizable protein requirement for pregnancy
MPtoNPFactor is the efficiency of use of protein for pregnancy
EAAPi is the efficiency of use of the ith AA for pregnancy
LPAAi is the lactation amino acid requirement for the ith AA
AALACTi is the amino acid composition of milk protein for the ith AA
MPLact is the metabolizable protein required for lactation
EAALi is the efficiency of use of the ith AA for lactation
GPAAi is the ith AA gain requirement (gms/d)
SWG is shrunk weight gain (kg/d)
ProteinInGain is the proportion of protein in the SWG
EAAGi is the efficiency of use of the ith AA for gain.

During a diet evaluation, the following are calculated:

ME allowable milk
MP allowable milk
AA allowable milk
Days to change a body condition score.

These calculations provide an index of diet allowable production and energy balance of the animal for a particular diet.

Dry Cows

Dry cow nutrition is the most important component of a successful lactation. Energy balance and mineral levels have been shown to influence the occurrence of post-calving metabolic disease as well as whole lactation performance. Feeding the dry cow is just one component of the dry cow program. Adequate grouping, housing, and management of the dry cows are equally important in determining the productivity in the upcoming lactation.

A mammogenesis requirement is included to represent growth of the mammary gland. It begins in the late dry period and is often referred to ‘springing’ in the field. Mammary development continues during the first three weeks post-calving. The resulting growth requirements are .94 Mcal ME and 277 gms MP per day. This brings the total MP requirement up to approximately 1100 gms of MP resulting in diets in the range of 13.5 to 14.5% crude protein.

Current guidelines (from: Managing the Transition Cow, L. Hutchinson, and L. Chase, 1997 Mid-Atlantic Dairy Management Conference) used to evaluate and formulate dry cow rations are:

	Early dry	Close-up dry
DMI	1.9-2.1% BW	1.6-1.8% BW
NEl Mcal/lb	.55 - .60	.60 - .70
Crude Protein % DM	12 –13	13 – 14
Soluble % CP	40 – 50	35 – 45
DIP % CP	65 –70	62 – 67
ADF % DM	35 – 40	33 – 38
NDF % DM	45 – 55	35 – 45
Ca % DM	.5 - .6	.6 - .7
P % DM	.25 - .30	.30 - .35
Mg % DM	.20 - .25	.25 - .30
K % DM	.8 - <1.52	.8 - <1.2
S % DM	.16 - .20	.20 - .25
Na % DM	.10 - .15	.10 - .15
Cl % DM	.20 - .25	.20 - .25
Fe ppm	100	100
Mn ppm	40 – 50	40 – 50
Zn ppm	60 – 80	60 – 80
Cu ppm	10 – 20	10 – 20
Co ppm	.1 - .3	.1 - .3
I ppm	.4 - .6	.5 - .7
Se ppm	.3	.3
Vit A KIU/lb	3.0 – 3.5	3.0 – 3.5
Vit D KIU/lb	.8 – 1.0	.8 – 1.0
Vit E IU/lb	25 – 35	35 – 40

Replacement Heifers

Background

Accurate prediction of daily gain that can be expected for the metabolizable energy and protein consumed depends on accurate prediction of energy required for maintenance and composition of gain, which is related to proportion of mature weight at a particular weight. A size scaling system is used to adjust shrunk body weight (SBW) to a weight equivalent to a standard reference animal at the same stage of growth. For replacement heifers, SRW is 478 kg. This system requires accurate estimation of mature weight if breeding herd replacements. Representative weights of mature cull cows sold in average body condition score can be used as a starting point for estimating mature weight for breeding herd replacements.

Daily gain is predicted as the residual energy available for production after meeting maintenance and pregnancy requirements. Protein required is calculated from the energy allowable gain.

Target rates for herd replacement heifers

Recent research has identified optimum growth rates for herd replacement heifers for minimizing replacement costs while maximizing first lactation milk production (3, 4, 5). After reaching maturity, body weight changes reflect use of energy reserves to either supplement ration deficiencies or to store energy consumed above requirements. Most beef and dairy producers monitor body condition score changes in cows to manage energy reserves. The 1996 National Research Council Nutrient Requirements of Beef Cattle model (3) is used to compute target weights and daily gains for replacement heifers. This model was modified and evaluated for computing growth requirements, target weights and energy reserves for any body size of dairy cattle (4). Target weights for dairy animals are:

Reproductive Stage	Target % of Mature Weight
1st breeding	55%
1st calving (post-parturition)	85%
2nd calving	92%
3rd calving	96%

These target weights are used with current age and weight, age at first calving and calving interval to compute daily gain required to reach the next target weight.

For example, heifers before first pregnant, target daily gain to target first pregnant weight is:

((mature weight x .55) – current weight) / ((days of age at first calving - 280) – current age).

For first bred heifers, daily gain required is:

((mature weight x .85) – current weight) / (280 – days pregnant)

Conceptus daily gain is added to get measured weight gain required.

Daily gain required during the first lactation (including the dry period) is:

((mature weight x .92) – current weight) / (calving interval days – days since calving).

Daily gain for the second and third lactations is computed the same way, using .96 or 1 to compute the next target weight for the second and third lactations, respectively.

The predicted target weights and daily gains required to minimize cost of growing replacement heifers while not affecting first lactation milk production agree with those reported for Holstein heifers in recent published studies (5). In that study, the daily gain before first calving averaged 0.82 kg/d Vs model target of 0.87 kg/d; weight at first pregnancy was 370 kg Vs model target of 352 kg; the daily gain during first pregnancy averaged 0.63 kg/d Vs model target of 0.69 kg/d; weight at post first calving averaged 533 kg vs target of 545 kg; first lactation daily gain averaged 0.136 kg/d vs target of 0.104; and second post calving weight was 592 kg vs target of 590 kg.

WORKING WITH THE WHOLE HERD

A little background

Dairy farms in New York are concerned with economic and environmental sustainability, which means maximizing profits while maintaining or improving water quality. The primary concerns are to maximize profitability while protecting water quality. The environmental goal is to keep nitrogen in the groundwater (caused by leaching of N through soil) well below the Federal standard of 10 ppm and to keep Phosphorus out of the streams (caused by high levels of P in manure spread on fields and runoff after rains or snowmelt), which causes algae growth in water bodies. The principal causes of excess nutrients are excess N and P over requirements in the rations, and importing too high a proportion of the nutrients so they cannot be recycled through the crops grown (See Fox and Tylutki, "Dairy Farming and Water Quality I. Problems and Solutions" and Tylutki and Fox, "Dairy Farming and Water Quality II. Whole Farm Nutrient Management Planning" for more details).

To accomplish these goals, a comprehensive nutrient management plan (CNMP) is needed, with the following components.

- Design a feeding program that maximizes use of home grown feeds, using purchased feeds only as needed to provide supplemental nutrients as needed to support nutrient requirements to meet the farm's production goals.
- Modify crop rotations to provide a mix of home grown feeds that better match herd requirements while minimizing excess nutrients in the ration, as well as to best match soil resources and soil conservation goals.
- Develop a crop and manure nutrient management plan that best allocates the manure to match crop requirements while minimizing risk of leakage into surface and ground water.
- Modify manure storage facilities that hold and preserve manure nutrients until they can be spread to meet item number 3 while minimizing risk to the environment.

The development of a CNMP requires a team with individuals certified to do planning in each of these four areas: animal nutritionist, crop planner, and structural planner. To assist in the development of CNMPs, Cornell has been working on developing a set of software 'tools'. The first tool is CNCPSv5 and the second is Cornell CropWare (a Crop Nutrient Management Planning System).

Competencies required to design an animal feeding nutrient management plan.

The USDA-EPA National Guidelines for Comprehensive Nutrient Management Planning (CNMP) and our case studies indicate four major competency areas are involved in developing a CNMP for animal feeding operations (AFO), based on how nutrients flow on the farm. They are: feed management and herd nutrition, structures to control and store feed and manure, crop production and manure nutrient management planning, and soil and water conservation. This requires three to four specialized individuals that typically address each of these areas on a farm: animal nutritionist, engineer, crop advisor, and soil and water conservationist. Rather than certifying planners to do all components of a CNMP, our experience indicates we should be certifying a CNMP for a particular

AFO with components developed by the appropriate certified planners (typically certified animal nutritionist, certified engineering specialist; and certified crop advisor).

As an example, we are suggesting the following competencies for certifying planners to do the feed management component in a CNMP in New York State to minimize excess manure nutrients/acre. Competencies of this type are being developed for the other components for the New York State Agriculture Environmental Management Planner Certification Program by our State's Agriculture Environmental Management Subcommittee.

1. Understand the influence a farm's feeding program, herd production level, and crop productivity has on excess nutrients/crop acre from manure.
   a. Impact of proportion of animal units kept that are not producing product for sale on nutrients exported from the farm.
   b. Importance of total product sold relative to number of animal units on farm in exporting nutrients.
   c. Impact of proportion of nutrients fed from homegrown vs. purchased feed.
      - Effect of crop yield and total tons produced vs. herd requirements.
      - Effect of crop quality on supplemental nutrients needed.
   d. Effect of variation in forage quality on safety factors needed to insure that animal requirements are met.
   e. Impact of match of crops grown with herd requirements.
   f. Impact of chronic feed shortages on nutrient imports required.
2. Know the principles of assessing a farm's feeding program.
   a. Regular feed analysis to:
      - Allow accurate ration balancing;
      - Determine variation in feed quality, and
      - Adjust as fed amounts for moisture content of feeds.
   b. Accurate scales, weighing and mixing procedures that consistently deliver formulated ration to each group.
   c. Adequate grouping of animals by requirements to avoid overfeeding those with low requirements in meeting the requirements of those with high requirements.
   d. Understand feeding management procedures that insure maximum voluntary intake is achieved while minimizing feed not consumed that must be discarded.
   e. Understand importance of monitoring dry matter intake actually consumed by each group of animals, and how to measure it.
   f. In ruminants, understand importance of intake of rumen fermentable carbohydrates in producing microbial protein to minimize purchased protein concentrates.
   g. In ruminants, understand importance of providing protein sources that:
      - optimize ruminal microbial protein production from rumen fermentable carbohydrates fed, and;
      - supplement microbial protein in meeting animal requirements for maintenance, growth, pregnancy, and milk production.
   h. In ruminants, understand the role of effective NDF in optimizing rumen fiber digestion and microbial protein production.
   i. Select sources of supplemental nutrients with a high bioavailability to minimize amount required in the diet to meet requirements.

3. Understand the importance of having a competent (certified) nutritionist that:
   a. understands and applies the principles of assessing and improve a farm's feeding program to accomplish competency areas 1 and 2 above;
   b. regularly evaluates rations for each group:
      - for accurate match of diet formula to requirements of each group of animals,
      - monitors herd performance to see that diet formulas are supporting the intended level of performance in each group,
      - that the diet formulas match forage and grain inventories,
      - that crop production plans will supply feed that matches herd requirements, and;
   c. understands the concepts of how computer models can be used for whole herd nutrient management and assessing manure nutrients produced/crop acre with alternative feeding management strategies.

d. Understand the importance of herd nutritionist, storage structures planner, crop and manure nutrient management planner, soil and water conservationist and producer working as a team to optimize whole farm nutrient management.

STEPS TO FOLLOW WHEN ANALYZING A WHOLE-HERD

These steps represent a logical approach to addressing a whole-farm analysis.

Steps 1-4 need to occur prior to entering any information into CNCPSv5. Having the information from these steps in front of you prior to data entry is the most efficient. The last two pages of this tutorial were developed to aid in whole-herd data collection.

1. Herd description:
   a. Number of groups
   b. Number of animals/group
   c. Production/group
   d. Bodyweights to be used in each group
   e. Housing type of each group
   f. All model inputs required for animal description (see attached table as an example)
2. Feed information
   a. Feed types
   b. Storage structures
      i. Capacities
      ii. When can be fed from
   c. Crop yields (to be used with the crop planner to determine if crop yields are acceptable)
   d. Feed analysis
   e. Feeds available from vendors as supplements
3. Rations
   a. By group
   b. Accurate dry matter intake values
4. Manure information
   a. Storage capability (to be used in conjunction with the crop planner)
   b. Analysis (to be used as an index of N and P excretion of the herd)

The next step is to enter the data in CNCPSv5. The list presented here represents the authors experience in conducting whole-herd analyses with 30 farms.

Now with all the information in front of you, follow these steps:

5. Create a new simulation
6. Create all the groups within the herd
    a. Enter days to feed for each group
    b. Enter number of animals in each group
7. Add all the feeds that you will be using on the farm
8. Save the simulation
9. Edit all the feed composition data (best to use the Edit Inputs screen)
10. Save the simulation
11. Enter the inputs for the first group
    c. Description
    d. Production
    e. Management/Environment
    f. Ration

    You can either begin working with the lactating cows or the replacement heifers. After several whole-herd analyses, you will develop a routine. One such routine is:
        i. open heifers first
        ii. short-bred heifers
        iii. late gestation heifers
        iv. far-off dry cows
        v. close-up dry cows
        vi. fresh-cows
        vii. high cows
        viii. low cows

    As you can see from this flow, it follows age and production stages. Following such a flow allows you to organize your inputs and thoughts making data entry and herd analysis faster and easier.
12. Evaluate the results. At this point, do not consider any reformulation. The objective at this point is to describe what the herd is currently doing.
13. Loop through steps 11 and 12 until all groups are entered.
14. Save the simulation
15. Evaluate the herds nutrient excretion (whole-herd analysis report) and feed requirements. Guidelines for this evaluation are later in this tutorial.
16. Reformulate based upon:
    g. Animal performance goals
    h. Feed inventory
    i. Environmental goals (e.g. decreasing P excretion)

    The reformulation can be of two types:
        a. Planning for next years crop season
        b. To allocate current inventory until the next cropping season.

Let's start the tutorial now!

Step	What to do …
1	*Create a new simulation.* Select File, New Simulation from the menu. Name this simulation Dairy Tutorial.
2	*Create the groups.* Group Name: Pen 20, with 40 animals Group Name: Pen 30, with 40 animals Group Name: Pen 40, with 80 animals Group Name: Pen 50, with 140 animals Group Name: Fresh cows, with 60 lactating cows Group Name: Pens 1 and 2, with 250 lactating cows Group Name: Pen 3, with 130 lactating cows Group Name: Far-off dry cows, with 60 animals Group Name: Close-up dry cows, with 30 animals For all groups, enter 175 days to feed. *FYI: Pens 1 and 2 are mature cows, Pen 3 is the first calf heifer group.* For all groups, enter 175 days to feed.
3	*Bring in feeds.* Feeds to bring in are: PCSil30G30dmMed GrassSil 16Cp55Ndf6Lndf Corn Gnd. – Grain56 (407) Soy Plus (901) PCSil50G40dmMed Limestone *(to be renamed Heifer mineral mix)* Orchardgrass – Hay, L. bloom (107) Cottonseed – High Lint (507) Soybean - Hulls (617) Soybean – Meal – 49 (525) Corn Glut. – Meal 60% CP (506) Molasses – Cane (414) Calcium Carbonate *(to be renamed Dry Cow Minerals)* Beet Pulp – Dehy (605) Calcium – Sulfate (806) Dicalcium – Phosphate (810) Limestone (813) Magnesium – Oxide (816) Magnesium Sulfate Minvit 2 *(to be renamed Trace min vit pack)* Salt (831) Sodium – Bicarbonate (832) Zinpro 4-Plex

Step	What to do …
	Then change the names of the feed you just brought in to:

Original name		New name
PCSil30G30dmMed		Corn silage
GrassSil 16Cp55Ndf6Lndf	Medium	Hay silage
Corn Gnd. – Grain56 (407)	Fine Meal	Corn meal
Soy Plus (901) Finely Ground		Homer meal
PCSil50G40dmMed		TMR weighback
Limestone		Heifer mins
Orchardgrass – Hay, L. bloom (107) Long		Grass hay
Cottonseed – High Lint (507) w/hay		Whole cotton
Soybean - Hulls (617) Pellets		Soy hulls
Soybean – Meal – 49 (525) Finely Ground		Soy 48
Corn Glut. – Meal 60% CP (506) Finely Ground		Gluten 60
Molasses – Cane (414)		Molasses
Calcium carobonate		Dry cow mineral mix
Beet Pulp – Dehy (605) Pellets		Beet pulp
Calcium – Sulfate (806)		Ca Sulf
Dicalcium – Phosphate (810)		DiCal
Limestone (813)		Limestone
Magnesium – Oxide (816)		Mag Ox
Magnesium Sulfate		Mag Sulf
Minvit 2		Trace min vit pack
Salt (831)		White salt
Sodium – Bicarbonate (832)		Sodium Bicarb
Zinpro 4-Plex		4 Plex

After you bring these feeds in, re-order them to be in the order shown above. Then change the names of them to:

Corn Silage
Hay silage
Grass hay
Corn meal
Whole cotton
Homer meal
TMR weighbacks
Soy hulls
Soy 48
Gluten 60
Beet Pulp – Dehy (605)
Molasses
Heifer mineral mix
Dry cow mineral mix
Dicalcium – Phosphate (810)
Limestone (813)
Calcium – Sulfate (806)

Step	**What to do …**
	Salt (831) Sodium – Bicarbonate (832) Magnesium – Oxide (816) Magnesium Sulfate Lact mins Zinpro 4-Plex
4	*Save the simulation.*
5	*Edit the feed composition. Hint: watch your units!*

	1998 corn	1999 Grass	Corn	Homer	TMR	Heif Mineral	
	silage	silage	meal	meal	weigh-backs	mix	
Cost ($/t)	$25.00	$35.00	$95.00	$208.00	$87.35	$630.00	
Homegrown	True	True	False	False	False	False	
DM	28.00	27.00	88.20	89.70	39.00	100.00	
NDF (%DM)	52.00	58.00	10.60	16.20	32.20	.00	
Lignin (%DM)	3.50	9.02	2.07	.19	3.51	.00	
CP (%DM)	7.10	17.40	8.53	48.90	18.00	.00	
SolCP (%CP)	62.00	50.00	18.20	8.00	44.00	.00	
NDFIP (%DM)	1.60	3.88	1.00	4.89	1.91	.00	
ADFIP (%DM)	1.30	2.29	.72	.85	.90	.00	
Fat (%DM)	3.60	3.70	4.24	5.30	4.60	.00	
Ash (%DM)	4.18	10.38	1.44	6.50	7.33	100.00	
Ca (%DM)	.24	1.24	.02	.27	1.03	16.00	
P (%DM)	.23	.40	.28	.65	.48	8.00	
Mg (%DM)	.19	.30	.12	.29	.33	4.00	
Cl (%DM)	.18	.41	.06	.03	.00	.00	
K (%DM)	1.03	3.41	.39	1.80	1.52	1.00	
Na (%DM)	.00	.02	.01	.00	.30	5.15	
S (%DM)	.10	.25	.09	.24	.20	3.00	
Co (ppm)	0	0	0	0	0	24	
Cu (ppm)	5	7	1	20	15	525	
I (ppm)	0	0	0	0	0	80	
Fe (ppm)	101	151	36	100	332	3500	
Mn (ppm)	26	46	7	40	63	2200	
Se (ppm)	0	0	0	0	0	15	
Zn (ppm)	21	28	19	62	60	2200	
Vit A (KIU/lb)	0	0	0	0	0	416	
Vit D (KIU/lb)	0	0	0	0	0	104	
Vit E (IU/lb)	0	0	0	0	0	2423	

For these feeds, use book values and these feed costs:

Whole cotton	$180
Soy hulls	$80
Soy 48	$200
Gluten 60	$300
Molasses	$240
Beet pulp	$100

Step **What to do …**

Ca Sulf	$500
DiCal	$500
Limestone	$500
Mag Ox	$500
Mag Sulf	$500
White salt	$500
Sodium Bicarb	$500
4 Plex	$1000

For these feeds, enter the following composition (watch units!):

	Grass hay	***Dry cow mineral mix***	***Lac min mix***
Cost ($/t)	$65.00	$396.43	$1000
Homegrown	False	False	False
DM	93.00	99.00	99.00
NDF (%DM)	65.00	0	0
Lignin (%NDF)	11.40	0	0
CP (%DM)	8.40	0	0
SolCP (%CP)	25.00	0	0
NDFIP (%CP)	31.00	0	0
ADFIP (%CP)	6.10	0	0
Fat (%DM)	3.40	0	0
Ash (%DM)	10.10	100	100
Ca (%DM)	.26	5.57	0
P (%DM)	.30	.30	0
Mg (%DM)	.11	4.81	0
Cl (%DM)	.00	8.98	0
K (%DM)	2.67	.88	0
Na (%DM)	.01	6.11	0
S (%DM)	.00	2.48	0
Co (ppm)	.3	105	0
Cu (ppm)	20	2823	100
I (ppm)	20	160	500
Fe (ppm)	84	3446	0
Mn (ppm)	167	9034	10
Se (ppm)	0	11	200
Zn (ppm)	38	8810	500
Vit A (KIU/lb)	0	1000	5000
Vit D (KIU/lb)	0	250	2200
Vit E (IU/lb)	0	6500	1600

6 *Save the simulation.*

For each animal class, steps 7-17 (19 for heifers) need to be completed. In this tutorial, the steps are repeated for each animal class.

Lactating cows (steps 7-17)

Step	What to do …
7	*Enter the description inputs for the group.* The first group we will work with is the Fresh cows. Enter the following inputs: Animal Type: Lactating Cow Age: 47 months Sex: Cow Current Body Weight: 1500 lbs SBW Mature Weight: 1515 Breed Type: Dairy Days Pregnant: 0 Days since calving: 30 Lactation Number: 4.0 Calving Interval: 13 Exp. Calf Birth Weight: 95 Age At First Calving: 22
8	*Enter the production inputs for the group.* Enter the following inputs: Rolling herd average: 22000 Milk production: 75.0 Milk Fat: 4.00 Milk Protein: 3.50 Crude Protein Milk Price: $11.00 /cwt Body Condition Score: 3.00 (on a Dairy Scale) Breeding System: Straightbred Breed: Holstein
9	*Enter the management/environment inputs for the group.* Enter the following inputs: Additive: None Added fat in diet: Should not be checked Wind Speed: 1 Prev. Temperature: 40 Prev. Rel. Humidity: 40 Temperature: 40 Relative Humidity: 40 Hours in Sunlight: 0 Storm Exposure: should not be checked Hair Depth: .25 Mud Depth: 0 Hide: Thin Hair Coat: No Mud Cattle Panting: None

Step	What to do …
	Minimum Night Temperature: 50
	Activity: Large free-stalls Close parlor
10	*Enter the ration for the group.*
	Enter the following ration:

Corn silage:	10.907 lbs DM/d
Hay silage:	4.675
Grass hay:	2.654
Corn meal:	9.542
Whole cotton:	2.222
Homer meal:	3.339
Soy 48:	2.680
Gluten 60:	.823
Molasses:	2.537
Dry cow mineral mix:	1.575
DiCal:	.250
Limestone:	.525
White salt:	.260
Sodium Bicarb:	.260

Total DMI should be: 42.249 pounds per day

Summary results should look like this:
Entered milk: 75.0
ME allowable milk: 56.1 lbs/day
MP allowable milk: 69.7 lbs/day
LYS allowable milk: 76.2 lbs/day
Days to Lose 1 Condition Score: 69
Rumen N balance: 23 g/d
Peptide balance: 24 g/day
eNDF balance: 1.4 lbs/day
Pred. DMI: 46.61 lbs/day

11 *Save the simulation.*

12 *Evaluate the group— Diet adequacy*.

1. The first question raised by this ration is the difference between entered and predicted DMI. Why are these cows consuming less?
    a. Is the entered ration correct?
    b. Is there a high percentage of 1st calf heifers in this group?
    c. Is the group described adequately?
        i. Specifically is body weight correct or was it a guess?
    d. Are animal numbers kept current?
    e. Are the animals under stress?
2. Ruminal N balance is 107% of requirement. The recommendation for ruminal N balance is 100 to 110%, therefore this is adequate.
3. Rumen peptide balance is 114%. This is not a true requirement for bacterial growth.

Step What to do …

Diets less than 100% will not maximize NSC microbial growth, however diets greater than 125% usually can be reformulated to improve nitrogen balance.

4. If MP balance is positive, excess peptides and ruminal N balance and excess MP result in a urea cost. The urea cost is the energetic cost (added to maintenance energy requirements) to convert ammonia to urea in the kidney's for nitrogen excretion. Since this diet is deficient in MP, the calculated urea cost is zero.
5. MP from bacteria in this diet is 1269 gms. MP from undegraded feed is 1013 grams. A goal in formulation with the CNCPSv5 is to have at least 50% of the total MP be of microbial origin. This diet achieves that goal.
6. Rumen health can be assessed using one of two values (effective NDF balance or Predicted Ruminal pH). Predicted Ruminal pH below 6.25 results in a depression of SC microbial growth and fiber digestion. A typical lower limit for Predicted ruminal pH is 6.28. This diet has a predicted ruminal pH of 6.41 suggesting that diet NFC levels (currently 38.7%) may be increased.
7. The Predicted MUN of this diet is 12 mg/dl. Animals in this group typically have an MUN of 16-18 mg/dl. The low value in this diet is the result of MP being deficient.
8. Total fat in this diet is 4.0%. This fat is 100% vegetable origin and is from two feeds (Whole cotton and Homer meal). No added fat is used in this diet as an intake depression is possible.
9. Days to lose one body condition score are predicted to be 70. This value (along with the ME allowable milk of 56.1 lbs/day) is a concern. If these cattle in this group were to produce 75 pounds as inputted and remain in this pen for 40 days, they would lose in excess of a ½ of a body condition score before peak milk production. Energy levels of this diet need to be evaluated and changed so that reserves loss is decreased. Typical recommendations for days to change one body condition score are at least 100 days.
10. This ration is 43% forage, or 0.67% body weight as forage NDF intake. The model does not consider feeds such as cotton, beet pulp, or soy hulls as forage. A 43% forage diet is on the low side of acceptable. If inventories allow, increasing the forage level is suggested.
11. The next step in diet evaluation is amino acid adequacy. While all amino acids are listed on the Amino Acid report, the confidence interval around all but MET and LYS is large. With the factorial system used, branched chain amino acids typically appear as first limiting, however data to support this is very limited. MET and LYS are the only amino acids that should be considered at this time. In this diet, MET is just balanced at 105% and LYS is 101% of requirement. Additional LYS could be added. Rulquin and Schwab ratios are also calculated by the model and can be used if desired.
12. Mineral balance of this diet is a weak area. Since the mineral mix is designed around the requirements of another group, additional minerals are added at the farm. This results in adequate macro minerals, and questionable micro levels. The diet is (on an absorbed basis):

    Adequate in Ca (49 gm excess)
    Adequate in P (5 gm excess)
    High in Mg (6 gm excess)
    High in K (1.54%)
    Very high in Na (92 gm excess)

Step	What to do …
	Very high in Cl (119 gm excess) Adequate in S (0.28%, 16 gm excess) Very high in Co (4.11 ppm) Very high in Cu (2235 mg fed) Very high in I (141 mg fed) High in Fe (6803 mg fed) Very high in Mn (7284 mg fed) High in Se (.43 ppm) Very high in Zn (6827 mg fed) Very high in Vit A (18 KIU/kg) Very high in Vit D (4.45 KIU/kg) High in Vit E (111.92 IU/kg)
	These micro-mineral levels are unacceptable. This mineral pack has to be reformulated.
13	*Evaluate the group—Nutrient Excretion.* View the Herd Analysis Report. This diet is 36.9% home grown. Most farms would have this group at a level of >45% home grown. It is depressed on this farm partially due to the grass hay, which is purchased from a neighboring crop farmer. Average N, P, and K purchased are 77, 77, and 58%, respectively and are typical for most herds. Increasing forage levels will result in lowering these values. The group will produce 615 tons of manure during this 175-day period.
14	*Tips for reformulation.* This diet has many areas where it can be improved. The following should be investigated: 1. Dry matter intake. What can be done to increase DMI? 2. Total ME of the diet needs to be increased to improve energy balance. 3. Total MP needs to be increased if these cows are to produce at the inputted level. 4. NSC levels could be increased. 5. If inventory allows, forage levels could be increased. 6. Peptide levels could be lowered slightly. 7. LYS levels could be increased. 8. Reformulate the mineral mix.
15	*Inputs for other groups.*

	Pens 1 and 2	Pen 3
Animal Type:	Lactating Cow	Lactating Cow
Age:	47	24
Sex:	Cow	Cow
Current Shrunk Body Weight:	1500	1400
Mature Weight:	1515	1515
Breed Type:	Dairy	Dairy
Days Pregnant:	50	50
Days since calving:	140	140
Lactation number	4.0	1.0
Calving Interval:	13	13
Exp. Calf Birth Weight:	95	95
Age At First Calving:	22	22

Step	What to do …		
	Rolling herd average	22000	22000
	Milk production	96.0	80.0
	Milk fat	4.00	4.00
	Milk true protein	3.30	3.26
	Milk price	11.00	11.00
	Body Condition Score:	2.90	3.25
	Breeding system	Straightbred	Straightbred
	Breed	Holstein	Holstein
	Additive	None	None
	Added fat in diet	No	No
	Wind Speed:	1	1
	Prev. Temperature:	40	40
	Prev. Rel. Humidity:	40	40
	Temperature:	40	40
	Relative Humidity:	40	40
	Hours in Sunlight:	0	0
	Hair Depth:	.25	.25
	Mud Depth:	0	0
	Hide:	Thin	Thin
	Minimum Night Temperature:	50	50
	Activity: Large free-stalls Close parlor for both		

Rations: feed the same ration to both groups. For Pen 3, after entering the ration, click on the Production tab, and then click on the Ration tab. In the Intake Scalar box, enter 90%.

Corn silage	17.25
Hay silage	10.00
Corn meal	12.00
Whole cotton	4.00
Homer meal	4.00
Soy 48	3.75
Gluten 60	.75
Beet pulp	1.85
Molasses	1.00
DiCal	.25
Limestone	.50
Ca Sulf	.30
White salt	.25
Sodium Bicarb	.45
Mag Ox	.05
Mag Sulf	.15
Trace min vit pack	.08
4 Plex	.03
Total	56.66

Step	What to do …
16	*Selected output from groups.*

Summary results should look like this:

	Pens 1 and 2	*Pen 3*	
Entered milk:	96.0	80.0	
ME allowable milk:	88.9	78.2	lbs/day
MP allowable milk:	92.9	82.7	lbs/day
LYS allowable milk:	98.4	88.2	Lbs/day
Days to Loose 1 Condition Score:	185	684	
Rumen N balance:	63	57	g/d
Peptide balance:	40	39	g/day
eNDF balance:	3.3	2.9	lbs/day
Pred. DMI:	59.63	52.66	lbs/day

Step	What to do …
17	*Save the simulation.*

Dry cows (steps 7-17)

Step	What to do …
7	Enter the description inputs for the group. The first group we will work with is the Far-off dry cows. Enter the following inputs: Animal Type: Dry cow Age: 47 months Sex: Cow Body Weight: 1500 lbs SBW Mature Weight: 1515 Breed Type: Dairy Days Pregnant: 215 Days since calving: 305 Calving Interval: 13 Exp. Calf Birth Weight: 95 Age At First Calving: 22
8	Enter the production inputs for the group. Enter the following inputs: Body Condition Score: 3.25 (on a Dairy Scale) Breeding System: Straightbred Breed: Holstein
9	Enter the management/environment inputs for the group. Enter the following inputs: Additive: None Added fat: Should not be checked Wind Speed: 1 Prev. Temperature: 40

Step	What to do …
	Prev. Rel. Humidity: 40 Temperature: 40 Relative Humidity: 40 Hours in Sunlight: 0 Storm Exposure: should not be checked Hair Depth: .25 Mud Depth: 0 Hide: Thin Minimum Night Temperature: 50 Activity: Small free-stalls (<200 cows)
10	Enter the ration for the group. Enter the following ration: Corn silage : 10.977 lbs DM/d Hay silage: 5.787 Grass hay: 5.958 Homer meal: 2.113 Dry cow mineral mix: 0.297 Total DMI should be: 25.130 pounds per day Summary results should look like this: ME balance: -0.1 Mcal/day MP balance: 302 g/day MET balance: 7 g/d Days to Lose 1 Condition Score: 15860 Rumen N balance: 28 g/d Peptide balance: 4 g/day eNDF balance: 6.8 lbs/day Pred. DMI: 30.77 lbs/day
11	Save the simulation.
12	Evaluate the group— Diet adequacy. 1. The first question raised by this ration is the difference between entered and predicted DMI. Why are these cows consuming 5.64 pounds less? a. Is the entered ration correct? b. Is the group described adequately? i. Specifically is body weight correct or was it a guess? c. Are animal numbers kept current? d. Are the animals under stress? 2. At the inputted DMI, animals are in energy balance. Is this acceptable for this group of cows? 3. Diet NEl is predicted to be .65 Mcal/lb. This is higher than the range suggested at the beginning of this tutorial. Part of the reason for this difference is the rumen sub-model. The Nel calculation is based on rumen degradation and may run higher than tabular values. For this reason, ME balance is the better number to work with.

Step	**What to do …**
	4. Diet crude protein is 13.2%, slightly higher than the suggested range. Protein may be slightly high in this diet. 5. Protein solubility is lower than the suggested range (36 vs. 40 – 50%). Why? At first glance, urea would be considered, however ruminal N balance of this diet is 110% of requirement and peptides are just balanced at 100% of requirement. Since the farm only has Homer meal in inventory, it was included in this diet to bring the peptide balance to at least zero. Since Homer meal is expellers type soy, it has lower protein solubility and degradability. Using Homer meal to balance peptides requires a higher inclusion rate vs. solvent extracted soy (like Soy 48). This is also why model predicted DIP is lower than suggested values. 6. NDF of this diet is 52.8%, within suggested range. 7. Mineral balance of this diet is a weak area. The mineral pack used in this group is formulated for a different group resulting in unbalanced minerals. The diet is: Adequate in Ca (-4 gm) Slightly in excess of P (8 gm excess) Adequate in Mg (.26%) Very high in K (2.03%) Low in Na (.08%) Slightly in excess of Cl (.28%) Marginal in S (.15%) Very high in Co (1.32 ppm) Very high in Cu (501 mg fed) Very high in I (76 mg fed) High in Fe (1691 mg fed) Very high in Mn (1969 mg fed) Low in Se (.14 ppm) High in Zn (1494 mg fed) Very high in Vit A (5.66 KIU/kg) Very high in Vit D (1.42 KIU/kg) High in Vit E (35.42 IU/kg) This mineral pack does not fit this group and should be reformulated.
13	Evaluate the group—Nutrient Excretion. View the Herd Analysis Report. This diet is 66.7% home grown. Most farms would have this group at a level of >80% home grown. It is depressed on this farm due to the grass hay, which is purchased from a neighboring crop farmer. Average N, P, and K purchased are 46, 40, and 39%, respectively and are acceptable for this group. The group will produce 454 tons of manure during this 175-day period.
14	Tips for reformulation. This diet has many areas where it can be improved. The following should be investigated: 9. Dry matter intake. With the high level of grass hay in this diet, are the cows being limited in DMI by NDF capacity? 10. Protein could be decreased, however watch peptide balance closely. Could soy 48 be used instead of Homer meal? 11. Reformulate the mineral mix. A specific mineral mix for the far-off dry cows is suggested.
15	Inputs for other groups.

Step	What to do …

	Close-up dry cows
Animal Type:	Dry Cow
Age:	45
Sex:	Cow
Current Body Weight:	1400
Mature Weight:	1515
Breed Type:	Dairy
Days Pregnant:	265
Days since calving	333
Calving Interval:	13
Exp. Calf Birth Weight:	95
Age At First Calving:	22
Body Condition Score:	3.25
Additive:	None
Added fat in ration:	No
Wind Speed:	1
Prev. Temperature:	40
Prev. Rel. Humidity:	40
Temperature:	40
Relative Humidity:	40
Hours in Sunlight:	0
Hair Depth:	.25
Mud Depth:	0
Hide:	Thin
Minimum Night Temperature:	50
Activity:	Small free-stalls (<200 cows)

Corn silage	9.590
Hay silage	5.110
Grass hay	.850
Corn meal	1.800
Whole cotton	1.990
Homer meal	2.000
Soy hulls	1.000
Soy 48	2.000
Gluten 60	.100
Molasses	1.000
Dry cow mineral mix	1.25
Total	26.690

16 Selected output from groups.

Summary results should look like this:

ME balance: 0.5 Mcal/day

Step	What to do …	
	MP balance:	71 g/day
	MET balance:	3 g/day
	Days to Gain 1 Condition Score:	1925
	Rumen N balance:	55 g/d
	Peptide balance:	53 g/day
	eNDF balance:	2.8 lbs/day
	Pred. DMI:	22.98 lbs/day
17	Save the simulation.	

Replacement heifers (steps 7-19)

Step	What to do …
7	*Enter the description inputs for the group.* The first group we will work with is Pen 20. Enter the following inputs: Animal Type: <u>Replacement Heifer</u> Age: <u>8</u> months Sex: <u>Heifer</u> Current Body Weight: <u>450</u> lbs <u>SBW</u> Mature Weight: <u>1515</u> Breed Type: <u>Dairy</u> Days Pregnant: <u>0</u> Calving Interval: <u>13</u> Exp. Calf Birth Weight: <u>95</u> Age At First Calving: <u>22</u>
8	*Enter the production inputs for the group.* Enter the following inputs: Body Condition Score: <u>3.0</u> (on a Dairy Scale) Breeding System: <u>Straightbred</u> Breed: <u>Holstein</u>
9	*Enter the management/environment inputs for the group.* Enter the following inputs: Additive: <u>None</u> Added fat in ration: <u>should not be checked</u> Wind Speed: 1 Prev. Temperature: <u>40</u> Prev. Rel. Humidity: <u>40</u> Temperature: <u>40</u> Relative Humidity: <u>40</u> Hours in Sunlight: 0 Storm Exposure: <u>should not be checked</u> Hair Depth: <u>.25</u> Mud Depth: <u>0</u> Hide: <u>Thin</u> Minimum Night Temperature: <u>50</u>

Step	**What to do …**

Activity: Small free-stalls (<200 cows)

10 *Enter the ration for the group.*
Enter the following ration:

Corn silage:	4.487 lbs DM/d
Hay silage:	3.671
Corn meal:	1.434
Homer meal:	0.319
TMR weighbacks:	2.224
Heifer mineral mix:	0.045

Summary results should look like this:

Target ADG (w/Conceptus):	2.63 lbs/day
ME Allowable Gain:	1.68 lbs/day
MP Allowable Gain:	1.33 lbs/day
LYS Allowable Gain:	1.71 lbs/day
Rumen N balance:	13 g/d
Peptide balance:	-11 g/day
eNDF balance:	2.1 lbs/day
Pred. DMI:	12.20 lbs/day

11 *Save the simulation.*

12 *Evaluate the group—Target weights and growth.* View the Target Weights report. With an inputted mature weight of 1515 pounds, the target weight at first calving is 1288 pounds; weight at 1st breeding is 833 pounds.

Average daily gains post-breeding need to be at least 1.62 pounds per day (without conceptus gain) to achieve 1288 post-calving weight. This assumes that cattle are bred at 833 pounds and have 280 days to gain 455 pounds. Gain lower than this target will result in lower post-calving weights than desired.

Pre-breeding gains are determined by target breeding weight (833 pounds), target age at first calving (22 months), current age (8 months), and current weight (450 pounds). In this tutorial, the calculation is:

((mature weight x .55) – current weight) / ((days of age at first calving - 280) – current age).
=((1515 x .55) – 450) / (((22 months x 30.4) – 280) – (8 months x 30.4))
=(833 – 450) / ((668.8 – 280) – 243.2)
=383 pounds / 145.6 days
=2.63 pounds per day

Using this system (with target breeding weight independent of age), age at first calving is influenced by pre-breeding growth rate and weight at calving is influenced by gain post-breeding.

13 *Evaluate the group—Predicted Performance.* View the Growth Requirements report.

Step	What to do …
	Growth in the CNCPS is calculated as the residual energy and protein after meeting maintenance, pregnancy, and lactation requirements. In this group, total ME required for maintenance is 8.12 Mcal/d leaving 1.71 Mcal/d NE available for growth, or an energy allowable gain of 1.68 lbs/d.

This level of gain requires 155 gms/d of net protein. Protein at this body weight is used at an efficiency of 67.2%. An additional 243 gms of MP is required for maintenance resulting in a total of 502 gm MP required daily. On the Diet Evaluation report, you will find MP allowable gain reported. This is the average daily gain allowed by the MP supply. In this example, it is 1.33 pounds per day, well below the target gain required.

14 *Evaluate the group—Diet adequacy.* View the Diet Evaluation report.

When evaluating a group of replacement heifers, the following is suggested as a starting point:

1. Does predicted DMI agree with observed DMI? In this case, observed DMI is within .01 pounds per day (12.18 observed vs. 12.19 predicted.).
2. Is protein allowable gain greater than or equal to energy allowable gain? If they are not (as in this example), excess energy will be deposited as body fat. This can be seen as an increase in body condition score as was being observed on this farm. By the time heifers were moved from this pen, average body condition score had increased .2 to .3 points. Since this group is pre-pubertal, body fat can be deposited in the mammary gland resulting in decreased lifetime milk production. As shown in the report, the diet crude protein is 13.4%; a level believed to be insufficient for heifers at this age and weight.
3. Are ME and MP allowable gain greater than or equal to target gains? To meet the target weight and age at 1st breeding, target gains must be met. In this case, neither ME nor MP allowable gains achieve the target.
4. Are rumen parameters met? Rumen N balance (ruminal ammonia) and Peptide balance should be at least 100% of requirement to maximize ruminal microbial growth at a high efficiency. In this case, ruminal N balance is 115% of requirement whereas peptides are only 71% of requirement. This level of peptides does not maximize NFC ruminal fermentation.
5. Minerals balance should be evaluated. This can be viewed using the Mineral Requirements report.

15 *Evaluate the group—Nutrient Excretion.* View the Herd Analysis Report. This report can be accessed only from the Reports screen. To view this report for this one group, click on the Reports button on the toolbar, make sure Pen 20 is selected, and then select Herd Analysis Report in the lower right corner of the screen. Now click on view.

As can be seen, this diet is 68.9% home-grown and costs $31.06 per day to feed. Of the nitrogen in the diet, 35% is purchased, 42% of the phosphorus, and 19% of the potassium. From a nutrient management standpoint, these are lower than most herds. The typical range is 60 to 90% of the N, P, and K is purchased.

The efficiency of nutrient use can also be viewed on this report. Growth is a relatively

Step	What to do …
	inefficient process capturing only 20 to 25% of the nitrogen as tissue. The remaining N is excreted.
16	*Tips for reformulation.* This diet has many areas where it can be improved. The following should be investigated:

1. Increase the protein level of the diet to allow protein allowable gain to slightly exceed target and energy allowable gains.
2. Increase energy intake to match target gain requirements.
3. Increase the level of peptides to at least meet requirements.
4. Decrease the level of Ca and P to required levels to minimize nutrient excretion.
5. Balance all other minerals to required levels.

A note about this diet. This diet was originally formulated using the inputs from the next pen assuming summer/early fall conditions. All open heifers were fed one diet formulated for the average animal in the barn. This approach was followed for several years on this farm. As can be seen here, this approach underfed protein to this pen of heifers resulting in MP allowable gains below energy allowable and target gain requirements. Body condition scores of this pen were increasing on this ration due to the protein deficiency. Another area of concern with this diet is the level of TMR weighbacks being fed. This poses several challenges to the nutritionist and the farm. From a heifer nutrition standpoint, TMR weighbacks overfeed minerals and other costly ingredients in replacement heifers and their composition varies daily. Many assumptions are made regarding composition and quality of weighbacks. The best approach is to not feed weighbacks. To do this, weighbacks from the lactating cows need to be decreased. This requires a high level of feed-bunk management so that lactating cow DMI is not limited. Many management challenges exist and must be discussed with the farms management team. Additionally, feeding TMR refusals is a bio-security issue. Manure contamination can result in the feed being a carrier for diseases such as Johnes and/or BVD. While practiced on many farms, feeding refusals to the replacement herd is not a recommended practice. The current rations and changes in feeding management on the farm have resulted in 50 to 75% less weighbacks. Weighbacks are currently fed only to one heifer group. All other heifer rations have been formulated to meet target gains.

17 *Inputs for other groups.*

	Pen 30	Pen 40	Pen 50
Animal Type:	Replacement Heifer	Replacement Heifer	Replacement Heifer
Age:	10	14	18
Sex:	Heifer	Heifer	Heifer
Current Shrunk Body Weight:	700	900	1050
Mature Weight	1515	1515	1515
Breed Type:	Dairy	Dairy	Dairy
Days Pregnant:	0	30	130
Calving Interval:	13	13	13
Exp. Calf Birth Wtt:	95	95	95
Age At First Calving:	22	22	22
BCS:	3.00	3.00	3.00

Step	What to do …			
	Additive	None	None	None
	Added fat	No	No	No
	Wind Speed:	1	1	1
	Prev. Temperature:	40	40	40
	Prev. Rel. Humidity:	40	40	40
	Temperature:	40	40	40
	Relative Humidity:	40	40	40
	Hours in Sunlight:	0	0	0
	Hair Depth:	.25	.25	.25
	Mud Depth:	0	0	0
	Hide:	Thin	Thin	Thin
	Min Night Temp:	50	50	50
	Activity:	Small free-stalls (<200 cows) for all groups		
	Corn silage	6.262	8.862	7.048
	Hay silage	5.123	7.250	14.804
	Corn meal	2.001	2.831	2.554
	Homer meal	.445	.630	2.611
	TMR weighbacks	3.104	4.393	0
	Heifer mineral mix	.063	.089	.185

18 *Selected output from groups.*

	Pen 30	Pen 40	Pen 50	Units
Target ADG	1.57	1.62	1.62	Lbs/d
ME allowable gain	1.81	.45	1.58	Lbs/d
MP allowable gain	2.37	3.46	4.12	Lbs/d
LYS gain (if first limiting)	2.88	4.07		Lbs/d
MET gain (if first limiting)			4.01	Lbs/d
Pred. DMI	16.99	24.11	27.19	Lbs/d
Inputted DMI	16.99	24.05	27.20	Lbs/d
Ruminal N balance	20	30	75	Gms
Peptide balance	-11	-17	15	Gms
eNDF balance	3.0	4.2	5.7	Lbs/d

19 *Save the simulation.*

WHOLE HERD ANALYSIS

One of the most challenging tasks we have found in whole-herd analysis and whole-herd ration formulation is forage allocation. Forage allocation is a multi-part task including:

a. Planning crop needs and feed needs for the next year
    i. Assumes steady-state conditions on the farm
b. Allocation of feeds in inventory
    i. Temporal dynamics as feeds are harvested at different times of the growing season.

CNCPSv5 can assist you in addressing both of these forage allocation tasks.

This tutorial will focus on the herd nutrient excretion, sensitivity of excretion to over-feeding N and P, planning for next years feed needs, and conclude with a method for allocating feeds in inventory.

Part 1—evaluating whole-herd excretion

The first step in this evaluation is to assume that the herd is steady-state (neither gaining or losing animal numbers or production). To do this, we need to change the days to feed for each group to 365 (the reason for starting with 175 in previous tutorials will become evident in the forage allocation section). After changing the days to feed each group (make sure animal numbers are correct—Pens 1 and 2: 250 animals, Pen 3: 130 animals), view the Whole-herd analysis report (go to reports, select all groups, select Whole-herd analysis report, View Report).

The Whole-herd analysis report summarizes the nutrient input and output across all selected groups for the number of days entered. Entering 365 days to feed all groups assumes that the number of animals in each group remains relatively constant throughout the year. As shown in this report, 830 cattle are represented averaging 1258 pounds. Lactating cows are averaging 88.4 pounds of milk daily. In this example, this does not agree with actual production since we are using formulated rations that include lead feeding. For an accurate evaluation of herd nutrient flows, we should change the entered milk production and DMI to agree with observed parameters.

In the Rations section of this report, we see that 53.8% of the diet is homegrown (46.2% purchased). While typical on many farms this size (and an improvement for this farm compared to 1997 when the value was 46% homegrown), this is unacceptable in terms of nutrient management. A reasonable goal for the proportion of homegrown feeds is at least 60%. The higher this value is, the greater the opportunity for the farm to allocate manure resources based upon P. The Total Ration Cost of the herd is $2,372.29 daily. This ration cost as we have entered includes the value of all homegrown feeds thus it may appear high.

The next section of this report is the Nutrients section. This section provides an estimate of the proportion of N, P, and K purchased, mass of nutrients excreted, and an efficiency of nutrient use. Values for these diets show that 60% of N is purchased, 59% of P, and 34% of K. Values typically found on farms of all sizes range from two-thirds to three-quarters for each of these nutrients. One objective of integrated nutrient management is to minimize these values. In 1997, values for this farm were 74%, 77%, 50% for N, P, and K respectively. Nutrient excretion is partitioned by excretion route: total manure, urinary, fecal, and productive use (milk and weight gain). Comparing 1997 (922 animal units) with 1999 (952 animal units), we see that total P excretion has decreased from 43,560 to 34,156 pounds annually (a 25% decrease). This was accomplished by decreasing the P content of the rations and increasing the proportion of the diet that is homegrown.

The final component of this report is the prediction of annual manure production. The farm is predicted to produce 11,692 tons of fecal and 6,534 tons of urine giving a total of 18,226 tons of raw manure (no bedding or added water) annually.

The next report to view is the Whole Herd Feed Requirements report. This report estimates feed requirements (Tons As-Fed per year) for each feed by group. It then sums each feed across group as well as all feeds within group. This report has two primary uses: planning for the upcoming crop season and allocating feeds in inventory post-harvest. The first way we will use this report is as a planning tool. With the rations we have loaded, we see that the herd would require 6,555 tons of corn silage annually assuming these rations did not change. This value is what needs to come out of storage. Storage losses need to be added to arrive at required crop yields. The farm utilizes bunk silos with excellent management. A 20% dry matter loss would still be considered during storage, thus 6,555 plus 20% loss results in 8,194 tons as fed to be harvested. If the farm were to harvest 450 acres of corn for silage, yields would have to average 18.2 tons per acre. With the dry conditions of 1999, the farm averaged 16.85 tons per acre. This report can also be used for planning feed purchases. As an example, the farm is planned to feed 329.5 tons of whole cottonseed over a 12-month period (27.5 tons monthly). The farm could forward contract whole cottonseed based upon these calculations. This could be done with many feeds allowing the producer to minimize price risk and project an operating margin.

NOW FOR SOME SENSITIVITY

Change the amount of DiCal fed to Pens 1 and 2 to .50 pounds, Pen 3 to .425 pounds. If you view the Mineral Requirement report for these groups, you will find that this changes the P concentration of the rations to .51 (Pens 1 and 2) and .51% (Pen 3), a level still seen on many farms. Now view the Whole-herd Analysis report. What is the:

P percent purchased: ____________
Excreted P: ____________ lb/yr
Total ration Cost of Herd: ____________ $/day

How do these values compare to the base diets?

Even this moderate level of over-feeding P has large implications on excretion and feed costs. Farm sustainability (economically and environmentally) dictates that we remove this safety factor.

FORAGE ALLOCATION—WORKING WITH CURRENT INVENTORY

Change the DiCal amounts back to their original values in Pens 1 and 2 and Pen 3. Also, change the days to feed each group back to 175. Now view the Feed Requirements report.

Why was 175 days inputted? This analysis was conducted in early December. Hay silages need to last until June 1 giving us 175 days to feed hay silage. Based upon entered diets, 1,170.5 tons of grass silage and 784.7 tons of Alfalfa silage were needed. Bunks were measured for what was remaining as well as what had been fed over a two-week period. It was determined that at the current feeding rates, grass silage would be depleted in less than 50 days and alfalfa depleted in less than 100 days. With this report and the calculated inventories available, diets were able to be re-formulated to stretch inventory until June 1.

WHAT-IFS

Lactating Cows

1. Evaluate the diet adequacy of Pen 3.
2. If we know that the standard deviation of the 1999 Alfalfa silage for NDF is 3 units and for crude protein it is 2.5 units, what is the potential impact?

   Focus on: MUN, MP balance, MP allowable milk. Note that as the NDF increases, crude protein decreases and vice versa. Calculate the impact on a daily and yearly basis for the entire group. For the group: calculate gross income, feed costs, income over feed costs. Present your findings as if you were the farms consultant and they wanted to minimize production variation. Include recommendations to decrease the variation in production. Use the back of this page for your answer.

   BONUS QUESTION

   Simulate the impact of dry matter content of the corn silage (standard deviation of 4 units) and alfalfa silage (SD of 3 units). This requires at least 7 runs of the model. Discuss the impact as outlined in question 2.

Dry cows

1. Evaluate the close-up diet as entered. Compare predictions to suggested values in the tutorial. Be specific in terms of DMI, energy balance, protein balance, ruminal N balance and peptides, and minerals.

2. In the Close-up diet, click on the Estimate button. Re-evaluate the diet.

3. In the Close-up diet, change the Previous temp to 30 and current temperature to 10. Click on the estimate button. What happens to ME balance?

   What could we expect post-calving if this energy balance were maintained throughout the close-up dry period?

4. Leave the temperatures the same. Change body weight to 1250 pounds (a group of heifers was just moved to the group). Click on the estimate button. Evaluate the diet and suggest what might happen post-calving.

5. A new forage analysis revealed the following for the grass hay: NDF 72%, Lignin (% NDF) 15.40, CP 5.6%, and ADFIP 15.10 (% CP). Enter this analysis and evaluate the far-off dry cows. What post-calving impact would this have if this hay were fed throughout the dry period?

Replacement heifers

Before we do any what-ifs, perform the following calculations:

Given: Mature body weight = 1475 lbs
Age at first calving = 23 months

1. Fill in the following table:

Age	Target Weight	Target ADG
1st breeding		
Post-1st calving		
Post-2nd calving		
Post-3rd calving		

2. In pen 20, change the current and previous temperatures to 68 degrees. Adjust intake if needed. Evaluate the diet (in terms of ME and MP allowable gain vs. target ADG).

3. In pen 50, change days pregnant to 189. What happens to gains (ME, MP and target)? Why?

4. In pen 50, change days pregnant to 191. What happens to gains (ME, MP and target)? (Hint: view the diet evaluation report) Why?

5. In pen 50 (leave days pregnant at 191), change Hair Coat to Mud on Lower Body and sides (to simulate animals not using the stalls), wind to 10 MPH, and current temperature to 20 degrees F.
    a. What happens to ME allowable gain?
    b. Why?
    c. What is the total maintenance requirement?
    d. What is the lower critical temperature?
    e. What does lower critical temperature mean?

Whole-herd

Unless stated, always use 365 days to feed each group.

This group of what-ifs begins the integration of animal nutrition and crop production. It is a mix of CNCPSv5 calculations and hand calculations.

The case-study farm has 1,250 tillable acres. Of this, 480 are planned for corn production in 2000, 440 are alfalfa, and the remainder is intensive grass production. Fill in the following tables:

Given these historical average yields (as chopped):
Corn silage: 21.5 t/a plus 20% storage loss, harvested 1x annually
Alfalfa silage: 12.5 t/a plus 20% storage loss, harvested 4x annually
Grass silage: 16.5 t/a plus 20% storage loss, harvested 4x annually

2000/2001 feeding season inventories:

	Corn silage	Alfalfa silage	Grass silage
Acres			
Average yield			
Potential inventory			
Storage loss			
Feedable inventory			
Days to feed			
Tons feedable/day			
DM content of feed			
Pounds DM feedable/day			

Bunk silos are the following dimensions:

Corn silage: 200 x 65 x 12' walls (at 15 pounds/cubic foot DM)
Alfalfa silage: 200 x 32 x 12 (at 13 pounds/cubic foot DM)
Grass silage: 200 x 32 x 12 (at 13 pounds/cubic foot DM)

What are their as fed capacities? Are they adequate?

How many days must the hay silage bunks be able to store? With this in mind, are their sizes adequate now?

If the farm increases the corn silage height to 23', losses have been calculated to be 38%. What is the capacity of the silo at 23' and what is the feedable amount with this loss? Calculate a new feed cost for the corn silage taking into account this loss.

Hint: $25 / ton x feedable inventory from the first table / feedable inventory if 45% loss

In 1999 (using the same acreage and yields as given above), the farm filled 4 12' x 270' bags with corn silage (at 2 tons as fed/linear foot). This decreased the height in the bunk to 13'. How much additional corn silage inventory does this give the farm?

Using the information from the base whole herd analysis report, fill in the following table:

	Corn silage	Alfalfa silage	Grass silage	Total
Acres				
P content of feed				
Total crop yield				
Crop dry matter				
P removed by crops (total)				
P removed per acre				
Total P excretion				
Difference				

If the manure were to be spread evenly across all acreage, how much P would be spread per acre?

Compare this value with the P removal you calculated in the above table.

Now use the P excretion you calculated when moderate over-feeding occurs (from the Tutorial) to re-do these calculations.

	Corn silage	Alfalfa silage	Grass silage	Total
Acres				
P content of feed				
Total crop yield				
Crop dry matter				
P removed by crops (total)				
P removed per acre				
Total P excretion				
Difference				

If the manure were to be spread evenly across all acreage, how much P would be spread per acre?

Compare this value with the P removal you calculated in the above table.

What is the impact of over-feeding P on the crop program? How many additional acres would be needed to utilize this additional P if the crop plan were based on crop removal?

REAL PROBLEM. The farms crop planner has recently informed the farm that if they were to base their nutrient management plan on P, greater than one-half of the acreage would not be spreadable due to P soil test levels. Keeping this simple, fill in the tables once more but reduce all the acreages 50%.

	Corn silage	Alfalfa silage	Grass silage	Total
Acres				
P content of feed				
Total crop yield				
Crop dry matter				
P removed by crops (total)				
P removed per acre				
Total P excretion				
Difference				

If the manure were to be spread evenly across all spreadable acreage, how much P would be spread per acre?

Compare this value with the P removal you calculated in the above table.

What would be the P accumulation rate if this were to occur?

Finally, let's take one look at Nitrogen. Increase the dry matter amount of Homer meal in these groups:

Pens 1 and 2: 5 pounds per day
Pen 3 4.25 pounds per day

How much is MP overfed in these two groups now (on a percentage basis)?

How much additional total N is excreted annually now?
What proportion of this excess N is excreted in the urine? Why?

Where would this excess N go in the environment?

For this part, use the new N excretion values you calculated.
N in manure is credited as follows:

Ammonia N (urinary) if not incorporated within 5 days, 100% loss
Organic N (fecal) is only 35% available the first year.

The farm does not incorporate manure thus all ammonia N is loss. If the farm were to meet all of the N requirements for corn with manure, what would be the P application? Compare this to P removal. Use this table to help in the calculations:

Acres of corn		
N required for third year corn	140	Pounds/acre
Ammonia N available		%
Organic N available this year		%
Total ammonia N available		Pounds
Total organic N available		Pounds
Manure N available		Pounds
Manure N concentration		%
Tons of manure required to meet N requirement		Tons/acre
P concentration of manure		%
P applied at N rate		Pounds/acre
P removed per acre		Pounds/acre
Excess/deficit of P		Pounds/acre

So, which is more important, N or P? Why?

What can farms do to address this?

TUTORIAL 3 – DUAL-PURPOSE COWS

Much of the milk in the tropics is produced by dual purpose cows. These dual purpose cows are used to harvest nutrients from predominantly grass pastures for the production of milk and meat. Nutritional systems are needed to predict milk production by cows on pastures of varying nutritive value under the prevailing environmental conditions, and to design supplements that will complement available forages to meet production objectives.

Forage quality is one of the greatest limitations to improving cattle productivity in the tropics. Because of its importance, it is important for researchers, educators, and farm advisors to understand the relative impact of variation in carbohydrate and protein fractions in forages on animal production. For this reason, our objective with this case study is to learn how to use the Cornell Net Carbohydrate and Protein System (CNCPS) model to evaluate the effect of tropical forage quality on milk production of dual purpose cows. For this case study, we will use the data published by Juarez Lagunes et al. (1999); details of the study and references can be obtained from that paper.

Those using the CNCPS often use the feed composition values in its feed library to evaluate diets and develop feeding programs. To compare the effects of using tabular or measured carbohydrate and protein fractions and rates of digestion, we will use the data from these dual purpose cows (described in Table 2) and the actual feeds fed to these cows (Tables 1 and 3). The source of the data and inputs used are summarized below.

Animal and environment inputs: These inputs (table 2) describe the averages for animals in this study; a mature, mid-lactation, crossbred cow (3/4 Holstein x 1/4 Zebu) in August in the Southeastern Gulf Coast region of Mexico. The climate of the area is tropical sub humid (no month with an average temperature below 18 degrees C and has a dry season). The mean temperature was 25 degrees C and the relative humidity was 81% during the study. CNCPS 5.0 accounts for these effects on maintenance requirement and predicted DMI. The cows were milked mechanically twice daily and calves were not allowed to suckle. Daily milk production and monthly analyses of fat, protein, and SNF were used to calculate biweekly measurements of milk production and composition for individual cows. Monthly BW was recorded. Changes in BW were calculated as the BW of the current month minus the BW of the previous month.

Feed intake: The month of August was chosen because it is the middle of the rainy season and forage availability does not limit voluntary DMI. The cows rotationally grazed 27 ha Pangola grass (*Digitaria decumbens*). The grazing plots were 1 ha each with cows grazing one plot each day. The plots were allowed to regrow for 27 d between grazing periods. Cows were fed 3.5 kg of concentrates daily (table 3). Two kilograms were offered in the morning and 1.5 kg were fed in the afternoon. The concentrate mix (DM basis) contained 64% sorghum, 22% soybean meal, 10% cane molasses, 3% mineral mixture, and 1% urea. Because the DMI of the pasture was unknown, a common situation in grazing studies, we determined the forage DMI required to support the observed performance, as described by Perry and Fox (15). Pasture intake was changed until the predicted (ME intake minus animal requirements, including body weight gain) and observed energy balance (as evidenced by body weight change) agreed.

Feed analysis: Samples of Pangola grass (*Digitaria decumbens*) were collected during August at 28 days of regrowth. These forage samples along with samples of the ingredients included in the concentrate were freeze-dried and sent to Cornell University for analysis. The chemical and in vitro digestion analyses for Pangola grass and the ingredients included in the concentrate are summarized in Table 1, along with tabular values. Most of the measured carbohydrate and protein pool sizes for Pangola grass were similar to the tabular values, except that the measured NPN value was considerably higher than the tabular value. The starch as a proportion of the NSC was higher because the original tabular value was erroneously entered as a percentage of DM instead of as a percentage of NSC. Measured digestion rates for Neutral Detergent Solubles (A + B_1 carbohydrate fractions) were lower than the tabular values but the measured digestion rates for the B_2 carbohydrate and B_3 protein fractions were higher. The digestion rates for the B_1 and B_2 protein fractions were not measured.

In this tutorial, we will evaluate the data presented from the performance of the dual purpose cows as a single group for the time the measurements were taken (August). To learn how to evaluate an entire herd for the year, see the **dairy herd tutorial**.

STEP 1. CREATE A NEW SIMULATION

1. Click on ***File***, then ***New Simulation***, from the menu. Name this simulation ***dual purpose tutorial***.
2. Create the animal group (required inputs are in table 2).
    a. Select ***create animal group***, then select ***lactating cow***, then name the group ***dual purpose cows.*** Then in this same screen (parameters) select the parameters for this group (units = metric, ration basis = DM, energy units = calories, level solution = 2, number in the group = 50, and days to feed = 31; month of August).
    b. Select the default group, then click on ***delete group***.

STEP 2. CREATE A FEED LIBRARY FOR THE FARM

1. Click on the ***feeds*** icon in the top menu bar.
2. Click on ***add feeds*** in the feeds screen.
3. When the feed library screen appears, click on ***tropical feed library.***
4. Select the feeds to be used on this farm (those listed in table 1 except for the NRC pangola grass; it is not in the feed library) from the feed categories in the feed library screen (grass forages, legume forages, energy concentrates, protein concentrates, etc). Click on the feed as listed in table 1*; be sure to use those with the indicated IFN number and* ***Mexico*** *at the end of the name.* When you click on the feed, it will be displayed at the bottom of the screen. Check this display at the bottom to make sure you selected the correct ones, based on NDF, lignin and Crude Protein content for forages and the closest feed description for concentrates. If it is not the correct feed, you can de-select the feed by clicking on it where listed in the category list.
5. When finished selecting feeds, select ***add feeds***.
6. Put the feeds in the order listed in table 1, using the up and down arrows to move the selected feed.
7. ***Save the simulation***.
8. Click on the first ***pangola grass fresh*** in the list of feeds, click on the name in the right column, and change the name to ***Pangola grass measured.***

9. Compare the composition values with those in table 1 under Pangola grass measured. Values are changed by clicking on the cell to the left of the parameter to be changed (you may have to double click to get a white box, which lets you edit the feed). NOTE: information from feed analysis reports has been organized to be in the units needed for the model. For example, lignin has been changed from % of DM to as % of NDF.
10. ***Save the simulation.***
11. Edit the remaining feeds as for the first feed.
12. ***Save the simulation.***

Table 1. Feed analysis used for evaluating Dual Purpose cattle performance with the CNCPS

	Pangola Grass[1]		Sorghum	Soybean	Cane
	NRC[2]	fresh[3]	Grain[3]	Meal[3]	Molasses[3]
		Mexico	Mexico	Mexico	Mexico
IFN number	-----	2-01-668	4-04-383	5-04-600	(only one)
Cost, $/metric ton as fed	3.00	3.00	60.00	250.00	40.00
DM, %	21.0	26.8	87.4	89.0	85.8
NDF, % of DM	70.0	69.5	10.3	11.4	0.0
Lignin, % of NDF	11.4	7.5	12.8	0.9	0.0
CP, % of DM	9.1	8.9	10.4	52.6	4.2
Solubility, % of CP	42.0	41.9	14.9	16.0	98.0
NPN, % of SolP	4.8	36.3	33.0	55.0	100.0
NDIP[4], % of CP	24.0	32.5	33.9	5.5	0.0
ADIP[5], % of CP	2.2	5.4	5.0	2.0	0.0
Fat, % of DM	2.3	2.4	3.6	2.0	2.2
Ash, % of DM	7.6	8.6	3.0	7.0	11.6
Unavail. NDF, % of DM[6]	19.2	12.5	3.2	0.3	0
Avail. NDF, % of DM7	48.7	54.1	3.6	8.3	0
NSC, % of DM[8]	13.2	13.5	76.2	29.9	82.0
Digestion rates, %/hr					
CHO A	250	19.7	14.3	7.9	17.5
CHO B1	30.0	19.7	14.3	7.9	17.5
Available NDF (CHO B2)	3.0	5.3	6.0	5.7	-
B1 protein	135.0	…	135.0[2]	230.0[2]	350.0[2]
B2 protein	11.0	…	6.0[2]	11.0[2]	11.0[2]
B3 protein[9]	0.09	5.3	0.12[2]	0.20[2]	0.25[2]

[1] *Digitaria decumbens*.
[2]Tabular values, National Research Council Nutrient Requirements of Beef Cattle (2000).
[3] Laboratory measurements except where noted.
[4] Neutral detergent insoluble protein.
[5] Acid detergent insoluble protein.
[6]Unavailable NDF = NDF **– (NDF * lignin (% of NDF)** * 2.4).
[7]Available NDF = NDF – (CP *(NDFIP/100)) – unavailable NDF.
[8] NSC = non structural carbohydrate, and is 100 – CP – fat – ash – unavailable NDF – available NDF.
[9]B3 protein = available NDF protein = NDFIP – ADFIP.

STEP 3. DESCRIBE THE ANIMALS AND THEIR FEED INTAKE

Table 2. Animal and environment descriptions

Description	Input Units
Description screen:	
Number in group	50 head
Days to feed	31 days
Animal Type	2 Lactating dairy cow
Age	66 mo
Sex	4 cow
Body Weight	511 kg (shrunk body weight)
Breed Type	Beef x dairy (dual purpose)
Mature Weight	550 kg (shrunk body weight)
Days Pregnant	55 d
Days since Calving	174 d
Lactation #	5
Calving interval	13 months
Expected Calf Birth Weight	38 kg
Age at first calving	30 months
Production screen:	
Rolling Herd Average	2866 kg
Milk Production	10 kg
Milk Fat	3.6 %
Milk Protein	3.2 % crude protein
Milk Price	your actual price/liter
Condition Score	3 (dairy scale of 1 to 5)
Breeding System	2 way cross
Dam's Breed	Brahman
Sire's Breed	Holstein
Management and Environment screen:	
Additive	None
Wind Speed	16 kph
Previous Temperature	27 °C
Previous Relative Humidity	81 %
Current Temperature	28 °C
Current relative humidity	81 %
Hours in Sunlight	10 hrs
Storm Exposure	no
Hair Depth	0.6 cm
Mud depth	0
Hide	Thin
Hair Coat	No mud
Cattle Panting	None
Minimum night temperature	20 °C
Activity	Intensive grazing

1. In the tree (displayed on the left), find the ***dual purpose cow*** group. Table 2 contains the information needed to describe the animals and their environment.
2. Click on ***description*** and enter the information requested from table 2.
3. Then select the next tab at the top of the screen ***(production)*** and use table 2 to choose or enter the information requested.
4. Then select the next tab ***(management and environment)*** at the top of the screen and use table 2 to choose or enter the information requested.
5. Then select the next tab ***(ration)*** at the top of the screen and use table 3 to enter the information requested.

Table 3. Feed intake of case study cows

Diet ingredient	Dry matter intake, kg/day
Sorghum grain (Mexico)	2.24
Soybean meal (Mexico)	0.77
Molasses cane (Mexico)	0.35
Minerals (minvit)	0.10
Urea (in feed byproduct)	0.04
Pangola grass[1] (Mexico)	7.7
Total	11.2

[1] DMI required to support observed performance.

6. ***Save the simulation***.

   Now you can review the results by clicking on ***ration*** under the group name in the tree. You can print out the results for the group by clicking on ***summary results***, then clicking on ***print report.***

Table 4. Performance of dual purpose cows

Actual milk production, kg/day	10.0
ME[4] allowable milk, kg/d	10.1
MP allowable milk, kg/d	10.1
Rumen N Balance, g/d	47
Peptide Balance, g/d	60
MP from Bacteria, g/d	610
MP from undegraded feed, g/d	343
Predicted DMI, kg/day	11.9

Table 4 shows the predicted voluntary DMI was similar to the amount of DMI needed to support the observed animal performance (11.9 actual vs. 11.2 kg predicted) when actual forage composition and measured digestion rates were used. We conclude that the CNCPS predicted animal requirements, nutritive values of the feeds, and forage DMI required accurately in this situation when measured feed composition values were used. Milk production was limited to both the MP and MP supply (10.1 kg ME and MP allowable milk vs. 10 kg actual milk/day); ruminal nitrogen balance was positive; this is important for maximizing fiber digestion as well as microbial yield (the model adjusts both when N is deficient). The peptide balance was positive, indicating maximum microbial yield is obtained from bacteria that ferment nonfiber carbohydrates.

STEP 4. EVALUATE THE IMPACT OF VARIATION IN FEED ANALYSIS ON ANIMAL PERFORMANCE

This step demonstrates the importance of having accurate feed analysis.

1. Click on the ***Feeds*** icon in the menu bar at the top of the screen.
2. Click on ***add feeds.***
3. Click on the ***tropical feed library*** in the box at the lower right in the feed library screen.
4. Click on the first ***Pangola grass fresh*** in the grass forages category, then ***add feed***.
5. Click on ***Pangola grass fresh Mexico (IFN 2-01-668)*** in the list of feeds.
6. Change the name to ***Pangola grass tabular***.
7. Change the feed composition values to those listed for library values in table 1 (first column).
8. Under the group name, click on ***ration.***
9. Enter **0** for ***pangola grass measured*** and 7.7 for ***pangola grass tabular***.
10. Print the ***summary results***.
11. Compare your results to table 5 values. Note the lower ME and MP allowable milk.
12. **Print the *summary results.***
13. In the ration screen, click on ***define mix.***
14. ***Highlight feeds wanted in the mix*** (all except the Pangola grass).
15. Name the mix ***Dual purpose lactating cows.***
16. Click on ***Create mix.*** It will now appear at the bottom of your screen with the total amount of ingredients contained (3.5 kg), and each separate ingredients will show as 0.
17. Click on ***file, save the simulation,*** name it ***dual purpose tutorial tabular forage.***
18. Substitute ***mix*** for ***forage*** until the ME allowable milk is equal to the observed milk, when actual total DMI is at the predicted DMI (forage intake = 7.0 and mix = 5.1).

Table 5. Expected milk production responses with measured or tabular values

Item	Measured	Library[1]	Library, ME balanced[2]
Actual Milk production, kg/d	10.0	10.0	10.0
ME allowable milk, kg/d	10.1	6.9	10.1
MP allowable milk, kg/d	10.1	8.6	11.6
Rumen N Balance, g/d	47	57	72
Peptide Balance, g/d	60	57	65
MP balance, g/d	4	-62	73
MP from Bacteria, g/d	610	538	587
MP from undegraded feed, g/d	343	420	500
Predicted DMI, kg/day	11.9	12.1	12.1
DMI required, kg/day	11.2	11.2	12.1
Cost per day, $.	0.50	0.50	0.70

[1]Forage intake at same level as with measured, but with NRC tabular feed composition values.
[2] Concentrate mix was substituted for forage until ME allowable milk matched actual milk.

Table 5 shows the use of tabular values would have resulted in under predicting milk production from the forage and overfeeding the concentrate mix for 10 kg milk production (1.3 kg more of concentrate mix were required for 10 kg ME allowable milk) with a higher cost. Although measured and tabular NDF values were nearly identical, the lower concentration of lignin and the higher measured rate of available fiber digestion for the actual forage fed resulted in a higher predicted ruminal degradation of fiber which results in higher microbial yield and higher ME value for the grass.

Evaluating effect of changes in forage composition on milk production.

Forage quality is one of the greatest limitations to improving cattle productivity in the tropics. Because of it's importance, it is important for researchers, educators, and farm advisors to understand the relative importance of carbohydrate and protein fractions on milk production. Table 6 summarizes the ranges in forage composition measured in 15 species of tropical forages at 35 to 42 days re-growth in the study of Juarez Lagunes et al. (1999). We will now evaluate each of these with our case study cow. The question we are asking is what would be the impact of each of these extremes in value on milk production of our case study cow compared to her observed performance.

Table 6. Ranges in forage carbohydrate and Protein fractions at 35 to 42 days re-growth[1]

Variable	Minimum	Maxiumum
Feed fraction		
NDF, % of DM	60	80
Lignin, % of NDF	4	8
Crude protein (CP)	4	12
Soluble protein, % of CP	20	50
Digestion rates, %/hr		
CHO A + B1(NDF solubles)	6	26
CHO B2 (Available NDF)	3	9
PROTEIN B3 (NDIP)	4	10

[1]Values were rounded for simplicity of use in this tutorial.

1. Click on ***file, load simulation, dual purpose cows tutorial.***
2. Under feeds in the tree, click on ***Pangola grass measured.***
3. Change the first variable in table 6 (**Minimum NDF, 60**).
4. Click on ***ration***, and review the results.
5. Compare the results to those in table 7; correct any errors in inputs.
6. Click on ***summary results***, then ***print.***
7. Click on ***Pangola grass measured,*** and change ***NDF*** to the **Maximum NDF of 80** (column 2, table 1).
8. Click on ***ration***, and review the results.
9. Compare the results to those in table 7; correct any errors in inputs.
10. Click on ***summary results***, then ***print.***
11. ***Change the NDF back to the measured value (69.5) shown in column 2, table 1 .***
12. Repeat steps 2 -11 for the rest of the variables ***(be sure to change back to the original value for lignin(7.5) before evaluating CP, and change CP back to the original (8.9) before evaluating SP***.

Table 7. Expected milk production responses to changes in feed carbohydrate and protein fractions (base is the original base values from table 4)

	Base	Min NDF	Max NDF	Min Lignin	Max Lignin	Min CP	Max CP	Min SP	Max SP
ME allowable milk, kg/d	10.1	11.3	8.7	11.3	9.9	10.0	9.7	10.0	10.1
MP balance, g/d	4	48	-70	61	-5	-31	26	39	-10
MP allowable milk, kg/d	10.1	11.0	8.7	11.3	9.9	9.3	10.6	10.8	9.8
Rumen N Balance, g/d	47	42	59	39	48	7	72	44	49
Peptide Balance, g/d	60	47	76	60	60	19	85	63	58
MP from Bacteria, g/d	610	627	563	640	606	646	585	610	610
MP from Undegraded feed, g/d	343	343	345	343	343	276	388	378	330

Balancing the ration

To balance the ration for any of the above, substitute between pangola grass and concentrate ingredients measured as needed to have ME and MP allowable milk to match the actual milk production (10 kg), and to have ruminal N and peptide balances positive, using the following sequence.

a. If ME allowable milk is not close to actual milk, first substitute between pangola grass and sorghum grain, then substitute between soybean meal and sorghum grain to balance MP and peptides, then adjust urea as needed to balance total ruminal N.
b. If ME allowable milk is close to actual milk but MP allowable milk is not, substitute between soybean meal and sorghum grain to balance MP and peptides, then adjust urea as needed to balance total ruminal N.
c. If only ruminal N is deficient, use urea to balance.

Neutral Detergent Fiber and Lignin. The impact of NDF and lignin concentrations are summarized in Table 7. The reduced milk production predicted as NDF increased was due to the replacement of NSC with structural carbohydrates (**SC**). The MP from bacteria decreased because there was less rumen degradation of carbohydrates resulting in less microbial growth; this reduced predicted MP allowable milk. Ruminal N balance was positive because of reduced microbial growth. The CNCPS calculates unavailable NDF by multiplying the lignin concentration by 2.4 (recently evaluated by Traxler et al., 1998) so higher levels of lignin decreased NDF availability. The impact of increased lignin was to reduce available cell wall, which reduced ME available for milk production and microbial yield from cell wall, which reduced MP from bacteria and MP allowable milk. Rumen N balance was positive because of lower microbial growth. Because NDF provides most of the energy in tropical grasses and NDF digestibility is highly variable, it is important to have accurate values for NDF and lignin in tropical forages when fed as a high proportion of the diet to lactating dual purpose cows.

CP and soluble protein. Table 7 also summarizes the results when CP and soluble protein are changed. At the measured protein solubility, as CP increased, the estimated MP allowable milk increased because of an increase in the MP from undegraded feed protein. At the measured forage CP, MP allowable milk production was reduced when the soluble protein percentage was increased. The decrease in MP allowable milk as a result of increased protein solubility resulted from a decrease in

MP from undegraded feed protein. However, as more feed protein escapes the rumen undegraded, less degradable protein is available to meet microbial growth requirements. This version of the CNCPS reduces NDF digestibility and microbial yield when ruminal N is deficient, using the model published by Tedeschi et al. (2000). If degradable protein equals or exceeds requirement for the carbohydrate allowable microbial growth, additional soluble protein would not be beneficial. An excess of soluble protein will increase energy requirement to excrete excess N (urea cost), which increases maintenance requirement and reduces energy allowable milk production.

Digestion rates of carbohydrates. Table 8 summarizes the results with changing digestion rates to the minimum and maximum measured values shown in table 6. Predicted ME allowable milk was insensitive to changes in digestion rates of the NSC (A and B_1 ruminal carbohydrate fractions), due to the high intestinal digestibility (75%) assumed for these fractions. The predicted MP allowable milk increased as the digestion rate of the A and B_1 fraction increased because more microbial protein is produced when more NSC is digested in the rumen. With all other values set to those measured (table 2) the ME allowable milk was very sensitive to change in the rate of digestion of the B_2 carbohydrate fraction. The ME allowable milk increased when the rate increased, due to a greater extent of degradation in the rumen. The predicted MP allowable milk increased as the B_2 rate increased due to greater microbial yield from the cell wall as the extent of ruminal digestion increased.

Table 8. Expected milk production responses to changes in forage digestion rates

	Base	Min. CHO A+B1	Max. CHO A+B1	Min. CHO B2	Max. CHO B2	Min. PROT B3	Max. PROT B3
ME allowable milk, kg/d	10.1	10.0	10.1	7.9	11.5	10.1	10.1
MP balance, g/d	4	-56	15	-138	133	13	-16
MP allowable milk, kg/d	10.1	8.8	10.3	7.0	12.9	10.3	9.7
Rumen N Balance, g/d	47	64	44	73	22	45	51
Peptide Balance, g/d	60	70	57	60	60	58	64
MP from Bacteria, g/d	610	546	623	511	705	610	610
MP from undegraded feed, g/d	343	346	342	343	343	353	323

B_3 protein rates of degradation. Increases in the degradation rates of the B_3 protein fraction for grasses decreased predicted MP allowable milk because less MP was obtained from undegraded feed. Because the rate of digestion of the B_3 protein approximated the passage rate, small changes in either the digestion rate of the B_3 protein or the predicted passage rate had a pronounced effect on the rumen degradability of the B_3 protein fraction. The B_3 protein rates in the original CNCPS library rates were much lower (generally less than 0.1%/h) than the measured rates. The original rates result in rumen escape of most of the B_3 protein.

CONCLUSIONS

The results presented show variations in feed carbohydrate and protein fractions and their digestion rates in tropical grasses can have a large effect on milk production of dual purpose cattle. In these evaluations, we assumed the CNCPS accurately predicted animal responses to these variations in feed composition, based on previous studies (Lanna et al., 1996). In those studies, the CNCPS as described in this paper was evaluated at the University of São Paulo at Piracicaba (Brazil) for accuracy of predictions in tropical conditions with actual DM intake of tropical feeds fed to cattle types typical of those used in the tropics. Feeds were characterized for their content of carbohydrate and protein fractions and their digestion rates. The energy and protein content of empty body weight gain (growing animals) and milk production (dual purpose lactating cows) were measured. The growing cattle data set included 943 Nellore (the most common Zebu breed in Brazil) bulls and steers fed 96 different diets, with a subset of approximately 200 head used to determine composition of weight gain. Average live weight and live weight gain were 337 kg and 0.923 kg/d, respectively. The CNCPS accounted for 72% of the variation in live weight gain with only a 2% bias. The lactating cow data set included 18 different diets fed to 178 Zebu crossbred cows representing the wide range in genotypes used for milk production in tropical conditions. The CNCPS accounted for 71% of the variation in milk production with a 10% bias. The 10% bias for the lactating cows is believed to be due to difficulty establishing the maintenance requirements of the animals because of the wide variation in their percentage of Holstein and Zebu. The authors observed that accounting for more of the variation in performance with the CNCPS would be difficult, because of the lack of uniformity in genotype within Zebu cattle. The authors (Lanna et al., 1996) concluded that the CNCPS was more accurate than the NRC under tropical conditions when the feeds and cattle types could be characterized adequately to provide accurate inputs into the CNCPS. The CNCPS then should provide for a more precise and dynamic estimate of nutrient requirements and animal performance.

Based on these evaluations, we conclude the CNCPS can be used to describe animal requirements and the biological values of tropical feeds for cattle typical of those kept in the tropics for developing feeding recommendations, if adequate forage analysis information is available. With tropical grasses, predictions of animal responses are highly dependent on accurate values for NDF, lignin, CP and soluble protein and rates of digestion for the B_2 carbohydrate and B_3 protein fractions.

TUTORIAL 4 – BEEF HERD

Sustainability of beef production in the future will depend on maintaining or improving profitabilitiy while protecting the environment. The profitability component depends on many variables, including supply and demand for beef, and cost of production. For the beef herd, accurate ration balancing is important to optimize use of forages available in each production situation to maintain a 12 month calving interval, high conception rates and weaning weights. Accurate ration balancing is also important to minimize the accumulation of excess nutrients on the farm. Regulations being proposed in most states in the US target animal production as a non-point source of water pollutants. Pollutants are mainly from those imported nutrients not accounted for in the export of nutrients as milk and animals. Nutrients accumulate on a livestock farm if a greater quantity is imported as purchased feeds, fertilizer, and symbiotic N fixation than is exported as products sold. Most of the P and K not exported is either lost from the farm through surface runoff or increases soil concentrations. Excess N is subject to loss across farm borders by surface run-off, leaching into groundwater, and volatilization into the atmosphere. Nitrates in drinking water can harm animals and humans and phosphorus run-off contributes to eutrophication of water bodies. Elevated K levels in soils and consequently in forages may negatively affect animal productivity

The objective of this tutorial is to learn how to use the Cornell Net Carbohydrate and Protein System version 5.0 to evaluate and improve feeding programs for the beef herd during the reproductive cycle. Because complete data is available to demonstrate how to use this program, the Cornell Animal Science Teaching and Research Center Beef farm will be used as a case study. Approximately 200 acres of valley cropland and 200 acres of hillside pasture are used to support the beef farm. A land divide runs through the farm with the area on the north side draining into the St. Lawrence River and the south draining into the Susquehanna River. The majority of this farmland and water flow is in this latter drainage system. The majority of the water drainage in this system is as ground water (98%). Only 2% is drained from this area of the farm as surface water. The source of 60% of the ground water is seepage from the upland (hillside) area in permanent grassland. Forty percent of the ground water is from drainage from the valley floor which was heavily farmed.

The beef herd consists of approximately 90 cows and 20 replacement heifers. In this tutorial, we will evaluate the herd through a 12 month reproductive cycle, beginning at calving and ending with the end of the dry period. The reproductive cycle includes 4 periods; (early lactation, late lactation, early dry, and late dry. Included are the nursing calves to weaning at approximately 200 days, and open and bred replacement heifers. At weaning, approximately 20 heifer calves are kept for replacement heifers, and the balance of the heifers and all of the steers are placed on a high energy corn diet for finishing. See the **beef feedlot tutorial** for instructions on evaluating growing and finishing cattle after weaning.

STEP 1. CREATE A NEW SIMULATION.

Click on ***File***, then ***New Simulation***, from the menu. Name this simulation *beef herd* ***tutorial***.
Create the animal groups (required inputs are in Table 3.1a).

Select ***create animal group***, then select ***lactating cow***, then name the group ***early lactation cows.*** Then in this same screen (parameters) select the parameters for this group (units = metric, ration basis = DM, level solution = 2, number in the group = 90, and days to feed = 100).
Select the default group, then click on ***delete group***.
Repeat the process for the rest of the groups in Table 3.1a.

Table 3.1a. Animal inputs for each group[1,4]

Period or Group	No. head[2]	Days [3]	Avg Age Mo.	Avg weight Lb.	Days Pregnant	Avg DIM	Body Condition Score
Early lactation	90	100	62	1350	0	50	5
Late lactation	90	100	62	1350	65	150	5
Early dry	90	85	62	1350	158	na	5
Late dry	90	80	62	1350	240	na	5
Replacement heifers open	25	250	10.6	680	0	na	5
Replacement heifers Early Bred.	20	140	17	877	70	na	5
Replacement heifers Late Bred	20	140	21.6	1011	210	na	5
Nursing steers	45	200	3.28	280	na	na	5
Nursing heifers	45	200	3.28	255	na	na	5

[1]Data for inputs were computed from the following Herd information:
Cow mature weight, lb. = 1350; First bred weight, lb. = 1350 x 0.60 = 810; First calving weight, lb. = 1350 x 0.80 = 1080; First calving age, mo. = 24; Gestation length, days = 280; First breeding age, months = 14.75;Weaning weight, steers, lb = 550; Weaning weight, heifers, lb. = 500; Weaning weight, replacement heifers, lb. = 550; Weaning age, days = 200; Weight at low choice grade, lb. = 1250 for steers, and 1050 for heifers.
[2]The number of nursing calves represents a 100% calf crop, which occurred last year because the number of twins born offset the calves that died.
[3]Herd groups relate to grazing and wintering periods, and feeding groups.
[4]Additional animal inputs needed: expected birth weight = 80 lb.; relative milk production scaler = 5 (uses breed average); breeding system = angus; additives = none.
[5]Steer ADG = (550 lb. weaning weight - 80 lb. birth weight)/200 days age at weaning = 2.35 lb./day.
[6]Heifer ADG = (500 lb. weaning weight - 80 lb. birth weight)/200 days age at weaning = 2.10 lb./day.

Table 3.1b. Description of environmental inputs for each group[1]

Period or Group	Wind speed (mph)	Prev Temp (^oF)	current Temp (^oF)	Hair depth inches	Min.night temp (^oF)	Hair coat	activity
Early lactation	1	60	60	.25	50	No mud	Intensive grazing
Late lactation	1	60	60	.25	50	No mud	Intensive grazing
Early dry	1	50	40	.25	30	No mud	Dry lot >200 sq. feet/head
Late dry	1	40	25	.5	15	No mud	Dry lot >200 sq. feet/head
Replacement heifers open	5	30	25	.5	20	Some mud	Conventional barn, 30-50 sq. ft./head
Replacement heifers Early Bred.	1	60	60	.25	50	No mud	Intensive grazing
Replacement heifers Late Bred	5	40	25	.5	20	No mud	Conventional barn, 30-50 sq. ft./head
Nursing steers	1	60	60	.25	50	No mud	Intensive grazing
Nursing heifers	1	60	60	.25	50	No mud	Intensive grazing

[1]Additional environmental inputs needed: no additives; relative humidity = 40% for all; hrs in sunlight = 10; mud depth = 2 inches for dry lot for late dry, and 0 for others; hide = average; cattle panting = none.

STEP 2. CREATE A FEED LIBRARY FOR THE FARM

Click on the ***feeds*** icon in the top menu bar.
Click on ***add feeds*** in the feeds screen.
Select the feeds fed on this farm from the feed categories in the feed library screen. Click on the feed numbers as listed in Table 3.2. Check the display at the bottom to make sure you selected the correct ones, based on NDF, lignin and Crude Protein content for forages and the closest feed description for concentrates.
When finished selecting feeds, select ***add feeds***.
Put the feeds in the order listed in Table 3.3, using the up and down arrows to move the selected feed. Also add corn meal, dicalcium phosphate, and salt.
Save the simulation.
Click on ***pasture grass summer well managed*** in the list of feeds, click on the name in the right column, and change the name to ***summer pasture.***
Compare the composition values with those in Table 3.2. Values are changed by clicking on the cell to the left of the parameter to be changed (you may have to double click to get a white box, which lets

you edit the feed). NOTE: information from feed analysis reports has been organized to be in the units needed for the model. For example, lignin has been changed from % of DM to as % of NDF.
Save the simulation.
Edit the remaining feeds as for the first feed.
Save the simulation.

Table 3.2. Feed analysis[1]

Item	Pasture-grass-Spring-Well Managed	Pasture - grass - Summer Well Managed	Orchard grass hay, Early bloom Long Hay	Orchard grass hay, Late bloom Long Hay	Corn silage 40% grain-medium grnd
Feed number					
Cost, $/ton	5	5	60	50	25
NDF, % in DM	45.5	52.7	56	62	42
Lignin % of NDF	9	11	7.7	11.4	8
CP, % of DM	22	18	12.8	8.4	9.2

[1] Indicate home grown feed for pasture, hay, and corn silage, and indicate purchased feed for all others.

STEP 3. DESCRIBE THE ANIMALS AND THEIR FEED INTAKE.

In the tree (displayed on the left), find the ***early lactation cow*** group**.**
Click on ***description*** and enter the information requested from Table 3.1a.
Then select the next tab at the top of the screen ***(production)*** and use Table 3.1a to choose or enter the information requested.
Enter 5 for milk production scaler to start. This will result in the breed average peak milk production being used in the NRC lactation equation to be used to compute the milk production requirement (select lactation report, then view to see the milk production). Then use actual weaning weights of the males and Table 3.3 values to determine whether to adjust the peak milk production up or down from the average of 5, using the scaler (scale of 1-9). Table shows the change in expected weaning weight for nursing male calves with cow mature weight and milk production. The nearest value is 572 lb. for a 210 day weaning weight; given the growth rate of 2.35 lb./day of these steer calves, this adjusts to 548 lb. at 200 days, the age at weaning for this herd. Therefore the model computed milk (17.4 lb. during early lactation, which will be when the peak is reached) is reasonable to use for this herd.

Table 3.3. Predicting peak milk in beef cows[1]

	Peak milk, lb./day				
Mature weight, lb.	6	12	18	24	30
	Avg. expected 210 day male calf weight, lb.				
880	398	444	477	Na	Na
950	416	460	493	Na	Na
1030	431	475	510	546	574
1100	449	491	526	561	590
1170	464	506	541	576	607
1250	477	521	557	590	623
1320	491	537	572	605	638
1400	504	550	587	620	656
1470	517	565	601	634	671

[1]National Research Council Nutrient Requirements of Beef Cattle (1996). Growth rates are computed from body size of calf with 28% fat weight the same as the dam mature weight, the milk intake predicted by the NRC equations for milk production during lactation, and adequate pasture in the immature stage of growth to allow the calves to consume 90 to 100% of voluntary intake.

Then select the next tab ***(management and environment)*** at the top of the screen and use Table 3.1b to choose or enter the information requested.
Then select the next tab ***(ration)*** at the top of the screen and use Table 3.4 to choose or enter the information requested.

Table 3.4. Rations fed to each group

	Spring Pasture[1]	Summer Pasture[2]	Late grass hay	Early grass hay	Corn silage	urea	Salt	Dical phos.
Period or Group								
Early lactation	30.2						0.1	
Late lactation		25.1					0.1	
Early dry			27.6				0.1	
Late dry			15.1		12		0.1	
Replacement heifers open					14.5	0.1	0.1	
Replacement heifers Early Bred.	19						0.1	
Replacement heifers Late Bred				4	14.6	0.1	0.1	0.12
Nursing steers	5.61							
Nursing heifers	5.09							

[1,2] DMI required to support observed performance. For nursing calves, forage intake is predicted DMI-milk intake (13.6 lb. (Table 3.5) or 1.63 lb. of milk dry matter) adjusted for forage availability; this calculation is explained under the section describing adjustment for the effect of forage availability.

Save the simulation.

Now you can review the results by clicking on ***ration*** under the group name in the tree. You can print out the results for the group by clicking on ***summary results***, then clicking on ***print report.*** Compare your results to those in Table 3.5.

Table 3.5. Summary of results of beef herd analysis

	Milk production or target ADG, lb/day[1]	ME Balance, Mcal/day	ME allowed production (milk or ADG), lb/day[1]	MP allowed production (milk or ADG), lb/day[1]	Days to change condition score	Rumen N balance, grams /day	Predicted DMI, lb/day[2]	Actual DMI, lb/day[2]
Period or Group								
Early lactation	17.4	0.35	18.1	37.3	1320	232	30.24	30.4
Late lactation	9.7	-1.27	7.3	27.2	331	70	27.93	25.2
Early dry	NA	0.31	Na	Na	No change	-2	27.7	27.7
Late dry	Na	1.1	Na	Na	431	-14	27.2	27.2
Replacement heifers open	1.05	Na	1.26	2.08	Na	0	15.9	14.7
Replacement heifers Early Bred.	0.96	Na	1.33	4.07	Na	126	21.4	19.1
Replacement heifers Late Bred	1.69	Na	1.31	2.62	Na	0	25.2	18.9
Nursing steers	Na	Na	2.28	2.66	Na	20	7.54	7.24
Nursing heifers	Na	Na	2.09	2.55	Na	18	6.99	6.72
Average for cows/year	Na	0.08	Na	Na	Na	Na	Na	Na

[1]Values given are Milk production for lactating cows and ADG for growing cattle.
[2]Includes 1.63 lb. of beef cow milk dry matter per day for nursing calves.

EFFECT OF PASTURE AVAILABILITY AND STOCKING RATE ON PASTURE INTAKE, MILK PRODUCTION, AND NURSING CALF GROWTH.

This evaluation will demonstrate how the CNCPS can be used to evaluate this effect on beef cow milk production and nursing calf growth. Pasture availability is often the most limiting factor in maximizing milk production of beef cows, which limits growth in the nursing calves. Table 3.6 contains adjustments for forage DMI under conditions where forage availability is limiting. Pasture consumption is a function of forage DM available to be consumed relative to the animal's potential forage intake. Forage available to be consumed per cow calf pair is forage DM available in the pasture / number of cow-calf pairs grazing that pasture. Then Table 3.6 can be used to determine the adjustment to voluntary forage DMI in the ration tab; (model predicted lactating cow DMI – supplemental feeds fed for lactating cows) plus (model predicted calf DMI – milk for nursing calves) in the ration tab. The calves will be most sensitive to this in late lactation, when they become more dependent on the pasture for growth.

In this case, the late lactation cows predicted DMI is 27.9. Since we only have calf information for the average of the grazing season, we will use their average information in the calculation of DFA. Actual milk production averaged over the entire lactation (see reports, whole herd analysis, for lactating cows) is 13.6 lb./day x 0.12 = 1.63 lb. DM. The average for steer and heifer nursing calves predicted forage DMI over the entire lactation is about (7 - 1.63 lb. milk DM) = 5.4 lb. Thus the cow-calf pair forage DMI is about 33 lb. With 90 cow calf pairs, a pasture mass of 1500 lb. pasture mass available/acre over the 7 days in the rotation, and a paddock size of 20 acres, the DFA for the 90 cow calf pairs is (1500 x 20)/ (33 x 90 x 7) = 1.4. Table 3.6 indicates an adjustment factor of 0.9 to apply to pasture DMI in the rations of the late lactation cows and 0.95 for nursing calves (averaged over the grazing season) would be appropriate. Thus actual DMI for the late lactation cows is 27.9 x 0.9 = 25.1, and ME allowable milk from consuming the pasture is 7.3 lb./day. Actual milk production at this time is 9.7 lb./day (1.16 lb. of DM), with 7.0 lb. coming from ME allowable milk from the pasture consumed and 2.5 lb./day coming from body reserves (rate of body condition score loss is 1 score in 331 days, or 1/3 of a score in this 100 day period). Nursing calf forage DMI is: nursing steers, (7.54 – 1.63) x 0.95 = 5.61 lb./day; and nursing heifer calves is (6.99 – 1.63) x 0.95 = 5.09 lb./day.

Now assume the forage available for grazing during this 7-day rotation is only 1250 lb. What is the effect on cow and calf forage DMI, milk production, calf ADG during this period, and weaning weight? Assume this decrease in ME allowable milk production cannot be made up from energy reserves.
Compute the DFA: (1250 x 20)/(33 x 90 x 7) = 1.2.
Use Table 3.6 to determine the adjustment factor for 1250 lb. pasture DM and a DFA of 1.2 (approximately 0.8).
Click on late lactation cows ration. Multiply the predicted DMI x 0.8, and enter this value for summer pasture (27.9 x 0.8 = 22.3).
Note the ME allowable milk production (2.7 lb./day).
Compute the reduction in calf milk DMI ((9.7 – 2.7) x 0.12) = 0.84 lb./day.
Click on nursing steer calves. Enter the new milk production (1.63 - 0.84 = 0.79)
Reduce forage intake to 80% of predicted (7.7 – 0.77) x 0.8 = 5.54 lb./day. The ME allowable ADG is 1.23, and the loss for 100 days is (2.28 – 1.23) x 100 = 105 lb.
Save this simulation as beef herd tutorial dry summer.

What is the effect on herd energy balance for the year, and corn needed for early dry cows to regain energy reserves lost before winter?
Click on reports, each group of cows in the upper right box (early and late lactation, and early and late dry), then whole herd analysis.
Compare new energy balances for lactating cows and all cows with the original values (- 1.65 vs. – 0.46 for lactating cows and 0.1 vs. - 0.55 for all groups).
Click on feeds, add feeds, and add corn meal. Add a cost of $90/ton.
Click on dry cow early ration. Substitute corn meal for late dry hay until the herd ME balance in the whole herd analysis screen is back to the original value (0.08 Mcal). To find this balance, click on reports, click on all cow groups, then click on whole herd analysis Approximately 3 lb./day of corn is needed to bring annual energy balance back to it's original slightly positive state.

See help, model biology, body reserves for more information on how body reserves are computed.

Table 3.6. Adjustment factors for pasture dry matter intake

Pasture DM available, lb/acre	Daily forage allowance (lb. pasture DM available/head/lb potential Pasture DMI)			
	4	3	2	1
	Pasture intake adjustment factor			
100	0.21	0.18	0.17	0.15
200	0.37	0.33	0.32	0.26
300	0.51	0.46	0.44	0.37
400	0.64	0.57	0.55	0.46
500	0.74	0.67	0.64	0.54
600	0.83	0.75	0.72	0.6
700	0.90	0.81	0.78	0.65
800	0.95	0.86	0.82	0.69
900	0.99	0.89	0.85	0.71
1000	1	0.9	0.86	0.72
1500	1	1	0.98	0.82
2000	1	1	1	0.92

EVALUATING EFFECT OF CHANGES IN FORAGE COMPOSITION ON ANIMAL PERFORMANCE.

Forage quality is one of the greatest limitations to improving beef herd productivity. In this example, we will examine the relative importance of carbohydrate and protein fractions on animal performance. The approach presented can also be used to determine if the quality of the forage matches the milk production of the cattle. If the quality of the forage would support more milk production, it makes sense to select for more milk if the forage quality is consistent. **See help, model biology, rumen fermentation** on the effect of feed composition on feed energy values.

Table 3.7 summarizes the ranges in forage composition that have been measured on this farm. The question we are asking is what would be the impact of each of these extremes on animal performance? We will examine the effect of pasture composition on milk production during late lactation, which typically occurs during the summer when forage quality often declines. We will then use this same approach to evaluate the effect of hay quality changes on dry cow body reserves and supplemental feed needs.

Table 3.7. Ranges in forage carbohydrate and Protein fractions in feeds

	Pasture[1]		Hay[2]	
Feed fraction	minimum	maximum	Minimum	Maxiumum
NDF, % of DM	34	65	55	70
Lignin, % of NDF	5	12	7	12
Crude protein (CP)	18	27	6	14

[1]Based on Cerosaletti et al. (1997 Cornell Nutrition Conference Proceedings) and Rayburn et al. (1998 NRAES proceedings of Northeast Grazing Conference) for cool season grasses.
[2]Based on CNCPS Feed library values for temperate grasses.

Click on ***late lactation cows.***
Under feeds in the tree, click on ***grass pasture summer.***
Change the first variable in Table 3.7 (*Minimum* ***NDF, 34***).
Click on ***ration***, and review the results.
Compare the results to those in Table 3.8; correct any errors in inputs.
Click on ***summary results***, then ***print.***
Click on ***grass pasture summer,*** and change ***NDF*** to the *Maximum NDF of* ***65*** (Table 3.7).
Click on ***ration***, and review the results.
Compare the results to those in Table 3.8; correct any errors in inputs.
Click on ***summary results***, then ***print.***
Change the NDF back to the original value (52.7) shown in Table 3.2.
Repeat steps 2 -11 for the rest of the variables in Table 3.7.

Table 3.8. Expected milk production responses to changes in feed carbohydrate and protein fractions (original is the original base values from Table 3.5)

	Base	Min. NDF	Max. NDF	Min. Lignin	Max. Lignin	Max CP[1]
ME allowable milk, kg/d	7.3	16.1	1.1	13.3	6.2	4.0
MP allowable milk, kg/d	27.2	33.7	21.8	32.1	26.4	35.0
Rumen N Balance, g/d	70	47	98	51	73	334
Predicted DMI, lb/day	27.93	30.35	26.75	29.51	27.69	28.16

[1]Minimum CP not included because it is the same as the base value.

Neutral Detergent Fiber and Lignin. The impacts of NDF and lignin concentrations are summarized in Table 3.8. The reduced milk production predicted as NDF increased was due to the replacement of non Structural Carbohydrates with structural carbohydrates. Higher levels of lignin decreased NDF availability. The impact of increased lignin was to reduce available cell wall, which reduced ME available for milk production and microbial yield from cell wall, which reduced MP from bacteria and MP allowable milk. Decreased NDF and lignin both increased predicted DMI, because of less slowly degraded cell wall, which increases rumen fill.

Crude Protein. Table 3.8 also summarizes the results when CP is changed to the maximum value. As CP increased, the MP allowable milk increased because of an increase in the MP from undegraded feed protein. However, as CP increased, the degradable and undegradable protein greatly exceeded the ruminal requirement for N and the animal's requirement for milk production, resulting in a high energy cost to get rid of the excess nitrogen.

EFFECT OF HAY QUALITY ON RATION NEEDED FOR LATE DRY COWS.

High quality forage is needed for cows in late gestation to support the increasing fetal size and fetal membranes, as well as to maintain or improve body reserves so early lactation requirements can be met in the 30 to 60 days before spring pasture is available. In this beef herd, corn silage is available to supplement late cut grass hay. However, corn silage is typically not available to beef herds.

In this evaluation, we will determine the impact of the variation in grass hay quality shown in Table 3.7 on supplementation requirements.

Click on ***late dry cows ration.*** Compare the values to the original to make sure you have the correct original values. If not, retrieve the original beef herd tutorial.
Under feeds in the tree, click on ***late grass hay.***
Change the first variable in Table 3.7 for hay (*Minimum NDF,* ***55*****).**
Click on ***ration***, and review the results.
Compare the results to those in Table 3.9; correct any errors in inputs.
Click on ***summary results***, then ***print.***
Click on *late grass hay***,** and change ***NDF*** to the *Maximum NDF of* ***70*** (Table 3.7).
Click on ***ration***, and review the results.
Compare the results to those in Table 3.9; correct any errors in inputs.
Click on ***summary results***, then ***print.***
Change the NDF back to the original value (62) shown in Table 3.2.
Repeat steps 1 -11 for the rest of the variables in Table 3.7.

Table 3.9. Effect of hay quality on beef cow requirements.

	original	Min. NDF	Max. NDF	Min. Lignin	Max. Lignin	Min CP	Max CP	Min NDF and lignin, max CP	Best hay, no corn silage[1]
ME balance, Mcal.	1.1	1.8	0.4	2.2	0.9	0.4	1.6	3.7	0.5
Days to change condition score	431	256	1037	211	507	1155	291	123	962
MP balance, grams	205	219	189	225	202	91	350	464	496
Rumen N Balance, g/d	-14	-27	0	-21	-14	-31	18	-1	21

[1]hay in column to the left replaces all of the hay and corn silage in the ration.

Lowering NDF increased the non cell wall components, which are more digestible in the rumen, resulting in an improved ME and MP balance. The requirement for rumen N increased because of more microbial growth on this more digestible material. To see the effect of a rumen N deficiency, add urea to the Min NDF example until the rumen N is balanced; you will see the ME balance go up from 1.8 to 2.6 Mcal because of an improvement in fiber digestibility. Lowering lignin improves the availability of the cell wall for ruminal digestion, resulting in an improved ME balance. Increased CP improves both the ruminal N and MP balance because of more total degraded and undegraded protein available.

EFFECT OF TEMPERATURE ON HEIFER PERFORMANCE.

Whether or not cold will affect animal performance depends on the current temperature compared to the animal's lower critical temperature (LCT). The LCT is computed from the animal's heat production relative to heat loss. Heat production depends on the animal's ME intake. Heat loss depends on the animal's surface area, hair depth, hide thickness, and body condition score, and wind speed. **See help, model biology, requirements for maintenance** for more detailed information on the calculation of maintenance requirements.

This winter was colder than usual, with most days averaging 15 degrees F. Lets examine this effect on open heifer growth rate.
Click on *ration* for open heifers. Note target ADG (1.05 lb./day) and ME allowable ADG (1.26 Lb./day).
Click on *management and environment*.
Change the current temperature to 15 degrees.
Click on *ration*, and note ME allowable ADG (.79 lb./day).
Click on *management and environment* and change hair coat to no mud.
Click on *ration* and note ME allowable ADG (1.24 lb./day).
Click on *management and environment* and change the hair coat back to some mud on lower body.
Change the *wind speed from 5 to 1 mph*.
Click on *ration* and note ME allowable ADG (1.21 lb./day).
Click on management and environment and be sure original values are entered before continuing (wind speed = 5, current temperature = 25, and coat condition is some mud on lower body).

EFFECT OF TARGET GROWTH RATE ON RATION REQUIRED.

Target growth rate is the ADG needed to reach the weight required by open heifers to conceive so they calve at the age of first calving entered, and for bred heifers to reach a first calving weight that results in re-breeding to calve within the interval indicated. Thus the bred heifer must be heavy enough at first calving so that competition of growth requirements after calving with milk production is minimal. Thus target growth rate in heifers depends on weaning weight, age at first calving, and mature size. After calving, calving interval is used to determine target growth rate**. See help, model biology, requirements for growth** for more detailed information on the calculation of target growth rates.

In this evaluation, we will look at the effects of these variables on target growth rate of open heifers.
Click on file, load simulation, beef herd tutorial to be sure you start with the original values.
Click on ***ration*** for open heifers, and note target growth rate (1.05) and ME allowed ADG (1.26).
Click on ***description***. Change shrunk body weight from 680 to 600 lb.
Click on ***ration***, and note target growth rate (1.67) and ME allowed ADG (1.83). The target growth rate went up because the animal has to gain faster to reach the target weight by breeding time. The ME allowed ADG went up on this same ration and intake because the lighter animal has a lower energy content of gain.
Click on ***description***, then change the shrunk body weight back to 680 lb.
In this same screen, change the age at first calving to 23 months, to allow the heifers to calve one month ahead of the cows.
Click on ***ration***, then note the new target ADG (1.37). It increased because the heifer has one month less to reach the target calving weight.
Click on ***description*** and change the age at first calving back to 24, and change mature weight from 1350 to 1200.
Click on ***ration*** and note new target growth rate (.32 lb./day). Given the current weight of 680 lb., the animal needs very little growth to reach the target breeding weight.

WHOLE HERD ANALYSIS AND FEED REQUIREMENTS

This section provides information summarized across all groups in the herd, as follows. Click on the ***reports*** icon in the menu bar at the top of your screen. Click on all of the groups in the upper left box. Then click on whole herd analysis and feed requirements in the box in the lower left corner of this screen. Then click on ***view report***. The herd average milk production for the lactation, overall herd energy balance, and total cost for the herd are displayed at the top of the herd analysis report. The expected nutrient excretion and % from home grown feeds are at the bottom of this report. The feed requirements are summarized by group and for the whole herd on the second page.

TUTORIAL 5 - BEEF FEEDLOT

Livestock farms are concerned with economic and environmental sustainability, which means maximizing profits while maintaining or improving water quality. The environmental goal is to keep nitrogen in the groundwater (caused by leaching of N through soil) well below the Federal standard of 10 ppm and to keep Phosphorus out of the streams (caused by high levels of P in manure spread on fields and runoff after rains or snowmelt), which causes algae growth in water bodies. The principal causes of excess nutrients are excess N and P over requirements in the rations, and importing too high a proportion of the nutrients so they cannot be recycled through the crops grown (Fox and Tylutki, 1998).

To accomplish these goals, a comprehensive nutrient management plan (CNMP) is needed, with the following components.

- Design a feeding program that maximizes use of home grown feeds, using purchased feeds only as needed to provide supplemental nutrients as needed to support nutrient requirements to meet the farm's production goals.
- Modify crop rotations to provide a mix of home grown feeds that better match herd requirements while minimizing excess nutrients in the ration, as well as to best match soil resources and soil conservation goals.
- Develop a crop and manure nutrient management plan that best allocates the manure to match crop requirements while minimizing risk of leakage into surface and ground water.
- Modify manure storage facilities that hold and preserve manure nutrients until they can be spread to meet item number 3 while minimizing risk to the environment.

The development of a CNMP requires a team with individuals including an animal nutritionist, crop planner, and structural planner. We have developed the Cornell University Nutrient Management Planning System for use in designing a CNMP, including; 1) The Cornell Net Carbohydrate and Protein System version 5.0 (CNCPS v5), and 2) The Cornell Crops, Soils, and Manure Nutrient Management Planning System. ***Our goal in this case study is learn how to use CNCPS v 5 to evaluate and improve a beef cattle feeding program, with some consideration of crop rotations and crop and manure nutrient management planning.***

BACKGROUND ON CASE STUDY FARM

The case study farm is a 550 a farmer feeding operation marketing 950 Holstein steers each year. The farm receives 300 lb. calves every seven weeks, which are integrated into a continuous flow operation. The cattle are fed and managed in three weight groups: light, medium and heavy (Table 3.10.) All of the forage and most of the corn is home grown. Byproduct feeds such as brewers grains provide protein and additional energy (Table 3.11).

In designing a feeding management plan for this farm, we take the approach of starting with where the farm is at, and evaluate it in a stepwise fashion, as follows:

- Evaluate the current feeding program.

- Describe each group in the herd in CNCPS 5.0, using forage analyses in Tables 3.10-3.11 to describe feeds fed and herd data in Tables 3.12 and 3.13.
- Evaluate inputs and modify as needed so that each group is accurately described. Adjustments are made based on comparing predicted and observed performance (Table 3.14).
- Evaluate nutrient balances in each group's rations, and identify excesses and first limiting factors **(current base).**

Improve the current feeding program and evaluate the impact on animal performance, economics and nutrient excretion.

EVALUATE ALTERNATIVE CROPPING PLANS.

The first step in evaluating whole farm nutrient management is to predict where the feedlot is at in nutrient balances to establish a baseline for comparison and identify opportunities for improvement. After the model is predicting well what is happening on the farm, the impact of alternatives can be predicted accurately (steps 2 & 3 above).

The CNCPS 5.0 is used to do all of the analyses for the herd nutrient management evaluation, using the guidelines in the next section and historical data from the farm. Keep a printout of the feedlot analysis output and group analysis for each evaluation made. For each evaluation, follow these steps in using the CNCPS version 5.0. Begin by retrieving the most current version of the CNCPS 5.0.

Step 1. Create a new simulation.

1. Click on ***File***, then ***New Simulation***, from the menu. Name this simulation ***Beef Feedlot tutorial***.
2. Create the animal groups (required inputs are in Table 3.10).
    - Select ***create animal group***, then select ***growing finishing***, then name the group ***light weight steers.*** Then in this same screen (parameters) select the parameters for this group (units = English, ration basis = DM, level solution = 2, number in the group = 425, and days to feed = 365).
    - Select ***create animal group,*** then select ***growing finishing,*** then name the group ***medium weight steers***. Use the same parameters as for the light weight steers, except the number in group = 200.
    - Select ***create animal group,*** then select growing finishing steers, then name the group ***heavy weight steers.*** Use the same parameters as for the light weight group, except number in group = 325.
    - Select the default group, then click on ***delete group***.

Table 3.10. Animal Description for animal and environmental inputs[1,2]

Group	# hd	Avg Age, months	Avg wt (SBW) lb	Body Condition Score (1-9)
Light	425	6.5	550	4
Medium	200	10.5	900	5
Heavy	325	14	1,175	6

[1]Other inputs required are the same for all groups: days to feed = 365; animal type = growing/finishing; sex = steer; breed type = dairy; breeding system = straight; grade = small marbling; expected final weight = 590; breed = Holstein; and additive = implant + ionophore.

[2]Environmental inputs are : wind speed = 1 mph; previous temperature = 45 degrees F, previous humidity = 30%; current temperature = 45 degrees F, current humidity = 30%; sun exposure = 0; storm exposure = N; hair depth = 0.25 in; mud depth = 1 in.; hide thickness = thin; hair coat condition = no mud; minimum night temperature = 45 degrees F; and facilities = conventional barn.

Step 2. Create a feed library for the farm

1. Click on the ***feeds*** icon from the menu at the top.
2. Click on ***add feeds*** in the feeds screen.
3. Select the feeds to be used on this farm from the feed categories in the feed library screen. Click on the feed numbers as listed in Tables 3.11 and 3.12. Check the display at the bottom to make sure you selected the correct ones, based on NDF and Crude Protein content for forages and the closest feed description for concentrates.
4. When finished selecting feeds, select ***add feeds***.
5. Put the feeds in the order listed in Tables 3.11 and 3.12, using the up and down arrows to move the selected feed.
6. ***Save the simulation***.
7. Click on the first feed, then use Table 3.11 to edit the name and feed composition. This is done by clicking on the cell to the left of the parameter to be changed (you may have to double click to get a white box, which lets you edit the feed). NOTE: information from feed analysis reports has been organized to be in the units needed for the model. For example, lignin has been changed from % of DM to as % of NDF.
8. ***Save the simulation.***
9. Edit the remaining feeds as for the first feed.
10. ***Save the simulation.***

Table 3.11. Feed analysis (average values)

Item	Alfalfa haylage	Dry shelled corn	HM corn	Wet brewers grains
Feed number	218	406	412	502
Cost, $/ton	32	77	59	23
Concentrate%	0	100	100	100
Forage %	100	0	0	0
DM%	35	86	72	21
NDF, % in DM	49.6	USE	USE	USE
Lignin % of NDF	15.9			
CP, % of DM	18			
Fat, % of DM	4.73			
Ash, % of DM	10.5			
Sol P, % of CP	66			
NDFIP % of CP	12.4	FEED	FEED	FEED
ADFIP % of CP	6.59			
Calcium %	1.09	LIBR.	LIBR.	LIBR.
Phosphorus %	.26			
Magnesium %	.23			
Potassium %	3.09			
Sodium %	USE	VAL.	VAL.	VAL.
Sulfur %				
Copper, mg/kg	LIBR.			
Iron, mg/kg				
Mangan., mg/kg				
Zinc, mg/kg	VAL.			
Home grown, Y or N	Y	N	Y	N
order	1	2	3	4

Table 3.12. Composition of mineral supplements

Item	Heavy mineral	Lt.& Med. Mineral
Feed number	831	salttmin
Cost, $/ton	500	500
Concentrate%	100	100
Forage %	0	0
DM%	100	100
Ash, % of DM	100	100
Calcium %	24.2	23
Phosphorus %	0	1.5
Magnesium %	1.5	1.5
Potassium %	7.1	1.1
Sodium %	15	25
Sulfur %	1.5	1.4
Cobalt, mg/kg	11.5	11.5

Copper, mg/kg	490	430
Iodine, mg/kg	63	63
Iron, mg/kg	6785	7060
Manganese, mg/kg	1180	1180
Selenium, mg/kg	0	0
Zinc, mg/kg	4730	4730
Vitamin A, IU/kg	174	200
Vitamin D, IU/kg	21	22.50
Vitamin E, IU/kg	97	97

Step 3. Describe the groups of animals

Uses Tables 3.10 and 3.13.

1. From the tree (displayed on the left), select the ***light weight group.***
2. Under the light weight group, click on ***description*** and enter the information requested. Then select the next tab ***(production)*** and use Table 3.10 to choose or enter the information requested.
3. Then select the next tab ***(management and environment)*** at the top of your screen and use Table 3.10 to choose or enter the information requested.
4. Then select the next tab ***(ration)*** at the top of your screen and use Table 3.13 to choose or enter the information requested.

Table 3.13. Rations fed to each group (lb./head/day)

Ingredient	Light[1]	Medium	Heavy
Alfalfa silage	4.40	4.50	4.80
Corn, HM	7.40	11.90	10.00
Corn, dry grain	-	-	6.50
Brewers grains	2.50	3.20	2.40
Light and medium Minerals	0.21	0.30	-
Heavy mineral	-	-	0.37
Totals	**14.51**	**19.90**	**24.07**

[1]Units are pounds dry matter per day

5. ***Save the simulation.*** Repeat the above steps for the remaining two groups.

Now you can review the results by clicking on ***ration*** under each group in the tree. You can print out the results for each group by clicking on ***summary results***, then clicking on ***print report.*** Table 3.14 summarizes the results for the three groups of cattle.

Table 3.14. Animal Performance (unadjusted)

Group	Actual Dry matter intake, lb/day	Predicted Dry matter intake, lb/day	Actual ADG, kg/day	ME allowed ADG, lb/day	MP allowed ADG, lb/day	Rumen N Balance g/day	Peptide Balance g/day	peNDF Balance lb/day	Diet NEg MC/lb
Light	14.51	14.18	3.00	2.85	3.13	12	-8	0.6	0.52
Medium	19.90	20.32	2.80	2.64	4.06	17	-15	0.1	0.55
Heavy	24.07	26.89	2.71	2.67	4.43	21	-16	0.1	0.56

Table 3.14 shows predicted and observed performance agree, except for the heavy group. The first step here is to check your inputs for each group to make sure there are no entry errors. The next step is to see if ruminal or absorbed protein is limiting performance. Table 3.14 shows rumen N balance is positive, MP allowable gain exceeds ME allowable ADG, and effective NDF balance is positive so they do not limit performance. Peptide balance is negative; increasing it to a 0 balance would increase MP from bacteria. However, a negative balance does not limit performance in this case because we do not need more MP since MP allowable ADG equals or exceeds ME allowable ADG.

Step 4. Adjust inputs until predicted and observed performance are similar

This step is important in identifying factors affecting performance, and for obtaining accurate projections when alternative management practices and strategies are evaluated.
This step is described in ***help, model biology, balancing rations.*** Since the model is overpredicting performance, we will adjust factors most likely to influence energy available for growth. We are confident the dry matter intake, feeds and feed analysis are accurate.

Since predicted and observed ME allowable ADG are similar for the light and medium groups, but the heavy group is overpredicted, we need to examine next what is different about that group. Since dry whole corn replaces part of the high moisture corn, we will next examine it's ruminal and intestinal digestion rates.

Click on ***help, contents and index, and digestion rates***. Note the range for dry whole corn is 5-10%/hour.

1. Under feeds in the tree, click on dry shelled corn and change the CHO B1 (%/hr) to 5 %.
2. Under the heavy group in the tree, click on ***ration***, and print summary results. Note the ADG is closer to actual, but is still overpredicted, suggesting the intestinal digestion rate needs to be adjusted.
3. Click on ***help, contents and index, and intestinal digestion***. Note the range for dry whole corn is 50-60%.
4. Under feeds in the tree, click on dry shelled corn and change the CHO B1 intestinal digestibility to 50%.
5. Under heavy group in the tree, click on ration, and print summary results. Note the ADG now agrees with the actual.
6. ***Save the simulation as beef tutorial adjusted.***

Table 3.15 summarizes the results of these adjustments for the heavy group.

Table 3.15. Animal Performance, heavy group (adjusted for dry corn starch digestion rates)

Adjust-ment	Actual Dry matter intake, kg/day	Predicted Dry matter intake, kg/day	Actual ADG, lb/day	ME allowed ADG, kg/day	MP allowed ADG, kg/day	Rumen N Balance g/day	Peptide Balance g/day	peNDF Balance kg/day	Diet NEg MC/lb
Initial	24.07	26.89	2.71	2.67	4.43	21	-16	0.1	0.56
Dry corn rumen B1 rate	24.07	27.09	2.71	2.56	3.92	37	-6	0.1	0.54
Dry corn B1 intestinal rate	24.07	27.16	2.71	2.51	3.88	37	-6	0.1	0.54

Next, balance the medium group for protein using a feed substitution approach.

Under medium weight calves in the tree, click on ***rations***. MP allowable gain exceeds ME allowable gain, so supplemental protein can be reduced. Substitute high moisture corn for brewers grains. Note that ME allowable ADG is increased to 2.99, gives a -0.1 lb. peNDF balance, and MP allowable and MP allowable ADG of 3.69 lb/d. Click on **summary report, then view.** Note the cost per day is 90 cents; this is 90/2.99 = 30 cents per lb. of ME gain. Before these changes, the cost was 94 cents per day for a 2.64 ADG, or 36 cents per lb. of gain. When overhead costs of 15 cents per lb per day are added, the cost of gain is 45 cents for the revised ration, vs. 51 cents for the current ration. Therefore the least cost gain is the revised ration. In this case, reducing excess nitrogen in the ration to reduce nitrogen excretion would also decrease cost of gain. Additionally, all of the nitrogen in the revised ration is home grown so the whole farm balance must be evaluated with each alternative to evaluate the impact on whole farm nutrient balance, which can be evaluated with comparing the whole herd annual excretion report with each scenario.

When finished balancing the diet, ***Save the simulation as beef tutorial rebalanced.***

Step 5. Evaluate the sensitivity of the animals to environmental conditions

1. Under lightweight steers in the tree, select *management and environment*. Change previous temperature to 25 (degrees F). Click the ration tab, view the ME allowable ADG, then print the summary report. Note the ME allowable ADG dropped from 2.85 to 2.61 kg.
2. Click the *management and environment* tab, and change current temperature to 25 (degrees F). Click the ration tab, view the ME allowable ADG, then print the *summary report*. Note the ADG dropped to 2.57 lb.
3. Click the *management and environment* tab, and change wind to 10 (mph). Then click the *ration* tab, view the ME allowable ADG, then print the *summary report*. Note the ADG dropped 1.30 lb./day.
4. Click the *management and environment* tab, and change the hair coat to some mud on lower body. Then click the ration tab, view the ME allowable ADG, then print the *summary report*. Note the ADG dropped 0.92 lb./day.

Step 6. Evaluate the overall feed requirements and nutrient excretion.

Retrieve Beef Feedlot tutorial, which should contain all of the original inputs. Click on the ***reports*** icon from the top screen. Then check all 3 boxes under ***animal groups*** and select ***herd analysis*** and ***feed requirements*** under ***herd report components,*** then choose ***print reports***.

Tables 3.16 and 3.17 summarize the whole herd analysis. These data can be used to compare to feed inventory needs and crop production required, and manure nutrients that will have to be managed.

Table 3.16. Ration Ingredients, Quantity (t/year) for case study Farm

Ingredient	**Light**	**Medium**	**Heavy**	**Total**
Alfalfa haylage	975.1	473.4	813.3	2261.7
Dry shell corn	0	0	448.2	448.2
Corn, HM	797.2	601.7	823.8	2222.7
Brewers grain	923.4	556.0	678.1	2157.5
Lt. And med. Mineral	16.3	11.0	0	27.2
Heavy mineral	0	0	21.9	21.9
Grand Total	**2711.9**	**1642.1**	**2785.4**	**7139.3**

Table 3.17. Summary of Animal Performance and Manure Nutrients per ha

Feed cost, $/yr	Feed cost of ADG	ADG	Crop Acres	Nitrogen excreted, kg. total and per crop ha		Phosphorus excreted, kg. total and per crop ha		Potassium excreted, kg. total and per crop ha	
312,238	0.33	2.74	550	116030	211	17896	32	69477	126

Step 7. Evaluate alternatives identified by the farm owners

Questions the farm owners have relate to determining the best match of animals and crops on this farm. Corn silage provides more energy/acre than alfalfa or grass. How does it compare to these two in cost of gain, feed requirements, and manure nutrients to manage? The quantity of feed fed and animal performance predicted by the model agreed well compared to actual amounts fed, based on farm records. The amount of alfalfa silage and high moisture corn required matched what was produced on the farm during the base year. To answer the owner’s questions, several different scenarios were evaluated with CNCPS version 5.0, as follows.

Replacing alfalfa with corn silage: In addition to replacing alfalfa silage with corn silage, brewers grains was replaced with soybean meal, and dry shelled corn replaced the high moisture corn. This was done in an attempt to optimize animal performance. The farmers have raised a concern with the performance of the Heavy Group. Dry matter intakes of this group are only 89% of that predicted by the model. The current ration uses a high percentage of high moisture corn. Research results have implicated subacute acidosis in reducing intakes on long fed cattle utilizing high moisture corn (Fox et al., 1991).

Compared to the current ration, this scenario increased animal performance and decreased cost of gain. The increased animal performance was due in part to better rumen health and increased intakes. Lowered cost of gain was due to utilizing a higher proportion of farm-produced feeds, decreasing purchased inputs and increasing animal performance. Total dry matter required for the two scenarios were virtually the same. Nutrient excretion was also improved with the corn silage scenario, projecting a noticeable decrease in the amount of N, P, and K excreted per a.

Replacement of alfalfa with grass: To minimize soil erosion and optimize yields, growing 100% corn is not practical on most farms in New York, and perennial grass is better suited to acid soils than is alfalfa. Therefore, a third evaluation with CNCPS 5.0 utilized silage from an intensively managed grass production system. The projections for this scenario are intermediate to the base and corn silage scenarios. Total Feed Cost per year is higher than the corn silage scenario due to higher production cost of grass versus corn silage ($35/ton vs. $25/ton). With equal average daily gains for the two systems, this creates a higher cost of gain for cattle on the grass silage scenario.

While there was a reduction in N excreted per acre for grass silage compared to the base ration, it was not as great a reduction as that produced by the corn silage system.

Evaluation of the proposed crop production plan: To keep soil erosion to a minimum, the goal of the cropping plan is to keep the sod to row crop acres in a ratio of 1:2. The proposed plan calls for a total of 179 a to be planted to a sod crop, either alfalfa or clover grass mixture. The remainder of the forage for this feedlot will come from corn silage (about 15 acres of corn will be harvested as silage). Thirty-eight acres are already committed to soybeans, leaving 318 acres of corn for grain, estimated to produce 1340 tons of corn. Total corn grain needed to annually feed 950 head of cattle is 2,671 t, requiring the purchase of 1331 t of dry shell corn. As would be expected due to the low level of corn silage feeding, the proposed crop plan scenario does not differ significantly from the grass silage scenario. However, the final plan has a considerably lower annual feed cost than the current program.

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4. Model Feed Libraries

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
Grass forages								
101	Brome Hay - Pre-Bloom (101) Long	1-00-887	100	88	55.0	7.7	100.0	46
101	Brome Hay - Pre-Bloom (101) Medium Chop	1-00-887	100	88	55.0	7.7	95.0	46
101	Brome Hay - Pre-Bloom (101) Fine Chop	1-00-887	100	88	55.0	7.7	90.0	46
102	Brome Hay - M. Bloom (102) Long	1-05-633	100	88	65.0	11.1	100.0	44
102	Brome Hay - M. Bloom (102) Medium Chop	1-05-633	100	88	65.0	11.1	95.0	44
102	Brome Hay - M. Bloom (102) Fine Chop	1-05-633	100	88	65.0	11.1	90.0	44
103	Brome Hay - Mature (103) Long	1-00-944	100	88	70.5	11.3	100.0	42
103	Brome Hay - Mature (103) Medium Chop	1-00-944	100	88	70.5	11.3	95.0	42
103	Brome Hay - Mature (103) Fine Chop	1-00-944	100	88	70.5	11.3	90.0	42
104	Fescue, K31 - Hay (104) Long	1-09-187	100	91	62.2	6.3	100.0	44
104	Fescue, K31 - Hay (104) Medium Chop	1-09-187	100	91	62.2	6.3	95.0	44
104	Fescue, K31 - Hay (104) Fine Chop	1-09-187	100	91	62.2	6.3	90.0	44
105	Fescue, K31 - Hay, F. bloom (105) Long	1-09-188	100	91	67.0	7.5	100.0	44
105	Fescue, K31 - Hay, F. bloom (105) Medium Chop	1-09-188	100	91	67.0	7.5	95.0	44
105	Fescue, K31 - Hay, F. bloom (105) Fine Chop	1-09-188	100	91	67.0	7.5	90.0	44
106	Orchardgrass - Hay, E. bloom (106) Long	1-03-425	100	89	59.6	7.7	100.0	44
106	Orchardgrass - Hay, E. bloom (106) Medium Chop	1-03-425	100	89	59.6	7.7	95.0	44
106	Orchardgrass - Hay, E. bloom (106) Fine Chop	1-03-425	100	89	59.6	7.7	90.0	44
107	Orchardgrass - Hay, L. bloom (107) Long	1-03-428	100	93	65.0	11.4	100.0	44
107	Orchardgrass - Hay, L. bloom (107) Medium Chop	1-03-428	100	93	65.0	11.4	95.0	44
107	Orchardgrass - Hay, L. bloom (107) Fine Chop	1-03-428	100	93	65.0	11.4	90.0	44
108	Pasture- Grass - Spring (108) Well Managed	2-00-956	100	23	47.9	6.0	60.0	47
108	Pasture- Grass - Spring (108) Over grazed	2-00-956	100	23	47.9	6.0	40.0	47
109	Pasture- Grass - Summer (109) Well Managed	00-00-00	100	25	55.0	7.0	60.0	45
109	Pasture- Grass - Summer (109) Over grazed	00-00-00	100	25	55.0	7.0	40.0	45
110	Pasture- Grass - Fall (110) Well Managed	2-00-956	100	24	67.0	6.5	60.0	45
110	Pasture- Grass - Fall (110) Over grazed	2-00-956	100	24	67.0	6.5	40.0	45
111	Pasture-mixed - Spring (111) Well Managed	00-00-00	100	21	41.5	7.0	60.0	50
111	Pasture-mixed - Spring (111) Over grazed	00-00-00	100	21	41.5	7.0	40.0	50
112	Pasture-mixed - Summer (112) Well Managed	00-00-00	100	22	46.5	7.8	60.0	48
112	Pasture-mixed - Summer (112) Over grazed	00-00-00	100	22	46.5	7.8	40.0	48
113	Pasture-Orch. - Spring (PA) (113) Well Managed	00-00-00	100	20	38.5	9.4	60.0	48
113	Pasture-Orch. - Spring (PA) (113) Over grazed	00-00-00	100	20	38.5	9.4	40.0	48
114	Pasture-Orch. - Summer (PA) (114) Well Managed	00-00-00	100	25	51.1	14.5	60.0	46
114	Pasture-Orch. - Summer (PA) (114) Over grazed	00-00-00	100	25	51.1	14.5	40.0	46
115	Pasture-Ryegrass - Spring (PA) (115) Well Managed	00-00-00	100	20	31.3	9.3	60.0	48
115	Pasture-Ryegrass - Spring (PA) (115) Over grazed	00-00-00	100	20	31.3	9.3	40.0	48
116	Pasture-Ryegrass - Summer (PA) (116) Well Managed	00-00-00	100	25	43.4	7.8	60.0	48
116	Pasture-Ryegrass - Summer (PA) (116) Over grazed	00-00-00	100	25	43.4	7.8	40.0	48
117	Prairie - Hay (117) Long Hay	1-03-191	100	91	72.7	6.0	100.0	38
117	Prairie - Hay (117) Chopped Medium	1-03-191	100	91	72.7	6.0	95.0	38
117	Prairie - Hay (117) Chopped Fine	1-03-191	100	91	72.7	6.0	90.0	38
118	Range - June Diet (118) Well Managed	00-00-00	100	20	65.6	5.0	70.0	38
118	Range - June Diet (118) Over grazed	00-00-00	100	20	65.6	5.0	50.0	38
119	Range - July Diet (119) Well Managed	00-00-00	100	20	67.7	5.5	70.0	38
119	Range - July Diet (119) Over grazed	00-00-00	100	20	67.7	5.5	50.0	38
120	Range - Aug. Diet (120) Well Managed	00-00-00	100	20	63.7	8.0	70.0	38
120	Range - Aug. Diet (120) Over grazed	00-00-00	100	20	63.7	8.0	50.0	38
121	Range - Sep. Diet (121) Well Managed	00-00-00	100	20	66.6	9.0	70.0	38
121	Range - Sep. Diet (121) Over grazed	00-00-00	100	20	66.6	9.0	50.0	38
122	Range - Winter (122) Over grazed	00-00-00	100	80	66.1	11.0	50.0	38
122	Range - Winter (122) Well Managed	00-00-00	100	80	66.1	11.0	70.0	38
123	Reed Canarygrass - Hay (123) Long	1-00-104	100	89	64.0	6.3	100.0	44
123	Reed Canarygrass - Hay (123) Medium Chop	1-00-104	100	89	64.0	6.3	95.0	44
123	Reed Canarygrass - Hay (123) Fine Chop	1-00-104	100	89	64.0	6.3	90.0	44
124	Ryegrass - Hay (124) Long Hay	1-04-077	100	88	41.0	4.9	95.0	47
124	Ryegrass - Hay (124) Medium	1-04-077	100	88	41.0	4.9	90.0	47
124	Ryegrass - Hay (124) Chopped Fine	1-04-077	100	88	41.0	4.9	85.0	47
125	SorgSud - Pasture (125) Well Managed	02-04-484	100	18	55.0	5.5	60.0	90

CP	Sol-P	NPN	NDFIP	ADFIP	UIP-1X	Fat	Ash	Degradation Rates CHO-A	CHO-B1	CHO-B2	Prot-B1	Prot-B2	Prot-B3
%DM	%CP	%Sol-P	%CP	%CP	%CP	%DM	%DM	%/h	%/h	%/h	%/h	%/h	%/h
16.0	25.0	96.0	31.0	6.5	34.8	2.6	10.0	250	30	5	135	11	0.09
16.0	25.0	96.0	31.0	6.5	34.8	2.6	10.0	250	30	5	135	11	0.09
16.0	25.0	96.0	31.0	6.5	34.8	2.6	10.0	250	30	5	135	11	0.09
10.5	25.0	96.0	31.0	6.5	34.4	2.3	9.0	250	30	4	135	11	0.09
10.5	25.0	96.0	31.0	6.5	34.4	2.3	9.0	250	30	4	135	11	0.09
10.5	25.0	96.0	31.0	6.5	34.4	2.3	9.0	250	30	4	135	11	0.09
6.0	25.0	96.0	31.0	6.5	34.2	2.0	7.2	250	30	3	135	11	0.09
6.0	25.0	96.0	31.0	6.5	34.2	2.0	7.2	250	30	3	135	11	0.09
6.0	25.0	96.0	31.0	6.5	34.2	2.0	7.2	250	30	3	135	11	0.09
15.0	25.9	25.4	34.2	8.9	37.4	5.5	9.0	250	30	4	135	11	0.09
15.0	25.9	25.4	34.2	8.9	37.4	5.5	9.0	250	30	4	135	11	0.09
15.0	25.9	25.4	34.2	8.9	37.4	5.5	9.0	250	30	4	135	11	0.09
12.9	25.9	25.4	34.2	8.9	37.2	5.3	8.0	250	30	4	135	11	0.09
12.9	25.9	25.4	34.2	8.9	37.2	5.3	8.0	250	30	4	135	11	0.09
12.9	25.9	25.4	34.2	8.9	37.2	5.3	8.0	250	30	4	135	11	0.09
12.8	25.0	96.0	31.0	5.7	34.6	2.9	8.5	250	30	4	135	11	0.09
12.8	25.0	96.0	31.0	5.7	34.6	2.9	8.5	250	30	4	135	11	0.09
12.8	25.0	96.0	31.0	5.7	34.6	2.9	8.5	250	30	4	135	11	0.09
8.4	25.0	96.0	31.0	6.1	34.4	3.4	10.1	250	30	4	135	11	0.09
8.4	25.0	96.0	31.0	6.1	34.4	3.4	10.1	250	30	4	135	11	0.09
8.4	25.0	96.0	31.0	6.1	34.4	3.4	10.1	250	30	4	135	11	0.09
24.0	41.0	2.4	14.5	2.0	16.4	4.0	10.7	350	40	9	250	13.5	1.1
24.0	41.0	2.4	14.5	2.0	16.4	4.0	10.7	350	40	9	250	13.5	1.1
15.0	42.0	4.8	24.0	2.2	19.1	3.7	9.0	350	40	9	200	10	2
15.0	42.0	4.8	24.0	2.2	19.1	3.7	9.0	350	40	9	200	10	2
22.0	43.0	2.3	16.4	2.0	14.9	3.7	10.4	350	40	7	200	12	2
22.0	43.0	2.3	16.4	2.0	14.9	3.7	10.4	350	40	7	200	12	2
26.0	43.0	2.3	12.4	2.1	13.7	3.2	10.3	350	45	9	200	14	2
26.0	43.0	2.3	12.4	2.1	13.7	3.2	10.3	350	45	9	200	14	2
19.5	44.0	3.4	12.5	2.6	13.6	3.2	9.4	350	45	9	200	14	2
19.5	44.0	3.4	12.5	2.6	13.6	3.2	9.4	350	45	9	200	14	2
23.4	46.0	2.4	9.0	1.7	12.8	3.6	9.7	24.2	31.3	13	200	12	2
23.4	46.0	2.4	9.0	1.7	12.8	3.6	9.7	24.2	31.3	13	200	12	2
21.4	34.0	4.8	15.9	4.7	17.8	6.4	9.7	62	28.3	13.9	200	12	2
21.4	34.0	4.8	15.9	4.7	17.8	6.4	9.7	62	28.3	13.9	200	12	2
24.2	46.0	2.4	4.5	1.7	11.4	6.9	10.7	25.3	21.5	11.5	200	12	2
24.2	46.0	2.4	4.5	1.7	11.4	6.9	10.7	25.3	21.5	11.5	200	12	2
26.3	43.0	4.8	9.1	3.0	13.7	7.3	11.4	85.3	19.2	14	200	12	2
26.3	43.0	4.8	9.1	3.0	13.7	7.3	11.4	85.3	19.2	14	200	12	2
5.3	25.0	5.0	2.0	1.0	21.9	3.0	8.0	250	30	3.5	135	3.5	0.09
5.3	25.0	5.0	2.0	1.0	21.9	3.0	8.0	250	30	3.5	135	3.5	0.09
5.3	25.0	5.0	2.0	1.0	21.9	3.0	8.0	250	30	3.5	135	3.5	0.09
11.0	42.0	5.0	24.0	2.0	15.7	3.0	10.0	250	30	7	135	12	3
11.0	42.0	5.0	24.0	2.0	15.7	3.0	10.0	250	30	7	135	12	3
10.5	42.0	5.0	24.0	2.0	17.8	3.0	10.0	250	30	7	135	12	2
10.5	42.0	5.0	24.0	2.0	17.8	3.0	10.0	250	30	7	135	12	2
9.7	42.0	5.0	24.0	2.0	23.8	3.0	10.0	250	30	7	135	10	0.75
9.7	42.0	5.0	24.0	2.0	23.8	3.0	10.0	250	30	7	135	10	0.75
6.9	42.0	5.0	24.0	2.0	22.9	3.0	10.0	250	30	7	135	12	0.75
6.9	42.0	5.0	24.0	2.0	22.9	3.0	10.0	250	30	7	135	12	0.75
4.7	42.0	5.0	24.0	2.0	27.8	3.0	10.0	250	30	7	135	10	0.2
4.7	42.0	5.0	24.0	2.0	27.8	3.0	10.0	250	30	7	135	10	0.2
10.3	25.0	96.0	31.0	6.1	34.4	3.1	10.0	250	30	5	135	11	0.09
10.3	25.0	96.0	31.0	6.1	34.4	3.1	10.0	250	30	5	135	11	0.09
10.3	25.0	96.0	31.0	6.1	34.4	3.1	10.0	250	30	5	135	11	0.09
8.6	25.0	96.0	31.0	5.7	35.5	2.2	10.0	250	30	5	135	11	0.09
8.6	25.0	96.0	31.0	5.7	35.5	2.2	10.0	250	30	5	135	11	0.09
8.6	25.0	96.0	31.0	5.7	35.5	2.2	10.0	250	30	5	135	11	0.09
16.8	45.0	11.1	30.0	5.0	20.9	3.9	9.0	250	20	9	200	14	2

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
101	Brome Hay - Pre-Bloom (101) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
101	Brome Hay - Pre-Bloom (101) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
101	Brome Hay - Pre-Bloom (101) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
102	Brome Hay - M. Bloom (102) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
102	Brome Hay - M. Bloom (102) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
102	Brome Hay - M. Bloom (102) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
103	Brome Hay - Mature (103) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
103	Brome Hay - Mature (103) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
103	Brome Hay - Mature (103) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
104	Fescue, K31 - Hay (104) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
104	Fescue, K31 - Hay (104) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
104	Fescue, K31 - Hay (104) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
105	Fescue, K31 - Hay, F. bloom (105) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
105	Fescue, K31 - Hay, F. bloom (105) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
105	Fescue, K31 - Hay, F. bloom (105) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
106	Orchardgrass - Hay, E. bloom (106) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
106	Orchardgrass - Hay, E. bloom (106) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
106	Orchardgrass - Hay, E. bloom (106) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
107	Orchardgrass - Hay, L. bloom (107) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
107	Orchardgrass - Hay, L. bloom (107) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
107	Orchardgrass - Hay, L. bloom (107) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
108	Pasture- Grass - Spring (108) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
108	Pasture- Grass - Spring (108) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
109	Pasture- Grass - Summer (109) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
109	Pasture- Grass - Summer (109) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
110	Pasture- Grass - Fall (110) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
110	Pasture- Grass - Fall (110) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
111	Pasture-mixed - Spring (111) Well Managed	0.7	4.425	4.61	3.915	7.375	4.42	5.485	1.81	4.91	3.12
111	Pasture-mixed - Spring (111) Over grazed	0.7	4.425	4.61	3.915	7.375	4.42	5.485	1.81	4.91	3.12
112	Pasture-mixed - Summer (112) Well Managed	0.7	4.425	4.61	3.915	7.375	4.42	5.485	1.81	4.91	3.12
112	Pasture-mixed - Summer (112) Over grazed	0.7	4.425	4.61	3.915	7.375	4.42	5.485	1.81	4.91	3.12
113	Pasture-Orch. - Spring (PA) (113) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
113	Pasture-Orch. - Spring (PA) (113) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
114	Pasture-Orch. - Summer (PA) (114) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
114	Pasture-Orch. - Summer (PA) (114) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
115	Pasture-Ryegrass - Spring (PA) (115) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
115	Pasture-Ryegrass - Spring (PA) (115) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
116	Pasture-Ryegrass - Summer (PA) (116) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
116	Pasture-Ryegrass - Summer (PA) (116) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
117	Prairie - Hay (117) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
117	Prairie - Hay (117) Chopped Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
117	Prairie - Hay (117) Chopped Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
118	Range - June Diet (118) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
118	Range - June Diet (118) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
119	Range - July Diet (119) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
119	Range - July Diet (119) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
120	Range - Aug. Diet (120) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
120	Range - Aug. Diet (120) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
121	Range - Sep. Diet (121) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
121	Range - Sep. Diet (121) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
122	Range - Winter (122) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
122	Range - Winter (122) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
123	Reed Canarygrass - Hay (123) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
123	Reed Canarygrass - Hay (123) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
123	Reed Canarygrass - Hay (123) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
124	Ryegrass - Hay (124) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
124	Ryegrass - Hay (124) Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
124	Ryegrass - Hay (124) Chopped Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
125	SorgSud - Pasture (125) Well Managed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.32	0.37	0.09	0	2.32	0.02	0.2	0	0	0	0	0	0	0
0.32	0.37	0.09	0	2.32	0.02	0.2	0	0	0	0	0	0	0
0.32	0.37	0.09	0	2.32	0.02	0.2	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.26	0.22	0.12	0	1.85	0.01	0	0	10.4	0	80	73	0	24
0.26	0.22	0.12	0	1.85	0.01	0	0	10.4	0	80	73	0	24
0.26	0.22	0.12	0	1.85	0.01	0	0	10.4	0	80	73	0	24
0.51	0.37	0.27	0	2.3	0	0.18	0	0	0	0	0	0	22
0.51	0.37	0.27	0	2.3	0	0.18	0	0	0	0	0	0	22
0.51	0.37	0.27	0	2.3	0	0.18	0	0	0	0	0	0	22
0.43	0.32	0.17	0	2.3	0	0.26	38	28	0	0	103	0	0
0.43	0.32	0.17	0	2.3	0	0.26	38	28	0	0	103	0	0
0.43	0.32	0.17	0	2.3	0	0.26	38	28	0	0	103	0	0
0.27	0.34	0.11	0.41	2.91	0.01	0.26	0.43	19	0	93	157	0	40
0.27	0.34	0.11	0.41	2.91	0.01	0.26	0.43	19	0	93	157	0	40
0.27	0.34	0.11	0.41	2.91	0.01	0.26	0.43	19	0	93	157	0	40
0.26	0.3	0.11	0	2.67	0.01	0	0.3	20	20	84	167	0.03	38
0.26	0.3	0.11	0	2.67	0.01	0	0.3	20	20	84	167	0.03	38
0.26	0.3	0.11	0	2.67	0.01	0	0.3	20	20	84	167	0.03	38
0.27	0.34	0.11	0.41	3	0.02	0.26	0.43	19	0	0.015	157	0	40
0.27	0.34	0.11	0.41	3	0.02	0.26	0.43	19	0	0.015	157	0	40
0.29	0.28	0.1	0	1.99	0.01	0.19	0.09	10	0	122	59	0.52	29
0.29	0.28	0.1	0	1.99	0.01	0.19	0.09	10	0	122	59	0.52	29
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.55	0.45	0.32	0	3.16	0	0.2	0	0	0	0	0	0	21
0.35	0.14	0.26	0	1	0	0	0	0	0	88	0	0	34
0.35	0.14	0.26	0	1	0	0	0	0	0	88	0	0	34
0.35	0.14	0.26	0	1	0	0	0	0	0	88	0	0	34
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.26	0.15	0	0	0	0	0	0.239	0	0	0	0	0	0
0.36	0.24	0.22	0	2.91	0.02	0	0	11.9	0	150	92.4	0	0
0.36	0.24	0.22	0	2.91	0.02	0	0	11.9	0	150	92.4	0	0
0.36	0.24	0.22	0	2.91	0.02	0	0	11.9	0	150	92.4	0	0
0.65	0.32	0	0	1.67	0	0	0	5	0	0	74	0	19
0.65	0.32	0	0	1.67	0	0	0	5	0	0	74	0	19
0.65	0.32	0	0	1.67	0	0	0	5	0	0	74	0	19
0.49	0.44	0.35	0	2.14	0	0.11	0.133	35.9	0	210	81.4	0	0

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
101	Brome Hay - Pre-Bloom (101) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
101	Brome Hay - Pre-Bloom (101) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
101	Brome Hay - Pre-Bloom (101) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
102	Brome Hay - M. Bloom (102) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
102	Brome Hay - M. Bloom (102) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
102	Brome Hay - M. Bloom (102) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
103	Brome Hay - Mature (103) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
103	Brome Hay - Mature (103) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
103	Brome Hay - Mature (103) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
104	Fescue, K31 - Hay (104) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
104	Fescue, K31 - Hay (104) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
104	Fescue, K31 - Hay (104) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
105	Fescue, K31 - Hay, F. bloom (105) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
105	Fescue, K31 - Hay, F. bloom (105) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
105	Fescue, K31 - Hay, F. bloom (105) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
106	Orchardgrass - Hay, E. bloom (106) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
106	Orchardgrass - Hay, E. bloom (106) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
106	Orchardgrass - Hay, E. bloom (106) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
107	Orchardgrass - Hay, L. bloom (107) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
107	Orchardgrass - Hay, L. bloom (107) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
107	Orchardgrass - Hay, L. bloom (107) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
108	Pasture- Grass - Spring (108) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
108	Pasture- Grass - Spring (108) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
109	Pasture- Grass - Summer (109) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
109	Pasture- Grass - Summer (109) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
110	Pasture- Grass - Fall (110) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
110	Pasture- Grass - Fall (110) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
111	Pasture-mixed - Spring (111) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
111	Pasture-mixed - Spring (111) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
112	Pasture-mixed - Summer (112) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
112	Pasture-mixed - Summer (112) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
113	Pasture-Orch. - Spring (PA) (113) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
113	Pasture-Orch. - Spring (PA) (113) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
114	Pasture-Orch. - Summer (PA) (114) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
114	Pasture-Orch. - Summer (PA) (114) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
115	Pasture-Ryegrass - Spring (PA) (115) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
115	Pasture-Ryegrass - Spring (PA) (115) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
116	Pasture-Ryegrass - Summer (PA) (116) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
116	Pasture-Ryegrass - Summer (PA) (116) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
117	Prairie - Hay (117) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
117	Prairie - Hay (117) Chopped Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
117	Prairie - Hay (117) Chopped Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
118	Range - June Diet (118) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
118	Range - June Diet (118) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
119	Range - July Diet (119) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
119	Range - July Diet (119) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
120	Range - Aug. Diet (120) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
120	Range - Aug. Diet (120) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
121	Range - Sep. Diet (121) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
121	Range - Sep. Diet (121) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
122	Range - Winter (122) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
122	Range - Winter (122) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
123	Reed Canarygrass - Hay (123) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
123	Reed Canarygrass - Hay (123) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
123	Reed Canarygrass - Hay (123) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
124	Ryegrass - Hay (124) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
124	Ryegrass - Hay (124) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
124	Ryegrass - Hay (124) Chopped Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
125	SorgSud - Pasture (125) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
125	SorgSud - Pasture (125) Over grazed	02-04-484	100	18	55.0	5.5	40.0	90
126	SorgSud - Hay (126) Long Hay	01-04-480	100	91	66.0	6.1	100.0	43
126	SorgSud - Hay (126) Medium Chop	01-04-480	100	91	66.0	6.1	95.0	43
126	SorgSud - Hay (126) Finely chopped	01-04-480	100	91	66.0	6.1	90.0	43
127	SorgSud - Silage (127) Coarse	03-04-499	100	28	68.0	7.0	90.0	56
127	SorgSud - Silage (127) Medium	03-04-499	100	28	68.0	7.0	85.0	56
127	SorgSud - Silage (127) Fine	03-04-499	100	28	68.0	7.0	80.0	56
128	Timothy Hay - L. Veg (128) Long Hay	1-04-881	100	89	55.0	5.5	100.0	46
128	Timothy Hay - L. Veg (128) Medium Chop	1-04-881	100	89	55.0	5.5	95.0	46
128	Timothy Hay - L. Veg (128) Finely chopped	1-04-881	100	89	55.0	5.5	90.0	46
129	Timothy Hay - E. bloom (129) Long Hay	1-04-882	100	89	61.4	6.6	100.0	44
129	Timothy Hay - E. bloom (129) Medium Chop	1-04-882	100	89	61.4	6.6	95.0	44
129	Timothy Hay - E. bloom (129) Finely chopped	1-04-882	100	89	61.4	6.6	90.0	44
130	Timothy Hay - Full bloom (130) Long Hay	1-04-884	100	89	64.2	8.8	100.0	42
130	Timothy Hay - Full bloom (130) Medium Chop	1-04-884	100	89	64.2	8.8	95.0	42
130	Timothy Hay - Full bloom (130) Finely chopped	1-04-884	100	89	64.2	8.8	90.0	42
131	Timothy Hay - Seed stage (131) Long Hay	1-04-888	100	89	72.0	12.5	100.0	42
131	Timothy Hay - Seed stage (131) Medium Chop	1-04-888	100	89	72.0	12.5	95.0	42
131	Timothy Hay - Seed stage (131) Finely chopped	1-04-888	100	89	72.0	12.5	90.0	42
190	GrassSil 7Cp72Ndf13Lndf Coarse	00-00-00	100	35	72.0	12.5	95.0	45
190	GrassSil 7Cp72Ndf13Lndf Medium	00-00-00	100	35	72.0	12.5	90.0	45
190	GrassSil 7Cp72Ndf13Lndf Fine	00-00-00	100	35	72.0	12.5	85.0	45
191	GrassSil 10Cp67Ndf8Lndf Coarse	00-00-00	100	30	67.0	7.5	95.0	48
191	GrassSil 10Cp67Ndf8Lndf Medium	00-00-00	100	30	67.0	7.5	90.0	48
191	GrassSil 10Cp67Ndf8Lndf Fine	00-00-00	100	30	67.0	7.5	85.0	48
192	GrassSil 16Cp55Ndf6Lndf Coarse	00-00-00	100	25	55.0	5.5	95.0	63
192	GrassSil 16Cp55Ndf6Lndf Medium	00-00-00	100	25	55.0	5.5	90.0	63
192	GrassSil 16Cp55Ndf6Lndf Fine	00-00-00	100	25	55.0	5.5	85.0	63
193	GrassSil 20Cp48Ndf5Lndf Coarse	00-00-00	100	20	48.0	5.0	95.0	59
193	GrassSil 20Cp48Ndf5Lndf Medium	00-00-00	100	20	48.0	5.0	90.0	59
193	GrassSil 20Cp48Ndf5Lndf Fine	00-00-00	100	20	48.0	5.0	85.0	59
195	Mixsil 9Cp61Ndf16LNdf Coarse	00-00-00	100	40	61.0	16.0	90.0	69
195	Mixsil 9Cp61Ndf16LNdf Medium	00-00-00	100	40	61.0	16.0	85.0	69
195	Mixsil 9Cp61Ndf16LNdf Fine	00-00-00	100	40	61.0	16.0	80.0	69
196	Mixsil 13Cp56Ndf14LNdf Coarse	00-00-00	100	40	56.5	14.0	90.0	68
196	Mixsil 13Cp56Ndf14LNdf Medium	00-00-00	100	40	56.5	14.0	85.0	68
196	Mixsil 13Cp56Ndf14LNdf Fine	00-00-00	100	40	56.5	14.0	80.0	68
197	Mixsil 15Cp52Ndf12LNdf Coarse	00-00-00	100	40	52.0	12.0	90.0	67
197	Mixsil 15Cp52Ndf12LNdf Medium	00-00-00	100	40	52.0	12.0	85.0	67
197	Mixsil 15Cp52Ndf12LNdf Fine	00-00-00	100	40	52.0	12.0	80.0	67
Legume forages								
201	Alfalfa Hay - E. Veg (201) Long Hay	1-00-N	100	91	36.0	14.7	95.0	64
201	Alfalfa Hay - E. Veg (201) Medium Chop	1-00-N	100	91	36.0	14.7	90.0	64
201	Alfalfa Hay - E. Veg (201) Fine Chop	1-00-N	100	91	36.0	14.7	85.0	64
202	Alfalfa Hay - L. Veg (202) Long Hay	1-00-N	100	91	39.0	16.7	95.0	64
202	Alfalfa Hay - L. Veg (202) Medium Chop	1-00-N	100	91	39.0	16.7	90.0	64
202	Alfalfa Hay - L. Veg (202) Fine Chop	1-00-N	100	91	39.0	16.7	85.0	64
203	Alfalfa Hay - E. Bloom (203) Long Hay	1-00-N	100	91	42.0	16.9	95.0	64
203	Alfalfa Hay - E. Bloom (203) Medium Chop	1-00-N	100	91	42.0	16.9	90.0	64
203	Alfalfa Hay - E. Bloom (203) Fine Chop	1-00-N	100	91	42.0	16.9	85.0	64
204	Alfalfa Hay - M. Bloom (204) Long Hay	1-00-N	100	91	46.0	18.9	95.0	64
204	Alfalfa Hay - M. Bloom (204) Medium Chop	1-00-N	100	91	46.0	18.9	90.0	64
204	Alfalfa Hay - M. Bloom (204) Fine Chop	1-00-N	100	91	46.0	18.9	85.0	64
205	Alfalfa Hay - F. Bloom (205) Long Hay	1-00-N	100	91	51.0	20.4	95.0	64
205	Alfalfa Hay - F. Bloom (205) Medium Chop	1-00-N	100	91	51.0	20.4	90.0	64
205	Alfalfa Hay - F. Bloom (205) Fine Chop	1-00-N	100	91	51.0	20.4	85.0	64
206	Alfalfa Hay - L. Bloom (206) Long Hay	1-00-N	100	91	55.0	22.2	95.0	64
206	Alfalfa Hay - L. Bloom (206) Medium Chop	1-00-N	100	91	55.0	22.2	90.0	64
206	Alfalfa Hay - L. Bloom (206) Fine Chop	1-00-N	100	91	55.0	22.2	85.0	64
207	Alfalfa Hay - E. Veg (207) Long Hay	1-00-54-S	100	91	33.0	18.2	95.0	64

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
16.8	45.0	11.1	30.0	5.0	20.9	3.9	9.0	250	20	9	200	14	2
11.3	20.0	95.0	40.0	11.0	42.6	1.8	9.6	250	20	5	135	11	0.09
11.3	20.0	95.0	40.0	11.0	42.6	1.8	9.6	250	20	5	135	11	0.09
11.3	20.0	95.0	40.0	11.0	42.6	1.8	9.6	250	20	5	135	11	0.09
10.8	50.0	90.0	40.0	11.0	28.5	2.8	9.8	10	20	5	175	12	1.5
10.8	50.0	90.0	40.0	11.0	28.5	2.8	9.8	10	20	5	175	12	1.5
10.8	50.0	90.0	40.0	11.0	28.5	2.8	9.8	10	20	5	175	12	1.5
14.0	25.0	96.0	31.0	5.7	34.8	3.0	8.0	250	30	4	135	11	0.09
14.0	25.0	96.0	31.0	5.7	34.8	3.0	8.0	250	30	4	135	11	0.09
14.0	25.0	96.0	31.0	5.7	34.8	3.0	8.0	250	30	4	135	11	0.09
10.8	25.0	96.0	31.0	5.7	34.5	2.8	5.7	250	30	4	135	11	0.09
10.8	25.0	96.0	31.0	5.7	34.5	2.8	5.7	250	30	4	135	11	0.09
10.8	25.0	96.0	31.0	5.7	34.5	2.8	5.7	250	30	4	135	11	0.09
8.1	25.0	96.0	31.0	6.1	34.4	2.9	5.2	250	30	3	135	11	0.09
8.1	25.0	96.0	31.0	6.1	34.4	2.9	5.2	250	30	3	135	11	0.09
8.1	25.0	96.0	31.0	6.1	34.4	2.9	5.2	250	30	3	135	11	0.09
6.0	25.0	96.0	31.0	6.5	34.1	2.0	6.0	250	30	3	135	11	0.09
6.0	25.0	96.0	31.0	6.5	34.1	2.0	6.0	250	30	3	135	11	0.09
6.0	25.0	96.0	31.0	6.5	34.1	2.0	6.0	250	30	3	135	11	0.09
7.0	30.0	100.0	31.0	14.0	26.2	2.6	6.0	10	25	4	200	9	1.75
7.0	30.0	100.0	31.0	14.0	26.2	2.6	6.0	10	25	4	200	9	1.75
7.0	30.0	100.0	31.0	14.0	26.2	2.6	6.0	10	25	4	200	9	1.75
10.0	40.0	100.0	31.0	12.0	24.2	2.6	6.3	10	25	4	200	9	1.75
10.0	40.0	100.0	31.0	12.0	24.2	2.6	6.3	10	25	4	200	9	1.75
10.0	40.0	100.0	31.0	12.0	24.2	2.6	6.3	10	25	4	200	9	1.75
16.0	50.0	100.0	31.0	10.0	22.5	2.6	7.2	10	25	4	200	9	1.75
16.0	50.0	100.0	31.0	10.0	22.5	2.6	7.2	10	25	4	200	9	1.75
16.0	50.0	100.0	31.0	10.0	22.5	2.6	7.2	10	25	4	200	9	1.75
22.0	60.0	100.0	31.0	8.0	20.4	2.6	7.5	10	25	4	200	9	1.75
22.0	60.0	100.0	31.0	8.0	20.4	2.6	7.5	10	25	4	200	9	1.75
22.0	60.0	100.0	31.0	8.0	20.4	2.6	7.5	10	25	4	200	9	1.75
8.5	45.0	100.0	30.0	15.0	25.1	2.6	7.7	10	30	5	175	12	1.5
8.5	45.0	100.0	30.0	15.0	25.1	2.6	7.7	10	30	5	175	12	1.5
8.5	45.0	100.0	30.0	15.0	25.1	2.6	7.7	10	30	5	175	12	1.5
13.0	45.0	100.0	26.0	12.0	22.4	2.6	7.7	10	30	5	175	12	1.5
13.0	45.0	100.0	26.0	12.0	22.4	2.6	7.7	10	30	5	175	12	1.5
13.0	45.0	100.0	26.0	12.0	22.4	2.6	7.7	10	30	5	175	12	1.5
15.0	50.0	100.0	22.0	10.0	19.5	2.8	8.0	10	30	5	175	12	1.5
15.0	50.0	100.0	22.0	10.0	19.5	2.8	8.0	10	30	5	175	12	1.5
15.0	50.0	100.0	22.0	10.0	19.5	2.8	8.0	10	30	5	175	12	1.5
23.4	30.0	70.0	15.0	10.0	22.1	3.2	10.0	250	30	10	150	9	1.25
23.4	30.0	70.0	15.0	10.0	22.1	3.2	10.0	250	30	10	150	9	1.25
23.4	30.0	70.0	15.0	10.0	22.1	3.2	10.0	250	30	10	150	9	1.25
21.7	30.0	70.0	15.0	10.0	21.9	3.0	10.0	250	30	8	150	9	1.25
21.7	30.0	70.0	15.0	10.0	21.9	3.0	10.0	250	30	8	150	9	1.25
21.7	30.0	70.0	15.0	10.0	21.9	3.0	10.0	250	30	8	150	9	1.25
19.0	29.0	70.0	18.0	11.0	23.5	2.5	9.0	250	30	10	150	9	1.25
19.0	29.0	70.0	18.0	11.0	23.5	2.5	9.0	250	30	10	150	9	1.25
19.0	29.0	70.0	18.0	11.0	23.5	2.5	9.0	250	30	10	150	9	1.25
17.0	28.0	70.0	25.0	14.0	27.5	3.2	8.0	250	30	9	150	9	1.25
17.0	28.0	70.0	25.0	14.0	27.5	3.2	8.0	250	30	9	150	9	1.25
17.0	28.0	70.0	25.0	14.0	27.5	3.2	8.0	250	30	9	150	9	1.25
13.0	27.0	70.0	29.0	16.0	29.8	1.8	9.0	250	30	7	150	9	1.25
13.0	27.0	70.0	29.0	16.0	29.8	1.8	9.0	250	30	7	150	9	1.25
13.0	27.0	70.0	29.0	16.0	29.8	1.8	9.0	250	30	7	150	9	1.25
12.0	26.0	70.0	33.0	18.0	32.2	1.6	8.0	250	30	6	150	9	1.25
12.0	26.0	70.0	33.0	18.0	32.2	1.6	8.0	250	30	6	150	9	1.25
12.0	26.0	70.0	33.0	18.0	32.2	1.6	8.0	250	30	6	150	9	1.25
30.0	30.0	70.0	15.0	10.0	22.4	4.0	10.0	250	30	11	150	9	1.25

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
125	SorgSud - Pasture (125) Over grazed	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
126	SorgSud - Hay (126) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
126	SorgSud - Hay (126) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
126	SorgSud - Hay (126) Finely chopped	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
127	SorgSud - Silage (127) Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
127	SorgSud - Silage (127) Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
127	SorgSud - Silage (127) Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
128	Timothy Hay - L. Veg (128) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
128	Timothy Hay - L. Veg (128) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
128	Timothy Hay - L. Veg (128) Finely chopped	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
129	Timothy Hay - E. bloom (129) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
129	Timothy Hay - E. bloom (129) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
129	Timothy Hay - E. bloom (129) Finely chopped	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
130	Timothy Hay - Full bloom (130) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
130	Timothy Hay - Full bloom (130) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
130	Timothy Hay - Full bloom (130) Finely chopped	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
131	Timothy Hay - Seed stage (131) Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
131	Timothy Hay - Seed stage (131) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
131	Timothy Hay - Seed stage (131) Finely chopped	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
190	GrassSil 7Cp72Ndf13Lndf Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
190	GrassSil 7Cp72Ndf13Lndf Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
190	GrassSil 7Cp72Ndf13Lndf Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
191	GrassSil 10Cp67Ndf8Lndf Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
191	GrassSil 10Cp67Ndf8Lndf Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
191	GrassSil 10Cp67Ndf8Lndf Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
192	GrassSil 16Cp55Ndf6Lndf Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
192	GrassSil 16Cp55Ndf6Lndf Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
192	GrassSil 16Cp55Ndf6Lndf Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
193	GrassSil 20Cp48Ndf5Lndf Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
193	GrassSil 20Cp48Ndf5Lndf Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
193	GrassSil 20Cp48Ndf5Lndf Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
195	Mixsil 9Cp61Ndf16LNdf Coarse	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	3.17
195	Mixsil 9Cp61Ndf16LNdf Medium	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	3.17
195	Mixsil 9Cp61Ndf16LNdf Fine	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	3.17
196	Mixsil 13Cp56Ndf14LNdf Coarse	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	2.65
196	Mixsil 13Cp56Ndf14LNdf Medium	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	2.65
196	Mixsil 13Cp56Ndf14LNdf Fine	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	2.65
197	Mixsil 15Cp52Ndf12LNdf Coarse	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	2.65
197	Mixsil 15Cp52Ndf12LNdf Medium	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	2.65
197	Mixsil 15Cp52Ndf12LNdf Fine	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1	4.91	2.65
201	Alfalfa Hay - E. Veg (201) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
201	Alfalfa Hay - E. Veg (201) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
201	Alfalfa Hay - E. Veg (201) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
202	Alfalfa Hay - L. Veg (202) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
202	Alfalfa Hay - L. Veg (202) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
202	Alfalfa Hay - L. Veg (202) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
203	Alfalfa Hay - E. Bloom (203) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
203	Alfalfa Hay - E. Bloom (203) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
203	Alfalfa Hay - E. Bloom (203) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
204	Alfalfa Hay - M. Bloom (204) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
204	Alfalfa Hay - M. Bloom (204) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
204	Alfalfa Hay - M. Bloom (204) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
205	Alfalfa Hay - F. Bloom (205) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
205	Alfalfa Hay - F. Bloom (205) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
205	Alfalfa Hay - F. Bloom (205) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
206	Alfalfa Hay - L. Bloom (206) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
206	Alfalfa Hay - L. Bloom (206) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
206	Alfalfa Hay - L. Bloom (206) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
207	Alfalfa Hay - E. Veg (207) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.49	0.44	0.35	0	2.14	0	0.11	0.133	35.9	0	210	81.4	0	0
0.51	0.31	0.37	0	2.08	0.02	0.06	0.127	31.4	0	170	76.3	0	38
0.51	0.31	0.37	0	2.08	0.02	0.06	0.127	31.4	0	170	76.3	0	38
0.51	0.31	0.37	0	2.08	0.02	0.06	0.127	31.4	0	170	76.3	0	38
0.5	0.21	0.42	0	2.61	0.02	0.06	0.27	36.6	0	120	98.8	0	0
0.5	0.21	0.42	0	2.61	0.02	0.06	0.27	36.6	0	120	98.8	0	0
0.5	0.21	0.42	0	2.61	0.02	0.06	0.27	36.6	0	120	98.8	0	0
0.45	0.4	0.11	0	3.05	0.07	0.13	0	25.8	0	0.024	89	0	67
0.45	0.4	0.11	0	3.05	0.07	0.13	0	25.8	0	0.024	89	0	67
0.45	0.4	0.11	0	3.05	0.07	0.13	0	25.8	0	0.024	89	0	67
0.51	0.29	0.13	0	2.41	0.01	0.13	0	11	0	203	103	0	62
0.51	0.29	0.13	0	2.41	0.01	0.13	0	11	0	203	103	0	62
0.51	0.29	0.13	0	2.41	0.01	0.13	0	11	0	203	103	0	62
0.43	0.2	0.09	0.62	1.99	0.07	0.14	0	29	0	140	93	0	54
0.43	0.2	0.09	0.62	1.99	0.07	0.14	0	29	0	140	93	0	54
0.43	0.2	0.09	0.62	1.99	0.07	0.14	0	29	0	140	93	0	54
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.31	0.14	0.09	0	2	0.02	0	0	0	0	0	0	0	0
0.31	0.14	0.09	0	2	0.02	0	0	0	0	0	0	0	0
0.31	0.14	0.09	0	2	0.02	0	0	0	0	0	0	0	0
0.29	0.28	0.1	0	1.99	0.01	0	0	10	0	122	59	0	29
0.29	0.28	0.1	0	1.99	0.01	0	0	10	0	122	59	0	29
0.29	0.28	0.1	0	1.99	0.01	0	0	10	0	122	59	0	29
0.32	0.37	0.09	0	2.3	0.02	0	0	0	0	200	0	0	0
0.32	0.37	0.09	0	2.3	0.02	0	0	0	0	200	0	0	0
0.32	0.37	0.09	0	2.3	0.02	0	0	0	0	200	0	0	0
0.31	0.14	0.09	0	2	0.02	0	0	0	0	0	0	0	0
0.31	0.14	0.09	0	2	0.02	0	0	0	0	0	0	0	0
0.31	0.14	0.09	0	2	0.02	0	0	0	0	0	0	0	0
1	0.23	0.29	0	1.5	0.01	0	0	7	0	184	48	0	27
1	0.23	0.29	0	1.5	0.01	0	0	7	0	184	48	0	27
1	0.23	0.29	0	1.5	0.01	0	0	7	0	184	48	0	27
1	0.23	0.29	0	1.5	0.01	0	0	7	0	184	48	0	27
1	0.23	0.29	0	1.5	0.01	0	0	7	0	184	48	0	27
1	0.23	0.29	0	1.5	0.01	0	0	7	0	184	48	0	27
1.3	0.36	0.3	0	3.86	0.01	0	0	7	0	184	48	0	27
1.3	0.36	0.3	0	3.86	0.01	0	0	7	0	184	48	0	27
1.3	0.36	0.3	0	3.86	0.01	0	0	7	0	184	48	0	27
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.41	0.22	0.34	0.34	2.51	0.12	0.3	0.285	12.7	0.17	240	36	0.55	30
1.41	0.22	0.34	0.34	2.51	0.12	0.3	0.285	12.7	0.17	240	36	0.55	30
1.41	0.22	0.34	0.34	2.51	0.12	0.3	0.285	12.7	0.17	240	36	0.55	30
1.39	0.24	0.35	0	1.56	0.12	0.28	0.394	17.1	0	225	60.5	0.55	30.9
1.39	0.24	0.35	0	1.56	0.12	0.28	0.394	17.1	0	225	60.5	0.55	30.9
1.39	0.24	0.35	0	1.56	0.12	0.28	0.394	17.1	0	225	60.5	0.55	30.9
1.19	0.24	0.27	0	1.56	0.07	0.27	0.23	9.9	0.13	155	42.3	0	26.1
1.19	0.24	0.27	0	1.56	0.07	0.27	0.23	9.9	0.13	155	42.3	0	26.1
1.19	0.24	0.27	0	1.56	0.07	0.27	0.23	9.9	0.13	155	42.3	0	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0.13	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0.13	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0.13	160	42.3	0.55	26.1
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
125	SorgSud - Pasture (125) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
126	SorgSud - Hay (126) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
126	SorgSud - Hay (126) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
126	SorgSud - Hay (126) Finely chopped	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
127	SorgSud - Silage (127) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
127	SorgSud - Silage (127) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
127	SorgSud - Silage (127) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
128	Timothy Hay - L. Veg (128) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
128	Timothy Hay - L. Veg (128) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
128	Timothy Hay - L. Veg (128) Finely chopped	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
129	Timothy Hay - E. bloom (129) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
129	Timothy Hay - E. bloom (129) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
129	Timothy Hay - E. bloom (129) Finely chopped	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
130	Timothy Hay - Full bloom (130) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
130	Timothy Hay - Full bloom (130) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
130	Timothy Hay - Full bloom (130) Finely chopped	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
131	Timothy Hay - Seed stage (131) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
131	Timothy Hay - Seed stage (131) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
131	Timothy Hay - Seed stage (131) Finely chopped	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
190	GrassSil 7Cp72Ndf13Lndf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
190	GrassSil 7Cp72Ndf13Lndf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
190	GrassSil 7Cp72Ndf13Lndf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
191	GrassSil 10Cp67Ndf8Lndf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
191	GrassSil 10Cp67Ndf8Lndf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
191	GrassSil 10Cp67Ndf8Lndf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
192	GrassSil 16Cp55Ndf6Lndf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
192	GrassSil 16Cp55Ndf6Lndf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
192	GrassSil 16Cp55Ndf6Lndf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
193	GrassSil 20Cp48Ndf5Lndf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
193	GrassSil 20Cp48Ndf5Lndf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
193	GrassSil 20Cp48Ndf5Lndf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
195	Mixsil 9Cp61Ndf16LNdf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
195	Mixsil 9Cp61Ndf16LNdf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
195	Mixsil 9Cp61Ndf16LNdf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
196	Mixsil 13Cp56Ndf14LNdf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
196	Mixsil 13Cp56Ndf14LNdf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
196	Mixsil 13Cp56Ndf14LNdf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
197	Mixsil 15Cp52Ndf12LNdf Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
197	Mixsil 15Cp52Ndf12LNdf Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
197	Mixsil 15Cp52Ndf12LNdf Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
201	Alfalfa Hay - E. Veg (201) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
201	Alfalfa Hay - E. Veg (201) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
201	Alfalfa Hay - E. Veg (201) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
202	Alfalfa Hay - L. Veg (202) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
202	Alfalfa Hay - L. Veg (202) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
202	Alfalfa Hay - L. Veg (202) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
203	Alfalfa Hay - E. Bloom (203) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
203	Alfalfa Hay - E. Bloom (203) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
203	Alfalfa Hay - E. Bloom (203) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
204	Alfalfa Hay - M. Bloom (204) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
204	Alfalfa Hay - M. Bloom (204) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
204	Alfalfa Hay - M. Bloom (204) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
205	Alfalfa Hay - F. Bloom (205) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
205	Alfalfa Hay - F. Bloom (205) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
205	Alfalfa Hay - F. Bloom (205) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
206	Alfalfa Hay - L. Bloom (206) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
206	Alfalfa Hay - L. Bloom (206) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
206	Alfalfa Hay - L. Bloom (206) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
207	Alfalfa Hay - E. Veg (207) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
207	Alfalfa Hay - E. Veg (207) Medium Chop	1-00-54-S	100	91	33.0	18.2	90.0	64
207	Alfalfa Hay - E. Veg (207) Fine Chop	1-00-54-S	100	91	33.0	18.2	85.0	64
208	Alfalfa Hay - L. Veg (208) Long Hay	1-00-059-S	100	91	37.0	18.9	95.0	64
208	Alfalfa Hay - L. Veg (208) Medium Chop	1-00-059-S	100	91	37.0	18.9	90.0	64
208	Alfalfa Hay - L. Veg (208) Fine Chop	1-00-059-S	100	91	37.0	18.9	85.0	64
209	Alfalfa Hay - E. Bloom (209) Long Hay	1-00-059-S	100	91	40.0	20.0	95.0	64
209	Alfalfa Hay - E. Bloom (209) Medium Chop	1-00-059-S	100	91	40.0	20.0	90.0	64
209	Alfalfa Hay - E. Bloom (209) Fine Chop	1-00-059-S	100	91	40.0	20.0	85.0	64
210	Alfalfa Hay - M. Bloom (210) Long Hay	1-00-063-S	100	91	44.0	22.7	95.0	64
210	Alfalfa Hay - M. Bloom (210) Medium Chop	1-00-063-S	100	91	44.0	22.7	90.0	64
210	Alfalfa Hay - M. Bloom (210) Fine Chop	1-00-063-S	100	91	44.0	22.7	85.0	64
211	Alfalfa Hay - F. Bloom (211) Long Hay	1-00-068-S	100	91	48.0	22.9	95.0	64
211	Alfalfa Hay - F. Bloom (211) Medium Chop	1-00-068-S	100	91	48.0	22.9	90.0	64
211	Alfalfa Hay - F. Bloom (211) Fine Chop	1-00-068-S	100	91	48.0	22.9	85.0	64
212	Alfalfa Hay - L. Bloom (212) Long Hay	1-00-070-S	100	91	53.0	23.0	95.0	64
212	Alfalfa Hay - L. Bloom (212) Medium Chop	1-00-070-S	100	91	53.0	23.0	90.0	64
212	Alfalfa Hay - L. Bloom (212) Fine Chop	1-00-070-S	100	91	53.0	23.0	85.0	64
213	Alfalfa Hay - Mature (213) Long Hay	1-00-71-S	100	91	58.0	24.8	95.0	64
213	Alfalfa Hay - Mature (213) Medium Chop	1-00-71-S	100	91	58.0	24.8	90.0	64
213	Alfalfa Hay - Mature (213) Fine Chop	1-00-71-S	100	91	58.0	24.8	85.0	64
214	Alfalfa Hay - Seeded (214) Long Hay	00-00-00	100	91	70.0	24.3	95.0	64
214	Alfalfa Hay - Seeded (214) Medium Chop	00-00-00	100	91	70.0	24.3	90.0	64
214	Alfalfa Hay - Seeded (214) Fine Chop	00-00-00	100	91	70.0	24.3	85.0	64
215	Alfalfa Hay - Weathered (215) Long Hay	00-00-00	100	89	58.0	25.9	95.0	64
215	Alfalfa Hay - Weathered (215) Medium Chop	00-00-00	100	89	58.0	25.9	90.0	64
215	Alfalfa Hay - Weathered (215) Fine Chop	00-00-00	100	89	58.0	25.9	85.0	64
216	Alfalfa Meal - dehy 15% (216) 3/8" Pellet	1-00-022	100	90	55.4	26.0	30.0	10
216	Alfalfa Meal - dehy 15% (216) 1/4" Pellet	1-00-022	100	90	55.4	26.0	20.0	10
216	Alfalfa Meal - dehy 15% (216) 1/8" Pellet	1-00-022	100	90	55.4	26.0	10.0	10
217	Alfalfa Sil - E. Bloom (217) Coarse	3-00-216	100	35	43.0	23.3	85.0	89
217	Alfalfa Sil - E. Bloom (217) Medium	3-00-216	100	35	43.0	23.3	80.0	89
217	Alfalfa Sil - E. Bloom (217) Fine	3-00-216	100	35	43.0	23.3	75.0	89
218	Alfalfa Sil - M. Bloom (218) Coarse	3-00-217	100	38	47.0	23.4	85.0	89
218	Alfalfa Sil - M. Bloom (218) Medium	3-00-217	100	38	47.0	23.4	80.0	89
218	Alfalfa Sil - M. Bloom (218) Fine	3-00-217	100	38	47.0	23.4	75.0	89
219	Alfalfa Sil - F. Bloom (219) Coarse	3-00-218	100	40	51.0	23.5	85.0	89
219	Alfalfa Sil - F. Bloom (219) Medium	3-00-218	100	40	51.0	23.5	80.0	89
219	Alfalfa Sil - F. Bloom (219) Fine	3-00-218	100	40	51.0	23.5	75.0	89
220	Birdsfoot - Trefoil, Hay (220) Long	10-05-044	100	91	47.5	19.1	95.0	64
220	Birdsfoot - Trefoil, Hay (220) Medium Chop	10-05-044	100	91	47.5	19.1	90.0	64
220	Birdsfoot - Trefoil, Hay (220) Fine Chop	10-05-044	100	91	47.5	19.1	85.0	64
221	Clover - Ladino Hay (221) Long	1-01-378	100	89	36.0	19.4	95.0	64
221	Clover - Ladino Hay (221) Medium Chop	1-01-378	100	89	36.0	19.4	90.0	64
221	Clover - Ladino Hay (221) Fine Chop	1-01-378	100	89	36.0	19.4	85.0	64
222	Clover - Red Hay (222) Long	1-01-415	100	88	46.9	17.9	95.0	64
222	Clover - Red Hay (222) Medium Chop	1-01-415	100	88	46.9	17.9	90.0	64
222	Clover - Red Hay (222) Fine Chop	1-01-415	100	88	46.9	17.9	85.0	64
223	Pasture-Legume - Spring (223) Well Managed	00-00-00	100	20	33.0	8.0	60.0	60
223	Pasture-Legume - Spring (223) Over grazed	00-00-00	100	20	33.0	8.0	40.0	60
224	Pasture-Legume - Summer (224) Well Managed	2-00-181	100	21	38.0	8.5	60.0	60
224	Pasture-Legume - Summer (224) Over grazed	2-00-181	100	21	38.0	8.5	40.0	60
225	Pasture-W Clover - Spring (PA) (225) Well Managed	00-00-00	100	20	15.1	18.8	60.0	60
225	Pasture-W Clover - Spring (PA) (225) Over grazed	00-00-00	100	20	15.1	18.8	40.0	60
226	Pasture-W Clover - Summer (PA) (226) Well Managed	00-00-00	100	25	27.1	18.8	60.0	60
226	Pasture-W Clover - Summer (PA) (226) Over grazed	00-00-00	100	25	27.1	18.8	40.0	60
227	Vetch - Hay (227) Long Hay	1-05-106	100	89	48.0	16.7	95.0	10
227	Vetch - Hay (227) Medium Chop	1-05-106	100	89	48.0	16.7	90.0	10
227	Vetch - Hay (227) Finely chopped	1-05-106	100	89	48.0	16.7	85.0	10
228	Barley - Straw (228) Long	1-00-498	100	91	72.5	13.8	100.0	100
228	Barley - Straw (228) Medium Chop	1-00-498	100	91	72.5	13.8	95.0	100

CP	Sol-P	NPN	NDFIP	ADFIP	UIP-1X	Fat	Ash	Degradation Rates					
								CHO-A	CHO-B1	CHO-B2	Prot-B1	Prot-B2	Prot-B3
%DM	%CP	%Sol-P	%CP	%CP	%CP	%DM	%DM	%/h	%/h	%/h	%/h	%/h	%/h
30.0	30.0	70.0	15.0	10.0	22.4	4.0	10.0	250	30	11	150	9	1.25
30.0	30.0	70.0	15.0	10.0	22.4	4.0	10.0	250	30	11	150	9	1.25
27.0	30.0	70.0	15.0	10.0	22.0	3.8	9.0	250	30	10	150	9	1.25
27.0	30.0	70.0	15.0	10.0	22.0	3.8	9.0	250	30	10	150	9	1.25
27.0	30.0	70.0	15.0	10.0	22.0	3.8	9.0	250	30	10	150	9	1.25
25.0	29.0	70.0	18.0	11.0	23.6	2.5	9.0	250	30	8	150	9	1.25
25.0	29.0	70.0	18.0	11.0	23.6	2.5	9.0	250	30	8	150	9	1.25
25.0	29.0	70.0	18.0	11.0	23.6	2.5	9.0	250	30	8	150	9	1.25
22.0	28.0	70.0	25.0	14.0	27.7	3.2	9.0	250	30	9	150	9	1.25
22.0	28.0	70.0	25.0	14.0	27.7	3.2	9.0	250	30	9	150	9	1.25
22.0	28.0	70.0	25.0	14.0	27.7	3.2	9.0	250	30	9	150	9	1.25
19.0	27.0	70.0	29.0	16.0	30.1	1.8	8.0	250	30	5	150	9	1.25
19.0	27.0	70.0	29.0	16.0	30.1	1.8	8.0	250	30	5	150	9	1.25
19.0	27.0	70.0	29.0	16.0	30.1	1.8	8.0	250	30	5	150	9	1.25
17.0	26.0	70.0	33.0	18.0	32.4	1.5	8.0	250	30	6	150	9	1.25
17.0	26.0	70.0	33.0	18.0	32.4	1.5	8.0	250	30	6	150	9	1.25
17.0	26.0	70.0	33.0	18.0	32.4	1.5	8.0	250	30	6	150	9	1.25
14.0	25.0	70.0	36.0	20.0	34.3	1.3	7.0	250	30	6	150	9	1.25
14.0	25.0	70.0	36.0	20.0	34.3	1.3	7.0	250	30	6	150	9	1.25
14.0	25.0	70.0	36.0	20.0	34.3	1.3	7.0	250	30	6	150	9	1.25
12.0	25.0	70.0	36.0	20.0	33.6	1.0	7.0	250	30	6	150	9	1.25
12.0	25.0	70.0	36.0	20.0	33.6	1.0	7.0	250	30	6	150	9	1.25
12.0	25.0	70.0	36.0	20.0	33.6	1.0	7.0	250	30	6	150	9	1.25
10.0	15.0	70.0	45.0	25.0	41.6	1.0	8.0	250	30	6	150	9	1.25
10.0	15.0	70.0	45.0	25.0	41.6	1.0	8.0	250	30	6	150	9	1.25
10.0	15.0	70.0	45.0	25.0	41.6	1.0	8.0	250	30	6	150	9	1.25
17.3	28.0	70.0	25.0	17.0	35.9	2.4	9.9	300	37	6	150	8	0.15
17.3	28.0	70.0	25.0	17.0	35.9	2.4	9.9	300	37	6	150	8	0.15
17.3	28.0	70.0	25.0	17.0	35.9	2.4	9.9	300	37	6	150	8	0.15
19.0	50.0	70.0	27.0	15.0	24.3	3.2	9.0	10	25	9	150	11	1.75
19.0	50.0	70.0	27.0	15.0	24.3	3.2	9.0	10	25	9	150	11	1.75
19.0	50.0	70.0	27.0	15.0	24.3	3.2	9.0	10	25	9	150	11	1.75
17.0	45.0	70.0	32.0	18.0	28.1	3.1	9.0	10	25	10	150	11	1.75
17.0	45.0	70.0	32.0	18.0	28.1	3.1	9.0	10	25	10	150	11	1.75
17.0	45.0	70.0	32.0	18.0	28.1	3.1	9.0	10	25	10	150	11	1.75
16.0	40.0	70.0	37.0	21.0	31.9	2.7	8.0	10	25	10	150	11	1.75
16.0	40.0	70.0	37.0	21.0	31.9	2.7	8.0	10	25	10	150	11	1.75
16.0	40.0	70.0	37.0	21.0	31.9	2.7	8.0	10	25	10	150	11	1.75
15.9	28.0	96.0	25.2	14.0	27.4	2.1	7.4	250	30	5.5	150	9	1.25
15.9	28.0	96.0	25.2	14.0	27.4	2.1	7.4	250	30	5.5	150	9	1.25
15.9	28.0	96.0	25.2	14.0	27.4	2.1	7.4	250	30	5.5	150	9	1.25
22.0	30.0	96.0	15.0	10.0	22.0	2.7	10.0	250	30	4.5	150	9	1.25
22.0	30.0	96.0	15.0	10.0	22.0	2.7	10.0	250	30	4.5	150	9	1.25
22.0	30.0	96.0	15.0	10.0	22.0	2.7	10.0	250	30	4.5	150	9	1.25
15.0	25.0	92.0	35.6	20.0	34.8	2.8	7.5	250	30	7	150	9	1.25
15.0	25.0	92.0	35.6	20.0	34.8	2.8	7.5	250	30	7	150	9	1.25
15.0	25.0	92.0	35.6	20.0	34.8	2.8	7.5	250	30	7	150	9	1.25
28.0	46.0	2.2	10.0	2.2	11.1	2.7	10.0	350	45	9	200	20	2
28.0	46.0	2.2	10.0	2.2	11.1	2.7	10.0	350	45	9	200	20	2
22.2	46.0	2.2	12.0	3.0	12.6	2.9	10.2	350	45	9	200	18	2
22.2	46.0	2.2	12.0	3.0	12.6	2.9	10.2	350	45	9	200	18	2
28.0	34.0	2.2	4.3	2.1	17.1	3.9	10.7	33.7	32.9	5.1	150	9	1.25
28.0	34.0	2.2	4.3	2.1	17.1	3.9	10.7	33.7	32.9	5.1	150	9	1.25
26.7	34.0	2.2	7.1	4.1	18.4	3.7	10.1	50	26	7.8	150	9	1.25
26.7	34.0	2.2	7.1	4.1	18.4	3.7	10.1	50	26	7.8	150	9	1.25
20.8	28.0	96.0	25.2	14.0	27.4	3.0	7.0	250	30	4.5	150	9	1.25
20.8	28.0	96.0	25.2	14.0	27.4	3.0	7.0	250	30	4.5	150	9	1.25
20.8	28.0	96.0	25.2	14.0	27.4	3.0	7.0	250	30	4.5	150	9	1.25
4.4	20.0	95.0	75.0	65.0	74.9	1.9	7.5	250	30	3	135	11	0.09
4.4	20.0	95.0	75.0	65.0	74.9	1.9	7.5	250	30	3	135	11	0.09

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
207	Alfalfa Hay - E. Veg (207) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
207	Alfalfa Hay - E. Veg (207) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
208	Alfalfa Hay - L. Veg (208) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
208	Alfalfa Hay - L. Veg (208) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
208	Alfalfa Hay - L. Veg (208) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
209	Alfalfa Hay - E. Bloom (209) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
209	Alfalfa Hay - E. Bloom (209) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
209	Alfalfa Hay - E. Bloom (209) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
210	Alfalfa Hay - M. Bloom (210) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
210	Alfalfa Hay - M. Bloom (210) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
210	Alfalfa Hay - M. Bloom (210) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
211	Alfalfa Hay - F. Bloom (211) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
211	Alfalfa Hay - F. Bloom (211) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
211	Alfalfa Hay - F. Bloom (211) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
212	Alfalfa Hay - L. Bloom (212) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
212	Alfalfa Hay - L. Bloom (212) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
212	Alfalfa Hay - L. Bloom (212) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
213	Alfalfa Hay - Mature (213) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
213	Alfalfa Hay - Mature (213) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
213	Alfalfa Hay - Mature (213) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
214	Alfalfa Hay - Seeded (214) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
214	Alfalfa Hay - Seeded (214) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
214	Alfalfa Hay - Seeded (214) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
215	Alfalfa Hay - Weathered (215) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
215	Alfalfa Hay - Weathered (215) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
215	Alfalfa Hay - Weathered (215) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
216	Alfalfa Meal - dehy 15% (216) 3/8" Pellet	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
216	Alfalfa Meal - dehy 15% (216) 1/4" Pellet	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
216	Alfalfa Meal - dehy 15% (216) 1/8" Pellet	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
217	Alfalfa Sil - E. Bloom (217) Coarse	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
217	Alfalfa Sil - E. Bloom (217) Medium	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
217	Alfalfa Sil - E. Bloom (217) Fine	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
218	Alfalfa Sil - M. Bloom (218) Coarse	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
218	Alfalfa Sil - M. Bloom (218) Medium	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
218	Alfalfa Sil - M. Bloom (218) Fine	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
219	Alfalfa Sil - F. Bloom (219) Coarse	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
219	Alfalfa Sil - F. Bloom (219) Medium	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
219	Alfalfa Sil - F. Bloom (219) Fine	1.22	3.21	2.44	3.3	6.4	3.13	7.14	0.63	4.18	1.84
220	Birdsfoot - Trefoil, Hay (220) Long	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
220	Birdsfoot - Trefoil, Hay (220) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
220	Birdsfoot - Trefoil, Hay (220) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
221	Clover - Ladino Hay (221) Long	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
221	Clover - Ladino Hay (221) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
221	Clover - Ladino Hay (221) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
222	Clover - Red Hay (222) Long	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
222	Clover - Red Hay (222) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
222	Clover - Red Hay (222) Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
223	Pasture-Legume - Spring (223) Well Managed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
223	Pasture-Legume - Spring (223) Over grazed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
224	Pasture-Legume - Summer (224) Well Managed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
224	Pasture-Legume - Summer (224) Over grazed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
225	Pasture-W Clover - Spring (PA) (225) Well Managed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
225	Pasture-W Clover - Spring (PA) (225) Over grazed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
226	Pasture-W Clover - Summer (PA) (226) Well Managed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
226	Pasture-W Clover - Summer (PA) (226) Over grazed	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
227	Vetch - Hay (227) Long Hay	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
227	Vetch - Hay (227) Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
227	Vetch - Hay (227) Finely chopped	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
228	Barley - Straw (228) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
228	Barley - Straw (228) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.5	0.33	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.63	0.22	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.63	0.22	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.63	0.22	0.21	0.34	2.51	0.12	0.54	0.285	11.4	0	240	47.1	0.55	37.4
1.37	0.22	0.35	0.38	1.56	0.12	0.28	0.394	17.7	0.16	225	28	0.55	30.9
1.37	0.22	0.35	0.38	1.56	0.12	0.28	0.394	17.7	0.16	225	28	0.55	30.9
1.37	0.22	0.35	0.38	1.56	0.12	0.28	0.394	17.7	0.16	225	28	0.55	30.9
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0.13	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0.13	160	42.3	0.55	26.1
1.19	0.24	0.27	0	1.56	0.07	0.3	0.23	9.9	0.13	160	42.3	0.55	26.1
1.18	0.21	0.22	0	2.07	0.08	0.25	0.406	13.7	0	170	38.5	0.55	22.1
1.18	0.21	0.22	0	2.07	0.08	0.25	0.406	13.7	0	170	38.5	0.55	22.1
1.18	0.21	0.22	0	2.07	0.08	0.25	0.406	13.7	0	170	38.5	0.55	22.1
1.18	0.21	0.22	0	2.07	0.08	0.25	0.406	13.7	0	170	38.5	0.55	22.1
1.18	0.21	0.22	0	2.07	0.08	0.25	0.406	13.7	0	170	38.5	0.55	22.1
1.18	0.21	0.22	0	2.07	0.08	0.25	0.406	13.7	0	170	38.5	0.55	22.1
2.29	0.23	0.27	0	2.42	0.06	0	0	2.8	0	290	24.8	0.55	26.6
2.29	0.23	0.27	0	2.42	0.06	0	0	2.8	0	290	24.8	0.55	26.6
2.29	0.23	0.27	0	2.42	0.06	0	0	2.8	0	290	24.8	0.55	26.6
1.38	0.25	0.29	0	2.46	0.08	0.21	0.19	10.5	0.13	309	31	0.31	21
1.38	0.25	0.29	0	2.46	0.08	0.21	0.19	10.5	0.13	309	31	0.31	21
1.38	0.25	0.29	0	2.46	0.08	0.21	0.19	10.5	0.13	309	31	0.31	21
1.32	0.31	0.26	0	2.85	0.02	0.28	0.65	12.1	0.16	252	32.4	0.18	19.5
1.32	0.31	0.26	0	2.85	0.02	0.28	0.65	12.1	0.16	252	32.4	0.18	19.5
1.32	0.31	0.26	0	2.85	0.02	0.28	0.65	12.1	0.16	252	32.4	0.18	19.5
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11.1	0	280	49.7	0	40.7
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11.1	0	280	49.7	0	40.7
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11.1	0	280	49.7	0	40.7
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11.1	0	280	49.7	0	40.7
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11.1	0	280	49.7	0	40.7
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11.1	0	280	49.7	0	40.7
1.7	0.23	0.51	0	1.92	0.07	0.25	0.111	9.26	0	227	29	0	77
1.7	0.23	0.51	0	1.92	0.07	0.25	0.111	9.26	0	227	29	0	77
1.7	0.23	0.51	0	1.92	0.07	0.25	0.111	9.26	0	227	29	0	77
1.45	0.34	0.47	0.3	2.44	0.13	0.21	0.161	9.4	0.301	0.047	123.1	0	17
1.45	0.34	0.47	0.3	2.44	0.13	0.21	0.161	9.4	0.301	0.047	123.1	0	17
1.45	0.34	0.47	0.3	2.44	0.13	0.21	0.161	9.4	0.301	0.047	123.1	0	17
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.71	0.3	0.36	0	2.27	0.21	0.36	0.17	10.7	0	111	41	0.55	30
1.71	0.3	0.36	0	2.27	0.21	0.36	0.17	10.7	0	111	41	0.55	30
1.71	0.3	0.36	0	2.27	0.21	0.36	0.17	10.7	0	111	41	0.55	30
1.71	0.3	0.36	0	2.27	0.21	0.36	0.17	10.7	0	111	41	0.55	30
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.38	0.24	0.38	0.32	1.81	0.18	0.16	0.156	11	0.245	238	108	0	17
1.36	0.34	0.27	0	2.12	0.52	0.15	0.335	9.9	0.492	0.049	60.8	0	0
1.36	0.34	0.27	0	2.12	0.52	0.15	0.335	9.9	0.492	0.049	60.8	0	0
1.36	0.34	0.27	0	2.12	0.52	0.15	0.335	9.9	0.492	0.049	60.8	0	0
0.3	0.07	0.23	0.67	2.37	0.14	0.17	0.067	5.4	0	200	16	0	7
0.3	0.07	0.23	0.67	2.37	0.14	0.17	0.067	5.4	0	200	16	0	7

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
207	Alfalfa Hay - E. Veg (207) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
207	Alfalfa Hay - E. Veg (207) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
208	Alfalfa Hay - L. Veg (208) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
208	Alfalfa Hay - L. Veg (208) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
208	Alfalfa Hay - L. Veg (208) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
209	Alfalfa Hay - E. Bloom (209) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
209	Alfalfa Hay - E. Bloom (209) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
209	Alfalfa Hay - E. Bloom (209) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
210	Alfalfa Hay - M. Bloom (210) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
210	Alfalfa Hay - M. Bloom (210) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
210	Alfalfa Hay - M. Bloom (210) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
211	Alfalfa Hay - F. Bloom (211) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
211	Alfalfa Hay - F. Bloom (211) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
211	Alfalfa Hay - F. Bloom (211) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
212	Alfalfa Hay - L. Bloom (212) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
212	Alfalfa Hay - L. Bloom (212) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
212	Alfalfa Hay - L. Bloom (212) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
213	Alfalfa Hay - Mature (213) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
213	Alfalfa Hay - Mature (213) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
213	Alfalfa Hay - Mature (213) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
214	Alfalfa Hay - Seeded (214) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
214	Alfalfa Hay - Seeded (214) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
214	Alfalfa Hay - Seeded (214) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
215	Alfalfa Hay - Weathered (215) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
215	Alfalfa Hay - Weathered (215) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
215	Alfalfa Hay - Weathered (215) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
216	Alfalfa Meal - dehy 15% (216) 3/8" Pellet	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
216	Alfalfa Meal - dehy 15% (216) 1/4" Pellet	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
216	Alfalfa Meal - dehy 15% (216) 1/8" Pellet	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
217	Alfalfa Sil - E. Bloom (217) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
217	Alfalfa Sil - E. Bloom (217) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
217	Alfalfa Sil - E. Bloom (217) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
218	Alfalfa Sil - M. Bloom (218) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
218	Alfalfa Sil - M. Bloom (218) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
218	Alfalfa Sil - M. Bloom (218) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
219	Alfalfa Sil - F. Bloom (219) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
219	Alfalfa Sil - F. Bloom (219) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
219	Alfalfa Sil - F. Bloom (219) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
220	Birdsfoot - Trefoil, Hay (220) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
220	Birdsfoot - Trefoil, Hay (220) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
220	Birdsfoot - Trefoil, Hay (220) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
221	Clover - Ladino Hay (221) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
221	Clover - Ladino Hay (221) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
221	Clover - Ladino Hay (221) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
222	Clover - Red Hay (222) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
222	Clover - Red Hay (222) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
222	Clover - Red Hay (222) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
223	Pasture-Legume - Spring (223) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
223	Pasture-Legume - Spring (223) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
224	Pasture-Legume - Summer (224) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
224	Pasture-Legume - Summer (224) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
225	Pasture-W Clover - Spring (PA) (225) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
225	Pasture-W Clover - Spring (PA) (225) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
226	Pasture-W Clover - Summer (PA) (226) Well Managed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
226	Pasture-W Clover - Summer (PA) (226) Over grazed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
227	Vetch - Hay (227) Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
227	Vetch - Hay (227) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
227	Vetch - Hay (227) Finely chopped	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
228	Barley - Straw (228) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
228	Barley - Straw (228) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
228	Barley - Straw (228) Fine Chop	1-00-498	100	91	72.5	13.8	90.0	100
290	AlfSil 17Cp43Ndf20LNDF Coarse	00-00-00	100	35	43.0	20.0	85.0	89
290	AlfSil 17Cp43Ndf20LNDF Medium	00-00-00	100	35	43.0	20.0	80.0	89
290	AlfSil 17Cp43Ndf20LNDF Fine	00-00-00	100	35	43.0	20.0	75.0	89
291	AlfSil 17Cp46Ndf20LNDF Coarse	00-00-00	100	35	46.0	20.0	85.0	89
291	AlfSil 17Cp46Ndf20LNDF Medium	00-00-00	100	35	46.0	20.0	80.0	89
291	AlfSil 17Cp46Ndf20LNDF Fine	00-00-00	100	35	46.0	20.0	75.0	89
292	AlfSil 20Cp37Ndf17LNDF Coarse	00-00-00	100	35	37.0	17.0	85.0	80
292	AlfSil 20Cp37Ndf17LNDF Medium	00-00-00	100	35	37.0	17.0	80.0	80
292	AlfSil 20Cp37Ndf17LNDF Fine	00-00-00	100	35	37.0	17.0	75.0	80
293	AlfSil 20Cp40Ndf17LNDF Coarse	00-00-00	100	35	40.0	17.0	85.0	80
293	AlfSil 20Cp40Ndf17LNDF Medium	00-00-00	100	35	40.0	17.0	80.0	80
293	AlfSil 20Cp40Ndf17LNDF Fine	00-00-00	100	35	40.0	17.0	75.0	80
294	AlfSil 25Cp32Ndf15LNDF Coarse	00-00-00	100	35	32.0	15.0	85.0	70
294	AlfSil 25Cp32Ndf15LNDF Medium	00-00-00	100	35	32.0	15.0	80.0	70
294	AlfSil 25Cp32Ndf15LNDF Fine	00-00-00	100	35	32.0	15.0	75.0	70
295	AlfSil 25Cp35Ndf15LNDF Coarse	00-00-00	100	35	35.0	15.0	85.0	70
295	AlfSil 25Cp35Ndf15LNDF Medium	00-00-00	100	35	35.0	15.0	80.0	70
295	AlfSil 25Cp35Ndf15LNDF Fine	00-00-00	100	35	35.0	15.0	75.0	70
Grain-type forages								
301	Barley - Silage (301) Coarse	00-00-00	100	39	56.8	5.4	90.0	100
301	Barley - Silage (301) Medium	00-00-00	100	39	56.8	5.4	85.0	100
301	Barley - Silage (301) Fine	00-00-00	100	39	56.8	5.4	80.0	100
302	Corn Cobs - Ground (302) Coarse	1-28-234	100	90	87.0	7.8	60.0	90
302	Corn Cobs - Ground (302) Medium	1-28-234	100	90	87.0	7.8	40.0	90
302	Corn Cobs - Ground (302) Finely Ground	1-28-234	100	90	87.0	7.8	30.0	90
303	Corn Sil - Immature (no Ears) (303) Coarse	3-28-252	100	25	60.0	5.0	90.0	80
303	Corn Sil - Immature (no Ears) (303) Medium	3-28-252	100	25	60.0	5.0	85.0	80
303	Corn Sil - Immature (no Ears) (303) Fine	3-28-252	100	25	60.0	5.0	80.0	80
304	Corn Sil. 30% GR - Fine grnd (304)	00-00-00	100	33	49.0	11.0	80.0	80
305	Corn Sil. 30% GR - Medium grnd (305)	00-00-00	100	33	49.0	11.0	85.0	80
305	Corn Sil. 30% GR - Coarse grnd (305)	00-00-00	100	33	49.0	11.0	90.0	80
306	Corn Sil. 30% GR NPN - (306)	00-00-00	100	33	49.0	11.0	90.0	80
306	Corn Sil. 30% GR NPN - (306)	00-00-00	100	33	49.0	11.0	85.0	80
306	Corn Sil. 30% GR NPN - (306)	00-00-00	100	33	49.0	11.0	80.0	80
307	Corn Sil. 40% GR - Fine grnd (307)	3-28-250	100	33	45.0	8.0	80.0	80
308	Corn Sil. 40% GR - Medium grnd (308)	3-28-250	100	33	45.0	8.0	85.0	80
308	Corn Sil. 40% GR - Coarse grnd (308)	3-28-250	100	33	45.0	8.0	90.0	80
309	Corn Sil. 40% GR NPN - (309) Coarse	3-28-250	100	33	45.0	8.0	90.0	80
309	Corn Sil. 40% GR NPN - (309) Medium	3-28-250	100	33	45.0	8.0	85.0	80
309	Corn Sil. 40% GR NPN - (309) Fine	3-28-250	100	33	45.0	8.0	80.0	80
310	Corn Sil. 50% GR - Fine grnd (310)	00-00-00	100	35	41.0	7.0	80.0	80
311	Corn Sil. 50% GR - Medium grnd (311)	00-00-00	100	35	41.0	7.0	85.0	80
311	Corn Sil. 50% GR - Coarse grnd (311)	00-00-00	100	35	41.0	7.0	90.0	80
312	Corn Sil. 50% GR NPN - (312) Coarse	00-00-00	100	35	41.0	7.0	90.0	80
312	Corn Sil. 50% GR NPN - (312) Medium	00-00-00	100	35	41.0	7.0	85.0	80
312	Corn Sil. 50% GR NPN - (312) Fine	00-00-00	100	35	41.0	7.0	80.0	80
313	Corn Silage - Stalklage (313) Coarse	3-28-251	100	30	68.0	10.3	90.0	59
313	Corn Silage - Stalklage (313) Medium	3-28-251	100	30	68.0	10.3	85.0	59
313	Corn Silage - Stalklage (313) Fine	3-28-251	100	30	68.0	10.3	80.0	59
314	Corn Stalks - Grazing (314)	00-00-00	100	50	65.0	10.0	80.0	10
315	Oat - Hay (315) Long	01-03-280	100	91	63.0	9.1	100.0	90
315	Oat - Hay (315) Medium Chop	01-03-280	100	91	63.0	9.1	95.0	90
315	Oat - Hay (315) Fine Chop	01-03-280	100	91	63.0	9.1	90.0	90
316	Oat - Silage Dough (316) Coarse	3-03-296	100	36.4	58.1	16.1	90.0	53
316	Oat - Silage Dough (316) Medium	3-03-296	100	36.4	58.1	16.1	85.0	53
316	Oat - Silage Dough (316) Fine	3-03-296	100	36.4	58.1	16.1	80.0	53
317	Oat - Straw (317) Long	1-03-283	100	92	74.4	20.0	100.0	5
317	Oat - Straw (317) Medium Chop	1-03-283	100	92	74.4	20.0	95.0	5
317	Oat - Straw (317) Fine Chop	1-03-283	100	92	74.4	20.0	90.0	5

CP	Sol-P	NPN	NDFIP	ADFIP	UIP-1X	Fat	Ash	Degradation Rates					
								CHO-A	CHO-B1	CHO-B2	Prot-B1	Prot-B2	Prot-B3
%DM	%CP	%Sol-P	%CP	%CP	%CP	%DM	%DM	%/h	%/h	%/h	%/h	%/h	%/h
4.4	20.0	95.0	75.0	65.0	74.9	1.9	7.5	250	30	3	135	11	0.09
17.0	50.0	70.0	24.0	16.0	23.7	3.0	10.0	10	25	9	150	11	1.75
17.0	50.0	70.0	24.0	16.0	23.7	3.0	10.0	10	25	9	150	11	1.75
17.0	50.0	70.0	24.0	16.0	23.7	3.0	10.0	10	25	9	150	11	1.75
17.0	50.0	95.0	24.0	16.0	23.4	3.0	10.0	10	25	9	150	11	1.75
17.0	50.0	95.0	24.0	16.0	23.4	3.0	10.0	10	25	9	150	11	1.75
17.0	50.0	95.0	24.0	16.0	23.4	3.0	10.0	10	25	9	150	11	1.75
20.0	60.0	70.0	18.0	12.0	18.4	3.0	10.0	10	25	10	150	11	1.75
20.0	60.0	70.0	18.0	12.0	18.4	3.0	10.0	10	25	10	150	11	1.75
20.0	60.0	70.0	18.0	12.0	18.4	3.0	10.0	10	25	10	150	11	1.75
20.0	60.0	95.0	18.0	12.0	18.2	3.0	10.0	10	25	8	150	11	1.75
20.0	60.0	95.0	18.0	12.0	18.2	3.0	10.0	10	25	8	150	11	1.75
20.0	60.0	95.0	18.0	12.0	18.2	3.0	10.0	10	25	8	150	11	1.75
25.0	70.0	70.0	13.0	9.0	13.9	3.0	10.0	10	25	11	150	11	1.75
25.0	70.0	70.0	13.0	9.0	13.9	3.0	10.0	10	25	11	150	11	1.75
25.0	70.0	70.0	13.0	9.0	13.9	3.0	10.0	10	25	11	150	11	1.75
25.0	70.0	95.0	13.0	9.0	13.6	3.0	10.0	10	25	11	150	11	1.75
25.0	70.0	95.0	13.0	9.0	13.6	3.0	10.0	10	25	11	150	11	1.75
25.0	70.0	95.0	13.0	9.0	13.6	3.0	10.0	10	25	11	150	11	1.75
11.9	70.0	100.0	7.7	6.1	10.6	2.9	8.3	10	50	4	300	10	0.5
11.9	70.0	100.0	7.7	6.1	10.6	2.9	8.3	10	50	4	300	10	0.5
11.9	70.0	100.0	7.7	6.1	10.6	2.9	8.3	10	50	4	300	10	0.5
2.8	25.0	10.0	15.0	10.0	21.8	0.6	1.8	300	35	4	150	12	0.1
2.8	25.0	10.0	15.0	10.0	21.8	0.6	1.8	300	35	4	150	12	0.1
2.8	25.0	10.0	15.0	10.0	21.8	0.6	1.8	300	35	4	150	12	0.1
9.0	45.0	100.0	16.0	4.5	19.9	3.1	11.0	10	30	4	300	10	0.2
9.0	45.0	100.0	16.0	4.5	19.9	3.1	11.0	10	30	4	300	10	0.2
9.0	45.0	100.0	16.0	4.5	19.9	3.1	11.0	10	30	4	300	10	0.2
9.5	60.0	100.0	16.0	6.0	16.5	3.0	4.0	10	35	6	300	20	0.3
9.5	58.0	100.0	16.0	7.0	17.4	3.0	4.0	10	30	5	300	15	0.25
9.5	58.0	100.0	16.0	7.0	17.4	3.0	4.0	10	30	5	300	15	0.25
13.0	70.0	100.0	12.0	6.0	13.8	3.0	4.0	10	30	5	300	10	0.25
13.0	70.0	100.0	12.0	6.0	13.8	3.0	4.0	10	30	5	300	10	0.25
13.0	70.0	100.0	12.0	6.0	13.8	3.0	4.0	10	30	5	300	10	0.25
9.2	55.0	100.0	16.0	6.0	17.0	3.1	4.0	10	40	7	300	20	0.3
9.2	53.0	100.0	16.0	7.0	18.1	3.1	4.0	10	35	6	300	15	0.25
9.2	53.0	100.0	16.0	7.0	18.1	3.1	4.0	10	35	6	300	15	0.25
13.2	66.0	100.0	16.0	7.0	16.7	3.1	4.0	10	35	6	300	15	0.25
13.2	66.0	100.0	16.0	7.0	16.7	3.1	4.0	10	35	6	300	15	0.25
13.2	66.0	100.0	16.0	7.0	16.7	3.1	4.0	10	35	6	300	15	0.25
8.0	55.0	100.0	16.4	7.9	17.8	3.5	4.2	10	40	7	300	20	0.3
8.0	50.0	100.0	16.4	7.9	19.1	3.5	4.2	10	35	6	300	15	0.25
8.0	50.0	100.0	16.4	7.9	19.1	3.5	4.2	10	35	6	300	15	0.25
13.0	63.0	100.0	16.0	4.9	17.0	3.5	5.8	10	35	6	300	15	0.25
13.0	63.0	100.0	16.0	4.9	17.0	3.5	5.8	10	35	6	300	15	0.25
13.0	63.0	100.0	16.0	4.9	17.0	3.5	5.8	10	35	6	300	15	0.25
6.3	45.0	100.0	16.0	4.5	19.3	2.1	9.0	10	25	4	300	10	0.25
6.3	45.0	100.0	16.0	4.5	19.3	2.1	9.0	10	25	4	300	10	0.25
6.3	45.0	100.0	16.0	4.5	19.3	2.1	9.0	10	25	4	300	10	0.25
6.5	20.0	95.0	31.4	13.6	42.6	2.1	7.2	250	30	5	135	4	0.09
9.5	30.0	93.0	30.0	10.0	33.3	2.4	7.9	250	30	4	135	11	0.09
9.5	30.0	93.0	30.0	10.0	33.3	2.4	7.9	250	30	4	135	11	0.09
9.5	30.0	93.0	30.0	10.0	33.3	2.4	7.9	250	30	4	135	11	0.09
12.7	50.0	100.0	30.0	10.0	30.5	3.1	10.1	10	50	5	300	12	0.2
12.7	50.0	100.0	30.0	10.0	30.5	3.1	10.1	10	50	5	300	12	0.2
12.7	50.0	100.0	30.0	10.0	30.5	3.1	10.1	10	50	5	300	12	0.2
4.4	20.0	95.0	75.0	65.0	74.9	2.2	7.8	250	30	4	135	11	0.09
4.4	20.0	95.0	75.0	65.0	74.9	2.2	7.8	250	30	4	135	11	0.09
4.4	20.0	95.0	75.0	65.0	74.9	2.2	7.8	250	30	4	135	11	0.09

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
228	Barley - Straw (228) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
290	AlfSil 17Cp43Ndf20LNDF Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
290	AlfSil 17Cp43Ndf20LNDF Medium	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
290	AlfSil 17Cp43Ndf20LNDF Fine	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
291	AlfSil 17Cp46Ndf20LNDF Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
291	AlfSil 17Cp46Ndf20LNDF Medium	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
291	AlfSil 17Cp46Ndf20LNDF Fine	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
292	AlfSil 20Cp37Ndf17LNDF Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
292	AlfSil 20Cp37Ndf17LNDF Medium	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
292	AlfSil 20Cp37Ndf17LNDF Fine	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
293	AlfSil 20Cp40Ndf17LNDF Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
293	AlfSil 20Cp40Ndf17LNDF Medium	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
293	AlfSil 20Cp40Ndf17LNDF Fine	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
294	AlfSil 25Cp32Ndf15LNDF Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
294	AlfSil 25Cp32Ndf15LNDF Medium	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
294	AlfSil 25Cp32Ndf15LNDF Fine	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
295	AlfSil 25Cp35Ndf15LNDF Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
295	AlfSil 25Cp35Ndf15LNDF Medium	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
295	AlfSil 25Cp35Ndf15LNDF Fine	0.73	6.02	6.39	5	9.26	6.01	7.14	2	6.32	1.84
301	Barley - Silage (301) Coarse	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
301	Barley - Silage (301) Medium	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
301	Barley - Silage (301) Fine	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
302	Corn Cobs - Ground (302) Coarse	0.76	1.14	1.9	3.42	14.4	3.42	4.56	2.66	4.9	0.38
302	Corn Cobs - Ground (302) Medium	0.76	1.14	1.9	3.42	14.4	3.42	4.56	2.66	4.9	0.38
302	Corn Cobs - Ground (302) Finely Ground	0.76	1.14	1.9	3.42	14.4	3.42	4.56	2.66	4.9	0.38
303	Corn Sil - Immature (no Ears) (303) Coarse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
303	Corn Sil - Immature (no Ears) (303) Medium	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
303	Corn Sil - Immature (no Ears) (303) Fine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
304	Corn Sil. 30% GR - Fine grnd (304)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
305	Corn Sil. 30% GR - Medium grnd (305)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
305	Corn Sil. 30% GR - Coarse grnd (305)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
306	Corn Sil. 30% GR NPN - (306)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
306	Corn Sil. 30% GR NPN - (306)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
306	Corn Sil. 30% GR NPN - (306)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
307	Corn Sil. 40% GR - Fine grnd (307)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
308	Corn Sil. 40% GR - Medium grnd (308)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
308	Corn Sil. 40% GR - Coarse grnd (308)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
309	Corn Sil. 40% GR NPN - (309) Coarse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
309	Corn Sil. 40% GR NPN - (309) Medium	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
309	Corn Sil. 40% GR NPN - (309) Fine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
310	Corn Sil. 50% GR - Fine grnd (310)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
311	Corn Sil. 50% GR - Medium grnd (311)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
311	Corn Sil. 50% GR - Coarse grnd (311)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
312	Corn Sil. 50% GR NPN - (312) Coarse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
312	Corn Sil. 50% GR NPN - (312) Medium	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
312	Corn Sil. 50% GR NPN - (312) Fine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
313	Corn Silage - Stalklage (313) Coarse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
313	Corn Silage - Stalklage (313) Medium	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
313	Corn Silage - Stalklage (313) Fine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
314	Corn Stalks - Grazing (314)	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
315	Oat - Hay (315) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
315	Oat - Hay (315) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
315	Oat - Hay (315) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
316	Oat - Silage Dough (316) Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
316	Oat - Silage Dough (316) Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
316	Oat - Silage Dough (316) Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
317	Oat - Straw (317) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
317	Oat - Straw (317) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
317	Oat - Straw (317) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.3	0.07	0.23	0.67	2.37	0.14	0.17	0.067	5.4	0	200	16	0	7
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.74	0.27	0.33	0	2.35	0.16	0	0	11	0	280	50	0	41
1.32	0.31	0.26	0	2.85	0.02	0	0	12	0	252	32	0	20
1.32	0.31	0.26	0	2.85	0.02	0	0	12	0	252	32	0	20
1.32	0.31	0.26	0	2.85	0.02	0	0	12	0	252	32	0	20
1.32	0.31	0.26	0	2.85	0.02	0	0	12	0	252	32	0	20
1.32	0.31	0.26	0	2.85	0.02	0	0	12	0	252	32	0	20
1.32	0.31	0.26	0	2.85	0.02	0	0	12	0	252	32	0	20
0.52	0.29	0.19	0	2.57	0.12	0.24	0.72	7.7	0	375	44.8	0.15	24.5
0.52	0.29	0.19	0	2.57	0.12	0.24	0.72	7.7	0	375	44.8	0.15	24.5
0.52	0.29	0.19	0	2.57	0.12	0.24	0.72	7.7	0	375	44.8	0.15	24.5
0.12	0.04	0.07	0	0.89	0.08	0.47	0.13	7	0	230	6	0.08	5
0.12	0.04	0.07	0	0.89	0.08	0.47	0.13	7	0	230	6	0.08	5
0.12	0.04	0.07	0	0.89	0.08	0.47	0.13	7	0	230	6	0.08	5
0.52	0.31	0.31	0	1.64	0	0	0	0	0	0.049	0	0	184.5
0.52	0.31	0.31	0	1.64	0	0	0	0	0	0.049	0	0	184.5
0.52	0.31	0.31	0	1.64	0	0	0	0	0	0.049	0	0	184.5
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0.31	0.27	0.22	0.18	1.22	0.03	0.12	0.097	9.2	0	180	41.1	0	21.2
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.62	0.09	0	0	1.63	0	0	0	0	0	0	0	0	0
0.32	0.25	0.29	0.52	1.49	0.18	0.23	0.073	4.8	0	406	99	0	45
0.32	0.25	0.29	0.52	1.49	0.18	0.23	0.073	4.8	0	406	99	0	45
0.32	0.25	0.29	0.52	1.49	0.18	0.23	0.073	4.8	0	406	99	0	45
0.58	0.31	0.21	0	2.88	0.09	0.24	0	8	0	367	66.3	0.07	29.8
0.58	0.31	0.21	0	2.88	0.09	0.24	0	8	0	367	66.3	0.07	29.8
0.58	0.31	0.21	0	2.88	0.09	0.24	0	8	0	367	66.3	0.07	29.8
0.23	0.06	0.17	0.78	2.53	0.42	0.22	0	10.3	0	164	31	0	6
0.23	0.06	0.17	0.78	2.53	0.42	0.22	0	10.3	0	164	31	0	6
0.23	0.06	0.17	0.78	2.53	0.42	0.22	0	10.3	0	164	31	0	6

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
228	Barley - Straw (228) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
290	AlfSil 17Cp43Ndf20LNDF Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
290	AlfSil 17Cp43Ndf20LNDF Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
290	AlfSil 17Cp43Ndf20LNDF Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
291	AlfSil 17Cp46Ndf20LNDF Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
291	AlfSil 17Cp46Ndf20LNDF Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
291	AlfSil 17Cp46Ndf20LNDF Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
292	AlfSil 20Cp37Ndf17LNDF Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
292	AlfSil 20Cp37Ndf17LNDF Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
292	AlfSil 20Cp37Ndf17LNDF Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
293	AlfSil 20Cp40Ndf17LNDF Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
293	AlfSil 20Cp40Ndf17LNDF Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
293	AlfSil 20Cp40Ndf17LNDF Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
294	AlfSil 25Cp32Ndf15LNDF Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
294	AlfSil 25Cp32Ndf15LNDF Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
294	AlfSil 25Cp32Ndf15LNDF Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
295	AlfSil 25Cp35Ndf15LNDF Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
295	AlfSil 25Cp35Ndf15LNDF Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
295	AlfSil 25Cp35Ndf15LNDF Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
301	Barley - Silage (301) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
301	Barley - Silage (301) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
301	Barley - Silage (301) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
302	Corn Cobs - Ground (302) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
302	Corn Cobs - Ground (302) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
302	Corn Cobs - Ground (302) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
303	Corn Sil - Immature (no Ears) (303) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
303	Corn Sil - Immature (no Ears) (303) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
303	Corn Sil - Immature (no Ears) (303) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
304	Corn Sil. 30% GR - Fine grnd (304)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
305	Corn Sil. 30% GR - Medium grnd (305)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
305	Corn Sil. 30% GR - Coarse grnd (305)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
306	Corn Sil. 30% GR NPN - (306)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
306	Corn Sil. 30% GR NPN - (306)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
306	Corn Sil. 30% GR NPN - (306)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
307	Corn Sil. 40% GR - Fine grnd (307)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
308	Corn Sil. 40% GR - Medium grnd (308)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
308	Corn Sil. 40% GR - Coarse grnd (308)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
309	Corn Sil. 40% GR NPN - (309) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
309	Corn Sil. 40% GR NPN - (309) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
309	Corn Sil. 40% GR NPN - (309) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
310	Corn Sil. 50% GR - Fine grnd (310)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
311	Corn Sil. 50% GR - Medium grnd (311)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
311	Corn Sil. 50% GR - Coarse grnd (311)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
312	Corn Sil. 50% GR NPN - (312) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
312	Corn Sil. 50% GR NPN - (312) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
312	Corn Sil. 50% GR NPN - (312) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
313	Corn Silage - Stalklage (313) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
313	Corn Silage - Stalklage (313) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
313	Corn Silage - Stalklage (313) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
314	Corn Stalks - Grazing (314)	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
315	Oat - Hay (315) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
315	Oat - Hay (315) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
315	Oat - Hay (315) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
316	Oat - Silage Dough (316) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
316	Oat - Silage Dough (316) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
316	Oat - Silage Dough (316) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
317	Oat - Straw (317) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
317	Oat - Straw (317) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
317	Oat - Straw (317) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
318	Sorghum - Silage (grain type) (318) Coarse	3-04-323	100	30	60.8	9.4	90.0	56
318	Sorghum - Silage (grain type) (318) Medium	3-04-323	100	30	60.8	9.4	85.0	56
318	Sorghum - Silage (grain type) (318) Fine	3-04-323	100	30	60.8	9.4	80.0	56
319	Wheat - Silage dough (319) Coarse	3-05-184	100	35	60.7	14.8	90.0	70
319	Wheat - Silage dough (319) Medium	3-05-184	100	35	60.7	14.8	85.0	70
319	Wheat - Silage dough (319) Fine	3-05-184	100	35	60.7	14.8	80.0	70
320	Wheat - Straw (320) Medium Chop	1-05-175	100	89	78.9	16.5	95.0	100
320	Wheat - Straw (320) Fine Chop	1-05-175	100	89	78.9	16.5	90.0	100
320	Wheat - Straw (320) Long	1-05-175	100	89	78.9	16.5	100.0	100
350	PCSil30G25dmMed	00-00-00	100	25	49.0	10.0	75.0	79
351	PCSil30G30dmMed	00-00-00	100	30	49.0	10.0	75.0	79
352	PCSil30G35dmMed	00-00-00	100	35	49.0	10.0	75.0	79
353	PCSil30G40dmMed	00-00-00	100	40	49.0	10.0	75.0	79
354	PCSil40G30dmMed	00-00-00	100	30	45.0	9.0	75.0	80
355	PCSil40G35dmMed	00-00-00	100	35	45.0	9.0	75.0	80
356	PCSil40G40dmMed	00-00-00	100	40	45.0	9.0	75.0	80
357	PCSil50G30dmCrse	00-00-00	100	30	41.0	7.0	80.0	81
358	PCSil50G30dmMed	00-00-00	100	30	41.0	7.0	75.0	81
359	PCSil50G35dmCrse	00-00-00	100	35	41.0	7.0	80.0	81
360	PCSil50G35dmMed	00-00-00	100	35	41.0	7.0	75.0	81
361	PCSil50G40dmCrse	00-00-00	100	40	41.0	7.0	80.0	81
362	PCSil50G40dmMed	00-00-00	100	40	41.0	7.0	75.0	81
363	Corn Sil. Brown mid-rib (363) Coarse	00-00-00	100	28.7	45.0	5.8	90.0	80
363	Corn Sil. Brown mid-rib (363) Medium	00-00-00	100	28.7	45.0	5.8	85.0	80
363	Corn Sil. Brown mid-rib (363) Fine	00-00-00	100	28.7	45.0	5.8	80.0	80
Energy concentrates								
401	Barley Grain - Heavy (401) Whole	4-00-549	0	88	18.1	10.6	85.0	90
401	Barley Grain - Heavy (401) Flaked	4-00-549	0	88	18.1	10.6	80.0	90
401	Barley Grain - Heavy (401) Finely Ground	4-00-549	0	88	18.1	10.6	30.0	90
402	Barley Grain - Light (402) Whole	00-00-00	0	88	28.0	10.4	85.0	90
402	Barley Grain - Light (402) Flaked	00-00-00	0	88	28.0	10.4	80.0	90
402	Barley Grain - Light (402) Finely Ground	00-00-00	0	88	28.0	10.4	30.0	90
403	Corn Dry - Ear45 (403) Finely Ground	00-00-00	0	86	31.0	7.1	30.0	90
403	Corn Dry - Ear45 (403) Coarse	00-00-00	0	86	31.0	7.1	60.0	90
403	Corn Dry - Ear45 (403) Medium	00-00-00	0	86	31.0	7.1	40.0	90
404	Corn Dry - Ear 56 lb/bu (404) Coarse	04-28-238	0	87	28.0	7.1	60.0	90
404	Corn Dry - Ear 56 lb/bu (404) Medium	04-28-238	0	87	28.0	7.1	40.0	90
404	Corn Dry - Ear 56 lb/bu (404) Finely Ground	04-28-238	0	87	28.0	7.1	30.0	90
405	Corn Dry - Grain45 (405) Whole	00-00-00	0	88	10.0	2.2	80.0	97.5
405	Corn Dry - Grain45 (405) Medium	00-00-00	0	88	10.0	2.2	60.0	97.5
405	Corn Dry - Grain45 (405) Finely Ground	00-00-00	0	88	10.0	2.2	20.0	97.5
406	Corn Dry - Grain56 (406) Whole	04-02-931	0	88	9.0	2.2	80.0	98.5
406	Corn Dry - Grain56 (406) Medium	04-02-931	0	88	9.0	2.2	60.0	98.5
406	Corn Dry - Grain56 (406) (same as 407) Finely Ground	04-02-931	0	88	9.0	2.2	20.0	98.5
407	Corn Gnd. - Grain56 (407) Fine Meal	04-02-931	0	88	9.0	2.2	20.0	98.5
408	Corn Gr. - Cracked (408)	4-20-698	0	88	9.0	2.2	60.0	98.5
409	Corn Gr. - Flaked (409)	4-20-224	0	86	9.0	2.2	80.0	98.5
410	Corn HM - Ear56 (410) Coarse	00-00-00	0	72	28.0	7.1	60.0	95
410	Corn HM - Ear56 (410) Medium	00-00-00	0	72	28.0	7.1	50.0	95
410	Corn HM - Ear56 (410) Finely Ground	00-00-00	0	72	28.0	7.1	20.0	95
411	Corn HM - Grain45 (411) Whole	00-00-000	0	72	10.5	2.2	70.0	95
411	Corn HM - Grain45 (411) Medium	00-00-000	0	72	10.5	2.2	50.0	95
411	Corn HM - Grain45 (411) Finely Ground	00-00-000	0	72	10.5	2.2	20.0	95
412	Corn HM - Grain56 (412) Whole	04-20-771	0	72	9.0	2.2	70.0	95
412	Corn HM - Grain56 (412) Medium	04-20-771	0	72	9.0	2.2	50.0	95
412	Corn HM - Grain56 (412) Finely Ground	04-20-771	0	72	9.0	2.2	20.0	95
413	Molasses - Beet (413)	4-00-668	0	77.9	0.0	0.0	0.0	0
414	Molasses - Cane (414)	4-00-696	0	74.3	0.0	0.0	0.0	0
415	Oats - 32 lb/bu (415) Whole/Crimped	4-03-318	0	91	42.0	9.5	80.0	90
415	Oats - 32 lb/bu (415) Medium Grind	4-03-318	0	91	42.0	9.5	60.0	90

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
9.4	45.0	100.0	50.0	5.0	45.4	2.6	5.9	10	20	5	175	12	0.2
9.4	45.0	100.0	50.0	5.0	45.4	2.6	5.9	10	20	5	175	12	0.2
9.4	45.0	100.0	50.0	5.0	45.4	2.6	5.9	10	20	5	175	12	0.2
12.5	45.0	100.0	27.0	8.0	29.1	2.5	7.5	10	50	6	300	10	0.2
12.5	45.0	100.0	27.0	8.0	29.1	2.5	7.5	10	50	6	300	10	0.2
12.5	45.0	100.0	27.0	8.0	29.1	2.5	7.5	10	50	6	300	10	0.2
3.5	20.0	95.0	75.0	65.0	74.8	2.0	7.7	250	50	3	135	11	0.09
3.5	20.0	95.0	75.0	65.0	74.8	2.0	7.7	250	50	3	135	11	0.09
3.5	20.0	95.0	75.0	65.0	74.8	2.0	7.7	250	50	3	135	11	0.09
9.5	58.0	100.0	16.0	7.0	17.3	3.0	4.0	10	40	10	300	15	0.25
9.5	58.0	100.0	16.0	7.0	17.3	3.0	4.0	10	35	8	300	15	0.25
9.5	58.0	100.0	16.0	7.0	17.3	3.0	4.0	10	32	6	300	15	0.25
9.5	58.0	100.0	16.0	7.0	17.3	3.0	4.0	10	27	5	300	15	0.25
9.2	53.0	100.0	16.0	7.0	18.0	3.1	4.0	10	35	8	300	15	0.25
9.2	53.0	100.0	16.0	7.0	18.0	3.1	4.0	10	32	6	300	15	0.25
9.2	53.0	100.0	16.0	7.0	18.0	3.1	4.0	10	27	5	300	15	0.25
8.0	45.0	100.0	16.0	4.9	20.6	3.5	4.2	10	33	7	300	10	0.2
8.0	50.0	100.0	16.0	4.9	18.2	3.5	4.2	10	35	8	300	15	0.25
8.0	45.0	100.0	16.0	4.9	20.6	3.5	4.2	10	30	5	300	10	0.2
8.0	50.0	100.0	16.0	4.9	18.2	3.5	4.2	10	32	6	300	15	0.25
8.0	45.0	100.0	16.0	4.9	20.6	3.5	4.2	10	25	4	300	10	0.2
8.0	50.0	100.0	16.0	4.9	18.2	3.5	4.2	10	27	5	300	15	0.25
9.4	57.7	100.0	19.1	11.7	17.4	3.9	3.8	10	30	7.3	300	15	0.25
9.4	57.7	100.0	19.1	11.7	17.4	3.9	3.8	10	30	7.3	300	15	0.25
9.4	57.7	100.0	19.1	11.7	17.4	3.9	3.8	10	30	7.3	300	15	0.25
13.2	17.0	29.0	8.0	5.0	19.8	2.2	2.4	300	30	5	300	12	0.35
13.2	17.0	29.0	8.0	5.0	19.8	2.2	2.4	300	30	5	300	12	0.35
13.2	17.0	29.0	8.0	5.0	19.8	2.2	2.4	300	30	5	300	12	0.35
14.0	17.0	29.0	8.0	5.0	19.5	2.3	4.0	300	30	5	300	12	0.35
14.0	17.0	29.0	8.0	5.0	19.5	2.3	4.0	300	30	5	300	12	0.35
14.0	17.0	29.0	8.0	5.0	19.5	2.3	4.0	300	30	5	300	12	0.35
9.0	16.0	69.0	18.0	3.0	32.5	3.7	2.0	200	15	5	135	7	0.1
9.0	16.0	69.0	18.0	3.0	32.5	3.7	2.0	200	15	5	135	7	0.1
9.0	16.0	69.0	18.0	3.0	32.5	3.7	2.0	200	15	5	135	7	0.1
9.0	16.0	69.0	18.0	3.0	32.6	3.7	1.9	150	18	5	135	7	0.1
9.0	16.0	69.0	18.0	3.0	32.6	3.7	1.9	150	18	5	135	7	0.1
9.0	16.0	69.0	18.0	3.0	32.6	3.7	1.9	150	18	5	135	7	0.1
9.8	12.0	73.0	15.0	5.0	35.0	4.3	1.6	200	10	4	135	6	0.1
9.8	12.0	73.0	15.0	5.0	35.0	4.3	1.6	200	10	4	135	6	0.1
9.8	12.0	73.0	15.0	5.0	35.0	4.3	1.6	200	10	4	135	6	0.1
9.8	11.0	73.0	15.0	5.0	35.3	4.3	1.6	200	10	4	135	6	0.1
9.8	11.0	73.0	15.0	5.0	35.3	4.3	1.6	200	10	4	135	6	0.1
9.8	11.0	73.0	15.0	5.0	35.3	4.3	1.6	200	10	4	135	6	0.1
9.8	11.0	73.0	15.0	5.0	33.9	4.3	1.6	200	25	6	135	7	0.1
9.8	11.0	73.0	15.0	5.0	36.2	4.1	1.5	150	15	6	135	6	0.09
9.8	8.0	73.0	15.0	5.0	43.8	4.3	1.6	300	30	6	135	4	0.08
9.0	30.0	80.0	18.7	8.3	28.1	3.7	1.9	25	30	5	135	9	0.1
9.0	30.0	80.0	18.7	8.3	28.1	3.7	1.9	25	30	5	135	9	0.1
9.0	30.0	80.0	18.7	8.3	28.1	3.7	1.9	25	30	5	135	9	0.1
9.8	40.0	100.0	15.9	5.3	24.0	4.3	1.6	50	30	6	135	10	0.15
9.8	40.0	100.0	15.9	5.3	24.0	4.3	1.6	50	30	6	135	10	0.15
9.8	40.0	100.0	15.9	5.3	24.0	4.3	1.6	50	30	6	135	10	0.15
9.8	40.0	100.0	15.9	5.3	24.0	4.3	1.6	50	30	6	135	10	0.15
9.8	40.0	100.0	15.9	5.3	24.0	4.3	1.6	50	30	6	135	10	0.15
9.8	40.0	100.0	15.9	5.3	24.0	4.3	1.6	50	30	6	135	10	0.15
8.5	100.0	100.0	0.0	0.0	0.0	0.0	11.4	500	30	3	300	11	0.25
5.8	100.0	100.0	0.0	0.0	0.0	0.0	13.3	500	30	20	350	11	0.25
13.1	53.0	19.0	11.0	5.0	15.9	4.9	5.0	300	35	5	325	12	0.35
13.1	53.0	19.0	11.0	5.0	15.9	4.9	5.0	300	35	5	325	12	0.35

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
318	Sorghum - Silage (grain type) (318) Coarse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.75
318	Sorghum - Silage (grain type) (318) Medium	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.75
318	Sorghum - Silage (grain type) (318) Fine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.75
319	Wheat - Silage dough (319) Coarse	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
319	Wheat - Silage dough (319) Medium	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
319	Wheat - Silage dough (319) Fine	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
320	Wheat - Straw (320) Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
320	Wheat - Straw (320) Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
320	Wheat - Straw (320) Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
350	PCSil30G25dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
351	PCSil30G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
352	PCSil30G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
353	PCSil30G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
354	PCSil40G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
355	PCSil40G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
356	PCSil40G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
357	PCSil50G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
358	PCSil50G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
359	PCSil50G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
360	PCSil50G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
361	PCSil50G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
362	PCSil50G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1	2.94	0.11
363	Corn Sil. Brown mid-rib (363) Coarse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
363	Corn Sil. Brown mid-rib (363) Medium	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
363	Corn Sil. Brown mid-rib (363) Fine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
401	Barley Grain - Heavy (401) Whole	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
401	Barley Grain - Heavy (401) Flaked	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
401	Barley Grain - Heavy (401) Finely Ground	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
402	Barley Grain - Light (402) Whole	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
402	Barley Grain - Light (402) Flaked	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
402	Barley Grain - Light (402) Finely Ground	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
403	Corn Dry - Ear45 (403) Finely Ground	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
403	Corn Dry - Ear45 (403) Coarse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
403	Corn Dry - Ear45 (403) Medium	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
404	Corn Dry - Ear 56 lb/bu (404) Coarse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
404	Corn Dry - Ear 56 lb/bu (404) Medium	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
404	Corn Dry - Ear 56 lb/bu (404) Finely Ground	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
405	Corn Dry - Grain45 (405) Whole	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
405	Corn Dry - Grain45 (405) Medium	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
405	Corn Dry - Grain45 (405) Finely Ground	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
406	Corn Dry - Grain56 (406) Whole	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
406	Corn Dry - Grain56 (406) Medium	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
406	Corn Dry - Grain56 (406) (same as 407) Finely Ground	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
407	Corn Gnd. - Grain56 (407) Fine Meal	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
408	Corn Gr. - Cracked (408)	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
409	Corn Gr. - Flaked (409)	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
410	Corn HM - Ear56 (410) Coarse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
410	Corn HM - Ear56 (410) Medium	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
410	Corn HM - Ear56 (410) Finely Ground	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
411	Corn HM - Grain45 (411) Whole	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
411	Corn HM - Grain45 (411) Medium	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
411	Corn HM - Grain45 (411) Finely Ground	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
412	Corn HM - Grain56 (412) Whole	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
412	Corn HM - Grain56 (412) Medium	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
412	Corn HM - Grain56 (412) Finely Ground	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
413	Molasses - Beet (413)	0	0	0	0	0	0	0	0	0	0
414	Molasses - Cane (414)	0	0	0	0	0	0	0	0	0	0
415	Oats - 32 lb/bu (415) Whole/Crimped	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
415	Oats - 32 lb/bu (415) Medium Grind	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.49	0.22	0.28	0.13	1.72	0.01	0.12	0.3	9.2	0	383	68.5	0.03	32
0.49	0.22	0.28	0.13	1.72	0.01	0.12	0.3	9.2	0	383	68.5	0.03	32
0.49	0.22	0.28	0.13	1.72	0.01	0.12	0.3	9.2	0	383	68.5	0.03	32
0.44	0.29	0.17	0	2.24	0.04	0.21	0	9	0	386	79.5	0	28
0.44	0.29	0.17	0	2.24	0.04	0.21	0	9	0	386	79.5	0	28
0.44	0.29	0.17	0	2.24	0.04	0.21	0	9	0	386	79.5	0	28
0.17	0.05	0.12	0.32	1.41	0.14	0.19	0.046	3.6	0	157	41	0	6
0.17	0.05	0.12	0.32	1.41	0.14	0.19	0.046	3.6	0	157	41	0	6
0.17	0.05	0.12	0.32	1.41	0.14	0.19	0.046	3.6	0	157	41	0	6
0.23	0.21	0.13	0	0.95	0.01	0	0	4	0	184	31	0	25
0.23	0.21	0.13	0	0.95	0.01	0	0	4	0	184	31	0	25
0.23	0.21	0.13	0	0.95	0.01	0	0	4	0	184	31	0	25
0.23	0.21	0.13	0	0.95	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.31	0.27	0.22	0	1.22	0.01	0	0	4	0	184	31	0	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.05	0.35	0.12	0.13	0.57	0.01	0.15	0.35	5.3	0.05	59.5	18.3	0.179	13
0.05	0.35	0.12	0.13	0.57	0.01	0.15	0.35	5.3	0.05	59.5	18.3	0.179	13
0.05	0.35	0.12	0.13	0.57	0.01	0.15	0.35	5.3	0.05	59.5	18.3	0.179	13
0.06	0.39	0.15	0.13	0.52	0.03	0.17	0.193	8.6	0.05	90	18.1	0.179	44.4
0.06	0.39	0.15	0.13	0.52	0.03	0.17	0.193	8.6	0.05	90	18.1	0.179	44.4
0.06	0.39	0.15	0.13	0.52	0.03	0.17	0.193	8.6	0.05	90	18.1	0.179	44.4
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	54.5	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	54.5	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	54.5	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.19	8	0.03	91	23	0.07	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.19	8	0.03	91	23	0.07	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.19	8	0.03	91	23	0.07	14
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.429	2.5	0	30	5.8	0	0
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.429	2.5	0	30	5.8	0	0
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.429	2.5	0	30	5.8	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.03	0.32	0.12	0.05	0.44	0.01	0.11	0.31	2.51	0.03	54.5	7.9	0.14	24.2
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	910	14	0.09	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	910	14	0.09	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	910	14	0.09	14
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.429	2.5	0	30	5.8	0	0
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.429	2.5	0	30	5.8	0	0
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.429	2.5	0	30	5.8	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.429	4.8	0	30	6.4	0	0
0.15	0.03	0.29	1.64	6.06	1.48	0.6	0.465	21.6	0	87	6	0	18
1	0.1	0.42	3.04	4.01	0.22	0.47	1.587	65.7	2.103	263	59	0	21
0.07	0.3	0.16	0.1	0.45	0.06	0.23	0.063	6.7	0.125	80	40.1	0.241	39.2
0.07	0.3	0.16	0.1	0.45	0.06	0.23	0.063	6.7	0.125	80	40.1	0.241	39.2

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
318	Sorghum - Silage (grain type) (318) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
318	Sorghum - Silage (grain type) (318) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
318	Sorghum - Silage (grain type) (318) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
319	Wheat - Silage dough (319) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
319	Wheat - Silage dough (319) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
319	Wheat - Silage dough (319) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
320	Wheat - Straw (320) Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
320	Wheat - Straw (320) Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
320	Wheat - Straw (320) Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
350	PCSil30G25dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
351	PCSil30G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
352	PCSil30G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
353	PCSil30G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
354	PCSil40G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
355	PCSil40G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
356	PCSil40G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
357	PCSil50G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
358	PCSil50G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
359	PCSil50G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
360	PCSil50G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
361	PCSil50G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
362	PCSil50G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
363	Corn Sil. Brown mid-rib (363) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
363	Corn Sil. Brown mid-rib (363) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
363	Corn Sil. Brown mid-rib (363) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
401	Barley Grain - Heavy (401) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
401	Barley Grain - Heavy (401) Flaked	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
401	Barley Grain - Heavy (401) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
402	Barley Grain - Light (402) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
402	Barley Grain - Light (402) Flaked	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
402	Barley Grain - Light (402) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
403	Corn Dry - Ear45 (403) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
403	Corn Dry - Ear45 (403) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
403	Corn Dry - Ear45 (403) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
404	Corn Dry - Ear 56 lb/bu (404) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
404	Corn Dry - Ear 56 lb/bu (404) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
404	Corn Dry - Ear 56 lb/bu (404) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
405	Corn Dry - Grain45 (405) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
405	Corn Dry - Grain45 (405) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
405	Corn Dry - Grain45 (405) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
406	Corn Dry - Grain56 (406) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
406	Corn Dry - Grain56 (406) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
406	Corn Dry - Grain56 (406) (same as 407) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
407	Corn Gnd. - Grain56 (407) Fine Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
408	Corn Gr. - Cracked (408)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
409	Corn Gr. - Flaked (409)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
410	Corn HM - Ear56 (410) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
410	Corn HM - Ear56 (410) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
410	Corn HM - Ear56 (410) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
411	Corn HM - Grain45 (411) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
411	Corn HM - Grain45 (411) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
411	Corn HM - Grain45 (411) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
412	Corn HM - Grain56 (412) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
412	Corn HM - Grain56 (412) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
412	Corn HM - Grain56 (412) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
413	Molasses - Beet (413)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
414	Molasses - Cane (414)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
415	Oats - 32 lb/bu (415) Whole/Crimped	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
415	Oats - 32 lb/bu (415) Medium Grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	87	20	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	85	22	100	100	100	80	95	50
100	87	20	100	100	100	80	95	50
100	80	22	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50
100	75	22	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	95	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
415	Oats - 32 lb/bu (415) Finely Ground	4-03-318	0	91	42.0	9.5	30.0	90
416	Oats - 38 lb/bu (416) Finely Ground	4-03-309	0	89	32.0	9.4	30.0	90
416	Oats - 38 lb/bu (416) Whole/Crimped	4-03-309	0	89	32.0	9.4	80.0	90
416	Oats - 38 lb/bu (416) Medium Grind	4-03-309	0	89	32.0	9.4	60.0	90
417	Rice Grain - Ground (417) Whole/coarse	4-03-938	0	89	16.0	13.0	80.0	90
417	Rice Grain - Ground (417) Medium	4-03-938	0	89	16.0	13.0	60.0	90
417	Rice Grain - Ground (417) Finely Ground	4-03-938	0	89	16.0	13.0	30.0	90
418	Rice Grain - Polished (418) Coarse	4-03-932	0	89	2.0	0.0	10.0	90
418	Rice Grain - Polished (418) Medium	4-03-932	0	89	2.0	0.0	5.0	90
418	Rice Grain - Polished (418) Finely Ground	4-03-932	0	89	2.0	0.0	1.0	90
419	Rye - Grain (419) Whole	4-04-047	0	88	19.0	5.3	80.0	90
419	Rye - Grain (419) Medium	4-04-047	0	88	19.0	5.3	60.0	90
419	Rye - Grain (419) Finely Ground	4-04-047	0	88	19.0	5.3	30.0	90
420	Sorghum - Dry grain (420) Whole	4-04-383	0	89	23.0	6.1	80.0	90
420	Sorghum - Dry grain (420) Medium grind	4-04-383	0	89	23.0	6.1	70.0	90
420	Sorghum - Dry grain (420) Finely Ground	4-04-383	0	89	23.0	6.1	30.0	90
421	Sorghum - Rolled grain (421)	4-04-383	0	90	23.0	6.1	70.0	90
422	Sorghum - Steam flaked (422)	00-00-00	0	70	23.0	6.1	80.0	100
423	Wheat - Middlings (423) Coarse	4-05-205	0	89	35.0	6.0	20.0	90
423	Wheat - Middlings (423) Finely Ground	4-05-205	0	89	35.0	6.0	1.0	90
424	Wheat Grain - Hard red spring (424) Whole	4-05-268	0	89	11.7	6.3	70.0	90
424	Wheat Grain - Hard red spring (424) Coarse	4-05-268	0	89	11.7	6.3	50.0	90
424	Wheat Grain - Hard red spring (424) Finely Ground	4-05-268	0	89	11.7	6.3	30.0	90
425	Wheat Grain - Soft white (425) Whole	4-05-337	0	90	9.7	4.3	70.0	90
425	Wheat Grain - Soft white (425) Coarse	4-05-337	0	90	9.7	4.3	50.0	90
425	Wheat Grain - Soft white (425) Finely Ground	4-05-337	0	90	9.7	4.3	30.0	90
Protein concentrates								
501	Brewers Grain - Dehy (501)	5-02-141	0	92	48.7	13.0	20.0	100
502	Brewers Grain - 21% DM (502)	5-02-142	0	21	42.0	9.5	20.0	100
503	Canola - Meal (503) Coarse	5-03-871	0	92	27.2	12.8	30.0	90
503	Canola - Meal (503) Fine	5-03-871	0	92	27.2	12.8	10.0	90
504	Corn - Hominy (504) Coarse	4-02-887	0	90	23.0	3.6	30.0	90
504	Corn - Hominy (504) Fine	4-02-887	0	90	23.0	3.6	10.0	90
505	Corn Glut. - Feed (505) Coarse	5-28-243	0	90	36.2	2.2	50.0	100
505	Corn Glut. - Feed (505) Fine	5-28-243	0	90	36.2	2.2	40.0	100
506	Corn Glut. - Meal 60%CP (506) Fine	5-28-242	0	91	8.9	7.1	30.0	100
506	Corn Glut. - Meal 60%CP (506) Coarse	5-28-242	0	91	8.9	7.1	50.0	100
507	Cottonseed - High Lint (507) with hay	00-00-00	0	92	51.6	16.0	90.0	90
507	Cottonseed - High Lint (507) w/o hay	00-00-00	0	92	51.6	16.0	60.0	90
508	Cottonseed - Black Whole (508) with hay	5-01-614	0	92	40.0	15.0	90.0	90
508	Cottonseed - Black Whole (508) w/o hay	5-01-614	0	92	40.0	15.0	60.0	90
509	Cottonseed - Meal - mech (509) Coarse	5-01-617	0	92	28.0	21.4	40.0	90
509	Cottonseed - Meal - mech (509) Fine	5-01-617	0	92	28.0	21.4	20.0	90
510	Cottonseed - Meal - Sol-41%CP (510) Coarse	5-07-873	0	92	28.9	20.8	40.0	90
510	Cottonseed - Meal - Sol-41%CP (510) Fine	5-07-873	0	92	28.9	20.8	20.0	90
511	Distillers Gr. - Dehy - Light (511) Coarse	5-28-236	0	91	46.0	10.0	30.0	100
511	Distillers Gr. - Dehy - Light (511) Fine	5-28-236	0	91	46.0	10.0	10.0	100
512	Distillers Gr. - Dehy - Inter. (512) Coarse	5-28-236	0	91	46.0	11.0	30.0	100
512	Distillers Gr. - Dehy - Inter. (512) Fine	5-28-236	0	91	46.0	11.0	10.0	100
513	Distillers Gr. - Dehy - Dark (513) Coarse	5-28-236	0	91	46.0	13.0	30.0	100
513	Distillers Gr. - Dehy - Dark (513) Fine	5-28-236	0	91	46.0	13.0	10.0	100
514	Distillers Gr. - Dehy - V. Dark (514) Coarse	5-28-236	0	91	46.0	15.0	30.0	100
514	Distillers Gr. - Dehy - V. Dark (514) Fine	5-28-236	0	91	46.0	15.0	10.0	100
515	Distillers Gr. - + solubles (515) Coarse	5-02-843	0	91	46.0	9.1	30.0	100
515	Distillers Gr. - + solubles (515) Fine	5-02-843	0	91	46.0	9.1	10.0	100
516	Distillers Gr. - sol. dehy (516) Coarse	5-28-844	0	91	23.0	4.4	30.0	100
516	Distillers Gr. - sol. dehy (516) Fine	5-28-844	0	91	23.0	4.4	10.0	100
517	Distillers Gr. - Wet (517) Coarse	00-00-00	0	25	40.0	10.0	30.0	100
517	Distillers Gr. - Wet (517) Fine	00-00-00	0	25	40.0	10.0	10.0	100
518	Linseed - Meal (518) Coarse	5-02-848	0	90	25.0	24.0	30.0	90

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
13.1	53.0	19.0	11.0	5.0	15.9	4.9	5.0	300	35	5	325	12	0.35
13.3	53.0	19.0	11.0	5.0	16.1	5.2	3.3	300	35	5	325	12	0.35
13.3	53.0	19.0	11.0	5.0	16.1	5.2	3.3	300	35	5	325	12	0.35
13.3	53.0	19.0	11.0	5.0	16.1	5.2	3.3	300	35	5	325	12	0.35
8.9	40.0	50.0	21.4	2.7	21.6	1.9	5.0	350	50	10	300	15	1
8.9	40.0	50.0	21.4	2.7	21.6	1.9	5.0	350	50	10	300	15	1
8.9	40.0	50.0	21.4	2.7	21.6	1.9	5.0	350	50	10	300	15	1
8.6	40.0	50.0	21.4	2.7	25.9	0.8	1.0	300	40	8	250	12	0.35
8.6	40.0	50.0	21.4	2.7	25.9	0.8	1.0	300	40	8	250	12	0.35
8.6	40.0	50.0	21.4	2.7	25.9	0.8	1.0	300	40	8	250	12	0.35
13.8	53.0	19.0	7.0	4.0	13.4	1.7	2.0	300	40	8	300	12	0.35
13.8	53.0	19.0	7.0	4.0	13.4	1.7	2.0	300	40	8	300	12	0.35
13.8	53.0	19.0	7.0	4.0	13.4	1.7	2.0	300	40	8	300	12	0.35
12.4	12.0	33.0	10.0	5.0	31.4	3.1	2.0	150	8	5	135	6	0.1
12.4	12.0	33.0	10.0	5.0	31.4	3.1	2.0	150	8	5	135	6	0.1
12.4	12.0	33.0	10.0	5.0	31.4	3.1	2.0	150	8	5	135	6	0.1
12.6	12.0	33.0	10.0	5.0	31.4	3.0	1.9	250	10	4	135	6	0.1
12.0	8.0	80.0	10.0	5.0	35.5	3.1	2.0	250	15	6	135	5	0.08
18.4	40.0	75.0	4.0	3.0	13.5	3.2	2.4	300	70	6	250	12	0.35
18.4	40.0	75.0	4.0	3.0	13.5	3.2	2.4	300	70	6	250	12	0.35
14.2	30.0	73.0	4.0	2.0	15.1	2.0	2.0	300	40	6	300	12	0.35
14.2	30.0	73.0	4.0	2.0	15.1	2.0	2.0	300	40	6	300	12	0.35
14.2	30.0	73.0	4.0	2.0	15.1	2.0	2.0	300	40	6	300	12	0.35
11.3	30.0	73.0	4.0	2.0	15.1	1.9	2.0	300	40	6	300	12	0.35
11.3	30.0	73.0	4.0	2.0	15.1	1.9	2.0	300	40	6	300	12	0.35
11.3	30.0	73.0	4.0	2.0	15.1	1.9	2.0	300	40	6	300	12	0.35
29.2	4.0	75.0	40.0	12.0	50.2	10.8	4.0	300	38	6	150	6	0.5
26.0	8.0	50.0	38.0	10.0	45.0	6.5	10.0	300	38	6	150	8	0.5
40.9	32.4	65.0	10.6	6.4	19.6	3.5	7.1	300	40	6	230	12	0.2
40.9	32.4	65.0	10.6	6.4	19.6	3.5	7.1	300	40	6	230	12	0.2
11.5	18.0	78.0	8.0	5.0	35.8	7.3	1.0	150	20	4	150	4	0.09
11.5	18.0	78.0	8.0	5.0	35.8	7.3	1.0	150	20	4	150	4	0.09
23.8	49.0	100.0	8.0	2.0	21.9	3.9	6.9	300	50	5	150	4	0.5
23.8	49.0	100.0	8.0	2.0	21.9	3.9	6.9	300	50	5	150	4	0.5
66.3	4.0	75.0	11.0	2.0	41.2	2.6	2.9	300	50	5	150	4	0.5
66.3	4.0	75.0	11.0	2.0	41.2	2.6	2.9	300	50	5	150	4	0.5
24.4	40.0	2.5	10.0	6.0	19.6	17.5	4.2	300	25	6	175	8	0.25
24.4	40.0	2.5	10.0	6.0	19.6	17.5	4.2	300	25	6	175	8	0.25
23.0	40.0	2.5	6.0	6.0	15.9	17.5	5.0	300	25	6	175	8	0.25
23.0	40.0	2.5	6.0	6.0	15.9	17.5	5.0	300	25	6	175	8	0.25
44.0	20.0	40.0	10.0	8.0	25.2	5.0	7.0	300	25	6	175	8	0.25
44.0	20.0	40.0	10.0	8.0	25.2	5.0	7.0	300	25	6	175	8	0.25
46.1	20.0	40.0	10.0	8.0	25.1	3.2	7.0	300	25	6	175	8	0.25
46.1	20.0	40.0	10.0	8.0	25.1	3.2	7.0	300	25	6	175	8	0.25
30.4	6.0	67.0	40.0	13.0	50.9	9.8	4.0	300	17	7	150	6	0.5
30.4	6.0	67.0	40.0	13.0	50.9	9.8	4.0	300	17	7	150	6	0.5
30.4	6.0	67.0	44.0	18.0	54.0	10.7	4.6	300	17	7	150	6	0.5
30.4	6.0	67.0	44.0	18.0	54.0	10.7	4.6	300	17	7	150	6	0.5
30.4	6.0	67.0	44.0	21.0	54.5	10.7	4.6	300	17	7	150	6	0.5
30.4	6.0	67.0	44.0	21.0	54.5	10.7	4.6	300	17	7	150	6	0.5
30.4	6.0	67.0	47.0	36.0	58.7	9.8	4.0	300	17	7	150	6	0.5
30.4	6.0	67.0	47.0	36.0	58.7	9.8	4.0	300	17	7	150	6	0.5
29.5	19.0	89.0	62.0	21.0	60.5	10.3	5.0	300	17	7	150	6	0.5
29.5	19.0	89.0	62.0	21.0	60.5	10.3	5.0	300	17	7	150	6	0.5
29.7	44.0	100.0	55.0	13.0	48.2	9.2	8.0	300	17	7	150	6	0.5
29.7	44.0	100.0	55.0	13.0	48.2	9.2	8.0	300	17	7	150	6	0.5
29.7	25.0	68.0	55.0	12.0	53.5	9.9	4.0	300	17	7	150	6	0.5
29.7	25.0	68.0	55.0	12.0	53.5	9.9	4.0	300	17	7	150	6	0.5
38.3	20.0	10.0	10.0	2.4	21.8	1.5	6.5	300	35	6	230	11	0.2

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
415	Oats - 32 lb/bu (415) Finely Ground	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
416	Oats - 38 lb/bu (416) Finely Ground	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
416	Oats - 38 lb/bu (416) Whole/Crimped	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
416	Oats - 38 lb/bu (416) Medium Grind	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
417	Rice Grain - Ground (417) Whole/coarse	2.2	4.3	7.4	3.6	7.4	3.7	5.4	2.6	4.8	1
417	Rice Grain - Ground (417) Medium	2.2	4.3	7.4	3.6	7.4	3.7	5.4	2.6	4.8	1
417	Rice Grain - Ground (417) Finely Ground	2.2	4.3	7.4	3.6	7.4	3.7	5.4	2.6	4.8	1
418	Rice Grain - Polished (418) Coarse	2.2	4.3	7.4	3.6	7.4	3.7	5.4	2.6	4.8	1
418	Rice Grain - Polished (418) Medium	2.2	4.3	7.4	3.6	7.4	3.7	5.4	2.6	4.8	1
418	Rice Grain - Polished (418) Finely Ground	2.2	4.3	7.4	3.6	7.4	3.7	5.4	2.6	4.8	1
419	Rye - Grain (419) Whole	1.38	3.47	4.42	2.97	5.8	3.84	4.64	2.1	4.64	0.94
419	Rye - Grain (419) Medium	1.38	3.47	4.42	2.97	5.8	3.84	4.64	2.1	4.64	0.94
419	Rye - Grain (419) Finely Ground	1.38	3.47	4.42	2.97	5.8	3.84	4.64	2.1	4.64	0.94
420	Sorghum - Dry grain (420) Whole	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
420	Sorghum - Dry grain (420) Medium grind	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
420	Sorghum - Dry grain (420) Finely Ground	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
421	Sorghum - Rolled grain (421)	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
422	Sorghum - Steam flaked (422)	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
423	Wheat - Middlings (423) Coarse	1.02	3.77	6.96	3.67	7.37	4.09	5.79	2.41	4.74	1.2
423	Wheat - Middlings (423) Finely Ground	1.02	3.77	6.96	3.67	7.37	4.09	5.79	2.41	4.74	1.2
424	Wheat Grain - Hard red spring (424) Whole	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
424	Wheat Grain - Hard red spring (424) Coarse	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
424	Wheat Grain - Hard red spring (424) Finely Ground	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
425	Wheat Grain - Soft white (425) Whole	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
425	Wheat Grain - Soft white (425) Coarse	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
425	Wheat Grain - Soft white (425) Finely Ground	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
501	Brewers Grain - Dehy (501)	1.26	2.15	2.61	2.76	8.46	3.53	3.78	1.47	4.8	1.12
502	Brewers Grain - 21% DM (502)	1.7	3.23	4.69	3.43	9.18	5.71	5.95	1.9	5.31	1.36
503	Canola - Meal (503) Coarse	1.4	6.67	6.78	4.85	7.99	4.94	6.44	4.04	4.68	1.22
503	Canola - Meal (503) Fine	1.4	6.67	6.78	4.85	7.99	4.94	6.44	4.04	4.68	1.22
504	Corn - Hominy (504) Coarse	1.11	3.2	5.42	3.67	10.83	3.91	5.19	2.87	4.88	0.11
504	Corn - Hominy (504) Fine	1.11	3.2	5.42	3.67	10.83	3.91	5.19	2.87	4.88	0.11
505	Corn Glut. - Feed (505) Coarse	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
505	Corn Glut. - Feed (505) Fine	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
506	Corn Glut. - Meal 60%CP (506) Fine	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
506	Corn Glut. - Meal 60%CP (506) Coarse	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
507	Cottonseed - High Lint (507) with hay	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
507	Cottonseed - High Lint (507) w/o hay	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
508	Cottonseed - Black Whole (508) with hay	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
508	Cottonseed - Black Whole (508) w/o hay	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
509	Cottonseed - Meal - mech (509) Coarse	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
509	Cottonseed - Meal - mech (509) Fine	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
510	Cottonseed - Meal - Sol-41%CP (510) Coarse	0.99	4.5	10.59	3.39	6.31	3.62	5.02	3.45	5.47	1.74
510	Cottonseed - Meal - Sol-41%CP (510) Fine	0.99	4.5	10.59	3.39	6.31	3.62	5.02	3.45	5.47	1.74
511	Distillers Gr. - Dehy - Light (511) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
511	Distillers Gr. - Dehy - Light (511) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
512	Distillers Gr. - Dehy - Inter. (512) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
512	Distillers Gr. - Dehy - Inter. (512) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
513	Distillers Gr. - Dehy - Dark (513) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
513	Distillers Gr. - Dehy - Dark (513) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
514	Distillers Gr. - Dehy - V. Dark (514) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
514	Distillers Gr. - Dehy - V. Dark (514) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
515	Distillers Gr. - + solubles (515) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
515	Distillers Gr. - + solubles (515) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
516	Distillers Gr. - sol. dehy (516) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
516	Distillers Gr. - sol. dehy (516) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
517	Distillers Gr. - Wet (517) Coarse	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
517	Distillers Gr. - Wet (517) Fine	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
518	Linseed - Meal (518) Coarse	1.95	4.31	10.7	4.22	6.8	5.37	5.76	2.52	5.25	1.63

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.07	0.3	0.16	0.1	0.45	0.06	0.23	0.063	6.7	0.125	80	40.1	0.241	39.2
0.009	0.41	0.16	0.1	0.51	0.02	0.21	0.063	8.6	0.125	94.1	40.3	0.241	40.8
0.009	0.41	0.16	0.1	0.51	0.02	0.21	0.063	8.6	0.125	94.1	40.3	0.241	40.8
0.009	0.41	0.16	0.1	0.51	0.02	0.21	0.063	8.6	0.125	94.1	40.3	0.241	40.8
0.07	0.36	0.14	0.08	0.53	0.07	0.05	0.05	3	0.05	0	20.2	0	16.9
0.07	0.36	0.14	0.08	0.53	0.07	0.05	0.05	3	0.05	0	20.2	0	16.9
0.07	0.36	0.14	0.08	0.53	0.07	0.05	0.05	3	0.05	0	20.2	0	16.9
0.03	0.13	0.1	0.04	0.26	0.02	0.09	0.955	6.1	0	20	33.4	0	15.4
0.03	0.13	0.1	0.04	0.26	0.02	0.09	0.955	6.1	0	20	33.4	0	15.4
0.03	0.13	0.1	0.04	0.26	0.02	0.09	0.955	6.1	0	20	33.4	0	15.4
0.07	0.36	0.14	0.03	0.52	0.03	0.17	0	8.6	0	80	82.3	0.44	32.2
0.07	0.36	0.14	0.03	0.52	0.03	0.17	0	8.6	0	80	82.3	0.44	32.2
0.07	0.36	0.14	0.03	0.52	0.03	0.17	0	8.6	0	80	82.3	0.44	32.2
0.05	0.34	0.14	0.09	0.47	0.04	0.12	0.531	4.9	0.069	60	17.9	0.227	19.1
0.05	0.34	0.14	0.09	0.47	0.04	0.12	0.531	4.9	0.069	60	17.9	0.227	19.1
0.05	0.34	0.14	0.09	0.47	0.04	0.12	0.531	4.9	0.069	60	17.9	0.227	19.1
0.04	0.34	0.17	0.09	0.44	0.01	0.14	0.531	4.7	0.069	80.8	15.4	0.46	16
0.05	0.34	0.14	0.09	0.35	0.04	0.12	0.531	4.9	0.069	60	17.9	0.227	19.1
0.15	1	0.38	0.04	1.1	0.01	0.19	0.11	11	0.123	110	128.3	0.828	109.1
0.15	1	0.38	0.04	1.1	0.01	0.19	0.11	11	0.123	110	128.3	0.828	109.1
0.05	0.42	0.16	0.09	0.41	0.02	0.17	0.14	6.8	0	70	42.2	0.3	43.3
0.05	0.42	0.16	0.09	0.41	0.02	0.17	0.14	6.8	0	70	42.2	0.3	43.3
0.05	0.42	0.16	0.09	0.41	0.02	0.17	0.14	6.8	0	70	42.2	0.3	43.3
0.07	0.33	0.11	0	0.43	0.02	0.13	0.15	7.8	0	0.004	40	0.051	30
0.07	0.33	0.11	0	0.43	0.02	0.13	0.15	7.8	0	0.004	40	0.051	30
0.07	0.33	0.11	0	0.43	0.02	0.13	0.15	7.8	0	0.004	40	0.051	30
0.29	0.7	0.27	0.17	0.58	0.15	0.4	0.083	11.3	0.072	221	44	0.76	82
0.29	0.7	0.27	0.13	0.58	0.15	0.34	0.101	11.3	0.072	270	40.9	0	106
0.7	1.2	0.57	0	1.37	0.03	1.17	0	7.95	0	211	55.8	0	71.5
0.7	1.2	0.57	0	1.37	0.03	1.17	0	7.95	0	211	55.8	0	71.5
0.05	0.57	0.26	0.06	0.65	0.09	0.03	0.061	15.1	0	80	16.1	0	0
0.05	0.57	0.26	0.06	0.65	0.09	0.03	0.061	15.1	0	80	16.1	0	0
0.07	0.95	0.4	0.25	1.4	0.26	0.47	0.097	6.98	0.074	226	22.1	0.302	73.3
0.07	0.95	0.4	0.25	1.4	0.26	0.47	0.097	6.98	0.074	226	22.1	0.302	73.3
0.07	0.61	0.15	0.07	0.48	0.06	0.9	0.085	4.76	0	159	20.6	0	61.4
0.07	0.61	0.15	0.07	0.48	0.06	0.9	0.085	4.76	0	159	20.6	0	61.4
0.17	0.62	0.38	0	1.24	0.01	0.27	0	7.9	0	107	131	0	37.7
0.17	0.62	0.38	0	1.24	0.01	0.27	0	7.9	0	107	131	0	37.7
0.16	0.62	0.35	0	1.22	0.03	0.26	0	7.9	0	160	12.2	0	37.7
0.16	0.62	0.35	0	1.22	0.03	0.26	0	7.9	0	160	12.2	0	37.7
0.16	0.76	0.35	0	1.22	0.03	0.26	0	53.9	0	0.016	12.2	0	0
0.16	0.76	0.35	0	1.22	0.03	0.26	0	53.9	0	0.016	12.2	0	0
0.2	1.16	0.65	0	1.65	0.07	0.42	0.53	16.5	0	162	26.9	0.98	74
0.2	1.16	0.65	0	1.65	0.07	0.42	0.53	16.5	0	162	26.9	0.98	74
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.26	0.83	0.33	0.28	1.08	0.3	0.44	0.18	10.6	0.085	358	27.6	0.4	67.8
0.26	0.83	0.33	0.28	1.08	0.3	0.44	0.18	10.6	0.085	358	27.6	0.4	67.8
0.26	0.83	0.33	0.28	1.08	0.3	0.44	0.18	10.6	0.085	358	27.6	0.4	67.8
0.26	0.83	0.33	0.28	1.08	0.3	0.44	0.18	10.6	0.085	358	27.6	0.4	67.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.32	0.83	0.33	0.28	1.07	0.24	0.4	0.18	10.56	0.085	560	27.6	0.4	67.8
0.32	0.83	0.33	0.28	1.07	0.24	0.4	0.18	10.56	0.085	560	27.6	0.4	67.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	83.9	0.085	560	77.6	0.4	94.8
0.43	0.89	0.66	0.04	1.53	0.15	0.43	0.21	29	0	354	42	0.91	0

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
415	Oats - 32 lb/bu (415) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
416	Oats - 38 lb/bu (416) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
416	Oats - 38 lb/bu (416) Whole/Crimped	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
416	Oats - 38 lb/bu (416) Medium Grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
417	Rice Grain - Ground (417) Whole/coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
417	Rice Grain - Ground (417) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
417	Rice Grain - Ground (417) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
418	Rice Grain - Polished (418) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
418	Rice Grain - Polished (418) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
418	Rice Grain - Polished (418) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
419	Rye - Grain (419) Whole	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
419	Rye - Grain (419) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
419	Rye - Grain (419) Finely Ground	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
420	Sorghum - Dry grain (420) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
420	Sorghum - Dry grain (420) Medium grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
420	Sorghum - Dry grain (420) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
421	Sorghum - Rolled grain (421)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
422	Sorghum - Steam flaked (422)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
423	Wheat - Middlings (423) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
423	Wheat - Middlings (423) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
424	Wheat Grain - Hard red spring (424) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
424	Wheat Grain - Hard red spring (424) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
424	Wheat Grain - Hard red spring (424) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
425	Wheat Grain - Soft white (425) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
425	Wheat Grain - Soft white (425) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
425	Wheat Grain - Soft white (425) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
501	Brewers Grain - Dehy (501)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
502	Brewers Grain - 21% DM (502)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
503	Canola - Meal (503) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
503	Canola - Meal (503) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
504	Corn - Hominy (504) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
504	Corn - Hominy (504) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
505	Corn Glut. - Feed (505) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
505	Corn Glut. - Feed (505) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
506	Corn Glut. - Meal 60%CP (506) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
506	Corn Glut. - Meal 60%CP (506) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
507	Cottonseed - High Lint (507) with hay	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
507	Cottonseed - High Lint (507) w/o hay	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
508	Cottonseed - Black Whole (508) with hay	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
508	Cottonseed - Black Whole (508) w/o hay	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
509	Cottonseed - Meal - mech (509) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
509	Cottonseed - Meal - mech (509) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
510	Cottonseed - Meal - Sol-41%CP (510) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
510	Cottonseed - Meal - Sol-41%CP (510) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
511	Distillers Gr. - Dehy - Light (511) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
511	Distillers Gr. - Dehy - Light (511) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
512	Distillers Gr. - Dehy - Inter. (512) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
512	Distillers Gr. - Dehy - Inter. (512) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
513	Distillers Gr. - Dehy - Dark (513) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
513	Distillers Gr. - Dehy - Dark (513) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
514	Distillers Gr. - Dehy - V. Dark (514) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
514	Distillers Gr. - Dehy - V. Dark (514) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
515	Distillers Gr. - + solubles (515) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
515	Distillers Gr. - + solubles (515) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
516	Distillers Gr. - sol. dehy (516) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
516	Distillers Gr. - sol. dehy (516) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
517	Distillers Gr. - Wet (517) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
517	Distillers Gr. - Wet (517) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
518	Linseed - Meal (518) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	65	100	100	100	80	95	50
100	75	93	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	90	100	100	100	80	95	50
100	75	90	100	100	100	80	95	50
100	75	90	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
518	Linseed - Meal (518) Fine	5-02-848	0	90	25.0	24.0	10.0	90
519	Lupins - (519) fine Whole	00-00-00	0	90	33.0	10.0	80.0	90
519	Lupins - (519) fine Coarse	00-00-00	0	90	33.0	10.0	30.0	90
519	Lupins - (519) fine Fine	00-00-00	0	90	33.0	10.0	10.0	90
520	Peanut - Meal (520) Coarse	5-03-650	0	92	14.0	10.0	60.0	90
520	Peanut - Meal (520) Fine	5-03-650	0	92	14.0	10.0	30.0	90
521	Soybean - Whole (521) Whole	5-04-610	0	90	14.9	1.5	70.0	90
521	Soybean - Whole (521) Medium	5-04-610	0	90	14.9	1.5	30.0	90
521	Soybean - Whole (521) Finely Ground	5-04-610	0	90	14.9	1.5	10.0	90
522	Soybean - Whole Roasted (522) Whole	00-00-00	0	90	13.4	10.0	70.0	90
522	Soybean - Whole Roasted (522) Medium	00-00-00	0	90	13.4	10.0	30.0	90
522	Soybean - Whole Roasted (522) Finely Ground	00-00-00	0	90	13.4	10.0	10.0	90
523	Soybean - Whole Extrd (523) Coarse	00-00-00	0	93.62	13.0	1.5	30.0	90
523	Soybean - Whole Extrd (523) Finely Ground	00-00-00	0	93.62	13.0	1.5	10.0	90
524	Soybean - Meal - 44 (524) Coarse	5-20-637	0	90	14.9	2.1	30.0	90
524	Soybean - Meal - 44 (524) Finely Ground	5-20-637	0	90	14.9	2.1	10.0	90
525	Soybean - Meal - 47.5 (525) Coarse	5-04-612	0	90	7.8	2.5	30.0	90
525	Soybean - Meal - 47.5 (525) Finely Ground	5-04-612	0	90	7.8	2.5	10.0	90
526	Sunflower - Seed meal (526) Coarse	5-04-740	0	90	40.0	30.0	30.0	90
526	Sunflower - Seed meal (526) Finely Ground	5-04-740	0	90	40.0	30.0	10.0	90
Food processing byproducts								
601	Almond Hulls- (601) Coarse	00-00-00	0	88	33.7	30.1	85.0	95
601	Almond Hulls- (601) Medium	00-00-00	0	88	33.7	30.1	80.0	95
601	Almond Hulls- (601) Fine	00-00-00	0	88	33.7	30.1	75.0	95
602	Apple - Pomace (602)	04-00-424	100	22	41.0	2.0	30.0	100
603	Bakery - Waste (603)	4-00-466	0	92	18.0	5.6	10.0	85
604	Barley - Malt Sprouts w/hulls (604)	4-00-545	0	93	46.0	6.5	40.0	85
605	Beet Pulp - Dehy (605) pellet (whole or ground)	4-00-669	0	91	44.6	3.7	30.0	90
606	Beet pulp - (606) shreds	00-00-00	0	91	35.8	4.1	50.0	90
607	Bloodmeal - (607)	5-00-380	0	90	0.9	0.0	0.0	0
608	Citrus Pulp - Dehy (608) pellets (whole or ground)	4-01-237	0	91	23.0	13.0	30.0	90
609	Citrus pulp - (609) shreds	4-01-237	0	91	17.7	5.1	50.0	90
610	Cottonseed Hulls - (610) with hay	00-00-00	100	91	90.0	24.0	90.0	60
610	Cottonseed Hulls - (610) w/o hay	00-00-00	100	91	90.0	24.0	60.0	60
611	Feather - Meal (611) Coarse	5-03-795	0	90	39.0	0.0	20.0	90
611	Feather - Meal (611) Fine	5-03-795	0	90	39.0	0.0	1.0	90
612	Fishmeal - (612)	5-02-009	0	90	0.0	0.0	0.0	90
613	Meat & - Bone Meal (613)	5-00-385	0	95	15.0	0.0	0.0	0
614	Meat meal - (614)	5-00-385	0	95	5.0	0.0	0.0	0
615	Rice Bran - (615) Coarse	4-03-928	0	91	33.0	13.0	10.0	90
615	Rice Bran - (615) Medium	4-03-928	0	91	33.0	13.0	5.0	90
615	Rice Bran - (615) Finely Ground	4-03-928	0	91	33.0	13.0	1.0	90
617	Soybean - Hulls (617) Loose	1-04-560	0	91	66.3	3.0	60.0	90
617	Soybean - Hulls (617) Pellets	1-04-560	0	91	66.3	3.0	30.0	90
618	Tallow (618)	4-00-386	0	99	0.0	0.0	0.0	0
619	Urea (619)	00-00-00	0	99	0.0	0.0	0.0	0
620	Wheat Bran - (620) Coarse	00-00-00	0	89	51.0	5.9	30.0	94.6
620	Wheat Bran - (620) Finely Ground	00-00-00	0	89	51.0	5.9	10.0	94.6
621	Whey - Acid (621)	4-08-134	0	7	0.0	0.0	0.0	0
622	Whey - Delact. (622)	4-01-186	0	93	0.0	0.0	0.0	0
Minerals and vitamins								
801	Ammonium - Phos (Mono) (801)	6-09-338	0	97	0.0	0.0	0.0	0
802	Ammonium - Phos (Dibasic) (802)	6-00-370	0	97	0.0	0.0	0.0	0
803	Ammonium - Sulfate (803)	6-09-339	0	100	0.0	0.0	0.0	0
804	Bone Meal - (804)	6-00-400	0	97	0.0	0.0	0.0	0
805	Calcium - Carbonate (805)	6-01-069	0	100	0.0	0.0	0.0	0
806	Calcium - Sulfate (806)	6-01-089	0	97	0.0	0.0	0.0	0
807	Calcium - Phosphate (Mono) (807)	6-01-082	0	97	0.0	0.0	0.0	0
808	Cobalt - Carbonate (808)	6-01-566	0	99	0.0	0.0	0.0	0
809	Copper - Sulfate (809)	6-01-720	0	100	0.0	0.0	0.0	0

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
38.3	20.0	10.0	10.0	2.4	21.8	1.5	6.5	300	35	6	230	11	0.2
34.2	26.0	23.0	4.0	3.0	17.1	5.5	5.1	300	30	5	200	10	0.2
34.2	26.0	23.0	4.0	3.0	17.1	5.5	5.1	300	30	5	200	10	0.2
34.2	26.0	23.0	4.0	3.0	17.1	5.5	5.1	300	30	5	200	10	0.2
52.9	33.0	27.3	10.0	1.0	18.2	2.3	6.3	300	45	6	230	13	0.2
52.9	33.0	27.3	10.0	1.0	18.2	2.3	6.3	300	45	6	230	13	0.2
40.3	44.0	22.7	4.0	3.0	14.2	18.2	4.6	300	25	5	200	10	0.2
40.3	44.0	22.7	4.0	3.0	14.2	18.2	4.6	300	25	5	200	10	0.2
40.3	44.0	22.7	4.0	3.0	14.2	18.2	4.6	300	25	5	200	10	0.2
42.8	5.7	100.0	23.6	7.3	45.1	18.8	5.8	300	25	5	150	5	0.18
42.8	5.7	100.0	23.6	7.3	45.1	18.8	5.8	300	25	5	150	5	0.18
42.8	5.7	100.0	23.6	7.3	45.1	18.8	5.8	300	25	5	150	5	0.18
42.8	14.0	85.7	15.0	6.0	37.2	18.8	6.0	300	25	5	150	5	0.18
42.8	14.0	85.7	15.0	6.0	37.2	18.8	6.0	300	25	5	150	5	0.18
49.9	20.0	55.0	5.0	2.0	18.2	1.6	7.2	300	25	6	230	11	0.2
49.9	20.0	55.0	5.0	2.0	18.2	1.6	7.2	300	25	6	230	11	0.2
52.8	20.0	55.0	5.0	2.0	18.4	1.1	6.7	300	25	6	230	11	0.2
52.8	20.0	55.0	5.0	2.0	18.4	1.1	6.7	300	25	6	230	11	0.2
25.9	30.0	37.0	8.0	5.0	19.4	2.9	8.1	300	35	4	160	10	0.15
25.9	30.0	37.0	8.0	5.0	19.4	2.9	8.1	300	35	4	160	10	0.15
5.7	93.0	93.0	30.5	30.0	26.8	2.4	5.0	300	40	4.2	300	12	0.35
5.7	93.0	93.0	30.5	30.0	26.8	2.4	5.0	300	40	4.2	300	12	0.35
5.7	93.0	93.0	30.5	30.0	26.8	2.4	5.0	300	40	4.2	300	12	0.35
5.4	11.0	100.0	30.0	31.5	41.0	4.7	5.0	350	50	5	350	11	0.25
9.0	40.0	75.0	6.0	3.0	15.1	12.7	5.0	300	16	7	100	12	0.35
28.1	48.0	83.0	27.0	4.0	30.2	1.4	7.0	250	30	5	135	11	0.09
9.8	27.0	96.0	53.0	11.0	50.1	0.6	5.3	300	40	8	300	12	0.35
8.7	27.0	96.0	46.1	7.4	44.7	0.5	8.5	300	40	8	300	12	0.35
93.8	5.0	0.0	1.0	1.0	43.5	1.7	2.6	0	0	0	135	3	0.09
6.7	27.0	96.0	53.0	11.0	52.3	3.7	6.6	350	50	9	350	11	0.25
6.4	27.0	96.0	6.8	5.1	18.2	1.1	5.1	350	50	9	350	11	0.25
4.1	20.0	50.0	13.0	13.0	19.4	1.7	4.0	300	25	6	175	11	0.09
4.1	20.0	50.0	13.0	13.0	19.4	1.7	4.0	300	25	6	175	11	0.09
85.8	9.0	89.0	50.0	32.0	66.9	7.2	3.5	0	0	0	125	3	0.09
85.8	9.0	89.0	50.0	32.0	66.9	7.2	3.5	0	0	0	125	3	0.09
67.9	21.0	0.0	1.0	1.0	56.9	10.7	20.6	0	0	0	150	1	0.8
50.0	16.1	21.4	56.0	3.0	61.9	11.8	38.1	0	0	0	150	6	0.12
58.2	13.4	26.5	56.4	3.2	64.1	11.0	21.3	0	0	0	150	5	0.12
14.4	40.0	80.0	47.0	2.0	43.7	15.1	10.0	300	40	8	250	12	0.35
14.4	40.0	80.0	47.0	2.0	43.7	15.1	10.0	300	40	8	250	12	0.35
14.4	40.0	80.0	47.0	2.0	43.7	15.1	10.0	300	40	8	250	12	0.35
12.2	18.0	72.0	20.0	14.0	30.2	2.1	4.9	350	40	8	150	12	0.15
12.2	18.0	72.0	20.0	14.0	30.2	2.1	4.9	350	40	8	150	12	0.15
0.0	0.0	0.0	0.0	0.0	0.0	99.0	1.0	0	0	0	0	0	0
281.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
17.1	29.4	45.0	21.9	6.4	37.0	4.4	6.9	300	40	4	250	12	0.35
17.1	29.4	45.0	21.9	6.4	37.0	4.4	6.9	300	40	4	250	12	0.35
14.2	100.0	8.0	0.0	0.0	0.6	0.7	10.0	350	0	0	350	0	0
17.9	100.0	8.0	0.0	0.0	0.6	1.1	17.0	350	0	0	350	0	0
70.9	100.0	100.0	0.0	0.0	0.0	0.0	100.0	0	0	0	500	0	0
115.9	100.0	100.0	0.0	0.0	0.0	0.0	100.0	0	0	0	500	0	0
134.1	100.0	100.0	0.0	0.0	0.0	0.0	100.0	0	0	0	500	0	0
13.2	40.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	500	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
518	Linseed - Meal (518) Fine	1.95	4.31	10.7	4.22	6.8	5.37	5.76	2.52	5.25	1.63
519	Lupins - (519) fine Whole	1.01	7.06	9.37	3.53	6.93	4.08	4.62	2.48	4.62	0.76
519	Lupins - (519) fine Coarse	1.01	7.06	9.37	3.53	6.93	4.08	4.62	2.48	4.62	0.76
519	Lupins - (519) fine Fine	1.01	7.06	9.37	3.53	6.93	4.08	4.62	2.48	4.62	0.76
520	Peanut - Meal (520) Coarse	1.1	3.14	10.88	2.53	6.06	3.16	3.82	2.18	4.92	0.98
520	Peanut - Meal (520) Fine	1.1	3.14	10.88	2.53	6.06	3.16	3.82	2.18	4.92	0.98
521	Soybean - Whole (521) Whole	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
521	Soybean - Whole (521) Medium	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
521	Soybean - Whole (521) Finely Ground	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
522	Soybean - Whole Roasted (522) Whole	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
522	Soybean - Whole Roasted (522) Medium	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
522	Soybean - Whole Roasted (522) Finely Ground	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
523	Soybean - Whole Extrd (523) Coarse	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
523	Soybean - Whole Extrd (523) Finely Ground	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
524	Soybean - Meal - 44 (524) Coarse	1.01	5.36	6.55	3.52	7.23	4.65	5.09	2.82	4.94	1.64
524	Soybean - Meal - 44 (524) Finely Ground	1.01	5.36	6.55	3.52	7.23	4.65	5.09	2.82	4.94	1.64
525	Soybean - Meal - 47.5 (525) Coarse	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
525	Soybean - Meal - 47.5 (525) Finely Ground	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
526	Sunflower - Seed meal (526) Coarse	2.15	4.29	9.87	4.51	6.86	4.29	6.87	2.36	4.94	1.93
526	Sunflower - Seed meal (526) Finely Ground	2.15	4.29	9.87	4.51	6.86	4.29	6.87	2.36	4.94	1.93
601	Almond Hulls- (601) Coarse	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	1.64
601	Almond Hulls- (601) Medium	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	1.64
601	Almond Hulls- (601) Fine	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	1.64
602	Apple - Pomace (602)	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
603	Bakery - Waste (603)	1.77	3.17	4.77	4.95	7.47	4.57	4.3	1.3	4.1	1
604	Barley - Malt Sprouts w/hulls (604)	1.17	3.5	11.7	2.83	6.67	3.67	4.5	2.17	5.17	1
605	Beet Pulp - Dehy (605) pellet (whole or ground)	0.65	3	4.43	3.17	4.61	2.69	4.5	1.87	2.8	1.1
606	Beet pulp - (606) shreds	0.65	3	4.43	3.17	4.61	2.69	4.5	1.87	2.8	1.1
607	Bloodmeal - (607)	1.07	9.34	5.01	4.73	13.4	0.88	9.08	6.45	7.86	1.88
608	Citrus Pulp - Dehy (608) pellets (whole or ground)	0.65	3	4.43	3.17	4.61	2.69	4.5	1.87	2.8	1.1
609	Citrus pulp - (609) shreds	0.65	3	4.43	3.17	4.61	2.69	4.5	1.87	2.8	1.1
610	Cottonseed Hulls - (610) with hay	1.91	5.05	11.81	4.14	6.67	4.34	5.49	2.4	6.59	0.3
610	Cottonseed Hulls - (610) w/o hay	1.91	5.05	11.81	4.14	6.67	4.34	5.49	2.4	6.59	0.3
611	Feather - Meal (611) Coarse	0.49	2.57	7.42	4.17	8.31	4.6	7.95	0.94	5.21	0.8
611	Feather - Meal (611) Fine	0.49	2.57	7.42	4.17	8.31	4.6	7.95	0.94	5.21	0.8
612	Fishmeal - (612)	2.84	7.13	7.19	4.17	7.012	4.53	4.81	2.3	4.33	1.52
613	Meat & - Bone Meal (613)	0.84	5.6	8.28	2.52	5.46	2.43	3.67	1.44	3.03	0.52
614	Meat meal - (614)	0.84	5.6	8.28	2.52	5.46	2.43	3.67	1.44	3.03	0
615	Rice Bran - (615) Coarse	1.88	4.31	7.01	3.5	6.64	3.28	4.96	2.55	4.38	0.88
615	Rice Bran - (615) Medium	1.88	4.31	7.01	3.5	6.64	3.28	4.96	2.55	4.38	0.88
615	Rice Bran - (615) Finely Ground	1.88	4.31	7.01	3.5	6.64	3.28	4.96	2.55	4.38	0.88
617	Soybean - Hulls (617) Loose	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	0.53
617	Soybean - Hulls (617) Pellets	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	0.53
618	Tallow (618)	0	0	0	0	0	0	0	0	0	0
619	Urea (619)	0	0	0	0	0	0	0	0	0	0
620	Wheat Bran - (620) Coarse	0.75	3.67	7.76	3.71	6.56	3.68	5.4	2.96	4.53	1.2
620	Wheat Bran - (620) Finely Ground	0.75	3.67	7.76	3.71	6.56	3.68	5.4	2.96	4.53	1.2
621	Whey - Acid (621)	0	0	0	0	0	0	0	0	0	0
622	Whey - Delact. (622)	0	0	0	0	0	0	0	0	0	0
801	Ammonium - Phos (Mono) (801)	0	0	0	0	0	0	0	0	0	0
802	Ammonium - Phos (Dibasic) (802)	0	0	0	0	0	0	0	0	0	0
803	Ammonium - Sulfate (803)	0	0	0	0	0	0	0	0	0	0
804	Bone Meal - (804)	0	0	0	0	0	0	0	0	0	0
805	Calcium - Carbonate (805)	0	0	0	0	0	0	0	0	0	0
806	Calcium - Sulfate (806)	0	0	0	0	0	0	0	0	0	0
807	Calcium - Phosphate (Mono) (807)	0	0	0	0	0	0	0	0	0	0
808	Cobalt - Carbonate (808)	0	0	0	0	0	0	0	0	0	0
809	Copper - Sulfate (809)	0	0	0	0	0	0	0	0	0	0

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.43	0.89	0.66	0.04	1.53	0.15	0.43	0.21	29	0	354	42	0.91	0
0.26	0.44	0	0	0.91	0	0	0	0	0	0	0	0	0
0.26	0.44	0	0	0.91	0	0	0	0	0	0	0	0	0
0.26	0.44	0	0	0.91	0	0	0	0	0	0	0	0	0
0.32	0.66	0.17	0	1.28	0.03	0.33	0	16	0.07	155	29	0	36
0.32	0.66	0.17	0	1.28	0.03	0.33	0	16	0.07	155	29	0	36
0.27	0.65	0.27	0.03	2.01	0.04	0.35	0	14.58	0	182	34.5	0.12	59
0.27	0.65	0.27	0.03	2.01	0.04	0.35	0	14.58	0	182	34.5	0.12	59
0.27	0.65	0.27	0.03	2.01	0.04	0.35	0	14.58	0	182	34.5	0.12	59
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0.4	0.71	0.31	0	2.22	0.04	0.46	0.12	22.4	0	185	35	0.51	57
0.4	0.71	0.31	0	2.22	0.04	0.46	0.12	22.4	0	185	35	0.51	57
0.29	0.71	0.33	0.08	2.36	0.01	0.48	0.12	22.5	0.12	145	41	0.22	63
0.29	0.71	0.33	0.08	2.36	0.01	0.48	0.12	22.5	0.12	145	41	0.22	63
0.45	1.02	0.7	0.11	1.27	0.03	0.33	0	4	0	33	20	2.3	105
0.45	1.02	0.7	0.11	1.27	0.03	0.33	0	4	0	33	20	2.3	105
0.22	0.08	0.16	0	2.57	0.02	0	0	11	0	334	21	0.067	30
0.22	0.08	0.16	0	2.57	0.02	0	0	11	0	334	21	0.067	30
0.22	0.08	0.16	0	2.57	0.02	0	0	11	0	334	21	0.067	30
0.23	0.11	0	0	0.53	0	0.11	0	0	0	0	0	0	0
0.15	0.24	0.18	1.61	0.43	1.12	0.02	1.342	12.1	0	180	71.2	0	19.5
0.19	0.68	0.18	0.39	0.27	0.95	0.85	0	6.3	0	200	31.7	0.448	60.7
0.68	0.1	0.28	0.04	0.22	0.2	0.22	0.081	13.8	0	293	37.7	0.12	1
1.14	0.06	0.26	0	2.01	1.19	0	0	8	0	451	73	0.139	31
0.4	0.32	0.04	0.33	0.31	0.4	0.8	0.097	13.9	0	2281	11.7	0.801	33
1.88	0.13	0.17	0	0.77	0.08	0.08	0.185	6.15	0	360	7	0	15
1.43	0.11	0.1	0	0.67	1.07	0	0	2	0	82	7	0	37
0.15	0.09	0.14	0.02	0.87	0.02	0.09	0.02	13	0	131	119	0.02	22
0.15	0.09	0.14	0.02	0.87	0.02	0.09	0.02	13	0	131	119	0.02	22
1.19	0.68	0.06	0.3	0.2	0.24	1.85	0.125	14.2	0.047	702	12	0.983	105
1.19	0.68	0.06	0.3	0.2	0.24	1.85	0.125	14.2	0.047	702	12	0.983	105
5.46	3.14	0.16	1.37	0.77	0.44	0.58	0.12	11.3	1.19	594	40	2.34	157
11.6	5.48	1.09	0.8	1.43	0.77	0.27	0.19	2	1.41	735	14	0.28	96
9.13	4.34	0.27	0	0.49	0.8	0.51	0	21.4	0	758	174	0	265
0.08	1.73	0.94	0.08	1.87	0.04	0.2	1.526	12.1	0	0.021	372.4	0.44	33
0.08	1.73	0.94	0.08	1.87	0.04	0.2	1.526	12.1	0	0.021	372.4	0.44	33
0.08	1.73	0.94	0.08	1.87	0.04	0.2	1.526	12.1	0	0.021	372.4	0.44	33
0.53	0.18	0.22	0	1.29	0.03	0.11	0.121	17.8	0	409	10	0.14	48
0.53	0.18	0.22	0	1.29	0.03	0.11	0.121	17.8	0	409	10	0.14	48
0.57	0.06	0.06	0	0.32	0.01	0	0.57	15	0.68	482	47	0	42
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.13	1.38	0.6	0.05	1.56	0.04	0.25	0.11	14	0.07	128	125	0.43	128
0.13	1.38	0.6	0.05	1.56	0.04	0.25	0.11	14	0.07	128	125	0.43	128
0.81	0.71	0	0	2.75	0	0	0	0	0	290	3.2	0	0
1.6	1.18	0.23	1.1	3.16	1.54	1.15	0	7.5	10.554	270	8.6	0.056	8.4
0.28	24.74	0.46	0	0.01	0.06	1.46	10	10	0	17400	400	0	100
0.52	20.6	0.46	0	0.01	0.05	2.16	0	10	0	12400	400	0	100
0	0	0	0	0	0	24.1	0	1	0	10	1	0	0
30.71	12.86	0.33	0	0.19	5.69	2.51	0	0	0	26700	0	0	100
39.39	0.04	0.05	0	0.06	0.06	0	0	0	0	300	300	0	0
23.28	0	0	0	0	0	18.62	0	0	0	0	0	0	0
16.4	21.6	0.61	0	0.08	0.06	1.22	10	10	0	15800	360	0	90
0	0	0	0	0	0	0.2	460000	0	0	500	0	0	0
0	0	0	0	0	0	12.84	0	254500	0	0	0	0	0

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
518	Linseed - Meal (518) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
519	Lupins - (519) fine Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
519	Lupins - (519) fine Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
519	Lupins - (519) fine Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
520	Peanut - Meal (520) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
520	Peanut - Meal (520) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
521	Soybean - Whole (521) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
521	Soybean - Whole (521) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
521	Soybean - Whole (521) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
522	Soybean - Whole Roasted (522) Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
522	Soybean - Whole Roasted (522) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
522	Soybean - Whole Roasted (522) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
523	Soybean - Whole Extrd (523) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
523	Soybean - Whole Extrd (523) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
524	Soybean - Meal - 44 (524) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
524	Soybean - Meal - 44 (524) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
525	Soybean - Meal - 47.5 (525) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
525	Soybean - Meal - 47.5 (525) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
526	Sunflower - Seed meal (526) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
526	Sunflower - Seed meal (526) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
601	Almond Hulls- (601) Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
601	Almond Hulls- (601) Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
601	Almond Hulls- (601) Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
602	Apple - Pomace (602)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
603	Bakery - Waste (603)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
604	Barley - Malt Sprouts w/hulls (604)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
605	Beet Pulp - Dehy (605) pellet (whole or ground)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
606	Beet pulp - (606) shreds	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
607	Bloodmeal - (607)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
608	Citrus Pulp - Dehy (608) pellets (whole or ground)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
609	Citrus pulp - (609) shreds	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
610	Cottonseed Hulls - (610) with hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
610	Cottonseed Hulls - (610) w/o hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
611	Feather - Meal (611) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
611	Feather - Meal (611) Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
612	Fishmeal - (612)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
613	Meat & - Bone Meal (613)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
614	Meat meal - (614)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
615	Rice Bran - (615) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
615	Rice Bran - (615) Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
615	Rice Bran - (615) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
617	Soybean - Hulls (617) Loose	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
617	Soybean - Hulls (617) Pellets	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
618	Tallow (618)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
619	Urea (619)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
620	Wheat Bran - (620) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
620	Wheat Bran - (620) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
621	Whey - Acid (621)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
622	Whey - Delact. (622)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
801	Ammonium - Phos (Mono) (801)	0.55	0.8	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
802	Ammonium - Phos (Dibasic) (802)	0.55	0.8	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
803	Ammonium - Sulfate (803)	0.55	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
804	Bone Meal - (804)	0.95	0.8	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
805	Calcium - Carbonate (805)	0.75	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
806	Calcium - Sulfate (806)	0.7	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
807	Calcium - Phosphate (Mono) (807)	0.8	0.75	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
808	Cobalt - Carbonate (808)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
809	Copper - Sulfate (809)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.5	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
810	Dicalcium - Phosphate (810)	6-01-080	0	97	0.0	0.0	0.0	0
811	EDTA (811)	6-01-842	0	98	0.0	0.0	0.0	0
812	Iron Sulfate (812)	6-20-734	0	98	0.0	0.0	0.0	0
813	Limestone (813)	6-02-632	0	100	0.0	0.0	0.0	0
814	Limestone - Magnesium (814)	6-02-633	0	99	0.0	0.0	0.0	0
815	Magnesium - Carbonate (815)	6-02-754	0	98	0.0	0.0	0.0	0
816	Magnesium - Oxide (816)	6-02-756	0	98	0.0	0.0	0.0	0
817	Manganese - Oxide (817)	6-03-056	0	99	0.0	0.0	0.0	0
818	Manganese - Carbonate (818)	6-03-036	0	97	0.0	0.0	0.0	0
819	Mono-Sodium - Phosphate (819)	6-04-288	0	97	0.0	0.0	0.0	0
820	Oystershell - Ground (820)	6-03-481	0	99	0.0	0.0	0.0	0
821	Phosphate - Deflourinated (821)	6-01-780	0	100	0.0	0.0	0.0	0
822	Phosphate - Rock (822)	6-03-945	0	100	0.0	0.0	0.0	0
823	Phosphate - Rock - Low Fl (823)	6-03-946	0	100	0.0	0.0	0.0	0
824	Phosphate - Rock - Soft (824)	6-03-947	0	100	0.0	0.0	0.0	0
825	Phosphate - Mono-Mono (825)	6-04-288	0	97	0.0	0.0	0.0	0
826	Phosphoric - Acid (826)	6-03-707	0	75	0.0	0.0	0.0	0
827	Potassium - Bicarbonate (827)	6-29-493	0	99	0.0	0.0	0.0	0
828	Potassium - Iodide (828)	6-03-759	0	100	0.0	0.0	0.0	0
829	Potassium - Sulfate (829)	6-06-098	0	98	0.0	0.0	0.0	0
830	Potassium - Chloride (830)	6-03-755	0	100	0.0	0.0	0.0	0
831	Salt (831)	6-04-152	0	100	0.0	0.0	0.0	0
832	Sodium - Bicarbonate (832)	6-04-272	0	100	0.0	0.0	0.0	0
833	Sodium - Selenite (833)	6-26-013	0	98	0.0	0.0	0.0	0
834	Sodium - Sulfate (834)	6-04-292	0	97	0.0	0.0	0.0	0
835	Sodium TriPoly - Phosphate (835)	6-08-076	0	96	0.0	0.0	0.0	0
836	Zinc - Oxide (836)	6-05-553	0	100	0.0	0.0	0.0	0
837	Zinc - Sulfate (837)	6-05-555	0	99	0.0	0.0	0.0	0
880	Salt TMin	00-00-00	0	98	0.0	0.0	0.0	0
889	Magnesium Sulfate	00-00-00	0	98	0.0	0.0	0.0	0
890	Magnesium Chloride	00-00-00	0	98	0.0	0.0	0.0	0
894	Dynamate	00-00-00	0	95	0.0	0.0	0.0	0
895	Calcium ChlorideDi	00-00-00	0	98	0.0	0.0	0.0	0
896	Calcium ChlorideAnhy	00-00-00	0	98	0.0	0.0	0.0	0
897	Bone Charcoal	00-00-00	0	90	0.0	0.0	0.0	0
897	Minvit2	00-00-00	0	99	0.0	0.0	0.0	0
898	Bicarbonate Sodium	00-00-00	0	100	0.0	0.0	0.0	0
899	Ammonium Chloride	00-00-00	0	97	0.0	0.0	0.0	0
Commercial feeds								
901	Soy Plus (901) Coarse	00-00-00	0	89.7	16.2	1.2	30.0	90
901	Soy Plus (901) Finely Ground	00-00-00	0	89.7	16.2	1.2	10.0	90
905	Alimet	00-00-00	0	88	0.0	0.0	0.0	0
906	Biochlor	00-00-00	0	85	30.0	3.0	30.0	10
907	Biophos	00-00-00	0	95	0.0	0.0	0.0	0
909	Ener GII	00-00-00	0	98	0.0	0.0	0.0	0
910	Energy Booster	00-00-00	0	99	0.0	0.0	0.0	0
911	Fermenten	00-00-00	0	90	25.0	3.0	30.0	10
920	Megalac	00-00-00	0	98	0.0	0.0	0.0	0
921	Megalac Plus	00-00-00	0	98	0.0	0.0	0.0	0
922	Mepron	00-00-00	0	98	0.0	0.0	0.0	0
923	Met Plus	00-00-00	0	98	0.0	0.0	0.0	0
924	Met Plus with Talc	00-00-00	0	98	0.0	0.0	0.0	0
925	Mopac 74/74	00-00-00	0	93	25.6	0.0	0.0	40
926	Mopac 75/76	00-00-00	0	94	23.1	0.0	0.0	31
927	Mopac Multi-60%	00-00-00	0	92	31.0	0.0	0.0	31
928	Mopac RenPlus-68%	00-00-00	0	93	23.9	0.0	0.0	25
929	Mopac RenPride-70%	00-00-00	0	91	29.7	0.0	0.0	38
930	Mopac RenSupreme-73%	00-00-00	0	94	24.1	0.0	0.0	32
931	Optigen 1200	00-00-00	0	99.5	0.0	0.0	0.0	0
932	Pro Peak-70	00-00-00	0	91	23.9	0.0	0.0	41

CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	Degradation Rates CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0		0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0		0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0		0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0		0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
163.5	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0	0	0	0	0	0
48.9	8.0	65.0	10.0	1.7	40.4	5.3	6.5	300	25	7	230	4	0.3
48.9	8.0	65.0	10.0	1.7	40.4	5.3	6.5	300	25	7	230	4	0.3
100.0	100.0	0.0	0.0	0.0	19.8	0.0	0.0	300	30	6	10	0	0
50.0	70.0	40.0	7.0	0.8	15.1	3.7	10.0	300	40	8	100	5	0.18
0.0	0.0	0.0	0.0	0.0		0.0	100.0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	85.0	15.0	300	30	6	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	99.0	1.0	300	30	6	0	0	0
50.0	70.0	40.0	7.0	0.8	15.1	3.7	10.0	300	40	8	100	5	0.18
0.0	0.0	0.0	0.0	0.0	0.0	84.5	15.5	300	30	6	0	0	0
6.1	0.0	0.0	0.0	0.0	45.2	79.9	14.0	300	30	6	0	3	0
85.0	15.0	100.0	0.0	17.0	85.0	0.0	2.0	300	30	6	300	0	0
67.0	10.0	0.0	0.0	5.0	29.8	29.5	3.5	0	0	0	7	7	7
66.0	5.0	0.0	0.0	10.0	50.6	29.0	5.0	0	0	0	3	3	3
79.7	10.0	47.0	34.0	16.2	54.2	8.9	7.6	263	28	4	180	4	0.18
79.8	11.0	39.0	31.0	13.1	48.9	7.9	9.0	267	28	4	189	5	0.2
67.5	14.0	47.0	43.0	14.5	51.3	11.6	14.1	272	25	3	231	7	0.28
73.1	12.0	35.0	33.0	11.2	47.1	9.1	12.7	264	26	3	207	6	0.25
71.3	12.0	50.0	40.0	16.2	52.0	10.8	10.5	263	26	3	205	6	0.23
77.8	12.0	39.0	33.0	13.1	49.5	8.5	10.6	270	28	4	197	5	0.23
270.0	35.0	100.0	0.0	0.0	3.1	0.0	0.0	0	0	0	350	50	0
76.5	9.0	43.0	35.0	12.4	57.3	7.2	11.5	295	30	3	202	3	0.31

ID	Feed Name	Amino Acids									
		MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
810	Dicalcium - Phosphate (810)	0	0	0	0	0	0	0	0	0	0
811	EDTA (811)	0	0	0	0	0	0	0	0	0	0
812	Iron Sulfate (812)	0	0	0	0	0	0	0	0	0	0
813	Limestone (813)	0	0	0	0	0	0	0	0	0	0
814	Limestone - Magnesium (814)	0	0	0	0	0	0	0	0	0	0
815	Magnesium - Carbonate (815)	0	0	0	0	0	0	0	0	0	0
816	Magnesium - Oxide (816)	0	0	0	0	0	0	0	0	0	0
817	Manganese - Oxide (817)	0	0	0	0	0	0	0	0	0	0
818	Manganese - Carbonate (818)	0	0	0	0	0	0	0	0	0	0
819	Mono-Sodium - Phosphate (819)	0	0	0	0	0	0	0	0	0	0
820	Oystershell - Ground (820)	0	0	0	0	0	0	0	0	0	0
821	Phosphate - Deflourinated (821)	0	0	0	0	0	0	0	0	0	0
822	Phosphate - Rock (822)	0	0	0	0	0	0	0	0	0	0
823	Phosphate - Rock - Low Fl (823)	0	0	0	0	0	0	0	0	0	0
824	Phosphate - Rock - Soft (824)	0	0	0	0	0	0	0	0	0	0
825	Phosphate - Mono-Mono (825)	0	0	0	0	0	0	0	0	0	0
826	Phosphoric - Acid (826)	0	0	0	0	0	0	0	0	0	0
827	Potassium - Bicarbonate (827)	0	0	0	0	0	0	0	0	0	0
828	Potassium - Iodide (828)	0	0	0	0	0	0	0	0	0	0
829	Potassium - Sulfate (829)	0	0	0	0	0	0	0	0	0	0
830	Potassium - Chloride (830)	0	0	0	0	0	0	0	0	0	0
831	Salt (831)	0	0	0	0	0	0	0	0	0	0
832	Sodium - Bicarbonate (832)	0	0	0	0	0	0	0	0	0	0
833	Sodium - Selenite (833)	0	0	0	0	0	0	0	0	0	0
834	Sodium - Sulfate (834)	0	0	0	0	0	0	0	0	0	0
835	Sodium TriPoly - Phosphate (835)	0	0	0	0	0	0	0	0	0	0
836	Zinc - Oxide (836)	0	0	0	0	0	0	0	0	0	0
837	Zinc - Sulfate (837)	0	0	0	0	0	0	0	0	0	0
880	Salt TMin	0	0	0	0	0	0	0	0	0	0
889	Magnesium Sulfate	0	0	0	0	0	0	0	0	0	0
890	Magnesium Chloride	0	0	0	0	0	0	0	0	0	0
894	Dynamate	0	0	0	0	0	0	0	0	0	0
895	Calcium ChlorideDi	0	0	0	0	0	0	0	0	0	0
896	Calcium ChlorideAnhy	0	0	0	0	0	0	0	0	0	0
897	Bone Charcoal	0	0	0	0	0	0	0	0	0	0
897	Minvit2	0	0	0	0	0	0	0	0	0	0
898	Bicarbonate Sodium	0	0	0	0	0	0	0	0	0	0
899	Ammonium Chloride	0	0	0	0	0	0	0	0	0	0
901	Soy Plus (901) Coarse	1.11	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
901	Soy Plus (901) Finely Ground	1.11	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	1.64
905	Alimet	100	0	0	0	0	0	0	0	0	0
906	Biochlor	2.8	8.2	6.96	5.59	7.51	5.88	6.16	2	5.16	1.63
907	Biophos	0	0	0	0	0	0	0	0	0	0
909	Ener GII	0	0	0	0	0	0	0	0	0	0
910	Energy Booster	0	0	0	0	0	0	0	0	0	0
911	Fermenten	2.8	8.2	6.96	5.59	7.51	5.88	6.16	2	5.16	1.63
920	Megalac	0	0	0	0	0	0	0	0	0	0
921	Megalac Plus	100	0	0	0	0	0	0	0	0	0
922	Mepron	100	0	0	0	0	0	0	0	0	0
923	Met Plus	100	0	0	0	0	0	0	0	0	0
924	Met Plus with Talc	100	0	0	0	0	0	0	0	0	0
925	Mopac 74/74	0.88	5.27	7.01	3.88	8.93	3	7.08	2	5.37	1.02
926	Mopac 75/76	1.24	6.24	7.07	4.32	9.68	3.18	7.28	3	5.66	1.17
927	Mopac Multi-60%	1.26	4.87	7.82	3.56	7.03	3.61	5.48	1	4.01	0.72
928	Mopac RenPlus-68%	1.44	6.13	7.23	4.13	8.73	3.35	6.4	2	4.97	1.05
929	Mopac RenPride-70%	1.42	5.33	7.6	4.3	8.44	4.06	6.55	2	4.79	0.95
930	Mopac RenSupreme-73%	1.26	6.05	7.24	4.17	9.18	3.25	6.92	2	5.35	1.1
931	Optigen 1200	0	0	0	0	0	0	0	0	0	0
932	Pro Peak-70	0.92	5.33	6.39	4.1	9.24	3.01	7.27	2	5.49	1.04

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
22	19.3	0.59	0	0.07	0.05	1.14	10	10	0	14400	300	0	100
0	0	0	0	0	0	0	0	0	803400	0	0	0	0
0	0	0	0	0	0	12.35	0	0	0	218400	0	0	0
34	0.02	2.06	0.03	0.12	0.06	0.04	0	0	0	3500	0	0	0
22.3	0.04	9.99	0.12	0.36	0	0	0	0	0	770	0	0	0
0.02	0	30.81	0	0	0	0	0	0	0	220	0	0	0
3.07	0	56.2	0	0	0	0	0	0	0	0	100	0	0
0	0	0	0	0	0	0	0	0	0	0	774500	0	0
0	0	0	0	0	0	0	0	0	0	0	478000	0	0
0	22.5	0	0	0	16.68	0	0	0	0	0	0	0	0
38	0.07	0.3	0.01	0.1	0.21	0	0	0	0	2870	100	0	0
32	18	0.42	0	0.08	4.9	0	10	20	0	6700	200	0	60
35	13	0.41	0	0.06	0.03	0	10	10	0	16800	200	0	100
36	14	0	0	0	0	0	0	0	0	0	0	0	0
17	9	0.38	0	0	0.1	0	0	0	0	19000	1000	0	0
0	22.5	0	0	0	16.68	0	0	0	0	0	0	0	0
0.05	31.6	0.51	0	0.02	0.04	1.55	10	10	0	17500	500	0	130
0	0	0	0	39.05	0	0	0	0	0	0	0	0	0
0	0	0	0	21	0	0	0	0	681700	0	0	0	0
0.15	0	0.61	1.55	41.84	0.09	17.35	0	0	0	710	10	0	0
0.05	0	0.34	47.3	50	1	0.45	0	0	0	600	0	0	0
0	0	0	60.66	0	39.34	0	0	0	0	0	0	0	0
0	0	0	0	0	27	0	0	0	0	0	0	0	0
0	0	0	0	0	26.6	0	0	0	0	0	0	456000	0
0	0	0	0	0	14.27	9.95	0	0	0	0	0	0	0
0	25	0	0	0	31	0	0	0	0	40	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	780000
0.02	0	0	0.015	0	0	17.68	0	0	0	10	10	0	363600
0			57.02	0	36.98	0	50	330	0	0	2000	0	0
		19.9	0	0	0	13	0	0	0	0	0	0	0
12			34.9	0	0	0	0	0	0	0	0	0	0
0.05	0	11.1	0	18.4	0.6	22.2	0	0	0	0	0	0	0
27.3	0	0	48.2	0	0	0	0	0	0	0	0	0	0
36.1	0	0	63.9	0	0	0	0	0	0	0	0	0	0
30.11	14.14	0.59	0	0.16	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	27	0	0	0	0	0	0	0	0	0	0
0			66.3	0	0	0	0	0	0	0	0	0	0
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0.27	0.65	0.29	0.03	1.8	0	0.24	0	19.8	0	100	39.6	0.12	61.8
0	0	0	0	0	0	21	0	0	0	0	0	0	0
0.18	1.17	0.43	8	1.51	1.5	2	0	9	0	252	105	0	74
	21.2	0.7	0	0.04	0.08	1	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.18	1.17	0.43	0	1.51	1.5	2	0	9	0	252	105	0	74
12	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.03	1.28	0.48	0	0.91	0.37	0	0	6	0	892	13	0	64
3.18	1.59	0.42	0	0.32	0.32	0	0	6.58	0	844	14	0	76
5.4	2.43	0.54	0	0.3	0.49	0	0	3.67	0	324	13	0	92
4.29	2.14	0.43	0	0.32	0.48	0	0	6.65	0	852	14	0	77
3.82	2.19	0.42	0	0.33	0.51	0	0	6	1	680	16	0	75
3.18	1.8	0.23	0	0.33	0.35	0	0	9	1	943	14	1	123
0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.59	1.78	0.11	0	0.35	0.55	0	0	14	0	256	12	0	77

ID	Feed Name	Minerals bioavailability Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
810	Dicalcium - Phosphate (810)	0.55	0.75	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
811	EDTA (811)	0.55	0.75	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
812	Iron Sulfate (812)	0.55	0.75	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.01	0.01	1	0.15
813	Limestone (813)	0.7	0.7	0.2	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
814	Limestone - Magnesium (814)	0.55	0.7	0.2	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
815	Magnesium - Carbonate (815)	0.6	0.7	0.3	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
816	Magnesium - Oxide (816)	0.3	0.7	0.7	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
817	Manganese - Oxide (817)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
818	Manganese - Carbonate (818)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
819	Mono-Sodium - Phosphate (819)	0.6	0.9	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
820	Oystershell - Ground (820)	0.7	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
821	Phosphate - Deflourinated (821)	0.55	0.65	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
822	Phosphate - Rock (822)	0.55	0.3	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
823	Phosphate - Rock - Low Fl (823)	0.3	0.3	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
824	Phosphate - Rock - Soft (824)	0.5	0.3	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
825	Phosphate - Mono-Mono (825)	0.5	0.8	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
826	Phosphoric - Acid (826)	0.55	0.9	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
827	Potassium - Bicarbonate (827)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
828	Potassium - Iodide (828)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
829	Potassium - Sulfate (829)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
830	Potassium - Chloride (830)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
831	Salt (831)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
832	Sodium - Bicarbonate (832)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
833	Sodium - Selenite (833)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
834	Sodium - Sulfate (834)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
835	Sodium TriPoly - Phosphate (835)	0.6	0.15	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
836	Zinc - Oxide (836)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
837	Zinc - Sulfate (837)	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
880	Salt TMin	0.6	0.7	0.7	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
889	Magnesium Sulfate	0.6	0.7	0.7	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
890	Magnesium Chloride	0.6	0.7	0.7	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
894	Dynamate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
895	Calcium ChlorideDi	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
896	Calcium ChlorideAnhy	0.95	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
897	Bone Charcoal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
897	Minvit2	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
898	Bicarbonate Sodium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
899	Ammonium Chloride	0.55	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
901	Soy Plus (901) Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
901	Soy Plus (901) Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
905	Alimet	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
906	Biochlor	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
907	Biophos	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
909	Ener GII	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
910	Energy Booster	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
911	Fermenten	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
920	Megalac	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
921	Megalac Plus	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
922	Mepron	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
923	Met Plus	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
924	Met Plus with Talc	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
925	Mopac 74/74	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
926	Mopac 75/76	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
927	Mopac Multi-60%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
928	Mopac RenPlus-68%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
929	Mopac RenPride-70%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
930	Mopac RenSupreme-73%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
931	Optigen 1200	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
932	Pro Peak-70	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
933	Pro Peak-75	00-00-00	0	91	16.2	0.5	0.0	65
934	Pro Peak-80	00-00-00	0	90	11.5	1.3	0.0	96
935	Prolak	00-00-00	0	93	17.7	0.0	0.0	0
936	Sea Lac	00-00-00	0	90	0.0	0.0	0.0	0
937	Smartamine M	00-00-00	0	98	0.0	0.0	0.0	0
939	Soy Best Coarse	00-00-00	0	88	35.8	11.9	30.0	95
939	Soy Best Finely Ground	00-00-00	0	88	35.8	11.9	10.0	95
940	Soy Pass Coarse	00-00-00	0	90	30.6	7.9	30.0	94
940	Soy Pass Finely Ground	00-00-00	0	90	30.6	7.9	10.0	94
941	Zinpro 100	00-00-00	0	95	36.9	0.0	10.0	100
942	Zinpro 40	00-00-00	0	95	34.2	0.0	10.0	100
943	Zinpro 4-Plex	00-00-00	0	95	54.0	0.0	10.0	100
950	AminoPlus, Finely Ground	00-00-00	0	88	11.5	2.5	10.0	95
955	Homer Meal Coarse	00-00-00	0	88.66	20.6	17.1	30.0	94
955	Homer Meal Finely Ground	00-00-00	0	88.66	20.6	17.1	10.0	94
988	AT88	00-00-00	0	88	0.0	0.0	0.0	0

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
80.2	7.0	38.0	22.0	8.5	52.3	6.2	8.5	294	38	3	169	3	0.28
85.2	5.0	41.0	13.0	8.1	49.3	4.8	4.9	250	41	5	135	3	0.09
76.9	10.0	50.0	23.0	6.6	58.9	9.7	13.7	300	25	3	106	2	0.21
71.0	9.0	83.0	24.0	2.0	54.7	8.4	21.1	300	50	7	130	2	1
70.0	10.0	0.0	0.0	10.0	90.1	0.0	30.0	300	30	6	300	0	0
45.0	9.0	53.0	45.0	6.0	49.7	6.3	8.1	300	25	6	230	11	0.2
45.0	9.0	53.0	45.0	6.0	49.7	6.3	8.1	300	25	6	230	11	0.2
49.9	5.0	50.0	48.0	7.5	54.5	1.2	6.7	300	25	6	230	2	2.12
49.9	5.0	50.0	48.0	7.5	54.5	1.2	6.7	300	25	6	230	2	2.12
11.8	100.0	0.0	0.0	0.0	70.4	0.0	20.0	250	30	8	1	1	0.1
5.4	100.0	0.0	0.0	0.0	70.4	0.0	51.5	250	30	8	1	1	0.1
11.5	100.0	0.0	0.0	0.0	70.0	1.5	26.5	250	30	8	1	1	0.1
51.6	6.0	65.0	9.2	2.0		1.4	6.5	300	25	7	230	4	0.3
46.6	6.8	65.0	12.5	2.1	0.0	7.9	6.2	300	25	6	150	5	0.18
46.6	6.8	65.0	12.5	2.1	0.0	7.9	6.2	300	25	6	150	5	0.18
100.0	100.0	0.0	0.0	0.0	19.8	0.0	0.0	300	30	6	500	0	0

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
933	Pro Peak-75	1.05	5.95	5.72	4.17	11.11	2.6	7.63	3	6.27	1.21
934	Pro Peak-80	1.09	6.03	5.36	4.26	12.5	2.52	8.06	4	6.88	1.31
935	Prolak	1.57	6.05	5.82	4.22	8.66	3.06	6.51	3	5.35	1.08
936	Sea Lac	3.13	8.39	5.97	4.27	7.68	4.13	4.69	2	3.84	1
937	Smartamine M	100	0	0	0	0	0	0	0	0	0
939	Soy Best Coarse	1.59	6.15	7.42	4.22	8.88	5.25	5.88	2	5.84	1.46
939	Soy Best Finely Ground	1.59	6.15	7.42	4.22	8.88	5.25	5.88	2	5.84	1.46
940	Soy Pass Coarse	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2	3.88	1.64
940	Soy Pass Finely Ground	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2	3.88	1.64
941	Zinpro 100	20	0	0	0	0	0	0	0	0	0
942	Zinpro 40	8	0	0	0	0	0	0	0	0	0
943	Zinpro 4-Plex	8.21	3.8	0	0	0	0	0	0	0	0
950	AminoPlus, Finely Ground	1.81	6.37	7.41	4.21	8.71	5.03	5.36	2.75	5.45	1.28
955	Homer Meal Coarse	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
955	Homer Meal Finely Ground	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
988	AT88	100	0	0	0	0	0	0	0	0	0

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
1.54	0.89	0.07	0	0.28	0.45	0	0	12	0	242	7	0	53
0.17	0.3	0.05	0	0.24	0.37	0	0	11	0	235	4	0	36
3.71	1.89	0.16	0	0.52	0.77	0	2	12	11	984	14	0	77
6.3	3.7	0.2	0	0.7	0.5	0	0	5	1	726	0	2	122
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.43	0.67	0.34	0	2.21	0	0	0	16	0	199	39	0	54
0.43	0.67	0.34	0	2.21	0	0	0	16	0	199	39	0	54
0.3	0.76	0.29	0	2.45	0.08	0	0	13	0	100	34	0	44
0.3	0.76	0.29	0	2.45	0.08	0	0	13	0	100	34	0	44
0	0	0	0	0	0.47	0	0	0	0	0	0	0	1000000
8.5	0	0	1	0	1.1	0	0	0	0	0	0	0	40000
0	0	0	0	0	0	0	1800	8800	0	0	14000	0	25300
0.36	0.69	0.32	0.05	2.36	0.014	0.46	0.03	22.3	0.12	145	39.7	0	58.2
0.29	0.7	0.32	0	2.3	0.03	0.48	0	22	0	148	41	0	61
0.29	0.7	0.32	0	2.3	0.03	0.48	0	22	0	148	41	0	61
0	0	0	0	0	0	21	0	0	0	0	0	0	0

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
933	Pro Peak-75	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
934	Pro Peak-80	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
935	Prolak	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
936	Sea Lac	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
937	Smartamine M	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
939	Soy Best Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
939	Soy Best Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
940	Soy Pass Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
940	Soy Pass Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
941	Zinpro 100	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
942	Zinpro 40	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
943	Zinpro 4-Plex	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
950	AminoPlus, Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15
955	Homer Meal Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
955	Homer Meal Finely Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
988	AT88	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.4	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
Grass forages								
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Long	00-00-000	100	15.2	68.3	4.7	100	38.5
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Medi	00-00-000	100	15.2	68.3	4.7	60	38.5
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Fine	00-00-000	100	15.2	68.3	4.7	40	38.5
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Long	2-00-464	100	19.1	71	6	100	46.4
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Medium	2-00-464	100	19.1	71	6	60	46.4
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Fine	2-00-464	100	19.1	71	6	40	46.4
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Long	2-00-712	100	24.7	79.8	8.4	100	6
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Medium	2-00-712	100	24.7	79.8	8.4	60	6
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Fine	2-00-712	100	24.7	79.8	8.4	40	6
1103	Bermudagrass (C. dactylon) Hay, Brazil Long Hay	1-00-703	100	88.2	75.5	7.5	100	6
1103	Bermudagrass (C. dactylon) Hay, Brazil Medium Chop	1-00-703	100	88.2	75.5	7.5	95	6
1103	Bermudagrass (C. dactylon) Hay, Brazil Fine Chop	1-00-703	100	88.2	75.5	7.5	90	6
1104	Bermudagrass (C. dactylon) Hay, Florida Long Hay	1-00-703	100	89.4	81	9.6	100	6
1104	Bermudagrass (C. dactylon) Hay, Florida Medium Chop	1-00-703	100	89.4	81	9.6	95	6
1104	Bermudagrass (C. dactylon) Hay, Florida Fine Chop	1-00-703	100	89.4	81	9.6	90	6
1105	Black oats (Avena strigosa) Hay, Brazil Long Hay	1-03-280	100	88.6	75.8	7.5	100	90
1105	Black oats (Avena strigosa) Hay, Brazil Medium Chop	1-03-280	100	88.6	75.8	7.5	95	90
1105	Black oats (Avena strigosa) Hay, Brazil Fine Chop	1-03-280	100	88.6	75.8	7.5	90	90
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Long Hay	00-00-000	100	92	75.7	11.2	100	0
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Medium Cho	00-00-000	100	92	75.7	11.2	95	0
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Fine Chop	00-00-000	100	92	75.7	11.2	90	0
1107	Calopo (C. mucunoides) Hay, Brazil Long	00-00-000	100	91.6	52.5	23	100	10
1107	Calopo (C. mucunoides) Hay, Brazil Medium Chop	00-00-000	100	91.6	52.5	23	95	10
1107	Calopo (C. mucunoides) Hay, Brazil Fine Chop	00-00-000	100	91.6	52.5	23	90	10
1108	Congograss (B. ruziziensis) Hay, Brazil, Long hay	00-00-000	100	91.2	75.5	10.6	100	6
1108	Congograss (B. ruziziensis) Hay, Brazil, Medium chop	00-00-000	100	91.2	75.5	10.6	95	6
1108	Congograss (B. ruziziensis) Hay, Brazil, Fine chop	00-00-000	100	91.2	75.5	10.6	90	6
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Long ha	00-00-000	100	87.3	28.9	24.2	100	10
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Mediun	00-00-000	100	87.3	28.9	24.2	95	10
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Fine ch	00-00-000	100	87.3	28.9	24.2	90	10
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Long	2-00-825	100	20.8	67.7	6.7	100	42.6
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Medium	2-00-825	100	20.8	67.7	6.7	60	42.6
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Fine	2-00-825	100	20.8	67.7	6.7	40	42.6
1111	Gambagrass (A. gayanus) Fresh, Mexico, Long	2-00-825	100	27.8	71.9	5.6	100	35.6
1111	Gambagrass (A. gayanus) Fresh, Mexico, Medium	2-00-825	100	27.8	71.9	5.6	60	35.6
1111	Gambagrass (A. gayanus) Fresh, Mexico, Fine	2-00-825	100	27.8	71.9	5.6	40	35.6
1112	Gambagrass (A. gayanus) Hay, Honduras, Long hay	00-00-000	100	89	72.1	6.4	100	35.6
1112	Gambagrass (A. gayanus) Hay, Honduras, Medium chop	00-00-000	100	89	72.1	6.4	95	35.6
1112	Gambagrass (A. gayanus) Hay, Honduras, Fine chop	00-00-000	100	89	72.1	6.4	90	35.6
1113	Jaraguagrass (H. rufa) Hay, Brazil, Medium Chop	00-00-000	100	91	72.8	6.6	95	0
1113	Jaraguagrass (H. rufa) Hay, Brazil, Fine Chop	00-00-000	100	91	72.8	6.6	90	0
1113	Jaraguagrass (H. rufa) Hay, Brazil, Long Hay	00-00-000	100	91	72.8	6.6	100	0
1114	Guineagrass (P. maximum) Fresh, Mexico, Long	2-09-409	100	26.1	72.6	6.4	100	31.3
1114	Guineagrass (P. maximum) Fresh, Mexico, Medium	2-09-409	100	26.1	72.6	6.4	60	31.3
1114	Guineagrass (P. maximum) Fresh, Mexico, Fine	2-09-409	100	26.1	72.6	6.4	40	31.3
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Long	2-09-409	100	18.4	66.9	6.8	100	38.1
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Mediu	2-09-409	100	18.4	66.9	6.8	60	38.1
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Fine	2-09-409	100	18.4	66.9	6.8	40	38.1
1116	Guineagrass (P. maximum) Hay, Brazil, Long hay	00-00-000	100	89.3	67.7	6.9	100	6
1116	Guineagrass (P. maximum) Hay, Brazil, Medium chop	00-00-000	100	89.3	67.7	6.9	95	6
1116	Guineagrass (P. maximum) Hay, Brazil, Fine chop	00-00-000	100	89.3	67.7	6.9	90	6
1117	Guineagrass (P. maximum) Hay, Honduras, Long hay	00-00-000	100	88.8	66.6	6.8	100	6
1117	Guineagrass (P. maximum) Hay, Honduras, Medium ch	00-00-000	100	88.8	66.6	6.8	95	6
1117	Guineagrass (P. maximum) Hay, Honduras, Fine chop	00-00-000	100	88.8	66.6	6.8	90	6
1118	Guineagrass (P. maximum) Pasture, Honduras, Well Ma	00-00-000	100	91.3	66.7	6.1	60	8

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
9.3	29.6	74.8	25.6	4.8	15.6	1.8	12.3	22.1	22.1	7.5	135	11	8.7
9.3	29.6	74.8	25.6	4.8	15.6	1.8	12.3	22.1	22.1	7.5	135	11	8.7
9.3	29.6	74.8	25.6	4.8	15.6	1.8	12.3	22.1	22.1	7.5	135	11	8.7
10.5	19.7	58.4	43.2	8.3	22.5	1.4	10.7	18.4	18.4	5.5	135	11	6.1
10.5	19.7	58.4	43.2	8.3	22.5	1.4	10.7	18.4	18.4	5.5	135	11	6.1
10.5	19.7	58.4	43.2	8.3	22.5	1.4	10.7	18.4	18.4	5.5	135	11	6.1
9.4	25.9	25.4	4.5	1.7	11.9	1.4	7.2	250	30	3	135	11	0.09
9.4	25.9	25.4	4.5	1.7	11.9	1.4	7.2	250	30	3	135	11	0.09
9.4	25.9	25.4	4.5	1.7	11.9	1.4	7.2	250	30	3	135	11	0.09
10.6	28.9	96	35.9	5.4	39.4	1.5	6.8	250	30	3	43.1	5.1	0.2
10.6	28.9	96	35.9	5.4	39.4	1.5	6.8	250	30	3	43.1	5.1	0.2
10.6	28.9	96	35.9	5.4	39.4	1.5	6.8	250	30	3	43.1	5.1	0.2
9.8	15.6	96	47.3	23.1	51.6	1.5	7	250	30	3	43.1	5.1	0.2
9.8	15.6	96	47.3	23.1	51.6	1.5	7	250	30	3	43.1	5.1	0.2
9.8	15.6	96	47.3	23.1	51.6	1.5	7	250	30	3	43.1	5.1	0.2
13.7	30	93	30	10	33.1	3.6	6.4	250	30	4	135	11	0.09
13.7	30	93	30	10	33.1	3.6	6.4	250	30	4	135	11	0.09
13.7	30	93	30	10	33.1	3.6	6.4	250	30	4	135	11	0.09
3.7	24.3	5	40.5	21.6	44.3	3	4.7	250	30	10	135	10	0.25
3.7	24.3	5	40.5	21.6	44.3	3	4.7	250	30	10	135	10	0.25
3.7	24.3	5	40.5	21.6	44.3	3	4.7	250	30	10	135	10	0.25
13	29.3	28	26	8.7	25.7	1.2	6	250	30	4.5	150	9	1.25
13	29.3	28	26	8.7	25.7	1.2	6	250	30	4.5	150	9	1.25
13	29.3	28	26	8.7	25.7	1.2	6	250	30	4.5	150	9	1.25
3.4	38.2	2.4	38.2	17.6	41.3	2.1	6.3	250	30	3	135	11	0.09
3.4	38.2	2.4	38.2	17.6	41.3	2.1	6.3	250	30	3	135	11	0.09
3.4	38.2	2.4	38.2	17.6	41.3	2.1	6.3	250	30	3	135	11	0.09
20.2	28	96	12.9	11.9	23.3	2.1	4.2	250	30	4.5	150	9	1.25
20.2	28	96	12.9	11.9	23.3	2.1	4.2	250	30	4.5	150	9	1.25
20.2	28	96	12.9	11.9	23.3	2.1	4.2	250	30	4.5	150	9	1.25
12.1	18.2	85.9	46.7	6.1	18.3	2.6	8.9	14.4	14.4	7.4	135	11	9.9
12.1	18.2	85.9	46.7	6.1	18.3	2.6	8.9	14.4	14.4	7.4	135	11	9.9
12.1	18.2	85.9	46.7	6.1	18.3	2.6	8.9	14.4	14.4	7.4	135	11	9.9
6.2	21.9	80	49.9	7.1	21.1	1.6	7.4	13.2	13.2	7.1	135	11	6.7
6.2	21.9	80	49.9	7.1	21.1	1.6	7.4	13.2	13.2	7.1	135	11	6.7
6.2	21.9	80	49.9	7.1	21.1	1.6	7.4	13.2	13.2	7.1	135	11	6.7
11.4	18.5	80	54.2	9.4	54.5	1.7	12.8	250	30	3	43.1	5.1	0.2
11.4	18.5	80	54.2	9.4	54.5	1.7	12.8	250	30	3	43.1	5.1	0.2
11.4	18.5	80	54.2	9.4	54.5	1.7	12.8	250	30	3	43.1	5.1	0.2
7.8	18.6	5	51.9	7.9	57.7	3	9.7	250	30	3.5	135	3.5	0.09
7.8	18.6	5	51.9	7.9	57.7	3	9.7	250	30	3.5	135	3.5	0.09
7.8	18.6	5	51.9	7.9	57.7	3	9.7	250	30	3.5	135	3.5	0.09
6.1	33.2	83.7	35.3	8.6	19.5	2	9.8	9.8	9.8	7.4	135	11	6.6
6.1	33.2	83.7	35.3	8.6	19.5	2	9.8	9.8	9.8	7.4	135	11	6.6
6.1	33.2	83.7	35.3	8.6	19.5	2	9.8	9.8	9.8	7.4	135	11	6.6
9.6	28.7	39.2	34.5	8.1	18.2	3	12.7	8.3	8.3	6.8	135	11	10.5
9.6	28.7	39.2	34.5	8.1	18.2	3	12.7	8.3	8.3	6.8	135	11	10.5
9.6	28.7	39.2	34.5	8.1	18.2	3	12.7	8.3	8.3	6.8	135	11	10.5
8.4	3.6	96	37	11.6	42.3	1.5	7.9	250	30	3	135	11	0.09
8.4	3.6	96	37	11.6	42.3	1.5	7.9	250	30	3	135	11	0.09
8.4	3.6	96	37	11.6	42.3	1.5	7.9	250	30	3	135	11	0.09
14.9	35.5	96	39.7	4.4	40.5	1.5	13.4	250	30	3	135	11	0.09
14.9	35.5	96	39.7	4.4	40.5	1.5	13.4	250	30	3	135	11	0.09
14.9	35.5	96	39.7	4.4	40.5	1.5	13.4	250	30	3	135	11	0.09
10.3	32.4	3.41	43.7	9.2	29.7	3.2	12.4	350	45	10	200	14	2

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
Grass forages											
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Medi	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1103	Bermudagrass (C. dactylon) Hay, Brazil Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1103	Bermudagrass (C. dactylon) Hay, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1103	Bermudagrass (C. dactylon) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1104	Bermudagrass (C. dactylon) Hay, Florida Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1104	Bermudagrass (C. dactylon) Hay, Florida Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1104	Bermudagrass (C. dactylon) Hay, Florida Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1105	Black oats (Avena strigosa) Hay, Brazil Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1105	Black oats (Avena strigosa) Hay, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1105	Black oats (Avena strigosa) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Long Hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Medium Cho	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1107	Calopo (C. mucunoides) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1107	Calopo (C. mucunoides) Hay, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1107	Calopo (C. mucunoides) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1108	Congograss (B. ruziziensis) Hay, Brazil, Long hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1108	Congograss (B. ruziziensis) Hay, Brazil, Medium chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1108	Congograss (B. ruziziensis) Hay, Brazil, Fine chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Long ha	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Mediun	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Fine ch	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1111	Gambagrass (A. gayanus) Fresh, Mexico, Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1111	Gambagrass (A. gayanus) Fresh, Mexico, Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1111	Gambagrass (A. gayanus) Fresh, Mexico, Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1112	Gambagrass (A. gayanus) Hay, Honduras, Long hay	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1112	Gambagrass (A. gayanus) Hay, Honduras, Medium chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1112	Gambagrass (A. gayanus) Hay, Honduras, Fine chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1113	Jaraguagrass (H. rufa) Hay, Brazil, Medium Chop	2.45	7.1	5.89	5.94	10.76	5.11	7.54	2.28	6.44	2.96
1113	Jaraguagrass (H. rufa) Hay, Brazil, Fine Chop	2.45	7.1	5.89	5.94	10.76	5.11	7.54	2.28	6.44	2.96
1113	Jaraguagrass (H. rufa) Hay, Brazil, Long Hay	2.45	7.1	5.89	5.94	10.76	5.11	7.54	2.28	6.44	2.96
1114	Guineagrass (P. maximum) Fresh, Mexico, Long	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1114	Guineagrass (P. maximum) Fresh, Mexico, Medium	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1114	Guineagrass (P. maximum) Fresh, Mexico, Fine	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Long	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Mediu	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Fine	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1116	Guineagrass (P. maximum) Hay, Brazil, Long hay	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1116	Guineagrass (P. maximum) Hay, Brazil, Medium chop	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1116	Guineagrass (P. maximum) Hay, Brazil, Fine chop	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1117	Guineagrass (P. maximum) Hay, Honduras, Long hay	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1117	Guineagrass (P. maximum) Hay, Honduras, Medium cho	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1117	Guineagrass (P. maximum) Hay, Honduras, Fine chop	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1118	Guineagrass (P. maximum) Pasture, Honduras, Well Ma	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.29	0.17	0.25		1.45						246.5			
0.29	0.17	0.25		1.45						246.5			
0.29	0.17	0.25		1.45						246.5			
0.47	0.28												
0.47	0.28												
0.47	0.28												
0.41	0.16	0.17		1.61		0.21				300			20
0.41	0.16	0.17		1.61		0.21				300			20
0.41	0.16	0.17		1.61		0.21				300			20
0.41	0.16	0.17		1.61		0.21				300			20
0.41	0.16	0.17		1.61		0.21				300			20
0.41	0.16	0.17		1.61		0.21				300			20
0.32	0.25	0.29	0.52	1.49	0.18	0.23	0.07	4.8		406	99	45	1
0.32	0.25	0.29	0.52	1.49	0.18	0.23	0.07	4.8		406	99	45	1
0.32	0.25	0.29	0.52	1.49	0.18	0.23	0.07	4.8		406	99	45	1
0.26	0.15						0.24						
0.26	0.15						0.24						
0.26	0.15						0.24						
0.35	0.13	0.06		0.51				16.1		650	36.8		
0.35	0.13	0.06		0.51				16.1		650	36.8		
0.35	0.13	0.06		0.51				16.1		650	36.8		
0.35	0.13	0.06		0.51				16.1		650	36.8		
0.35	0.13	0.06		0.51				16.1		650	36.8		
0.35	0.13	0.06		0.51				16.1		650	36.8		
0.56	0.23	2.68		2.83	0.64		0.65	11		859.6	196.9		51.4
0.56	0.23	2.68		2.83	0.64		0.65	11		859.6	196.9		51.4
0.56	0.23	2.68		2.83	0.64		0.65	11		859.6	196.9		51.4
0.56	0.23	2.68		2.83	0.64		0.65	11		859.6	196.9		51.4
0.56	0.23	2.68		2.83	0.64		0.65	11		859.6	196.9		51.4
0.56	0.23	2.68		2.83	0.64		0.65	11		859.6	196.9		51.4

ID	Feed Name	Minerals bioavailability Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
Grass forages															
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Medi	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1100	Alemangrass (E. polistachya) Fresh, Fert., Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1101	Bahiagrass (P. notatum) Fresh, Fert., Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1102	Bermudagrass (C. dactylon) Fresh, Brazil, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1103	Bermudagrass (C. dactylon) Hay, Brazil Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1103	Bermudagrass (C. dactylon) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1103	Bermudagrass (C. dactylon) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1104	Bermudagrass (C. dactylon) Hay, Florida Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1104	Bermudagrass (C. dactylon) Hay, Florida Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1104	Bermudagrass (C. dactylon) Hay, Florida Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1105	Black oats (Avena strigosa) Hay, Brazil Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1105	Black oats (Avena strigosa) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1105	Black oats (Avena strigosa) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1106	Buffelgrass (Cenchrus ciliaris) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1107	Calopo (C. mucunoides) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1107	Calopo (C. mucunoides) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1107	Calopo (C. mucunoides) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1108	Congograss (B. ruziziensis) Hay, Brazil, Long hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1108	Congograss (B. ruziziensis) Hay, Brazil, Medium chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1108	Congograss (B. ruziziensis) Hay, Brazil, Fine chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Long ha	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Mediun	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1109	Enterolobium (E. cyclocarpum) Hay, Honduras, Fine cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1110	Gambagrass (A. gayanus) Fresh, Fert., Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1111	Gambagrass (A. gayanus) Fresh, Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1111	Gambagrass (A. gayanus) Fresh, Mexico, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1111	Gambagrass (A. gayanus) Fresh, Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1112	Gambagrass (A. gayanus) Hay, Honduras, Long hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1112	Gambagrass (A. gayanus) Hay, Honduras, Medium chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1112	Gambagrass (A. gayanus) Hay, Honduras, Fine chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1113	Jaraguagrass (H. rufa) Hay, Brazil, Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1113	Jaraguagrass (H. rufa) Hay, Brazil, Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1113	Jaraguagrass (H. rufa) Hay, Brazil, Long Hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1114	Guineagrass (P. maximum) Fresh, Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1114	Guineagrass (P. maximum) Fresh, Mexico, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1114	Guineagrass (P. maximum) Fresh, Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Mediur	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1115	Guineagrass (P. maximum) Fresh, Fert., Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1116	Guineagrass (P. maximum) Hay, Brazil, Long hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1116	Guineagrass (P. maximum) Hay, Brazil, Medium chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1116	Guineagrass (P. maximum) Hay, Brazil, Fine chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1117	Guineagrass (P. maximum) Hay, Honduras, Long hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1117	Guineagrass (P. maximum) Hay, Honduras, Medium cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1117	Guineagrass (P. maximum) Hay, Honduras, Fine chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1118	Guineagrass (P. maximum) Pasture, Honduras, Well Ma	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
1118	Guineagrass (P. maximum) Pasture, Honduras, Over-gra	00-00-000	100	91.3	66.7	6.1	40	8
1119	Guineagrass (P. maximum) Silage, Honduras, Coarse	00-00-000	100	87.5	60.7	9.6	95	100
1119	Guineagrass (P. maximum) Silage, Honduras, Medium	00-00-000	100	87.5	60.7	9.6	90	100
1119	Guineagrass (P. maximum) Silage, Honduras, Fine	00-00-000	100	87.5	60.7	9.6	85	100
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Long	00-00-000	100	22.9	75.7	8.1	100	21.2
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Medium	00-00-000	100	22.9	75.7	8.1	60	21.2
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Fine	00-00-000	100	22.9	75.7	8.1	40	21.2
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Lo	00-00-000	100	14	70.3	7.2	100	35.1
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Me	00-00-000	100	14	70.3	7.2	60	35.1
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Fir	00-00-000	100	14	70.3	7.2	40	35.1
1122	Koroniviagrass (B. humidicola) Hay, Brazil Long	00-00-000	100	93.6	79	7.5	100	0
1122	Koroniviagrass (B. humidicola) Hay, Brazil Medium Ch	00-00-000	100	93.6	79	7.5	95	0
1122	Koroniviagrass (B. humidicola) Hay, Brazil Fine Chop	00-00-000	100	93.6	79	7.5	90	0
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Long	00-00-000	100	92.4	53.9	21.5	100	0
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Medium Cho	00-00-000	100	92.4	53.9	21.5	95	0
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Fine Chop	00-00-000	100	92.4	53.9	21.5	90	0
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Long	00-00-000	100	22.4	74	5.4	100	26
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Medium Cl	00-00-000	100	22.4	74	5.4	60	26
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Fine Chop	00-00-000	100	22.4	74	5.4	40	26
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Long	00-00-000	100	18.4	69.9	6.1	100	32.1
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Medi	00-00-000	100	18.4	69.9	6.1	60	32.1
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Fine	00-00-000	100	18.4	69.9	6.1	40	32.1
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Fine Chop	00-00-000	100	30.1	78.3	6.8	90	0
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Long	00-00-000	100	30.1	78.3	6.8	100	0
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Medium Cl	00-00-000	100	30.1	78.3	6.8	95	0
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Long	00-00-000	100	17.6	70.2	4.7	100	0
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Med	00-00-000	100	17.6	70.2	4.7	60	0
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Fine	00-00-000	100	17.6	70.2	4.7	40	0
1128	Molassesgrass (M. minutiflora) Hay, Brazil Long	00-00-000	100	90.8	81.5	10.3	100	0
1128	Molassesgrass (M. minutiflora) Hay, Brazil Medium Ch	00-00-000	100	90.8	81.5	10.3	95	0
1128	Molassesgrass (M. minutiflora) Hay, Brazil Fine Chop	00-00-000	100	90.8	81.5	10.3	90	0
1129	Napiergrass (P. purpureum) Fresh, Brazil Long	2-03-162	100	23.7	74	9.6	100	8
1129	Napiergrass (P. purpureum) Fresh, Brazil Medium Chop	2-03-162	100	23.7	74	9.6	60	8
1129	Napiergrass (P. purpureum) Fresh, Brazil Fine Chop	2-03-162	100	23.7	74	9.6	40	8
1130	Napiergrass (P. purpureum) Hay, Brazil Long	1-08-462	100	91.3	65.8	7.3	100	10
1130	Napiergrass (P. purpureum) Hay, Brazil Medium Chop	1-08-462	100	91.3	65.8	7.3	95	10
1130	Napiergrass (P. purpureum) Hay, Brazil Fine Chop	1-08-462	100	91.3	65.8	7.3	90	10
1131	Napiergrass (P. purpureum) Silage, Brazil Long	00-00-000	100	23.8	78.4	12.2	95	100
1131	Napiergrass (P. purpureum) Silage, Brazil Medium Chop	00-00-000	100	23.8	78.4	12.2	90	100
1131	Napiergrass (P. purpureum) Silage, Brazil Fine Chop	00-00-000	100	23.8	78.4	12.2	85	100
1132	Palisadegrass (B. brizantha) Fresh, Brazil Long	00-00-000	100	25.1	76.4	8.3	100	5
1132	Palisadegrass (B. brizantha) Fresh, Brazil Medium Chop	00-00-000	100	25.1	76.4	8.3	60	5
1132	Palisadegrass (B. brizantha) Fresh, Brazil Fine Chop	00-00-000	100	25.1	76.4	8.3	40	5
1133	Palisadegrass (B. brizantha) Fresh, Mexico Long	00-00-000	100	25.1	67.8	5.3	100	32.7
1133	Palisadegrass (B. brizantha) Fresh, Mexico Medium Cho	00-00-000	100	25.1	67.8	5.3	60	32.7
1133	Palisadegrass (B. brizantha) Fresh, Mexico Fine Chop	00-00-000	100	25.1	67.8	5.3	40	32.7
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Long	00-00-000	100	19.8	63.7	5.9	100	26.5
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Mediu	00-00-000	100	19.8	63.7	5.9	60	26.5
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Fine Cl	00-00-000	100	19.8	63.7	5.9	40	26.5
1135	Palisadegrass (B. brizantha) Hay, Brazil Long	00-00-000	100	88.8	75.2	5.9	100	0
1135	Palisadegrass (B. brizantha) Hay, Brazil Medium Chop	00-00-000	100	88.8	75.2	5.9	95	0
1135	Palisadegrass (B. brizantha) Hay, Brazil Fine Chop	00-00-000	100	88.8	75.2	5.9	90	0
1136	Pangolagrass (D. decumbens) Fresh, Mexico Long	2-01-668	100	26.8	69.5	7.5	100	28.2
1136	Pangolagrass (D. decumbens) Fresh, Mexico Medium Cl	2-01-668	100	26.8	69.5	7.5	60	28.2
1136	Pangolagrass (D. decumbens) Fresh, Mexico Fine Chop	2-01-668	100	26.8	69.5	7.5	40	28.2
1137	Pangolagrass (D. decumbens) Fresh, Mexico Long	2-01-668	100	26.8	70	7.3	100	31.5

CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	Degradation Rates CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
10.3	32.4	3.41	43.7	9.2	29.7	3.2	12.4	350	45	10	200	14	2
10.5	39	90	33.3	14.3	29.4	2.8	17.1	10	20	5	175	12	1.5
10.5	39	90	33.3	14.3	29.4	2.8	17.1	10	20	5	175	12	1.5
10.5	39	90	33.3	14.3	29.4	2.8	17.1	10	20	5	175	12	1.5
6	47	50.5	21.2	7.3	18.3	1.6	6.6	17.8	17.8	7.5	135	11	2.6
6	47	50.5	21.2	7.3	18.3	1.6	6.6	17.8	17.8	7.5	135	11	2.6
6	47	50.5	21.2	7.3	18.3	1.6	6.6	17.8	17.8	7.5	135	11	2.6
9.8	39.9	53.6	17.1	4.3	16	2	10.6	18.6	18.6	7.9	135	11	3.2
9.8	39.9	53.6	17.1	4.3	16	2	10.6	18.6	18.6	7.9	135	11	3.2
9.8	39.9	53.6	17.1	4.3	16	2	10.6	18.6	18.6	7.9	135	11	3.2
4.4	25	5	36.2	16	45.8	0.9	5.3	250	30	3.5	135	3.5	0.09
4.4	25	5	36.2	16	45.8	0.9	5.3	250	30	3.5	135	3.5	0.09
4.4	25	5	36.2	16	45.8	0.9	5.3	250	30	3.5	135	3.5	0.09
14	26	5	32.9	18	33	1.6	8	250	30	4.5	150	9	1.25
14	26	5	32.9	18	33	1.6	8	250	30	4.5	150	9	1.25
14	26	5	32.9	18	33	1.6	8	250	30	4.5	150	9	1.25
5.4	41	59.9	22.7	8.2	19.1	1.3	8.4	25.5	25.5	8.2	135	11	3.4
5.4	41	59.9	22.7	8.2	19.1	1.3	8.4	25.5	25.5	8.2	135	11	3.4
5.4	41	59.9	22.7	8.2	19.1	1.3	8.4	25.5	25.5	8.2	135	11	3.4
7.7	41.5	56.1	20.8	5.8	17.6	1.8	10.9	22.9	22.9	8.1	135	11	3.1
7.7	41.5	56.1	20.8	5.8	17.6	1.8	10.9	22.9	22.9	8.1	135	11	3.1
7.7	41.5	56.1	20.8	5.8	17.6	1.8	10.9	22.9	22.9	8.1	135	11	3.1
7.1	25	5	3.4	1.7	37.6	2.2	8.3	250	30	3.5	52.4	1.4	0.1
7.1	25	5	3.4	1.7	37.6	2.2	8.3	250	30	3.5	52.4	1.4	0.1
7.1	25	5	3.4	1.7	37.6	2.2	8.3	250	30	3.5	52.4	1.4	0.1
8.6	27.9	50.1	33	4.9	16.4	2.5	12.8	10.6	10.6	8	135	11	7.3
8.6	27.9	50.1	33	4.9	16.4	2.5	12.8	10.6	10.6	8	135	11	7.3
8.6	27.9	50.1	33	4.9	16.4	2.5	12.8	10.6	10.6	8	135	11	7.3
3.9	25	5	2	1	21.1	2.9	6.1	250	30	3.5	135	3.5	0.09
3.9	25	5	2	1	21.1	2.9	6.1	250	30	3.5	135	3.5	0.09
3.9	25	5	2	1	21.1	2.9	6.1	250	30	3.5	135	3.5	0.09
6.6	46	2.2	2.2	0.9	30.1	2.3	9.4	250	30	3	69.7	1.7	0.1
6.6	46	2.2	2.2	0.9	30.1	2.3	9.4	250	30	3	69.7	1.7	0.1
6.6	46	2.2	2.2	0.9	30.1	2.3	9.4	250	30	3	69.7	1.7	0.1
10.4	32.4	95	39.7	10	41	1.7	11.8	250	20	3	135	11	0.09
10.4	32.4	95	39.7	10	41	1.7	11.8	250	20	3	135	11	0.09
10.4	32.4	95	39.7	10	41	1.7	11.8	250	20	3	135	11	0.09
5.4	50	90	52.6	26.1	40.2	2.3	7.7	10	20	5	175	12	1.5
5.4	50	90	52.6	26.1	40.2	2.3	7.7	10	20	5	175	12	1.5
5.4	50	90	52.6	26.1	40.2	2.3	7.7	10	20	5	175	12	1.5
7.1	41	2.4	4.6	2.1	38.6	1.6	7.6	34.8	34.8	8.6	132.2	1.1	0.3
7.1	41	2.4	4.6	2.1	38.6	1.6	7.6	34.8	34.8	8.6	132.2	1.1	0.3
7.1	41	2.4	4.6	2.1	38.6	1.6	7.6	34.8	34.8	8.6	132.2	1.1	0.3
7.1	45.9	70.7	15.9	3.8	12.3	2	8	34.8	34.8	8.6	135	11	6.3
7.1	45.9	70.7	15.9	3.8	12.3	2	8	34.8	34.8	8.6	135	11	6.3
7.1	45.9	70.7	15.9	3.8	12.3	2	8	34.8	34.8	8.6	135	11	6.3
11.7	37.5	68.3	10.1	2.9	12.8	2.8	11.1	20	20	8.2	135	11	4.9
11.7	37.5	68.3	10.1	2.9	12.8	2.8	11.1	20	20	8.2	135	11	4.9
11.7	37.5	68.3	10.1	2.9	12.8	2.8	11.1	20	20	8.2	135	11	4.9
5.9	38.2	5	33.7	10.5	40	1.4	7.2	250	30	3.5	135	3.5	0.09
5.9	38.2	5	33.7	10.5	40	1.4	7.2	250	30	3.5	135	3.5	0.09
5.9	38.2	5	33.7	10.5	40	1.4	7.2	250	30	3.5	135	3.5	0.09
8.9	41.9	36.3	32.5	5.4	16.5	2.4	8.6	19.7	19.7	5.3	135	11	5.3
8.9	41.9	36.3	32.5	5.4	16.5	2.4	8.6	19.7	19.7	5.3	135	11	5.3
8.9	41.9	36.3	32.5	5.4	16.5	2.4	8.6	19.7	19.7	5.3	135	11	5.3
7	36.7	38.3	31.3	6.1	19.2	1.8	8	22.4	22.4	5.2	135	11	3.9

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
1118	Guineagrass (P. maximum) Pasture, Honduras, Over-gra	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1119	Guineagrass (P. maximum) Silage, Honduras, Coarse	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1119	Guineagrass (P. maximum) Silage, Honduras, Medium	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1119	Guineagrass (P. maximum) Silage, Honduras, Fine	2.05	5.56	4.85	4.72	8.41	4.25	6.59	1.8	5.34	2.2
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Medium	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Lo	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Me	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Fir	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1122	Koroniviagrass (B. humidicola) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1122	Koroniviagrass (B. humidicola) Hay, Brazil Medium Ch	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1122	Koroniviagrass (B. humidicola) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Long	1.8	4.4	4	4.2	6.7	3.9	4.5	2.7	4.2	2.4
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Medium Cho	1.8	4.4	4	4.2	6.7	3.9	4.5	2.7	4.2	2.4
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Fine Chop	1.8	4.4	4	4.2	6.7	3.9	4.5	2.7	4.2	2.4
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Medium Cl	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Medi	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Medium Cl	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Med	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1128	Molassesgrass (M. minutiflora) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1128	Molassesgrass (M. minutiflora) Hay, Brazil Medium Cho	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1128	Molassesgrass (M. minutiflora) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1129	Napiergrass (P. purpureum) Fresh, Brazil Long	1.4	3.1	2.1	3.8	6.2	4.7	5.9	1.9	7.3	0.6
1129	Napiergrass (P. purpureum) Fresh, Brazil Medium Chop	1.4	3.1	2.1	3.8	6.2	4.7	5.9	1.9	7.3	0.6
1129	Napiergrass (P. purpureum) Fresh, Brazil Fine Chop	1.4	3.1	2.1	3.8	6.2	4.7	5.9	1.9	7.3	0.6
1130	Napiergrass (P. purpureum) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1130	Napiergrass (P. purpureum) Hay, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1130	Napiergrass (P. purpureum) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1131	Napiergrass (P. purpureum) Silage, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1131	Napiergrass (P. purpureum) Silage, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1131	Napiergrass (P. purpureum) Silage, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1132	Palisadegrass (B. brizantha) Fresh, Brazil Long	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1132	Palisadegrass (B. brizantha) Fresh, Brazil Medium Chop	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1132	Palisadegrass (B. brizantha) Fresh, Brazil Fine Chop	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1133	Palisadegrass (B. brizantha) Fresh, Mexico Long	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1133	Palisadegrass (B. brizantha) Fresh, Mexico Medium Cho	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1133	Palisadegrass (B. brizantha) Fresh, Mexico Fine Chop	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Long	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Mediu	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Fine Cl	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1135	Palisadegrass (B. brizantha) Hay, Brazil Long	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1135	Palisadegrass (B. brizantha) Hay, Brazil Medium Chop	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1135	Palisadegrass (B. brizantha) Hay, Brazil Fine Chop	2.25	6.02	5.04	4.94	8.66	4.55	6.8	2.01	5.58	2.1
1136	Pangolagrass (D. decumbens) Fresh, Mexico Long	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1136	Pangolagrass (D. decumbens) Fresh, Mexico Medium Cl	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1136	Pangolagrass (D. decumbens) Fresh, Mexico Fine Chop	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1137	Pangolagrass (D. decumbens) Fresh, Mexico Long	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.51	0.28	0.26		1.31	0.01	0.1							
0.51	0.28	0.26		1.31	0.01	0.1							
0.51	0.28	0.26		1.31	0.01	0.1							
0.41	0.17												
0.41	0.17												
0.41	0.17												
0.34	0.29	0.16		2.27	0.55		0.27	14		130.6	206.5		
0.34	0.29	0.16		2.27	0.55		0.27	14		130.6	206.5		
0.34	0.29	0.16		2.27	0.55		0.27	14		130.6	206.5		
0.34	0.29	0.16		2.27	0.55		0.27	14		130.6	206.5		

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
1118	Guineagrass (P. maximum) Pasture, Honduras, Over-gra	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1119	Guineagrass (P. maximum) Silage, Honduras, Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1119	Guineagrass (P. maximum) Silage, Honduras, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1119	Guineagrass (P. maximum) Silage, Honduras, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1120	Koroniviagrass (B. humidicola) Fresh, Mexico, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Lo	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Me	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1121	Koroniviagrass (B. humidicola) Fresh, Fert., Mexico, Fir	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1122	Koroniviagrass (B. humidicola) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1122	Koroniviagrass (B. humidicola) Hay, Brazil Medium Ch	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1122	Koroniviagrass (B. humidicola) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1123	Kudzu (Pueraria phaseoloides) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Medium Cl	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1124	Llanerograss (B. dictyoneura) Fresh, Mexico Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Medi	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1125	Llanerograss (B. dictyoneura) Fresh, Fert., Mexico Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1126	Molassesgrass (M. minutiflora) Fresh, Brazil Medium Cl	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Med	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1127	Molassesgrass (M. minutiflora) Fresh, Fert., Mexic Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1128	Molassesgrass (M. minutiflora) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1128	Molassesgrass (M. minutiflora) Hay, Brazil Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1128	Molassesgrass (M. minutiflora) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1129	Napiergrass (P. purpureum) Fresh, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1129	Napiergrass (P. purpureum) Fresh, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1129	Napiergrass (P. purpureum) Fresh, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1130	Napiergrass (P. purpureum) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1130	Napiergrass (P. purpureum) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1130	Napiergrass (P. purpureum) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1131	Napiergrass (P. purpureum) Silage, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1131	Napiergrass (P. purpureum) Silage, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1131	Napiergrass (P. purpureum) Silage, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1132	Palisadegrass (B. brizantha) Fresh, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1132	Palisadegrass (B. brizantha) Fresh, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1132	Palisadegrass (B. brizantha) Fresh, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1133	Palisadegrass (B. brizantha) Fresh, Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1133	Palisadegrass (B. brizantha) Fresh, Mexico Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1133	Palisadegrass (B. brizantha) Fresh, Mexico Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Mediu	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1134	Palisadegrass (B. brizantha) Fresh, Fert., Mexico Fine Cl	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1135	Palisadegrass (B. brizantha) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1135	Palisadegrass (B. brizantha) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1135	Palisadegrass (B. brizantha) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1136	Pangolagrass (D. decumbens) Fresh, Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1136	Pangolagrass (D. decumbens) Fresh, Mexico Medium Cl	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1136	Pangolagrass (D. decumbens) Fresh, Mexico Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1137	Pangolagrass (D. decumbens) Fresh, Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
1137	Pangolagrass (D. decumbens) Fresh, Mexico Medium Cl	2-01-668	100	26.8	70	7.3	60	31.5
1137	Pangolagrass (D. decumbens) Fresh, Mexico Fine Chop	2-01-668	100	26.8	70	7.3	40	31.5
1138	Pangolagrass (D. decumbens) Hay, Brazil Long	1-01-667	100	88.9	72.3	9.6	100	6
1138	Pangolagrass (D. decumbens) Hay, Brazil Medium Chop	1-01-667	100	88.9	72.3	9.6	95	6
1138	Pangolagrass (D. decumbens) Hay, Brazil Fine Chop	1-01-667	100	88.9	72.3	9.6	90	6
1139	Pangolagrass (D. decumbens) Hay, Honduras Long	1-01-667	100	89.9	63.9	7.2	100	6
1139	Pangolagrass (D. decumbens) Hay, Honduras Medium C	1-01-667	100	89.9	63.9	7.2	95	6
1139	Pangolagrass (D. decumbens) Hay, Honduras Fine Chop	1-01-667	100	89.9	63.9	7.2	90	6
1140	Pangolagrass (D. decumbens) Hay, Florida Long	1-01-667	100	89.7	76.8	9	100	6
1140	Pangolagrass (D. decumbens) Hay, Florida Medium Chc	1-01-667	100	89.7	76.8	9	95	6
1140	Pangolagrass (D. decumbens) Hay, Florida Fine Chop	1-01-667	100	89.7	76.8	9	90	6
1141	Pangolagrass (D. decumbens) Pasture, Honduras Well m	00-00-000	100	90.2	65.5	5.5	60	0
1141	Pangolagrass (D. decumbens) Pasture, Honduras Over-g	00-00-000	100	90.2	65.5	5.5	40	0
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Long	00-00-000	100	18.5	63.5	5.7	100	55.8
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Mediun	00-00-000	100	18.5	63.5	5.7	60	55.8
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Fine Ch	00-00-000	100	18.5	63.5	5.7	40	55.8
1143	Paspalum (P. fasciculatum) Hay, Florida Long	1-00-462	100	89.4	80.8	7.3	100	6
1143	Paspalum (P. fasciculatum) Hay, Florida Medium Chop	1-00-462	100	89.4	80.8	7.3	95	6
1143	Paspalum (P. fasciculatum) Hay, Florida Fine Chop	1-00-462	100	89.4	80.8	7.3	90	6
1144	Golden Timothy (S. sphacelata) Hay, Brazil Long	00-00-000	100	92.2	66.9	3.8	100	0
1144	Golden Timothy (S. sphacelata) Hay, Brazil Medium Ch	00-00-000	100	92.2	66.9	3.8	95	0
1144	Golden Timothy (S. sphacelata) Hay, Brazil Fine Chop	00-00-000	100	92.2	66.9	3.8	90	0
1145	Signalgrass (B. decumbens) Fresh, Brazil Long	00-00-000	100	28.9	75.8	7.5	100	5
1145	Signalgrass (B. decumbens) Fresh, Brazil Medium Chop	00-00-000	100	28.9	75.8	7.5	60	5
1145	Signalgrass (B. decumbens) Fresh, Brazil Fine Chop	00-00-000	100	28.9	75.8	7.5	40	5
1146	Signalgrass (B. decumbens) Fresh, Mexico Long	00-00-000	100	23.2	71.3	6.3	100	24.8
1146	Signalgrass (B. decumbens) Fresh, Mexico Medium Chc	00-00-000	100	23.2	71.3	6.3	60	24.8
1146	Signalgrass (B. decumbens) Fresh, Mexico Fine Chop	00-00-000	100	23.2	71.3	6.3	40	24.8
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Long	00-00-000	100	20.1	67.1	6.5	100	21.2
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Mediu	00-00-000	100	20.1	67.1	6.5	60	21.2
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Fine Cl	00-00-000	100	20.1	67.1	6.5	40	21.2
1148	Signalgrass (B. decumbens) Hay, Brazil Long	00-00-000	100	88.8	84.2	10	100	0
1148	Signalgrass (B. decumbens) Hay, Brazil Medium Chop	00-00-000	100	88.8	84.2	10	95	0
1148	Signalgrass (B. decumbens) Hay, Brazil Fine Chop	00-00-000	100	88.8	84.2	10	90	0
1149	Stargrass (C. plectostachyus) Fresh, Mexico Long	00-00-000	100	30.2	76.8	7.6	100	28
1149	Stargrass (C. plectostachyus) Fresh, Mexico Medium Ch	00-00-000	100	30.2	76.8	7.6	60	28
1149	Stargrass (C. plectostachyus) Fresh, Mexico Fine Chop	00-00-000	100	30.2	76.8	7.6	40	28
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Long	00-00-000	100	21.5	71.6	7.3	100	22.6
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Mediu	00-00-000	100	21.5	71.6	7.3	60	22.6
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Fine C	00-00-000	100	21.5	71.6	7.3	40	22.6
1151	Sugarcane (S. officinarum) Bagasse, Brazil Long	1-04-686	100	15.6	75.6	11.3	100	100
1151	Sugarcane (S. officinarum) Bagasse, Brazil Medium Chc	1-04-686	100	15.6	75.6	11.3	95	100
1151	Sugarcane (S. officinarum) Bagasse, Brazil Fine Chop	1-04-686	100	15.6	75.6	11.3	90	100
1152	Sugarcane (S. officinarum) Fresh, Brazil Long	2-04-689	100	29.7	57.1	11	100	0
1152	Sugarcane (S. officinarum) Fresh, Brazil Medium Chop	2-04-689	100	29.7	57.1	11	60	0
1152	Sugarcane (S. officinarum) Fresh, Brazil Fine Chop	2-04-689	100	29.7	57.1	11	40	0
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Long	00-00-000	100	46.9	61.4	15.8	85	0
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Medi	00-00-000	100	46.9	61.4	15.8	80	0
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Fine	00-00-000	100	46.9	61.4	15.8	75	0
Legume forages								
1200	Alfalfa (Medicago sativa) Hay, Brazil, Long hay	1-00-078	100	89.5	66.9	18.1	100	10
1200	Alfalfa (Medicago sativa) Hay, Brazil, Medium Chop	1-00-078	100	89.5	66.9	18.1	95	10
1200	Alfalfa (Medicago sativa) Hay, Brazil, Fine Chop	1-00-078	100	89.5	66.9	18.1	90	10
1201	Alfalfa (Medicago sativa) Silage, Brazil, Coarse	3-00-212	100	49.7	43.5	18.3	90	10
1201	Alfalfa (Medicago sativa) Silage, Brazil, Medium	3-00-212	100	49.7	43.5	18.3	85	10
1201	Alfalfa (Medicago sativa) Silage, Brazil Fine	3-00-212	100	49.7	43.5	18.3	80	10

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
7	36.7	38.3	31.3	6.1	19.2	1.8	8	22.4	22.4	5.2	135	11	3.9
7	36.7	38.3	31.3	6.1	19.2	1.8	8	22.4	22.4	5.2	135	11	3.9
7.3	30.9	96	38.2	16.4	40.1	2.3	6.9	250	30	3	135	11	0.09
7.3	30.9	96	38.2	16.4	40.1	2.3	6.9	250	30	3	135	11	0.09
7.3	30.9	96	38.2	16.4	40.1	2.3	6.9	250	30	3	135	11	0.09
14.2	29.6	96	42.9	8.1	43.9	1.6	13.8	250	30	3	135	11	0.09
14.2	29.6	96	42.9	8.1	43.9	1.6	13.8	250	30	3	135	11	0.09
14.2	29.6	96	42.9	8.1	43.9	1.6	13.8	250	30	3	135	11	0.09
8.7	14.1	96	66.8	22.9	65.9	1.6	7.5	250	30	3	135	11	0.09
8.7	14.1	96	66.8	22.9	65.9	1.6	7.5	250	30	3	135	11	0.09
8.7	14.1	96	66.8	22.9	65.9	1.6	7.5	250	30	3	135	11	0.09
11.1	42.2	5	34.5	10.8	23.7	3	10	250	30	12	135	12	3
11.1	42.2	5	34.5	10.8	23.7	3	10	250	30	12	135	12	3
11.9	15.1	87.1	41.9	6.5	21	1.2	14.2	9.8	9.8	6.3	135	11	6.4
11.9	15.1	87.1	41.9	6.5	21	1.2	14.2	9.8	9.8	6.3	135	11	6.4
11.9	15.1	87.1	41.9	6.5	21	1.2	14.2	9.8	9.8	6.3	135	11	6.4
9.9	12.7	25.4	75	29.7	73.2	1.6	5.5	250	30	3	135	11	0.09
9.9	12.7	25.4	75	29.7	73.2	1.6	5.5	250	30	3	135	11	0.09
9.9	12.7	25.4	75	29.7	73.2	1.6	5.5	250	30	3	135	11	0.09
12.1	18.4	5	45.9	5.1	48.7	3	8.2	250	30	6	135	8	0.09
12.1	18.4	5	45.9	5.1	48.7	3	8.2	250	30	6	135	8	0.09
12.1	18.4	5	45.9	5.1	48.7	3	8.2	250	30	6	135	8	0.09
7.2	42	4.8	2.1	0.8	36.2	1.2	8.2	250	30	3	78.3	1.2	0.9
7.2	42	4.8	2.1	0.8	36.2	1.2	8.2	250	30	3	78.3	1.2	0.9
7.2	42	4.8	2.1	0.8	36.2	1.2	8.2	250	30	3	78.3	1.2	0.9
7.1	46.6	68.6	15.8	4.3	13.8	1.8	7.9	250	30	3	135	11	3.6
7.1	46.6	68.6	15.8	4.3	13.8	1.8	7.9	250	30	3	135	11	3.6
7.1	46.6	68.6	15.8	4.3	13.8	1.8	7.9	250	30	3	135	11	3.6
8.9	40.4	64.7	10.6	4.5	14.2	2	10.3	25.6	25.6	8.1	135	11	3.1
8.9	40.4	64.7	10.6	4.5	14.2	2	10.3	25.6	25.6	8.1	135	11	3.1
8.9	40.4	64.7	10.6	4.5	14.2	2	10.3	25.6	25.6	8.1	135	11	3.1
5.5	38.5	5	13.3	6.1	30.6	2.3	7	250	30	3.5	95.9	1.9	0.4
5.5	38.5	5	13.3	6.1	30.6	2.3	7	250	30	3.5	95.9	1.9	0.4
5.5	38.5	5	13.3	6.1	30.6	2.3	7	250	30	3.5	95.9	1.9	0.4
6.7	35.6	31.4	42.7	10.8	22.9	1.1	7.7	13.1	13.1	3.4	135	11	5.2
6.7	35.6	31.4	42.7	10.8	22.9	1.1	7.7	13.1	13.1	3.4	135	11	5.2
6.7	35.6	31.4	42.7	10.8	22.9	1.1	7.7	13.1	13.1	3.4	135	11	5.2
10	35.7	40.1	34	8	19.9	1.6	11	13.2	13.2	4.2	135	11	5.3
10	35.7	40.1	34	8	19.9	1.6	11	13.2	13.2	4.2	135	11	5.3
10	35.7	40.1	34	8	19.9	1.6	11	13.2	13.2	4.2	135	11	5.3
2.6	20	95	75	65	74.9	1.8	1.9	250	30	3	135	11	0.09
2.6	20	95	75	65	74.9	1.8	1.9	250	30	3	135	11	0.09
2.6	20	95	75	65	74.9	1.8	1.9	250	30	3	135	11	0.09
2.5	55	100	16	9	19.4	1.4	2.9	275	25	4	300	10	0.2
2.5	55	100	16	9	19.4	1.4	2.9	275	25	4	300	10	0.2
2.5	55	100	16	9	19.4	1.4	2.9	275	25	4	300	10	0.2
1.8	42	5	45.8	50.4	52.3	1.4	4.6	250	30	10	135	10	0.2
1.8	42	5	45.8	50.4	52.3	1.4	4.6	250	30	10	135	10	0.2
1.8	42	5	45.8	50.4	52.3	1.4	4.6	250	30	10	135	10	0.2
19	30	93	1	0.5	10.5	1.9	10.4	250	30	4.5	150	9	1.25
19	30	93	1	0.5	10.5	1.9	10.4	250	30	4.5	150	9	1.25
19	30	93	1	0.5	10.5	1.9	10.4	250	30	4.5	150	9	1.25
18.6	45	100	19.8	10.4	20.3	1.7	9.6	10	35	5.5	150	11	1.75
18.6	45	100	19.8	10.4	20.3	1.7	9.6	10	35	5.5	150	11	1.75
18.6	45	100	19.8	10.4	20.3	1.7	9.6	10	35	5.5	150	11	1.75

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
1137	Pangolagrass (D. decumbens) Fresh, Mexico Medium Cl	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1137	Pangolagrass (D. decumbens) Fresh, Mexico Fine Chop	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1138	Pangolagrass (D. decumbens) Hay, Brazil Long	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1138	Pangolagrass (D. decumbens) Hay, Brazil Medium Chop	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1138	Pangolagrass (D. decumbens) Hay, Brazil Fine Chop	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1139	Pangolagrass (D. decumbens) Hay, Honduras Long	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1139	Pangolagrass (D. decumbens) Hay, Honduras Medium C	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1139	Pangolagrass (D. decumbens) Hay, Honduras Fine Chop	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1140	Pangolagrass (D. decumbens) Hay, Florida Long	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1140	Pangolagrass (D. decumbens) Hay, Florida Medium Cho	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1140	Pangolagrass (D. decumbens) Hay, Florida Fine Chop	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1141	Pangolagrass (D. decumbens) Pasture, Honduras Well m	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1141	Pangolagrass (D. decumbens) Pasture, Honduras Over-g	1.33	3.43	3.12	3.27	5.11	2.8	4.43	1.23	3.18	1.38
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Mediun	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Fine Ch	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1143	Paspalum (P. fasciculatum) Hay, Florida Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1143	Paspalum (P. fasciculatum) Hay, Florida Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1143	Paspalum (P. fasciculatum) Hay, Florida Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1144	Golden Timothy (S. sphacelata) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1144	Golden Timothy (S. sphacelata) Hay, Brazil Medium Ch	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1144	Golden Timothy (S. sphacelata) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1145	Signalgrass (B. decumbens) Fresh, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1145	Signalgrass (B. decumbens) Fresh, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1145	Signalgrass (B. decumbens) Fresh, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1146	Signalgrass (B. decumbens) Fresh, Mexico Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1146	Signalgrass (B. decumbens) Fresh, Mexico Medium Cho	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1146	Signalgrass (B. decumbens) Fresh, Mexico Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Mediu	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Fine Cl	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1148	Signalgrass (B. decumbens) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1148	Signalgrass (B. decumbens) Hay, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1148	Signalgrass (B. decumbens) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1149	Stargrass (C. plectostachyus) Fresh, Mexico Long	1.77	4.59	4.21	4.03	6.78	3.47	5.24	1.46	3.96	1.63
1149	Stargrass (C. plectostachyus) Fresh, Mexico Medium Ch	1.77	4.59	4.21	4.03	6.78	3.47	5.24	1.46	3.96	1.63
1149	Stargrass (C. plectostachyus) Fresh, Mexico Fine Chop	1.77	4.59	4.21	4.03	6.78	3.47	5.24	1.46	3.96	1.63
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Long	1.77	4.59	4.21	4.03	6.78	3.47	5.24	1.46	3.96	1.63
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Mediu	1.77	4.59	4.21	4.03	6.78	3.47	5.24	1.46	3.96	1.63
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Fine C	1.77	4.59	4.21	4.03	6.78	3.47	5.24	1.46	3.96	1.63
1151	Sugarcane (S. officinarum) Bagasse, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1151	Sugarcane (S. officinarum) Bagasse, Brazil Medium Cho	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1151	Sugarcane (S. officinarum) Bagasse, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1152	Sugarcane (S. officinarum) Fresh, Brazil Long	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
1152	Sugarcane (S. officinarum) Fresh, Brazil Medium Chop	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
1152	Sugarcane (S. officinarum) Fresh, Brazil Fine Chop	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Medi	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
Legume forages											
1200	Alfalfa (Medicago sativa) Hay, Brazil, Long hay	0.83	6.13	4.92	3.81	6.85	5.3	4.03	1.71	4.36	1.05
1200	Alfalfa (Medicago sativa) Hay, Brazil, Medium Chop	0.83	6.13	4.92	3.81	6.85	5.3	4.03	1.71	4.36	1.05
1200	Alfalfa (Medicago sativa) Hay, Brazil, Fine Chop	0.83	6.13	4.92	3.81	6.85	5.3	4.03	1.71	4.36	1.05
1201	Alfalfa (Medicago sativa) Silage, Brazil, Coarse	1.22	3.21	2.44	3.3	6.4	3.13		0.63	4.18	1.84
1201	Alfalfa (Medicago sativa) Silage, Brazil, Medium	1.22	3.21	2.44	3.3	6.4	3.13		0.63	4.18	1.84
1201	Alfalfa (Medicago sativa) Silage, Brazil, Fine	1.22	3.21	2.44	3.3	6.4	3.13		0.63	4.18	1.84

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.34	0.29	0.16		2.27	0.55		0.27	14		130.6	206.5		
0.34	0.29	0.16		2.27	0.55		0.27	14		130.6	206.5		
0.38	0.25			1.62	0.44								
0.38	0.25			1.62	0.44								
0.38	0.25			1.62	0.44								
0.38	0.25			1.62	0.44								
0.38	0.25			1.62	0.44								
0.38	0.25			1.62	0.44								
0.42	0.16	0.19								60			
0.42	0.16	0.19								60			
0.42	0.16	0.19								60			
0.18	0.16	0.08		0.28	0.05	0.1		12.3		237.4	24		1
0.18	0.16	0.08		0.28	0.05	0.1		12.3		237.4	24		1
0.18	0.16	0.08		0.28	0.05	0.1		12.3		237.4	24		1
0.37	0.24	0.55		1.06	0.03			2.1		164	170.3		26.5
0.37	0.24	0.55		1.06	0.03			2.1		164	170.3		26.5
0.37	0.24	0.55		1.06	0.03			2.1		164	170.3		26.5
1.55	0.28	0.39	0.5	2.07	0.16	0.34	0.1581	11.4		275.1	44		31.2
1.55	0.28	0.39	0.5	2.07	0.16	0.34	0.1581	11.4		275.1	44		31.2
1.55	0.28	0.39	0.5	2.07	0.16	0.34	0.1581	11.4		275.1	44		31.2
1.86	0.27	0.33	0.41	2.32	0.23	0.31		11.1		273.1	49.7		40.7
1.86	0.27	0.33	0.41	2.32	0.23	0.31		11.1		273.1	49.7		40.7
1.86	0.27	0.33	0.41	2.32	0.23	0.31		11.1		273.1	49.7		40.7

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
1137	Pangolagrass (D. decumbens) Fresh, Mexico Medium Cl	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1137	Pangolagrass (D. decumbens) Fresh, Mexico Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1138	Pangolagrass (D. decumbens) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1138	Pangolagrass (D. decumbens) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1138	Pangolagrass (D. decumbens) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1139	Pangolagrass (D. decumbens) Hay, Honduras Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1139	Pangolagrass (D. decumbens) Hay, Honduras Medium C	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1139	Pangolagrass (D. decumbens) Hay, Honduras Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1140	Pangolagrass (D. decumbens) Hay, Florida Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1140	Pangolagrass (D. decumbens) Hay, Florida Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1140	Pangolagrass (D. decumbens) Hay, Florida Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1141	Pangolagrass (D. decumbens) Pasture, Honduras Well m	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1141	Pangolagrass (D. decumbens) Pasture, Honduras Over-g	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1142	Paspalum (P. fasciculatum) Fresh, Fert., Mexico Fine Ch	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1143	Paspalum (P. fasciculatum) Hay, Florida Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1143	Paspalum (P. fasciculatum) Hay, Florida Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1143	Paspalum (P. fasciculatum) Hay, Florida Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1144	Golden Timothy (S. sphacelata) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1144	Golden Timothy (S. sphacelata) Hay, Brazil Medium Ch	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1144	Golden Timothy (S. sphacelata) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1145	Signalgrass (B. decumbens) Fresh, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1145	Signalgrass (B. decumbens) Fresh, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1145	Signalgrass (B. decumbens) Fresh, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1146	Signalgrass (B. decumbens) Fresh, Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1146	Signalgrass (B. decumbens) Fresh, Mexico Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1146	Signalgrass (B. decumbens) Fresh, Mexico Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Mediu	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1147	Signalgrass (B. decumbens) Fresh, Fert., Mexico Fine Cl	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1148	Signalgrass (B. decumbens) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1148	Signalgrass (B. decumbens) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1148	Signalgrass (B. decumbens) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1149	Stargrass (C. plectostachyus) Fresh, Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1149	Stargrass (C. plectostachyus) Fresh, Mexico Medium Ch	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1149	Stargrass (C. plectostachyus) Fresh, Mexico Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Mediu	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1150	Stargrass (C. plectostachyus) Fresh, Fert., Mexico Fine (	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1151	Sugarcane (S. officinarum) Bagasse, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1151	Sugarcane (S. officinarum) Bagasse, Brazil Medium Cho	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1151	Sugarcane (S. officinarum) Bagasse, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1152	Sugarcane (S. officinarum) Fresh, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1152	Sugarcane (S. officinarum) Fresh, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1152	Sugarcane (S. officinarum) Fresh, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Medi	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1153	Sugarcane (S. officinarum) Bagasse, hidrolized, Br Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Legume forages															
1200	Alfalfa (Medicago sativa) Hay, Brazil, Long hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1200	Alfalfa (Medicago sativa) Hay, Brazil, Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1200	Alfalfa (Medicago sativa) Hay, Brazil, Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1201	Alfalfa (Medicago sativa) Silage, Brazil, Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1201	Alfalfa (Medicago sativa) Silage, Brazil, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1201	Alfalfa (Medicago sativa) Silage, Brazil Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Long hay	00-00-000	100	88.5	37.3	24.4	100	10
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Medium c	00-00-000	100	88.5	37.3	24.4	95	10
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Fine chop	00-00-000	100	88.5	37.3	24.4	90	10
1203	Leucaena (L. leucocephala) Hay, Brazil Long	1-02-492	100	94.7	64.3	21.4	95	38
1203	Leucaena (L. leucocephala) Hay, Brazil Medium Chop	1-02-492	100	94.7	64.3	21.4	90	38
1203	Leucaena (L. leucocephala) Hay, Brazil Fine Chop	1-02-492	100	94.7	64.3	21.4	85	38
1204	Perennial soy (N. wightii) Fresh, Brazil Long	00-00-000	100	33.2	57.2	19.9	90	10
1204	Perennial soy (N. wightii) Fresh, Brazil Medium Chop	00-00-000	100	33.2	57.2	19.9	85	10
1204	Perennial soy (N. wightii) Fresh, Brazil Fine Chop	00-00-000	100	33.2	57.2	19.9	80	10
1205	Perennial soy (N. wightii) Hay, Brazil Long	00-00-000	100	90.1	51.6	22.9	95	10
1205	Perennial soy (N. wightii) Hay, Brazil Medium Chop	00-00-000	100	90.1	51.6	22.9	90	10
1205	Perennial soy (N. wightii) Hay, Brazil Fine Chop	00-00-000	100	90.1	51.6	22.9	85	10
1206	Siratro (M. atropupureum) Hay, Brazil Long	00-00-000	100	92	47.5	22.7	100	10
1206	Siratro (M. atropupureum) Hay, Brazil Medium Chop	00-00-000	100	92	47.5	22.7	95	10
1206	Siratro (M. atropupureum) Hay, Brazil Fine Chop	00-00-000	100	92	47.5	22.7	90	10
Grain-type forages								
1300	Corn (Zea mays) Silage, Brazil, Coarse	3-02-912	80	31.4	53.2	8.1	90	100
1300	Corn (Zea mays) Silage, Brazil, Medium	3-02-912	80	31.4	53.2	8.1	85	100
1300	Corn (Zea mays) Silage, Brazil, Fine	3-02-912	80	31.4	53.2	8.1	80	100
1301	Corn (Zea mays) Silage, Honduras, Coarse	3-02-912	80	87.2	56.3	10.3	90	100
1301	Corn (Zea mays) Silage, Honduras, Medium	3-02-912	80	87.2	56.3	10.3	85	100
1301	Corn (Zea mays) Silage, Honduras, Fine	3-02-912	80	87.2	56.3	10.3	80	100
1302	Sorghum (S. vulgare) Residue, Honduras Coarse	00-00-000	100	88.2	66.2	10	90	6
1302	Sorghum (S. vulgare) Residue, Honduras Fine	00-00-000	100	88.2	66.2	10	80	6
1303	Sorghum (S. vulgare) Silage, Brazil Long	3-04-323	80	28.8	61.6	9.4	90	100
1303	Sorghum (S. vulgare) Silage, Brazil Medium Chop	3-04-323	80	28.8	61.6	9.4	85	100
1303	Sorghum (S. vulgare) Silage, Brazil Fine Chop	3-04-323	80	28.8	61.6	9.4	80	100
1304	Sorghum (S. vulgare) Silage, Honduras Long	3-04-323	80	89.4	69.6	10.2	90	100
1304	Sorghum (S. vulgare) Silage, Honduras Medium Chop	3-04-323	80	89.4	69.6	10.2	85	100
1304	Sorghum (S. vulgare) Silage, Honduras Fine Chop	3-04-323	80	89.4	69.6	10.2	80	100
1305	Soybean (Glycine max) Residue, Brazil Coarse	00-00-000	0	89.4	28.5	9.1	60	8
1305	Soybean (Glycine max) Residue, Brazil Finely ground	00-00-000	0	89.4	28.5	9.1	40	8
1306	Soybean (Glycine max) Straw, Brazil Long	1-04-567	100	87.4	56.8	1.9	90	100
1306	Soybean (Glycine max) Straw, Brazil Medium Chop	1-04-567	100	87.4	56.8	1.9	85	100
1306	Soybean (Glycine max) Straw, Brazil Fine Chop	1-04-567	100	87.4	56.8	1.9	80	100
Energy concentrates								
1400	Corn (Zea mays) Cracked, Brazil, Coarse	4-02-698	0	87.9	10.9	7.3	60	90
1400	Corn (Zea mays) Cracked, Brazil, Fine	4-02-698	0	87.9	10.9	7.3	40	90
1401	Corn (Zea mays) Grain, Brazil, Whole	4-02-935	0	88	13.4	2.8	80	90
1401	Corn (Zea mays) Grain, Brazil, Coarse grind	4-02-935	0	88	13.4	2.8	80	90
1401	Corn (Zea mays) Grain, Brazil, Fine grind	4-02-935	0	88	13.4	2.8	20	90
1402	Corn (Zea mays) Rolão MPS, Brazil, Coarse	00-00-000	20	87.5	21.36	3.86	60	92
1402	Corn (Zea mays) Rolão MPS, Brazil, Fine	00-00-000	20	87.5	21.36	3.86	20	92
1403	Corn (Zea mays) Rolão Total, Brazil, Coarse	00-00-000	30	89.4	33.3	5.45	60	95
1403	Corn (Zea mays) Rolão Total, Brazil, Fine	00-00-000	30	89.4	33.3	5.45	20	95
1404	Pearlmillet (P. americanum) Grain, Brazil Whole	4-03-118	0	88	27.3	7.1	80	90
1404	Pearlmillet (P. americanum) Grain, Brazil Medium grind	4-03-118	0	88	27.3	7.1	40	90
1404	Pearlmillet (P. americanum) Grain, Brazil Finely ground	4-03-118	0	88	27.3	7.1	20	90
1405	Sorghum (S. vulgare) Grain cracked, Brazil Coarse	4-04-383	0	87.2	24.2	9.2	60	100
1405	Sorghum (S. vulgare) Grain cracked, Brazil Medium	4-04-383	0	87.2	24.2	9.2	40	100
1406	Sorghum (S. vulgare) Grain, Brazil Whole	4-04-383	0	88.2	11.2	2.22	80	90
1406	Sorghum (S. vulgare) Grain, Brazil Flaked	4-04-383	0	88.2	11.2	2.22	80	90
1406	Sorghum (S. vulgare) Grain, Brazil Finely ground	4-04-383	0	88.2	11.2	2.22	30	90
1407	Sorghum (S. vulgare) Grain, Mexico Whole	4-04-383	0	87.4	10.3	12.8	80	90
1407	Sorghum (S. vulgare) Grain, Mexico Flaked	4-04-383	0	87.4	10.3	12.8	80	90
1407	Sorghum (S. vulgare) Grain, Mexico Finely ground	4-04-383	0	87.4	10.3	12.8	30	90

CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	Degradation Rates CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
24.4	31.6	96	25.4	11.9	27.4	3.2	8.6	250	30	4.5	150	9	1.25
24.4	31.6	96	25.4	11.9	27.4	3.2	8.6	250	30	4.5	150	9	1.25
24.4	31.6	96	25.4	11.9	27.4	3.2	8.6	250	30	4.5	150	9	1.25
11.7	25	5	33.9	14.5	45.1	0.7	4.8	250	30	3.5	135	3.5	0.09
11.7	25	5	33.9	14.5	45.1	0.7	4.8	250	30	3.5	135	3.5	0.09
11.7	25	5	33.9	14.5	45.1	0.7	4.8	250	30	3.5	135	3.5	0.09
15.8	28	96	4.6	4.3	12.6	3.4	8	250	30	4.5	65.4	11.1	0.5
15.8	28	96	4.6	4.3	12.6	3.4	8	250	30	4.5	65.4	11.1	0.5
15.8	28	96	4.6	4.3	12.6	3.4	8	250	30	4.5	65.4	11.1	0.5
15.4	33.7	96	24.8	9.9	24.3	3.2	8	250	30	4.5	150	9	1.25
15.4	33.7	96	24.8	9.9	24.3	3.2	8	250	30	4.5	150	9	1.25
15.4	33.7	96	24.8	9.9	24.3	3.2	8	250	30	4.5	150	9	1.25
18.8	28.7	96	16	8	20.9	3	8.2	250	30	4.5	150	9	1.25
18.8	28.7	96	16	8	20.9	3	8.2	250	30	4.5	150	9	1.25
18.8	28.7	96	16	8	20.9	3	8.2	250	30	4.5	150	9	1.25
7.1	41.4	98.3	14.6	10.8	37.7	2.5	4.2	10	25	6	94.1	1.5	0.2
7.1	41.4	98.3	14.6	10.8	37.7	2.5	4.2	10	25	6	94.1	1.5	0.2
7.1	41.4	98.3	14.6	10.8	37.7	2.5	4.2	10	25	6	94.1	1.5	0.2
8.3	47	100	19.3	9.6	23.1	2.1	6.5	10	25	6	300	10	0.2
8.3	47	100	19.3	9.6	23.1	2.1	6.5	10	25	6	300	10	0.2
8.3	47	100	19.3	9.6	23.1	2.1	6.5	10	25	6	300	10	0.2
8.8	51.3	96	20.9	12.8	23.5	2.3	11.1	250	30	3	135	11	0.09
8.8	51.3	96	20.9	12.8	23.5	2.3	11.1	250	30	3	135	11	0.09
6.2	45	100	19.6	16.8	25	3.5	5.3	10	20	5	300	8	0.2
6.2	45	100	19.6	16.8	25	3.5	5.3	10	20	5	300	8	0.2
6.2	45	100	19.6	16.8	25	3.5	5.3	10	20	5	300	8	0.2
3.2	34.4	100	34.4	18.8	37.3	2.64	10.6	10	20	5	300	8	0.2
3.2	34.4	100	34.4	18.8	37.3	2.64	10.6	10	20	5	300	8	0.2
3.2	34.4	100	34.4	18.8	37.3	2.64	10.6	10	20	5	300	8	0.2
23.4	12.7	2.17	15.1	6.4	18.2	8.7	8.2	350	45	10	200	20	2
23.4	12.7	2.17	15.1	6.4	18.2	8.7	8.2	350	45	10	200	20	2
11.9	70	100	33.3	27	31.4	2.8	10.5	300	50	10	300	10	0.5
11.9	70	100	33.3	27	31.4	2.8	10.5	300	50	10	300	10	0.5
11.9	70	100	33.3	27	31.4	2.8	10.5	300	50	10	300	10	0.5
9.2	17.8	30	6.8	2.3	41.7	4	1.9	150	15	5	50.2	2.9	0.2
9.2	17.8	30	6.8	2.3	41.7	4	1.9	150	15	5	50.2	2.9	0.2
9.5	11	73	10.7	4	25.2	4.4	1.5	300	35	6	135	10	0.15
9.5	11	73	10.7	4	25.2	4.4	1.5	300	35	6	135	10	0.15
9.5	11	73	10.7	4	25.2	4.4	1.5	300	35	6	135	10	0.15
30.4	17.08	78.06	11.48	5.36	26	2	4.8	242	33	6	126.82	8.3	0.16
30.4	17.08	78.06	11.48	5.36	26	2	4.8	242	33	6	126.82	8.3	0.16
6.8	26.2	85.65	12.65	7.4	27.9	2.3	4.4	155	30	6	114.55	5.75	0.175
6.8	26.2	85.65	12.65	7.4	27.9	2.3	4.4	155	30	6	114.55	5.75	0.175
15.1	53	19	32.8	18.9	33.5	3.8	2	300	40	8	300	12	0.35
15.1	53	19	32.8	18.9	33.5	3.8	2	300	40	8	300	12	0.35
15.1	53	19	32.8	18.9	33.5	3.8	2	300	40	8	300	12	0.35
9.9	12	33	1.9	0.1	15.4	8.7	0.9	250	20	8	34.8	12.6	0.1
9.9	12	33	1.9	0.1	15.4	8.7	0.9	250	20	8	34.8	12.6	0.1
8.9	13	41.9	15	5	37.4	5.1	2	150	15	5	150	5	0.09
8.9	13	41.9	15	5	37.4	5.1	2	150	15	5	150	5	0.09
8.9	13	41.9	15	5	37.4	5.1	2	150	15	5	150	5	0.09
10.4	14.9	33	33.9	5	47.4	3.6	3	14.3	14.3	6	135	6	0.1
10.4	14.9	33	33.9	5	47.4	3.6	3	14.3	14.3	6	135	6	0.1
10.4	14.9	33	33.9	5	47.4	3.6	3	14.3	14.3	6	135	6	0.1

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Long hay										
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Medium chop										
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Fine chop										
1203	Leucaena (L. leucocephala) Hay, Brazil Long	1.4	6.7	6.4	4.6	9	5	5.8	2.7	5.4	4.5
1203	Leucaena (L. leucocephala) Hay, Brazil Medium Chop	1.4	6.7	6.4	4.6	9	5	5.8	2.7	5.4	4.5
1203	Leucaena (L. leucocephala) Hay, Brazil Fine Chop	1.4	6.7	6.4	4.6	9	5	5.8	2.7	5.4	4.5
1204	Perennial soy (N. wightii) Fresh, Brazil Long	1.45	4.86	4.16	3.43	6.41	3.45	4.29	1.64	4.05	1.3
1204	Perennial soy (N. wightii) Fresh, Brazil Medium Chop	1.45	4.86	4.16	3.43	6.41	3.45	4.29	1.64	4.05	1.3
1204	Perennial soy (N. wightii) Fresh, Brazil Fine Chop	1.45	4.86	4.16	3.43	6.41	3.45	4.29	1.64	4.05	1.3
1205	Perennial soy (N. wightii) Hay, Brazil Long	1.45	4.86	4.16	3.43	6.41	3.45	4.29	1.64	4.05	1.3
1205	Perennial soy (N. wightii) Hay, Brazil Medium Chop	1.45	4.86	4.16	3.43	6.41	3.45	4.29	1.64	4.05	1.3
1205	Perennial soy (N. wightii) Hay, Brazil Fine Chop	1.45	4.86	4.16	3.43	6.41	3.45	4.29	1.64	4.05	1.3
1206	Siratro (M. atropupureum) Hay, Brazil Long	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1206	Siratro (M. atropupureum) Hay, Brazil Medium Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1206	Siratro (M. atropupureum) Hay, Brazil Fine Chop	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
Grain-type forages											
1300	Corn (Zea mays) Silage, Brazil, Coarse	5.3	5.18	11.69	4.34	11.2	3.01	5.42	2.53	4.34	3.61
1300	Corn (Zea mays) Silage, Brazil, Medium	5.3	5.18	11.69	4.34	11.2	3.01	5.42	2.53	4.34	3.61
1300	Corn (Zea mays) Silage, Brazil, Fine	5.3	5.18	11.69	4.34	11.2	3.01	5.42	2.53	4.34	3.61
1301	Corn (Zea mays) Silage, Honduras, Coarse	5.3	5.18	11.69	4.34	11.2	3.01	5.42	2.53	4.34	3.61
1301	Corn (Zea mays) Silage, Honduras, Medium	5.3	5.18	11.69	4.34	11.2	3.01	5.42	2.53	4.34	3.61
1301	Corn (Zea mays) Silage, Honduras, Fine	5.3	5.18	11.69	4.34	11.2	3.01	5.42	2.53	4.34	3.61
1302	Sorghum (S. vulgare) Residue, Honduras Coarse	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1302	Sorghum (S. vulgare) Residue, Honduras Fine	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1303	Sorghum (S. vulgare) Silage, Brazil Long	0.75	3.61	7.07	2.26	4.29	3.01	2.78	1.35	2.78	0.75
1303	Sorghum (S. vulgare) Silage, Brazil Medium Chop	0.75	3.61	7.07	2.26	4.29	3.01	2.78	1.35	2.78	0.75
1303	Sorghum (S. vulgare) Silage, Brazil Fine Chop	0.75	3.61	7.07	2.26	4.29	3.01	2.78	1.35	2.78	0.75
1304	Sorghum (S. vulgare) Silage, Honduras Long	0.75	3.61	7.07	2.26	4.29	3.01	2.78	1.35	2.78	0.75
1304	Sorghum (S. vulgare) Silage, Honduras Medium Chop	0.75	3.61	7.07	2.26	4.29	3.01	2.78	1.35	2.78	0.75
1304	Sorghum (S. vulgare) Silage, Honduras Fine Chop	0.75	3.61	7.07	2.26	4.29	3.01	2.78	1.35	2.78	0.75
1305	Soybean (Glycine max) Residue, Brazil Coarse	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1305	Soybean (Glycine max) Residue, Brazil Finely ground	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
1306	Soybean (Glycine max) Straw, Brazil Long	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
1306	Soybean (Glycine max) Straw, Brazil Medium Chop	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
1306	Soybean (Glycine max) Straw, Brazil Fine Chop	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
Energy concentrates											
1400	Corn (Zea mays) Cracked, Brazil, Coarse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
1400	Corn (Zea mays) Cracked, Brazil, Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
1401	Corn (Zea mays) Grain, Brazil, Whole	1.92	3.27	4.71	3.94	12.98	3.85	5.19	2.98	1.92	3.37
1401	Corn (Zea mays) Grain, Brazil, Coarse grind	1.92	3.27	4.71	3.94	12.98	3.85	5.19	2.98	1.92	3.37
1401	Corn (Zea mays) Grain, Brazil, Fine grind	1.92	3.27	4.71	3.94	12.98	3.85	5.19	2.98	1.92	3.37
1402	Corn (Zea mays) Rolão MPS, Brazil, Coarse	2.6	3.65	6.11	4.02	12.63	3.68	5.24	2.89	2.41	3.42
1402	Corn (Zea mays) Rolão MPS, Brazil, Fine	2.6	3.65	6.11	4.02	12.63	3.68	5.24	2.89	2.41	3.42
1403	Corn (Zea mays) Rolão Total, Brazil, Coarse	3.61	4.22	8.2	4.14	12.09	3.43	5.31	2.76	3.13	3.49
1403	Corn (Zea mays) Rolão Total, Brazil, Fine	3.61	4.22	8.2	4.14	12.09	3.43	5.31	2.76	3.13	3.49
1404	Pearlmillet (P. americanum) Grain, Brazil Whole	1.87	2.95	4.68	3.67	9.64	3.6	4.39	2.16	4.6	0.86
1404	Pearlmillet (P. americanum) Grain, Brazil Medium grind	1.87	2.95	4.68	3.67	9.64	3.6	4.39	2.16	4.6	0.86
1404	Pearlmillet (P. americanum) Grain, Brazil Finely ground	1.87	2.95	4.68	3.67	9.64	3.6	4.39	2.16	4.6	0.86
1405	Sorghum (S. vulgare) Grain cracked, Brazil Coarse	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1405	Sorghum (S. vulgare) Grain cracked, Brazil Medium	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1406	Sorghum (S. vulgare) Grain, Brazil Whole	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1406	Sorghum (S. vulgare) Grain, Brazil Flaked	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1406	Sorghum (S. vulgare) Grain, Brazil Finely ground	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1407	Sorghum (S. vulgare) Grain, Mexico Whole	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1407	Sorghum (S. vulgare) Grain, Mexico Flaked	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84
1407	Sorghum (S. vulgare) Grain, Mexico Finely ground	1.26	2.44	3.87	3.28	13.36	3.87	4.71	2.27	5.13	0.84

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
2.28	0.2												
2.28	0.2												
2.28	0.2												
0.25	0.26	0.25	0.18	1.12	0.03	0.12	0.1	7		267.1	43.6		57.3
0.25	0.26	0.25	0.18	1.12	0.03	0.12	0.1	7		267.1	43.6		57.3
0.25	0.26	0.25	0.18	1.12	0.03	0.12	0.1	7		267.1	43.6		57.3
0.25	0.26	0.25	0.18	1.12	0.03	0.12	0.1	7		267.1	43.6		57.3
0.25	0.26	0.25	0.18	1.12	0.03	0.12	0.1	7		267.1	43.6		57.3
0.25	0.26	0.25	0.18	1.12	0.03	0.12	0.1	7		267.1	43.6		57.3
0.38	0.24	0.27	0.12	1.56	0.03	0.1	0.204	12.9		354.4	105	0.22	26.9
0.38	0.24	0.27	0.12	1.56	0.03	0.1	0.204	12.9		354.4	105	0.22	26.9
0.38	0.24	0.27	0.12	1.56	0.03	0.1	0.204	12.9		354.4	105	0.22	26.9
0.38	0.24	0.27	0.12	1.56	0.03	0.1	0.204	12.9		354.4	105	0.22	26.9
0.38	0.24	0.27	0.12	1.56	0.03	0.1	0.204	12.9		354.4	105	0.22	26.9
0.38	0.24	0.27	0.12	1.56	0.03	0.1	0.204	12.9		354.4	105	0.22	26.9
1.3	0.06	0.92		0.56	0.12	0.26				300	51.1		
1.3	0.06	0.92		0.56	0.12	0.26				300	51.1		
1.3	0.06	0.92		0.56	0.12	0.26				300	51.1		
0.03	0.35	0.14	0.05	0.35	0.01	0.14	0.04	4.3		30	6	0.08	21.5
0.03	0.35	0.14	0.05	0.35	0.01	0.14	0.04	4.3		30	6	0.08	21.5
0.05	0.32	0.12	0.06	0.37	0.01	0.13	0.08	4.1		35.2	6.1	0.14	21.6
0.05	0.32	0.12	0.06	0.37	0.01	0.13	0.08	4.1		35.2	6.1	0.14	21.6
0.05	0.32	0.12	0.06	0.37	0.01	0.13	0.08	4.1		35.2	6.1	0.14	21.6
0.09	0.308	0.146	0.084	0.52	0.014	0.128	0.084	4.68	0	81.58	13.6	0.112	28.74
0.09	0.308	0.146	0.084	0.52	0.014	0.128	0.084	4.68	0	81.58	13.6	0.112	28.74
0.15	0.29	0.185	0.12	0.745	0.02	0.125	0.09	5.55	0	151.15	24.85	0.07	39.45
0.15	0.29	0.185	0.12	0.745	0.02	0.125	0.09	5.55	0	151.15	24.85	0.07	39.45
0.09	0.32	0.18	0.16	0.39	0.04	0.14	0.11	18.4		108.7	19.6		22.4
0.09	0.32	0.18	0.16	0.39	0.04	0.14	0.11	18.4		108.7	19.6		22.4
0.09	0.32	0.18	0.16	0.39	0.04	0.14	0.11	18.4		108.7	19.6		22.4
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9
0.06	0.34	0.15	0.08	0.45	0.03	0.15	0.1124	7		47.2	13		41.9

ID	Feed Name	Minerals bioavailability Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Long hay	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Medium c	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1202	Gliricidia (Gliricidia sepium) Hay, Honduras, Fine chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1203	Leucaena (L. leucocephala) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1203	Leucaena (L. leucocephala) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1203	Leucaena (L. leucocephala) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1204	Perennial soy (N. wightii) Fresh, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1204	Perennial soy (N. wightii) Fresh, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1204	Perennial soy (N. wightii) Fresh, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1205	Perennial soy (N. wightii) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1205	Perennial soy (N. wightii) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1205	Perennial soy (N. wightii) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1206	Siratro (M. atropupureum) Hay, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1206	Siratro (M. atropupureum) Hay, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1206	Siratro (M. atropupureum) Hay, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Grain-type forages															
1300	Corn (Zea mays) Silage, Brazil, Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1300	Corn (Zea mays) Silage, Brazil, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1300	Corn (Zea mays) Silage, Brazil, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1301	Corn (Zea mays) Silage, Honduras, Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1301	Corn (Zea mays) Silage, Honduras, Medium	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1301	Corn (Zea mays) Silage, Honduras, Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1302	Sorghum (S. vulgare) Residue, Honduras Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1302	Sorghum (S. vulgare) Residue, Honduras Fine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1303	Sorghum (S. vulgare) Silage, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1303	Sorghum (S. vulgare) Silage, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1303	Sorghum (S. vulgare) Silage, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1304	Sorghum (S. vulgare) Silage, Honduras Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1304	Sorghum (S. vulgare) Silage, Honduras Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1304	Sorghum (S. vulgare) Silage, Honduras Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1305	Soybean (Glycine max) Residue, Brazil Coarse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1305	Soybean (Glycine max) Residue, Brazil Finely ground	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1306	Soybean (Glycine max) Straw, Brazil Long	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1306	Soybean (Glycine max) Straw, Brazil Medium Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1306	Soybean (Glycine max) Straw, Brazil Fine Chop	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Energy concentrates															
1400	Corn (Zea mays) Cracked, Brazil, Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1400	Corn (Zea mays) Cracked, Brazil, Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1401	Corn (Zea mays) Grain, Brazil, Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1401	Corn (Zea mays) Grain, Brazil, Coarse grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1401	Corn (Zea mays) Grain, Brazil, Fine grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1402	Corn (Zea mays) Rolão MPS, Brazil, Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1402	Corn (Zea mays) Rolão MPS, Brazil, Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1403	Corn (Zea mays) Rolão Total, Brazil, Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1403	Corn (Zea mays) Rolão Total, Brazil, Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1404	Pearlmillet (P. americanum) Grain, Brazil Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1404	Pearlmillet (P. americanum) Grain, Brazil Medium grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1404	Pearlmillet (P. americanum) Grain, Brazil Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1405	Sorghum (S. vulgare) Grain cracked, Brazil Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1405	Sorghum (S. vulgare) Grain cracked, Brazil Medium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1406	Sorghum (S. vulgare) Grain, Brazil Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1406	Sorghum (S. vulgare) Grain, Brazil Flaked	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1406	Sorghum (S. vulgare) Grain, Brazil Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1407	Sorghum (S. vulgare) Grain, Mexico Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1407	Sorghum (S. vulgare) Grain, Mexico Flaked	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1407	Sorghum (S. vulgare) Grain, Mexico Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	55	20	100	100	100	80	95	50
100	50	20	100	100	100	80	95	50
100	50	20	100	100	100	80	95	50
100	50	20	100	100	100	80	95	50
100	50	20	100	100	100	80	95	50
100	50	20	100	100	100	80	95	50
100	50	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
Protein concentrates								
1500	Blood Meal, Brazil	5-00-380	0	84.1	0	0	0	0
1501	Brewers Dry residue, Brazil	5-02-141	0	90.2	52.3	5.2	20	100
1502	Brewers Wet residue, Brazil	5-02-142	0	15.2	58	6.8	20	100
1503	Cottonseed (Gossypium spp) Meal, Brazil, coarse grind	5-17-728	0	90.1	46.9	15.1	40	90
1503	Cottonseed (Gossypium spp) Meal, Brazil, fine grind	5-17-728	0	90.1	46.9	15.1	20	90
1504	Cottonseed (Gossypium spp) Whole, Brazil with hay	5-01-614	0	89.5	44.1	23	90	6
1504	Cottonseed (Gossypium spp) Whole, Brazil without hay	5-01-614	0	89.5	44.1	23	60	6
1505	Meat Meal, Brazil	5-07-314	0	94.7	0	0	0	0
1506	Meat and Bone Meal, Brazil	5-00-388	0	95.1	0	0	0	0
1507	Soybean (Glycine max) Grain, Brazil Whole	5-04-610	0	91.6	19.1	1.54	80	90
1507	Soybean (Glycine max) Grain, Brazil Medium grind	5-04-610	0	91.6	19.1	1.54	40	90
1507	Soybean (Glycine max) Grain, Brazil Finely ground	5-04-610	0	91.6	19.1	1.54	20	90
1508	Soybean (Glycine max) Meal, Brazil Coarse	5-04-600	0	88.7	14.1	19	60	90
1508	Soybean (Glycine max) Meal, Brazil Finely ground	5-04-600	0	88.7	14.1	19	30	90
1509	Soybean (Glycine max) Meal, Mexico Coarse	5-04-600	0	89	11.4	0.9	60	90
1509	Soybean (Glycine max) Meal, Mexico Finely ground	5-04-600	0	89	11.4	0.9	30	90
Food processing byproducts								
1600	Cassava (Manihot utilissima) Residue, Brazil, Coarse	00-00-000	0	18.8	20.2	12	30	13.6
1600	Cassava (Manihot utilissima) Residue, Brazil, Fine	00-00-000	0	18.8	20.2	12	10	13.6
1601	Citrus Pulp, Brazil, Loose	4-01-235	0	86.9	18.2	10	50	90
1601	Citrus Pulp, Brazil, Pellets	4-01-235	0	86.9	18.2	10	30	90
1602	Molasses Sugarcane, Mexico	00-00-000	0	85.8	0	0	0	0
1603	Poultry Bedding, Brazil	5-05-587	35	82	39.1	9.4	30	8
1604	Poultry Manure, Brazil	5-14-015	35	84	16	2.3	30	90
1605	Soybean (Glycine max) Hulls, Brazil Loose	00-00-000	0	89.8	62.7	3.2	60	90
1605	Soybean (Glycine max) Hulls, Brazil Pellets	00-00-000	0	89.8	62.7	3.2	30	90
1606	Wheat (Triticum spp) Hay, Brazil Long	1-05-172	100	89	55	3.5	100	100
1606	Wheat (Triticum spp) Hay, Brazil Medium Chop	1-05-172	100	89	55	3.5	95	100
1606	Wheat (Triticum spp) Hay, Brazil Fine Chop	1-05-172	100	89	55	3.5	90	100
1607	Wheat (Triticum spp) Middling, Brazil Coarse	00-00-000	0	88.3	43	11.2	40	90
1607	Wheat (Triticum spp) Middling, Brazil Finely ground	00-00-000	0	88.3	43	11.2	20	90
1608	Yeast (S. cerevisae) Dry, Brazil	7-05-533	0	91.7	11	0	10	90

CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	Degradation Rates CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
89.8	5	0	1	1	45.2	0.4	4	0	0	0	75	3	0.09
17.6	4	75	40	3.5	49.7	3.3	5.4	300	38	6	150	6	0.5
30.1	8	50	62.8	11.7	60.6	10.1	3.9	300	38	6	150	8	0.5
37.9	20	40	9.3	1.5	21.8	1.5	5.8	300	25	3	186.7	9.9	0.2
37.9	20	40	9.3	1.5	21.8	1.5	5.8	300	25	3	186.7	9.9	0.2
22.6	12.3	57.7	12	7.5	28.2	16.6	4.1	300	25	3	175	8	0.25
22.6	12.3	57.7	12	7.5	28.2	16.6	4.1	300	25	3	175	8	0.25
46.9	8.6	26.5	0	0	31.7	12	37.5	0	0	0	150	5	0.12
46.1	16.09	21.4	0	0	24.7	11	40.8	0	0	0	150	6	0.12
40.5	44	22.7	4	3	13.1	23.1	4.9	300	30	5	200	10	0.2
40.5	44	22.7	4	3	13.1	23.1	4.9	300	30	5	200	10	0.2
40.5	44	22.7	4	3	13.1	23.1	4.9	300	30	5	200	10	0.2
47	35.9	11.1	2.8	1.6	16.5	5.5	6.2	300	45	6	238.2	8.4	0.4
47	35.9	11.1	2.8	1.6	16.5	5.5	6.2	300	45	6	238.2	8.4	0.4
52.6	16	55	5.5	2	19.4	2	7	7.9	7.9	5.7	230	11	0.2
52.6	16	55	5.5	2	19.4	2	7	7.9	7.9	5.7	230	11	0.2
2.2	25	45	30	5	35.3	0.2	1.4	300	40	8	300	12	0.35
2.2	25	45	30	5	35.3	0.2	1.4	300	40	8	300	12	0.35
7.1	27	96	21.1	16.34	29.4	2	6.1	300	40	8	300	12	0.35
7.1	27	96	21.1	16.34	29.4	2	6.1	300	40	8	300	12	0.35
4.2	98	100	0	0	0.4	2.2	11.6	17.5	17.5	20	350	11	0.3
20.4	46	2.17	12	9.2	15.6	1.3	18.5	350	45	10	200	18	2
15.8	53	19	7	4	13.7	0.5	49.8	300	40	8	300	12	0.35
13.4	18	72	21.1	5.8	30.6	2	5.5	350	40	8	150	12	0.15
13.4	18	72	21.1	5.8	30.6	2	5.5	350	40	8	150	12	0.15
4.1	20	95	75	65	75.1	0.9	6.1	250	50	8	135	11	0.09
4.1	20	95	75	65	75.1	0.9	6.1	250	50	8	135	11	0.09
4.1	20	95	75	65	75.1	0.9	6.1	250	50	8	135	11	0.09
17.6	53	19	3	0.5	19.2	5.3	5.6	300	35	5	113	4	0.8
17.6	53	19	3	0.5	19.2	5.3	5.6	300	35	5	113	4	0.8
31.9	44	22.7	22.3	3.2	28.4	0.4	6.7	300	30	5	200	10	0.2

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
Protein concentrates											
1500	Blood Meal, Brazil	1.28	8.23	4.28	4.7	12.75	1.35	8.4	5.16	7.02	4.7
1501	Brewers Dry residue, Brazil	1.78	3.36	4.76	3.53	9.62	5.94	6.05	2.06	5.52	1.4
1502	Brewers Wet residue, Brazil	1.3	7		4.7	7	6.1	5.8	2	3.8	1.4
1503	Cottonseed (Gossypium spp) Meal, Brazil, coarse grind	1.43	4.34	11.19	3.49	5.97	3.42	4.79	3.22	4.45	1.3
1503	Cottonseed (Gossypium spp) Meal, Brazil, fine grind	1.43	4.34	11.19	3.49	5.97	3.42	4.79	3.22	4.45	1.3
1504	Cottonseed (Gossypium spp) Whole, Brazil with hay	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
1504	Cottonseed (Gossypium spp) Whole, Brazil without hay	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
1505	Meat Meal, Brazil	0.84	5.6	8.28	2.52	5.46	2.43	3.67	1.44	3.03	0
1506	Meat and Bone Meal, Brazil	0.84	5.6	8.28	2.52	5.46	2.43	3.67	1.44	3.03	0.52
1507	Soybean (Glycine max) Grain, Brazil Whole	1.24	6.73	7.23	4.35	7.57	4.78	5.04	2.85	5.28	1.21
1507	Soybean (Glycine max) Grain, Brazil Medium grind	1.24	6.73	7.23	4.35	7.57	4.78	5.04	2.85	5.28	1.21
1507	Soybean (Glycine max) Grain, Brazil Finely ground	1.24	6.73	7.23	4.35	7.57	4.78	5.04	2.85	5.28	1.21
1508	Soybean (Glycine max) Meal, Brazil Coarse	1.42	6.17	6.79	3.79	7.11	5.33	4.89	2.42	4.71	1.4
1508	Soybean (Glycine max) Meal, Brazil Finely ground	1.42	6.17	6.79	3.79	7.11	5.33	4.89	2.42	4.71	1.4
1509	Soybean (Glycine max) Meal, Mexico Coarse	1.42	6.17	6.79	3.79	7.11	5.33	4.89	2.42	4.71	1.4
1509	Soybean (Glycine max) Meal, Mexico Finely ground	1.42	6.17	6.79	3.79	7.11	5.33	4.89	2.42	4.71	1.4
Food processing byproducts											
1600	Cassava (Manihot utilissima) Residue, Brazil, Coarse	1.33	3.33	4.67	2.67	4.67	3	3.67	3	1	0.67
1600	Cassava (Manihot utilissima) Residue, Brazil, Fine	1.33	3.33	4.67	2.67	4.67	3	3.67	3	1	0.67
1601	Citrus Pulp, Brazil, Loose	1.5	3.67	5.17	3.17	4.61	2.69	4.5	1.87	2.8	1.1
1601	Citrus Pulp, Brazil, Pellets	1.5	3.67	5.17	3.17	4.61	2.69	4.5	1.87	2.8	1.1
1602	Molasses Sugarcane, Mexico	71									
1603	Poultry Bedding, Brazil	0.48	1.73	1.6	1.8	3.06	1.94	2.48	0.78	1.7	2.04
1604	Poultry Manure, Brazil	0.57	1.8	1.84	1.87	2.97	1.8	2.51	0.85	1.7	2.01
1605	Soybean (Glycine max) Hulls, Brazil Loose	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	0.67
1605	Soybean (Glycine max) Hulls, Brazil Pellets	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	0.67
1606	Wheat (Triticum spp) Hay, Brazil Long	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1606	Wheat (Triticum spp) Hay, Brazil Medium Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1606	Wheat (Triticum spp) Hay, Brazil Fine Chop	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
1607	Wheat (Triticum spp) Middling, Brazil Coarse	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
1607	Wheat (Triticum spp) Middling, Brazil Finely ground	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
1608	Yeast (S. cerevisae) Dry, Brazil	2.76	10.46	7.17	6.89	10.2	9.92	8.83	15.43	6.89	1.1

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.41	0.3	0.22	0.33	0.12	0.35	0.37	0.0963	13.8		4038.8	5.8	0.8	4.8
0.32	0.55	0.16	0.14	0.09	0.22	0.32	0.0825	23.6	0.07	252.9	40.4		29.6
0.25	0.56	0.18	0.13	0.09	0.28	0.34	0.1	27.6		262.5	55.9		98.5
0.14	1.1	0.52	1.49	0.06	0.04	0.35	0.82	20		190	23	69	1
0.14	1.1	0.52	1.49	0.06	0.04	0.35	0.82	20		190	23	69	1
0.2	0.41			0.49			0.14	5.8		303.3	26.3		42.3
0.2	0.41			0.49			0.14	5.8		303.3	26.3		42.3
0.25	0.7	0.29	0.14	0.93	0.02	0.33		20.3		89.1	39.3	0.12	60
0.25	0.7	0.29	0.14	0.93	0.02	0.33		20.3		89.1	39.3	0.12	60
0.25	0.7	0.29	0.14	0.93	0.02	0.33		20.3		89.1	39.3	0.12	60
0.29	0.66	0.29	0.08	2.23	0.03	0.37	0.198	24.2		194.1	37.2	0.11	63.6
0.29	0.66	0.29	0.08	2.23	0.03	0.37	0.198	24.2		194.1	37.2	0.11	63.6
0.29	0.66	0.29	0.08	2.23	0.03	0.37	0.198	24.2		194.1	37.2	0.11	63.6
0.29	0.66	0.29	0.08	2.23	0.03	0.37	0.198	24.2		194.1	37.2	0.11	63.6
2.17	0.12	0.18		0.68	0.11			6.6		180	7.7		16.1
2.17	0.12	0.18		0.68	0.11			6.6		180	7.7		16.1
3.59	2.1	0.45		1.78	0.48	1.26		204		778.2	288.4	0.65	364.1
7.6	2.22	0.6	0.95	2.17	0.64	0.18	0.0007	67.7		1003.9	486.1		550.6
0.15	0.21	0.12	1.4	1.19	0.32	0.23	0.04	3.8		341.4	44.5		18.8
0.15	0.21	0.12	1.4	1.19	0.32	0.23	0.04	3.8		341.4	44.5		18.8
0.15	0.21	0.12	1.4	1.19	0.32	0.23	0.04	3.8		341.4	44.5		18.8
0.15	1.43	0.25	0.08	1.82	0.08	0.46	0.54	41.3	0.38	94.7	7.2	0.98	41.9

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
Protein concentrates															
1500	Blood Meal, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1501	Brewers Dry residue, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1502	Brewers Wet residue, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1503	Cottonseed (Gossypium spp) Meal, Brazil, coarse grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1503	Cottonseed (Gossypium spp) Meal, Brazil, fine grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1504	Cottonseed (Gossypium spp) Whole, Brazil with hay	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1504	Cottonseed (Gossypium spp) Whole, Brazil without hay	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1505	Meat Meal, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1506	Meat and Bone Meal, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1507	Soybean (Glycine max) Grain, Brazil Whole	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1507	Soybean (Glycine max) Grain, Brazil Medium grind	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1507	Soybean (Glycine max) Grain, Brazil Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1508	Soybean (Glycine max) Meal, Brazil Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1508	Soybean (Glycine max) Meal, Brazil Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1509	Soybean (Glycine max) Meal, Mexico Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1509	Soybean (Glycine max) Meal, Mexico Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Food processing byproducts															
1600	Cassava (Manihot utilissima) Residue, Brazil, Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1600	Cassava (Manihot utilissima) Residue, Brazil, Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1601	Citrus Pulp, Brazil, Loose	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1601	Citrus Pulp, Brazil, Pellets	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1602	Molasses Sugarcane, Mexico	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1603	Poultry Bedding, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1604	Poultry Manure, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1605	Soybean (Glycine max) Hulls, Brazil Loose	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1605	Soybean (Glycine max) Hulls, Brazil Pellets	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1606	Wheat (Triticum spp) Hay, Brazil Long	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1606	Wheat (Triticum spp) Hay, Brazil Medium Chop	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1606	Wheat (Triticum spp) Hay, Brazil Fine Chop	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1607	Wheat (Triticum spp) Middling, Brazil Coarse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1607	Wheat (Triticum spp) Middling, Brazil Finely ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
1608	Yeast (S. cerevisae) Dry, Brazil	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	65	20	100	100	100	80	95	50
100	65	20	100	100	100	80	95	50
100	65	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
Grass forages								
145	BarleySil 12Cp57Ndf5LNdf	00-00-0000	100	39	56.8	5.4	93.0	70
146	BerMudHay 5Cp80Ndf12LNdf	00-00-0000	100	88	80.0	12.0	100.0	81
147	BermudHay 10Cp70Ndf9LNdf	00-00-0000	100	88	65.0	9.0	100.0	72
148	BermudHay 15Cp55Ndf7LNdf	00-00-0000	100	91	55.0	7.0	100.0	63
149	BermudSil 5Cp80Ndf12LNdf	00-00-0000	100	35	80.0	12.0	95.0	81
150	BermudSil 10Cp70Ndf9LNdf	00-00-0000	100	30	70.0	9.0	94.0	72
151	BermudSil 15Cp55Ndf7LNdf	00-00-0000	100	25	55.0	7.0	93.0	63
152	Bromehay 6Cp71Ndf11LNDF	00-00-0000	100	88	71.0	11.3	100.0	87
153	Bromehay 10Cp65Ndf11LNDF	00-00-0000	100	88	65.0	11.1	100.0	84
154	Bromehay 15Cp48Ndf8LNDF	00-00-0000	100	88	47.7	7.7	100.0	90
210	Grasshy 7Cp72Ndf13Lndf	00-00-0000	100	90	72.0	12.5	100.0	81
211	Grasshy 10Cp67Ndf8Lndf	00-00-0000	100	89	67.0	7.5	100.0	78
212	Grasshy 16Cp55Ndf6Lndf	00-00-0000	100	88	55.0	5.5	98.0	75
213	GrassPs 16Cp55Ndf7Lndf	00-00-0000	100	25	55.0	7.0	70.0	55
214	GrassPs 22Cp48Ndf6Lndf	00-00-0000	100	24	41.0	6.0	68.0	58
215	GrassPs 24Cp40Ndf6Lndf	00-00-0000	100	23	40.0	6.0	65.0	58
216	GrassSil 7Cp72Ndf13Lndf	00-00-0000	100	35	72.0	12.5	98.0	45
217	GrassSil 10Cp67Ndf8Lndf	00-00-0000	100	30	67.0	7.5	95.0	48
218	GrassSil 16Cp55Ndf6Lndf	00-00-0000	100	25	55.0	5.5	92.0	63
219	GrassSil 20Cp48Ndf5Lndf	00-00-0000	100	20	48.0	5.0	90.0	59
222	Mixhay 9Cp61Ndf16LNdf	00-00-0000	100	90	61.0	16.0	98.0	69
223	Mixhay 13Cp56Ndf14LNdf	00-00-0000	100	87	56.5	14.0	98.0	68
224	Mixhay 15Cp52Ndf12LNdf	00-00-0000	100	87	52.0	12.0	98.0	67
225	Mixpas 20Cp46Ndf11LNdf	00-00-0000	100	22	46.5	11.0	70.0	67
226	Mixpas 26Cp41Ndf9LNdf	00-00-0000	100	21	41.5	9.0	70.0	64
227	Mixsil 9Cp61Ndf16LNdf	00-00-0000	100	40	61.0	16.0	90.0	69
228	Mixsil 13Cp56Ndf14LNdf	00-00-0000	100	40	56.5	14.0	87.0	68
229	Mixsil 15Cp52Ndf12LNdf	00-00-0000	100	40	52.0	12.0	85.0	67
230	OatHay 9Cp63Ndf9LNdf	00-00-0000	100	91	63.0	9.1	100.0	75
231	Oatsil 13Cp58Ndf16LNdf	00-00-0000	100	36.4	58.1	16.1	90.0	53
232	OatStraw 4Cp74Ndf20LNdf	00-00-0000	100	92	74.4	20.0	98.0	75
233	Orchardhay 13Cp59Ndf8LNdf	00-00-0000	100	89	59.0	7.7	100.0	80.7
234	Orchardhay 8Cp65Ndf12LNdf	00-00-0000	100	93	65.0	11.4	100.0	88.2
235	PangHay 9Cp70Ndf11LNdf	00-00-0000	100	94.1	70.0	11.4	100.0	27
236	RcanaryHay 10Cp64Ndf6LNdf	00-00-0000	100	89	64.0	6.3	100.0	93
237	RyeHay 9Cp41Ndf5LNdf	00-00-0000	100	88	41.0	4.9	100.0	62
240	SorgsudHay 11Cp68Ndf9LNdf	00-00-0000	100	90	68.0	9.2	100.0	60
241	SorgsudPast 17Cp55Ndf10LNdf	00-00-0000	100	18	55.0	9.9	75.0	55
242	SorgsudSil 11Cp68Ndf10LNdf	00-00-0000	100	28	68.0	10.4	90.0	56.3
243	TimHay 8Cp69Ndf7LNDF	00-00-0000	100	89	69.0	7.5	100.0	83
244	TimHay 11Cp61Ndf6LNdf	00-00-0000	100	89	61.0	6.6	100.0	80
245	TimHay 14Cp55Ndf5LNdf	00-00-0000	100	89	55.0	5.5	98.0	76
248	WheatHay 9CP68Ndf9LNdf	00-00-0000	100	92	68.0	9.2	100.0	88.3
250	WheatStraw 4Cp79Ndf16LNdf	00-00-0000	100	89	78.9	16.5	98.0	72.5
Legume forages								
122	AlfCube 20Cp44Ndf17LNdf	00-00-0000	100	91	44.0	17.0	85.0	80
123	AlfGc 17Cp43Ndf20LNDF	00-00-0000	100	20	43.0	20.0	85.0	89
124	AlfGc 17Cp46Ndf20LNDF	00-00-0000	100	20	46.0	20.0	85.0	89
125	AlfGc 20Cp37Ndf17LNDF	00-00-0000	100	18	37.0	17.0	82.0	80
126	AlfGc 20Cp40Ndf17LNDF	00-00-0000	100	18	40.0	17.0	82.0	80
127	AlfGc 25Cp32Ndf15LNDF	00-00-0000	100	15	32.0	15.0	80.0	70
128	AlfGc 25Cp35Ndf15LNdf	00-00-0000	100	15	35.0	15.0	80.0	70
129	AlfHay 17Cp43Ndf20LNDF	00-00-0000	100	90	43.0	20.0	93.0	89
130	AlfHay 17Cp46Ndf20LNDF	00-00-0000	100	90	46.0	20.0	95.0	89
131	AlfHay 20Cp37Ndf17LNDF	00-00-0000	100	90	37.0	17.0	90.0	80
132	AlfHay 20Cp40Ndf17LNDF	00-00-0000	100	90	40.0	17.0	92.0	80
133	AlfHay 25Cp32Ndf15LNDF	00-00-0000	100	90	32.0	15.0	83.0	70
134	AlfHay 25Cp35Ndf15LNDF	00-00-0000	100	90	35.0	15.0	85.0	70
135	AlfMeal 20Cp44Ndf17LNdf	00-00-0000	100	90	44.0	17.0	40.0	80

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
11.9	70.0	100.0	7.7	6.1		2.9	8.3	10	50	4	300	10	0.5
5.0	25.0	100.0	30.0	12.0		2.5	7.0	250	20	3	200	9	1.5
10.0	30.0	80.0	30.0	8.0		2.5	7.0	250	20	4	200	9	1.5
15.0	34.0	96.0	28.9	4.7		4.7	10.0	250	30	5	135	11	0.09
5.0	30.0	100.0	30.0	20.0		2.5	7.0	10	30	2	250	11	1.75
10.0	40.0	100.0	30.0	15.0		2.5	7.0	10	30	3	250	11	1.75
15.0	50.0	100.0	30.0	10.0		2.5	7.0	10	30	4	250	11	1.75
6.0	25.0	96.0	31.0	6.5		2.0	7.2	250	30	3	135	11	0.09
10.0	25.0	96.0	31.0	6.5		2.3	9.0	250	30	4	135	11	0.09
16.0	25.0	96.0	31.0	6.5		2.6	10.0	250	30	5	135	11	0.09
7.0	25.0	80.0	31.0	6.5		2.6	6.0	250	30	4	150	11	1.5
10.0	25.0	80.0	31.0	6.1		2.6	6.3	250	30	4	150	11	1.5
16.0	25.0	80.0	31.0	5.7		2.6	7.2	250	30	4	150	11	1.5
16.0	42.0	4.8	24.0	2.2		3.7	9.0	350	40	4	200	11	2
21.3	41.0	2.3	14.5	2.0		4.0	10.4	350	45	5	200	13	2
24.0	41.0	2.4	14.5	2.0		3.7	10.7	350	40	5	200	13	2
7.0	30.0	100.0	31.0	14.0		2.6	6.0	10	25	4	200	9	1.75
10.0	40.0	100.0	31.0	12.0		2.6	6.3	10	25	4	200	9	1.75
16.0	50.0	100.0	31.0	10.0		2.6	7.2	10	25	4	200	9	1.75
22.0	60.0	100.0	31.0	8.0		2.6	7.5	10	25	4	200	9	1.75
8.5	25.0	96.0	33.3	13.3		2.3	7.6	250	30	5	140	10	0.12
13.0	25.0	96.0	28.0	10.0		2.6	7.7	250	30	5	140	10	0.12
15.0	28.0	96.0	24.4	8.0		2.8	8.0	250	30	5	140	10	0.12
19.5	44.0	3.4	12.5	2.6		3.2	9.4	350	30	6	200	14	2
26.0	43.0	2.3	12.4	2.1		3.2	10.3	350	30	6	200	14	2
8.5	45.0	100.0	30.0	15.0		2.6	7.7	10	30	5	175	12	1.5
13.0	45.0	100.0	26.0	12.0		2.6	7.7	10	30	5	175	12	1.5
15.0	50.0	100.0	22.0	10.0		2.8	8.0	10	30	5	175	12	1.5
9.5	30.0	30.0	30.0	10.0		2.4	7.9	250	30	4	135	11	0.09
12.7	50.0	100.0	30.0	10.0		3.1	10.1	10	50	5	300	12	0.2
4.4	20.0	95.0	75.0	65.0		2.2	7.8	250	30	5	135	11	0.09
13.0	25.0	96.0	31.0	5.7		2.8	10.0	250	30	4	135	11	0.09
8.0	25.0	96.0	31.0	6.1		3.4	10.1	250	30	4	135	11	0.09
9.1	20.0	96.0	24.0	2.2		2.0	7.6	250	30	4	135	5	0.09
10.3	25.0	96.0	31.0	6.1		3.1	10.0	250	30	3	135	11	0.09
8.6	25.0	96.0	31.0	5.7		2.2	10.0	250	30	3	135	11	0.09
11.3	20.0	95.0	40.0	4.0		1.8	9.6	250	20	4	175	12	0.2
16.8	45.0	11.1	30.0	5.0		3.9	9.0	250	20	5	175	12	0.2
10.8	50.0	90.0	40.0	11.0		2.8	9.8	10	20	5	175	12	0.2
8.0	25.0	96.0	31.0	6.1		2.7	7.0	250	30	4	135	11	0.09
11.0	25.0	96.0	31.0	5.7		3.0	8.0	250	30	4	135	11	0.09
14.0	25.0	96.0	31.0	5.7		3.0	8.0	250	30	3	135	11	0.09
8.5	25.0	95.0	31.0	6.1		2.2	7.0	250	30	4	135	11	0.09
3.5	20.0	95.0	75.0	65.0		2.0	7.7	250	50	4	135	11	0.09
20.0	22.0	90.0	24.0	8.0		3.0	10.0	250	30	5	150	9	1.25
17.0	45.0	70.0	24.0	8.0		3.0	10.0	250	30	5	150	10	1.25
17.0	45.0	50.0	24.0	8.0		3.0	10.0	250	30	5	150	10	1.25
20.0	50.0	70.0	18.0	6.0		3.0	10.0	250	30	5	150	10	1.25
20.0	50.0	50.0	18.0	6.0		3.0	10.0	250	30	5	150	10	1.25
25.0	55.0	70.0	13.0	4.0		3.0	10.0	250	30	5	150	10	1.25
25.0	55.0	50.0	13.0	4.0		3.0	10.0	250	30	5	150	10	1.25
17.0	35.0	70.0	24.0	8.0		3.0	10.0	250	30	5	150	9	1.25
17.0	35.0	70.0	24.0	8.0		3.0	10.0	250	30	5	150	9	1.25
20.0	40.0	70.0	18.0	6.0		3.0	10.0	250	30	5	150	9	1.25
20.0	40.0	70.0	18.0	6.0		3.0	10.0	250	30	5	150	9	1.25
25.0	45.0	70.0	13.0	4.0		3.0	10.0	250	30	5	150	9	1.25
25.0	45.0	70.0	13.0	4.0		3.0	10.0	250	30	5	150	9	1.25
20.0	18.0	90.0	25.0	11.0		3.0	10.0	250	30	5	150	9	1.25

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
Grass forages											
145	BarleySil 12Cp57Ndf5LNdf	1.73	3.65	1.73	3.94	6.35	3.65	5.48	1.83	3.94	1.35
146	BerMudHay 5Cp80Ndf12LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
147	BermudHay 10Cp70Ndf9LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
148	BermudHay 15Cp55Ndf7LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
149	BermudSil 5Cp80Ndf12LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
150	BermudSil 10Cp70Ndf9LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
151	BermudSil 15Cp55Ndf7LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
152	Bromehay 6Cp71Ndf11LNDF	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
153	Bromehay 10Cp65Ndf11LNDF	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
154	Bromehay 15Cp48Ndf8LNDF	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
210	Grasshy 7Cp72Ndf13Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
211	Grasshy 10Cp67Ndf8Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
212	Grasshy 16Cp55Ndf6Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
213	GrassPs 16Cp55Ndf7Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
214	GrassPs 22Cp48Ndf6Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
215	GrassPs 24Cp40Ndf6Lndf	0.76	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
216	GrassSil 7Cp72Ndf13Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
217	GrassSil 10Cp67Ndf8Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
218	GrassSil 16Cp55Ndf6Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
219	GrassSil 20Cp48Ndf5Lndf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
222	Mixhay 9Cp61Ndf16LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	0.06
223	Mixhay 13Cp56Ndf14LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	1.63
224	Mixhay 15Cp52Ndf12LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	0.91
225	Mixpas 20Cp46Ndf11LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	3.12
226	Mixpas 26Cp41Ndf9LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	3.12
227	Mixsil 9Cp61Ndf16LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	3.17
228	Mixsil 13Cp56Ndf14LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	2.65
229	Mixsil 15Cp52Ndf12LNdf	0.7	4.43	4.61	3.92	7.38	4.42	5.49	1.81	4.91	2.65
230	OatHay 9Cp63Ndf9LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
231	Oatsil 13Cp58Ndf16LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
232	OatStraw 4Cp74Ndf20LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
233	Orchardhay 13Cp59Ndf8LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
234	Orchardhay 8Cp65Ndf12LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
235	PangHay 9Cp70Ndf11LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	0
236	RcanaryHay 10Cp64Ndf6LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
237	RyeHay 9Cp41Ndf5LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
240	SorgsudHay 11Cp68Ndf9LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
241	SorgsudPast 17Cp55Ndf10LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
242	SorgsudSil 11Cp68Ndf10LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
243	TimHay 8Cp69Ndf7LNDF	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
244	TimHay 11Cp61Ndf6LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
245	TimHay 14Cp55Ndf5LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
248	WheatHay 9CP68Ndf9LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
250	WheatStraw 4Cp79Ndf16LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
Legume forages											
122	AlfCube 20Cp44Ndf17LNdf	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
123	AlfGc 17Cp43Ndf20LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
124	AlfGc 17Cp46Ndf20LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
125	AlfGc 20Cp37Ndf17LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
126	AlfGc 20Cp40Ndf17LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
127	AlfGc 25Cp32Ndf15LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
128	AlfGc 25Cp35Ndf15LNdf	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
129	AlfHay 17Cp43Ndf20LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
130	AlfHay 17Cp46Ndf20LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
131	AlfHay 20Cp37Ndf17LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
132	AlfHay 20Cp40Ndf17LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
133	AlfHay 25Cp32Ndf15LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
134	AlfHay 25Cp35Ndf15LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
135	AlfMeal 20Cp44Ndf17LNdf	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.52	0.29	0.19	0.05	2.57	0.12	0.24	0.72	8	0	375	45	0.15	25
0.21	0.14	0.11	0.05	1	0	0.1	0	0	0	39	4	0	13
0.26	0.18	0.13	0	1.3	0.08	0.21	0.12	9	0	290	4	0	20
0.28	0.2	0.14	0	1.8	0	0.28	0	0	0	0	4	0	0
0.21	0.14	0.11	0	1	0	0.1	0	0	0	0	4	0	0
0.26	0.18	0.13	0	1.3	0.08	0.21	0.12	9	0	290	4	0	20
0.28	0.2	0.14	0.05	1.8	0	0.28	0	0	0	39	4	0	13
0.26	0.22	0.12	0.05	1.85	0.01	0.08	0	10	0	80	73	0	24
0.28	0.3	0.1	0.05	2	0.02	0.1	0	11	0	85	78	0	26
0.32	0.37	0.09	0.05	2.32	0.02	0.2	0	12	0	90	83	0	28
0.31	0.14	0.09	0	2	0.02	0.2	0	0	0	0	0	0	0
0.29	0.28	0.1	0	1.99	0.01	0.19	0.09	10	0	122	59	0.52	29
0.32	0.37	0.09	0	2.3	0.02	0.2	0	0	0	200	0	0	0
0.29	0.28	0.1	0	1.99	0.01	0.19	0.09	10	0	122	59	0.52	29
0.55	0.45	0.32	0	3.16	0.02	0.2	0	0	0	0	0	0	0
0.32	0.37	0.09	0	2.3	0.02	0.2	0	0	0	200	0	0	0
0.31	0.14	0.09	0	2	0.02	0.2	0	0	0	0	0	0	0
0.29	0.28	0.1	0	1.99	0.01	0.19	0.09	10	0	122	59	0.52	29
0.32	0.37	0.09	0	2.3	0.02	0.2	0	0	0	200	0	0	0
0.31	0.14	0.09	0	2	0.02	0.2	0	0	0	0	0	0	0
0.56	0.2	0.31	0	1	0.01	0.14	0	7	0	170	34	0	24
1	0.23	0.29	0	1.5	0.01	0.17	0.09	7	0	184	48	0.02	27
1.3	0.36	0.3	0	3.86	0.01	0.17	0.09	7	0	184	48	0.02	27
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.23	0.29	0	1.5	0.01	0.17	0.09	7	0	184	48	0.02	27
1	0.23	0.29	0	1.5	0.01	0.17	0.09	7	0	184	48	0.02	27
1.3	0.36	0.3	0	3.86	0.01	0.17	0.09	7	0	184	48	0.02	27
0.32	0.25	0.29	0	1.44	0.18	0.23	0.07	15	0	155	64	0.17	39
0.58	0.31	0.21	0	2.88	0.37	0.24	0.07	15	0	155	64	0.17	39
0.23	0.06	0.17	0.78	2.53	0.42	0.22	0	10	0	175	37	0	6
0.13	0.34	0.11	0	2.91	0.02	0.26	0.43	19	0	0	157	0	40
0.26	0.3	0.11	0	2.67	0.02	0.2	0.3	20	0	0	167	0	38
0.38	0.22	0.18	0	1.43	0	0	0	0	0	0	0	0	0
0.36	0.24	0.22	0	2.91	0	0	0	12	0	0	92	0	0
0.65	0.32	0	0	1.67	0	0	0	5	0	0	74	0	19
0.51	0.31	0.32	0	2.08	0.02	0.06	0.13	37	0	193	91	0	38
0.49	0.44	0.35	0	2.14	0.01	0.11	0	0	0	200	0	0	0
0.5	0.21	0.42	0	2.61	0.02	0.06	0.31	37	0	127	99	0	0
0.4	0.15	0.11	0	1.61	0.01	0.09	0	29	0	0	93	0	54
0.51	0.29	0.13	0	2.41	0.01	0.11	0	11	0	0	103	0	62
0.45	0.4	0.11	0	3.05	0.07	0.13	0	26	0	0	89	0	67
0.15	0.2	0.12	0.32	1	0.14	0.22	0.05	4	0	157	41	1.02	6
0.17	0.05	0.12	0.32	1.41	0.19	0.19	0.05	4	0	157	41	1.02	6
1.7	0.3	0.3	0.4	2.5	0.16	0.21	0.2	10	0.13	280	40	0.3	40
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.32	0.31	0.26	0.05	2.85	0.02	0.28	1	12	0	252	32	0	20
1.32	0.31	0.26	0.05	2.85	0.02	0.28	0.65	12	0.16	252	32	0.18	20
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.32	0.31	0.26	0.05	2.85	0.02	0.28	0.65	12	0.16	252	32	0.18	20
1.32	0.31	0.26	0.05	2.85	0.02	0.28	0.65	12	0.16	252	32	0.18	20
1.3	0.25	0.3	0.05	2.5	0.08	0.21	0.2	10	0.13	309	31	0.3	21

ID	Feed Name	Minerals bioavailability Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
Grass forages															
145	BarleySil 12Cp57Ndf5LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
146	BerMudHay 5Cp80Ndf12LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
147	BermudHay 10Cp70Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
148	BermudHay 15Cp55Ndf7LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
149	BermudSil 5Cp80Ndf12LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
150	BermudSil 10Cp70Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
151	BermudSil 15Cp55Ndf7LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
152	Bromehay 6Cp71Ndf11LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
153	Bromehay 10Cp65Ndf11LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
154	Bromehay 15Cp48Ndf8LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
210	Grasshy 7Cp72Ndf13Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
211	Grasshy 10Cp67Ndf8Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
212	Grasshy 16Cp55Ndf6Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
213	GrassPs 16Cp55Ndf7Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
214	GrassPs 22Cp48Ndf6Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
215	GrassPs 24Cp40Ndf6Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
216	GrassSil 7Cp72Ndf13Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
217	GrassSil 10Cp67Ndf8Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
218	GrassSil 16Cp55Ndf6Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
219	GrassSil 20Cp48Ndf5Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
222	Mixhay 9Cp61Ndf16LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
223	Mixhay 13Cp56Ndf14LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
224	Mixhay 15Cp52Ndf12LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
225	Mixpas 20Cp46Ndf11LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
226	Mixpas 26Cp41Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
227	Mixsil 9Cp61Ndf16LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
228	Mixsil 13Cp56Ndf14LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
229	Mixsil 15Cp52Ndf12LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
230	OatHay 9Cp63Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
231	Oatsil 13Cp58Ndf16LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
232	OatStraw 4Cp74Ndf20LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
233	Orchardhay 13Cp59Ndf8LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
234	Orchardhay 8Cp65Ndf12LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
235	PangHay 9Cp70Ndf11LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
236	RcanaryHay 10Cp64Ndf6LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
237	RyeHay 9Cp41Ndf5LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
240	SorgsudHay 11Cp68Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
241	SorgsudPast 17Cp55Ndf10LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
242	SorgsudSil 11Cp68Ndf10LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
243	TimHay 8Cp69Ndf7LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
244	TimHay 11Cp61Ndf6LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
245	TimHay 14Cp55Ndf5LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
248	WheatHay 9CP68Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
250	WheatStraw 4Cp79Ndf16LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Legume forages															
122	AlfCube 20Cp44Ndf17LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
123	AlfGc 17Cp43Ndf20LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
124	AlfGc 17Cp46Ndf20LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
125	AlfGc 20Cp37Ndf17LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
126	AlfGc 20Cp40Ndf17LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
127	AlfGc 25Cp32Ndf15LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
128	AlfGc 25Cp35Ndf15LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
129	AlfHay 17Cp43Ndf20LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
130	AlfHay 17Cp46Ndf20LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
131	AlfHay 20Cp37Ndf17LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
132	AlfHay 20Cp40Ndf17LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
133	AlfHay 25Cp32Ndf15LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
134	AlfHay 25Cp35Ndf15LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
135	AlfMeal 20Cp44Ndf17LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
136	AlfPellet 18Cp46Ndf17LNdf	00-00-0000	100	90	46.0	17.0	40.0	89
137	AlfSil 17Cp43Ndf20LNDF	00-00-0000	100	35	43.0	20.0	83.0	89
138	AlfSil 17Cp46Ndf20LNDF	00-00-0000	100	35	46.0	20.0	85.0	89
139	AlfSil 20Cp37Ndf17LNDF	00-00-0000	100	35	37	17	80	80
140	AlfSil 20Cp40Ndf17LNDF	00-00-0000	100	35	40	17	80	80
141	AlfSil 25Cp32Ndf15LNDF	00-00-0000	100	35	32	15	75	70
142	AlfSil 25Cp35Ndf15LNDF	00-00-0000	100	35	35	15	78	70
220	LegPs 24Cp38Ndf15Lndf	00-00-0000	100	21	38	15	65	78
221	LegPs 28Cp33Ndf14Lndf	00-00-0000	100	20	33	14	65	77
Grain-type forages								
155	CornSil Mex	00-00-0000	100	30	60.0	11.0	95.0	78
156	CornSil Stalklage	00-00-0000	100	30	68.0	10.3	95.0	59
157	PCSil30G25dmCrse	00-00-0000	100	25	49.0	10.0	93.0	79
158	PCSil30G25dmMed	00-00-0000	100	25	49.0	10.0	87.0	79
159	PCSil30G30dmCrse	00-00-0000	100	30	49.0	10.0	93.0	79
160	PCSil30G30dmMed	00-00-0000	100	30	49.0	10.0	87.0	79
161	PCSil30G35dmCrse	00-00-0000	100	35	49.0	10.0	93.0	79
162	PCSil30G35dmMed	00-00-0000	100	35	49.0	10.0	87.0	79
163	PCSil30G40dmCrse	00-00-0000	100	40	49.0	10.0	93.0	79
164	PCSil30G40dmMed	00-00-0000	100	40	49.0	10.0	87.0	79
165	PCSil40G30dmCrse	00-00-0000	100	30	45.0	9.0	90.0	80
166	PCSil40G30dmMed	00-00-0000	100	30	45.0	9.0	85.0	80
167	PCSil40G35dmCrse	00-00-0000	100	35	45.0	9.0	90.0	80
168	PCSil40G35dmMed	00-00-0000	100	35	45.0	9.0	85.0	80
169	PCSil40G40dmCrse	00-00-0000	100	40	45.0	9.0	90.0	80
170	PCSil40G40dmMed	00-00-0000	100	40	45.0	9.0	85.0	80
171	PCSil50G30dmCrse	00-00-0000	100	30	41.0	7.0	87.0	81
172	PCSil50G30dmMed	00-00-0000	100	30	41.0	7.0	82.0	81
173	PCSil50G35dmCrse	00-00-0000	100	35	41.0	7.0	87.0	81
174	PCSil50G35dmMed	00-00-0000	100	35	41.0	7.0	82.0	81
175	PCSil50G40dmCrse	00-00-0000	100	40	41.0	7.0	87.0	81
176	PCSil50G40dmMed	00-00-0000	100	40	41.0	7.0	82.0	81
177	UCSil30G25dmCrse	00-00-0000	100	25	49.0	10.0	93.0	79
178	UCSil30G25dmFine	00-00-0000	100	25	49.0	10.0	83.0	79
179	UCSil30G25dmMed	00-00-0000	100	25	49.0	10.0	87.0	79
180	UCSil30G30dmCrse	00-00-0000	100	30	49.0	10.0	93.0	79
181	UCSil30G30dmFine	00-00-0000	100	30	49.0	10.0	83.0	79
182	UCSil30G30dmMed	00-00-0000	100	30	49.0	10.0	87.0	79
183	UCSil30G35dmCrse	00-00-0000	100	35	49.0	10.0	93.0	79
184	UCSil30G35dmFine	00-00-0000	100	35	49.0	10.0	83.0	79
185	UCSil30G35dmMed	00-00-0000	100	35	49.0	10.0	87.0	79
186	UCSil30G40dmCrse	00-00-0000	100	40	49.0	10.0	93.0	79
187	UCSil30G40dmFine	00-00-0000	100	40	49.0	10.0	83.0	79
188	UCSil30G40dmMed	00-00-0000	100	40	49.0	10.0	87.0	79
189	UCSil40G30dmCrse	00-00-0000	100	30	45.0	9.0	90.0	80
190	UCSil40G30dmFine	00-00-0000	100	30	45.0	9.0	80.0	80
191	UCSil40G30dmMed	00-00-0000	100	30	45.0	9.0	85.0	80
192	UCSil40G35dmCrse	00-00-0000	100	35	45.0	9.0	90.0	80
193	UCSil40G35dmFine	00-00-0000	100	35	45.0	9.0	80.0	80
194	UCSil40G35dmMed	00-00-0000	100	35	45.0	9.0	85.0	80
195	UCSil40G40dmCrse	00-00-0000	100	40	45.0	9.0	90.0	80
196	UCSil40G40dmFine	00-00-0000	100	40	45.0	9.0	80.0	80
197	UCSil40G40dmMed	00-00-0000	100	40	45.0	9.0	85.0	80
198	UCSil50G NPNMed	00-00-0000	100	35	41.0	7.0	82.0	81
199	UCSil50G30dmCrse	00-00-0000	100	30	41.0	7.0	87.0	81
200	UCSil50G30dmFine	00-00-0000	100	30	41.0	7.0	77.0	81
201	UCSil50G30dmMed	00-00-0000	100	30	41.0	7.0	82.0	81
202	UCSil50G35dmCrse	00-00-0000	100	35	41.0	7.0	87.0	81
203	UCSil50G35dmFine	00-00-0000	100	35	41.0	7.0	77.0	81
204	UCSil50G35dmMed	00-00-0000	100	35	41.0	7.0	82.0	81

CP	Sol-P	NPN	NDFIP	ADFIP	UIP-1X	Fat	Ash	Degradation Rates					
								CHO-A	CHO-B1	CHO-B2	Prot-B1	Prot-B2	Prot-B3
%DM	%CP	%Sol-P	%CP	%CP	%CP	%DM	%DM	%/h	%/h	%/h	%/h	%/h	%/h
18.0	18.0	90.0	27.0	11.0		3.0	10.0	250	30	5	150	9	1.25
17.0	50.0	70.0	24.0	16.0		3.0	10.0	10	25	4	150	11	1.75
17.0	50.0	95.0	24.0	16.0		3.0	10.0	10	25	4	150	11	1.75
20	60	70	18	12		3	10	10	25	4	150	11	1.75
20	60	95	18	12		3	10	10	25	4	150	11	1.75
25	70	70	13	9		3	10	10	25	4	150	11	1.75
25	70	95	13	9		3	10	10	25	4	150	11	1.75
22.2	46	2.17	12	3		2.9	10.2	350	30	6	200	15	2
28	46	2.17	10	2.15		2.7	10	350	30	6	200	15	2
6.0	50.0	100.0	16.0	9.0		2.0	5.0	10	25	4	300	10	0.2
6.3	45.0	100.0	16.0	4.5		2.1	9.0	10	25	4	300	10	0.2
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	38	9	300	10	0.2
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	40	10	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	33	7	300	10	0.2
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	35	8	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	30	5	300	10	0.2
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	32	6	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	25	4	300	10	0.2
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	27	5	300	15	0.25
9.2	50.0	100.0	16.0	8.0		3.1	4.0	10	33	7	300	10	0.2
9.2	53.0	100.0	16.0	7.0		3.1	4.0	10	35	8	300	15	0.25
9.2	50.0	100.0	16.0	8.0		3.1	4.0	10	30	5	300	10	0.2
9.2	53.0	100.0	16.0	7.0		3.1	4.0	10	32	6	300	15	0.25
9.2	50.0	100.0	16.0	8.0		3.1	4.0	10	25	4	300	10	0.2
9.2	53.0	100.0	16.0	7.0		3.1	4.0	10	27	5	300	15	0.25
8.0	45.0	100.0	16.9	4.9		3.5	4.2	10	33	7	300	10	0.2
8.0	50.0	100.0	16.4	4.9		3.5	4.2	10	35	8	300	15	0.25
8.0	45.0	100.0	16.9	4.9		3.5	4.2	10	30	5	300	10	0.2
8.0	50.0	100.0	16.4	4.9		3.5	4.2	10	32	6	300	15	0.25
8.0	45.0	100.0	16.9	4.9		3.5	4.2	10	25	4	300	10	0.2
8.0	50.0	100.0	16.4	4.9		3.5	4.2	10	27	5	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	30	7	300	10	0.2
9.5	60.0	100.0	16.0	6.0		3.0	4.0	10	40	9	300	20	0.3
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	35	8	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	25	5	300	10	0.2
9.5	60.0	100.0	16.0	6.0		3.0	4.0	10	35	7	300	20	0.3
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	30	6	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	20	3	300	10	0.2
9.5	60.0	100.0	16.0	6.0		3.0	4.0	10	30	5	300	20	0.3
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	25	4	300	15	0.25
9.5	55.0	100.0	16.0	8.0		3.0	4.0	10	10	2	300	10	0.2
9.5	60.0	100.0	16.0	6.0		3.0	4.0	10	20	4	300	20	0.3
9.5	58.0	100.0	16.0	7.0		3.0	4.0	10	15	3	300	15	0.25
9.2	50.0	100.0	16.0	8.0		3.1	4.0	10	25	5	300	10	0.2
9.2	55.0	100.0	16.0	6.0		3.1	4.0	10	40	7	300	20	0.3
9.2	53.0	100.0	16.0	7.0		3.1	4.0	10	30	6	300	15	0.25
9.2	50.0	100.0	16.0	8.0		3.1	4.0	10	20	3	300	10	0.2
9.2	55.0	100.0	16.0	6.0		3.1	4.0	10	30	5	300	20	0.3
9.2	53.0	100.0	16.0	7.0		3.1	4.0	10	25	4	300	15	0.25
9.2	50.0	100.0	16.0	8.0		3.1	4.0	10	10	2	300	10	0.2
9.2	55.0	100.0	16.0	6.0		3.1	4.0	10	20	4	300	20	0.3
9.2	53.0	100.0	16.0	7.0		3.1	4.0	10	15	3	300	15	0.25
13.0	63.0	100.0	16.0	4.9		3.5	4.5	10	25	5	300	15	0.25
8.0	45.0	100.0	16.9	4.9		3.5	4.2	10	25	5	300	10	0.2
8.0	55.0	100.0	16.4	4.9		3.5	4.2	10	35	7	300	20	0.3
8.0	50.0	100.0	16.4	4.9		3.5	4.2	10	30	6	300	15	0.25
8.0	45.0	100.0	16.9	4.9		3.5	4.2	10	20	3	300	10	0.2
8.0	55.0	100.0	16.4	4.9		3.5	4.2	10	30	5	300	20	0.3
8.0	50.0	100.0	16.4	4.9		3.5	4.2	10	25	4	300	15	0.25

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
136	AlfPellet 18Cp46Ndf17LNdf	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
137	AlfSil 17Cp43Ndf20LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
138	AlfSil 17Cp46Ndf20LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
139	AlfSil 20Cp37Ndf17LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
140	AlfSil 20Cp40Ndf17LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
141	AlfSil 25Cp32Ndf15LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
142	AlfSil 25Cp35Ndf15LNDF	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
220	LegPs 24Cp38Ndf15Lndf	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
221	LegPs 28Cp33Ndf14Lndf	0.73	6.02	6.39	5	9.26	6.01	7.14	2.62	6.32	1.84
Grain-type forages											
155	CornSil Mex	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
156	CornSil Stalklage	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
157	PCSil30G25dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
158	PCSil30G25dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
159	PCSil30G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
160	PCSil30G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
161	PCSil30G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
162	PCSil30G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
163	PCSil30G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
164	PCSil30G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
165	PCSil40G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
166	PCSil40G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
167	PCSil40G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
168	PCSil40G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
169	PCSil40G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
170	PCSil40G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
171	PCSil50G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
172	PCSil50G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
173	PCSil50G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
174	PCSil50G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
175	PCSil50G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
176	PCSil50G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
177	UCSil30G25dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
178	UCSil30G25dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
179	UCSil30G25dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
180	UCSil30G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
181	UCSil30G30dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
182	UCSil30G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
183	UCSil30G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
184	UCSil30G35dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
185	UCSil30G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
186	UCSil30G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
187	UCSil30G40dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
188	UCSil30G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
189	UCSil40G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
190	UCSil40G30dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
191	UCSil40G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
192	UCSil40G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
193	UCSil40G35dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
194	UCSil40G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
195	UCSil40G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
196	UCSil40G40dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
197	UCSil40G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
198	UCSil50G NPNMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
199	UCSil50G30dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
200	UCSil50G30dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
201	UCSil50G30dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
202	UCSil50G35dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
203	UCSil50G35dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
204	UCSil50G35dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
1.4	0.2	0.3	0.05	2.5	0.08	0.21	0.2	10	0.13	300	31	0.3	21
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.74	0.27	0.33	0.41	2.35	0.16	0.31	0	11	0	280	50	0	41
1.32	0.31	0.26	0.05	2.85	0.02	0.28	0.65	12	0.16	252	32	0.18	20
1.32	0.31	0.26	0.05	2.85	0.02	0.28	0.65	12	0.16	252	32	0.18	20
1.71	0.3	0.36	0.35	2.21	0.08	0.25	0.09	14	0	153	44	0	24
1.71	0.3	0.36	0	2.27	0.21	0.48	0.16	7	0	164	46	0.02	27
0.2	0.1	0.4	0	1.43	0.03	0.17	0.06	5	0	200	34	0	21
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
136	AlfPellet 18Cp46Ndf17LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
137	AlfSil 17Cp43Ndf20LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
138	AlfSil 17Cp46Ndf20LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
139	AlfSil 20Cp37Ndf17LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
140	AlfSil 20Cp40Ndf17LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
141	AlfSil 25Cp32Ndf15LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
142	AlfSil 25Cp35Ndf15LNDF	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
220	LegPs 24Cp38Ndf15Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
221	LegPs 28Cp33Ndf14Lndf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Grain-type forages															
155	CornSil Mex	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
156	CornSil Stalklage	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
157	PCSil30G25dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
158	PCSil30G25dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
159	PCSil30G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
160	PCSil30G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
161	PCSil30G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
162	PCSil30G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
163	PCSil30G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
164	PCSil30G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
165	PCSil40G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
166	PCSil40G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
167	PCSil40G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
168	PCSil40G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
169	PCSil40G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
170	PCSil40G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
171	PCSil50G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
172	PCSil50G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
173	PCSil50G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
174	PCSil50G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
175	PCSil50G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
176	PCSil50G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
177	UCSil30G25dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
178	UCSil30G25dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
179	UCSil30G25dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
180	UCSil30G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
181	UCSil30G30dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
182	UCSil30G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
183	UCSil30G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
184	UCSil30G35dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
185	UCSil30G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
186	UCSil30G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
187	UCSil30G40dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
188	UCSil30G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
189	UCSil40G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
190	UCSil40G30dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
191	UCSil40G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
192	UCSil40G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
193	UCSil40G35dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
194	UCSil40G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
195	UCSil40G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
196	UCSil40G40dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
197	UCSil40G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
198	UCSil50G NPNMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
199	UCSil50G30dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
200	UCSil50G30dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
201	UCSil50G30dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
202	UCSil50G35dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
203	UCSil50G35dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
204	UCSil50G35dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	87	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	85	22	100	100	100	80	95	50
100	87	20	100	100	100	80	95	50
100	80	22	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50
100	75	22	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	60	20	100	100	100	80	95	50
100	60	20	100	100	100	80	95	50
100	60	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	60	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	60	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
205	UCSil50G40dmCrse	00-00-0000	100	40	41.0	7.0	87.0	81
206	UCSil50G40dmFine	00-00-0000	100	40	41.0	7.0	77.0	81
207	UCSil50G40dmMed	00-00-0000	100	40	41.0	7.0	82.0	81
208	Cornstlk Grazing	00-00-0000	100	50	65.0	10.0	100.0	80
238	RyeSil 21Cp53Ndf7LNdf	00-00-0000	100	18	53.0	7.0	90.0	7
239	SorgGrainSil 9Cp64Ndf9LNdf	00-00-0000	100	30	64.0	9.4	90.0	56.4
246	UCornSil30G NPNMed	00-00-0000	100	33	49.0	10.0	87.0	79
247	UCornSil40G NPNMed	00-00-0000	100	33	45.0	9.0	75.0	80
249	WheatSil 13Cp61Ndf15LNdf	00-00-0000	100	35	60.7	14.8	90.0	69.8
Energy concentrates								
34	BarleyGrn Heavy	00-00-0000	0	88	18.1	11.0	35.0	96
35	BarleyGrn HeavyFlkd	00-00-0000	0	87	18.1	11.0	40.0	96
36	BarleyGrn Light	00-00-0000	0	88	28.0	11.0	40.0	96
39	CrnEar45DryCrse	00-00-0000	0	87	31.0	7.1	65.0	98.7
40	CrnEar45DryFine	00-00-0000	0	87	31.0	7.1	35.0	98.7
41	CrnEar45DryMed	00-00-0000	0	87	31.0	7.1	45.0	98.7
42	CrnEar45Hm22%Crse	00-00-0000	0	78	31.0	7.1	60.0	95.6
43	CrnEar45Hm22%Fine	00-00-0000	0	78	31.0	7.1	60.0	95.6
44	CrnEar45Hm22%Med	00-00-0000	0	78	31.0	7.1	60.0	95.6
45	CrnEar45Hm28%Crse	00-00-0000	0	72	31.0	7.1	75.0	95.6
46	CrnEar45Hm28%Fine	00-00-0000	0	72	31.0	7.1	75.0	95.6
47	CrnEar45Hm28%Med	00-00-0000	0	72	31.0	7.1	75.0	95.6
48	CrnEar45Hm32%Crse	00-00-0000	0	68	31.0	7.1	80.0	95.6
49	CrnEar45Hm32%Fine	00-00-0000	0	68	31.0	7.1	80.0	95.6
50	CrnEar45Hm32%Med	00-00-0000	0	68	31.0	7.1	80.0	95.6
51	CrnGrn45 Hm32%Fine	00-00-0000	0	68	10.5	2.2	80.0	95
52	CrnGrn45DryCrack	00-00-0000	0	88	10.5	2.2	65.0	97.5
53	CrnGrn45DryCrse	00-00-0000	0	88	10.5	2.2	60.0	97.5
54	CrnGrn45DryFine	00-00-0000	0	88	10.5	2.2	25.0	97.5
55	CrnGrn45DryMed	00-00-0000	0	88	10.5	2.2	40.0	97.5
56	CrnGrn45Flkd22lb	00-00-0000	0	88	10.5	2.2	65.0	97.5
57	CrnGrn45Flkd24lb	00-00-0000	0	88	10.5	2.2	65.0	97.5
58	CrnGrn45Flkd28lb	00-00-0000	0	88	10.5	2.2	65.0	97.5
59	CrnGrn45Hm22%Crse	00-00-0000	0	78	10.5	2.2	60.0	95
60	CrnGrn45Hm22%Fine	00-00-0000	0	78	10.5	2.2	60.0	95
61	CrnGrn45Hm22%Med	00-00-0000	0	78	10.5	2.2	60.0	95
62	CrnGrn45Hm24%Crse	00-00-0000	0	76	10.5	2.2	70.0	95
63	CrnGrn45Hm24%Fine	00-00-0000	0	76	10.5	2.2	70.0	95
64	CrnGrn45Hm24%Med	00-00-0000	0	76	10.5	2.2	70.0	95
65	CrnGrn45Hm28%Crse	00-00-0000	0	72	10.5	2.2	75.0	95
66	CrnGrn45Hm28%Fine	00-00-0000	0	72	10.5	2.2	75.0	95
67	CrnGrn45Hm28%Med	00-00-0000	0	72	10.5	2.2	75.0	95
68	CrnGrn45Hm32%Crse	00-00-0000	0	68	10.5	2.2	80.0	95
69	CrnGrn45Hm32%Med	00-00-0000	0	68	10.5	2.2	80.0	95
70	CrnGrn45StmRl34lb	00-00-0000	0	88	10.5	2.2	60.0	97.5
71	CrnGrn45StmRl38lb	00-00-0000	0	88	10.5	2.2	60.0	97.5
72	CrnGrn45StmRl42lb	00-00-0000	0	88	10.5	2.2	60.0	97.5
73	CrnGrn56DryCrack	00-00-0000	0	88	9.0	2.2	65.0	98.5
74	CrnGrn56DryFine	00-00-0000	0	88	9.0	2.2	25.0	98.5
75	CrnGrn56DryMed	00-00-0000	0	88	9.0	2.2	40.0	98.5
76	CrnGrn56Flkd22lb	00-00-0000	0	86	9.0	2.2	65.0	98.5
77	CrnGrn56Flkd24lb	00-00-0000	0	86	9.0	2.2	65.0	98.5
78	CrnGrn56Flkd28lb	00-00-0000	0	86	9.0	2.2	65.0	98.5
79	CrnGrn56Hm22%Crse	00-00-0000	0	78	9.0	2.2	60.0	95
80	CrnGrn56Hm22%Fine	00-00-0000	0	78	9.0	2.2	60.0	95
81	CrnGrn56Hm22%Med	00-00-0000	0	78	9.0	2.2	60.0	95
82	CrnGrn56Hm24%Crse	00-00-0000	0	76	9.0	2.2	70.0	95
83	CrnGrn56Hm24%Fine	00-00-0000	0	76	9.0	2.2	70.0	95
84	CrnGrn56Hm24%Med	00-00-0000	0	76	9.0	2.2	70.0	95
85	CrnGrn56Hm28%Crse	00-00-0000	0	72	9.0	2.2	75.0	95

CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	Degradation Rates CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
8.0	45.0	100.0	16.9	4.9		3.5	4.2	10	10	2	300	10	0.2
8.0	55.0	100.0	16.4	4.9		3.5	4.2	10	20	4	300	20	0.3
8.0	50.0	100.0	16.4	4.9		3.5	4.2	10	15	3	300	15	0.25
6.5	20.0	95.0	31.4	13.6		2.1	7.2	250	30	4	135	4	0.09
21.0	60.0	100.0	15.0	5.0		6.0	7.0	10	30	3	135	11	0.09
9.4	45.0	100.0	50.0	5.0		2.6	5.9	10	20	4	175	12	0.2
13.0	70.0	100.0	12.0	6.0		3.0	4.0	10	28	6	300	10	0.25
13.2	66.0	100.0	16.0	7.0		3.1	4.0	10	28	6	300	15	0.25
12.5	45.0	100.0	27.0	8.0		2.5	7.5	10	50	6	300	10	0.2
13.2	17.0	8.0	8.0	5.0		2.2	2.4	300	30	5	300	12	0.35
13.2	11.0	8.0	8.0	5.0		2.2	2.4	300	40	6	300	11	0.35
14.0	17.0	8.0	8.0	5.0		2.3	4.0	300	30	5	300	12	0.35
10.0	10.0	70.0	18.0	8.0		3.7	1.9	200	10	4	135	6	0.1
10.0	10.0	70.0	18.0	8.0		3.7	1.9	200	20	6	135	8	0.1
10.0	10.0	70.0	18.0	8.0		3.7	1.9	200	15	5	135	7	0.1
10.0	32.0	100.0	18.9	8.0		3.7	1.9	75	20	3	135	8	0.1
10.0	32.0	100.0	18.9	8.0		3.7	1.9	75	30	5	135	8	0.1
10.0	32.0	100.0	18.9	8.0		3.7	1.9	75	25	4	135	8	0.1
10.0	35.0	100.0	18.8	8.0		3.7	1.9	50	25	4	135	9	0.1
10.0	35.0	100.0	18.8	8.0		3.7	1.9	50	35	6	135	9	0.1
10.0	35.0	100.0	18.8	8.0		3.7	1.9	50	30	5	135	9	0.1
10.0	37.0	100.0	18.7	8.0		3.7	1.9	25	30	5	135	10	0.1
10.0	37.0	100.0	18.7	8.0		3.7	1.9	25	40	7	135	10	0.1
10.0	37.0	100.0	18.7	8.0		3.7	1.9	25	35	6	135	10	0.1
9.8	50.0	100.0	15.9	5.3		4.3	1.6	25	40	9	135	13	0.15
9.8	11.0	70.0	15.0	5.3		4.3	1.6	150	15	4	135	6	0.09
9.8	11.0	70.0	15.0	5.3		4.3	1.6	200	10	4	135	6	0.1
9.8	11.0	70.0	15.0	5.3		4.3	1.6	200	30	6	135	8	0.1
9.8	11.0	70.0	15.0	5.3		4.3	1.6	200	25	5	135	7	0.1
9.8	8.0	80.0	15.0	5.3		4.3	1.6	300	40	8	135	6	0.08
9.8	8.0	80.0	15.0	5.3		4.3	1.6	300	30	7	135	6	0.08
9.8	8.0	80.0	15.0	5.3		4.3	1.6	300	25	6	135	6	0.08
9.8	35.0	70.0	16.2	5.3		4.3	1.6	75	15	4	135	5	0.15
9.8	35.0	70.0	16.2	5.3		4.3	1.6	75	25	6	135	5	0.15
9.8	35.0	70.0	16.2	5.3		4.3	1.6	75	20	5	135	5	0.15
9.8	40.0	70.0	16.1	5.3		4.3	1.6	60	20	5	135	7	0.15
9.8	40.0	70.0	16.1	5.3		4.3	1.6	60	30	7	135	7	0.15
9.8	40.0	70.0	16.1	5.3		4.3	1.6	60	25	6	135	7	0.15
9.8	45.0	100.0	16.0	5.3		4.3	1.6	50	25	6	135	10	0.15
9.8	45.0	100.0	16.0	5.3		4.3	1.6	50	35	8	135	10	0.15
9.8	45.0	100.0	16.0	5.3		4.3	1.6	50	30	7	135	10	0.15
9.8	50.0	100.0	15.9	5.3		4.3	1.6	25	30	7	135	13	0.15
9.8	50.0	100.0	15.9	5.3		4.3	1.6	25	35	8	135	13	0.15
9.8	8.0	80.0	15.0	5.3		4.3	1.6	300	28	6	135	5	0.08
9.8	8.0	80.0	15.0	5.3		4.3	1.6	300	25	5	135	5	0.08
9.8	8.0	80.0	15.0	5.3		4.3	1.6	300	23	4	135	5	0.08
9.8	11.0	70.0	15.0	5.0		4.3	1.6	150	10	4	135	6	0.09
9.8	11.0	70.0	15.0	5.0		4.3	1.6	200	30	6	135	8	0.1
9.8	11.0	70.0	15.0	5.0		4.3	1.6	200	25	5	135	7	0.1
9.8	8.0	80.0	15.0	5.0		4.3	1.6	300	40	7	135	5	0.08
9.8	8.0	80.0	15.0	5.0		4.3	1.6	300	35	6	135	5	0.08
9.8	8.0	80.0	15.0	5.0		4.3	1.6	300	30	5	135	5	0.08
9.8	35.0	100.0	16.2	5.3		4.3	1.6	75	15	3	135	8	0.15
9.8	35.0	100.0	16.2	5.3		4.3	1.6	75	25	3	135	8	0.15
9.8	35.0	100.0	16.2	5.3		4.3	1.6	75	20	3	135	8	0.15
9.8	40.0	100.0	16.1	5.3		4.3	1.6	60	18	4	135	9	0.15
9.8	40.0	100.0	16.1	5.3		4.3	1.6	60	28	4	135	9	0.15
9.8	40.0	100.0	16.1	5.3		4.3	1.6	60	23	4	135	9	0.15
9.8	45.0	100.0	16.0	5.3		4.3	1.6	50	25	5	135	10	0.15

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
205	UCSil50G40dmCrse	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
206	UCSil50G40dmFine	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
207	UCSil50G40dmMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
208	Cornstlk Grazing	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
238	RyeSil 21Cp53Ndf7LNdf	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
239	SorgGrainSil 9Cp64Ndf9LNdf	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.75
246	UCornSil30G NPNMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
247	UCornSil40G NPNMed	0.8	2.13	1.87	2.13	6.4	2.4	3.2	1.07	2.94	0.11
249	WheatSil 13Cp61Ndf15LNdf	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
Energy concentrates											
34	BarleyGrn Heavy	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
35	BarleyGrn HeavyFlkd	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
36	BarleyGrn Light	0.81	3.07	4.83	3.15	6.83	3.92	4.88	2.29	5.6	1.26
39	CrnEar45DryCrse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
40	CrnEar45DryFine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
41	CrnEar45DryMed	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
42	CrnEar45Hm22%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
43	CrnEar45Hm22%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
44	CrnEar45Hm22%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
45	CrnEar45Hm28%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
46	CrnEar45Hm28%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
47	CrnEar45Hm28%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
48	CrnEar45Hm32%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
49	CrnEar45Hm32%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
50	CrnEar45Hm32%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
51	CrnGrn45 Hm32%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
52	CrnGrn45DryCrack	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
53	CrnGrn45DryCrse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
54	CrnGrn45DryFine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
55	CrnGrn45DryMed	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
56	CrnGrn45Flkd22lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
57	CrnGrn45Flkd24lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
58	CrnGrn45Flkd28lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
59	CrnGrn45Hm22%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
60	CrnGrn45Hm22%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
61	CrnGrn45Hm22%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
62	CrnGrn45Hm24%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
63	CrnGrn45Hm24%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
64	CrnGrn45Hm24%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
65	CrnGrn45Hm28%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
66	CrnGrn45Hm28%Fine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
67	CrnGrn45Hm28%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
68	CrnGrn45Hm32%Crse	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
69	CrnGrn45Hm32%Med	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
70	CrnGrn45StmRl34lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
71	CrnGrn45StmRl38lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
72	CrnGrn45StmRl42lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
73	CrnGrn56DryCrack	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
74	CrnGrn56DryFine	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
75	CrnGrn56DryMed	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
76	CrnGrn56Flkd22lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
77	CrnGrn56Flkd24lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
78	CrnGrn56Flkd28lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
79	CrnGrn56Hm22%Crse	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
80	CrnGrn56Hm22%Fine	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
81	CrnGrn56Hm22%Med	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
82	CrnGrn56Hm24%Crse	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
83	CrnGrn56Hm24%Fine	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
84	CrnGrn56Hm24%Med	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
85	CrnGrn56Hm28%Crse	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.62	0.09	0.45	0	1.63	0.07	0.17	0.06	5	0	200	34	0	21
0.65	0.32	0	0	1.67	0	0	0	5	0	0	74	0	19
0.49	0.22	0.28	0.11	1.72	0.02	0.12	0.3	35	0	285	73	0.22	32
0.23	0.21	0.13	0	0.95	0.01	0.12	0.06	4	0	184	31	0.03	25
0.31	0.27	0.22	0	1.22	0.01	0.12	0.06	4	0	184	31	0.03	25
0.44	0.29	0.17	0.07	2.24	0.07	0.24	0.05	14	0	190	130	0	0
0.05	0.35	0.12	0.13	0.57	0.01	0.15	0.35	5	0.05	60	18	0.18	13
0.05	0.35	0.12	0.13	0.57	0.01	0.15	0.35	5	0.05	60	18	0.18	13
0.06	0.39	0.15	0.13	0.52	0.03	0.17	0.19	9	0.05	70	18	0.18	49
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.07	0.27	0.14	0.05	0.53	0.02	0.16	0.31	8	0.03	55	14	0.14	14
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.04	0.3	0.15	0.06	0.32	0.01	0.12	0.43	3	0.07	39	6	0.11	13
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	13
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	13
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	13
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
205	UCSil50G40dmCrse	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
206	UCSil50G40dmFine	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
207	UCSil50G40dmMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
208	Cornstlk Grazing	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
238	RyeSil 21Cp53Ndf7LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
239	SorgGrainSil 9Cp64Ndf9LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
246	UCornSil30G NPNMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
247	UCornSil40G NPNMed	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
249	WheatSil 13Cp61Ndf15LNdf	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Energy concentrates															
34	BarleyGrn Heavy	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
35	BarleyGrn HeavyFlkd	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
36	BarleyGrn Light	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
39	CrnEar45DryCrse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
40	CrnEar45DryFine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
41	CrnEar45DryMed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
42	CrnEar45Hm22%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
43	CrnEar45Hm22%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
44	CrnEar45Hm22%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
45	CrnEar45Hm28%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
46	CrnEar45Hm28%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
47	CrnEar45Hm28%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
48	CrnEar45Hm32%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
49	CrnEar45Hm32%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
50	CrnEar45Hm32%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
51	CrnGrn45 Hm32%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
52	CrnGrn45DryCrack	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
53	CrnGrn45DryCrse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
54	CrnGrn45DryFine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
55	CrnGrn45DryMed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
56	CrnGrn45Flkd22lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
57	CrnGrn45Flkd24lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
58	CrnGrn45Flkd28lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
59	CrnGrn45Hm22%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
60	CrnGrn45Hm22%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
61	CrnGrn45Hm22%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
62	CrnGrn45Hm24%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
63	CrnGrn45Hm24%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
64	CrnGrn45Hm24%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
65	CrnGrn45Hm28%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
66	CrnGrn45Hm28%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
67	CrnGrn45Hm28%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
68	CrnGrn45Hm32%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
69	CrnGrn45Hm32%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
70	CrnGrn45StmRl34lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
71	CrnGrn45StmRl38lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
72	CrnGrn45StmRl42lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
73	CrnGrn56DryCrack	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
74	CrnGrn56DryFine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
75	CrnGrn56DryMed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
76	CrnGrn56Flkd22lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
77	CrnGrn56Flkd24lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
78	CrnGrn56Flkd28lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
79	CrnGrn56Hm22%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
80	CrnGrn56Hm22%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
81	CrnGrn56Hm22%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
82	CrnGrn56Hm24%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
83	CrnGrn56Hm24%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
84	CrnGrn56Hm24%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
85	CrnGrn56Hm28%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	60	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	60	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	95	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	95	23	100	100	100	80	95	50
100	70	15	100	100	100	80	95	50
100	75	10	100	100	100	80	95	50
100	85	25	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	97	15	100	100	100	80	95	50
100	95	15	100	100	100	80	95	50
100	90	15	100	100	100	80	95	50
100	78	16	100	100	100	80	95	50
100	83	16	100	100	100	80	95	50
100	80	16	100	100	100	80	95	50
100	80	18	100	100	100	80	95	50
100	85	18	100	100	100	80	95	50
100	82	18	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	23	100	100	100	80	95	50
100	90	23	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	85	25	100	100	100	80	95	50
100	80	22	100	100	100	80	95	50
100	97	20	100	100	100	80	95	50
100	95	20	100	100	100	80	95	50
100	90	20	100	100	100	80	95	50
100	78	16	100	100	100	80	95	50
100	83	16	100	100	100	80	95	50
100	80	16	100	100	100	80	95	50
100	80	18	100	100	100	80	95	50
100	85	18	100	100	100	80	95	50
100	82	18	100	100	100	80	95	50
100	83	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
86	CrnGrn56Hm28%Fine	00-00-0000	0	72	9.0	2.2	75.0	95
87	CrnGrn56Hm28%Med	00-00-0000	0	72	9.0	2.2	75.0	95
88	CrnGrn56Hm32%Crse	00-00-0000	0	68	9.0	2.2	80.0	95
89	CrnGrn56Hm32%Fine	00-00-0000	0	68	9.0	2.2	80.0	95
90	CrnGrn56Hm32%Med	00-00-0000	0	68	9.0	2.2	80.0	95
91	CrnGrn56StmRl34lb	00-00-0000	0	86	9.0	2.2	60.0	98.5
92	CrnGrn56StmRl38lb	00-00-0000	0	86	9.0	2.2	60.0	98.5
93	CrnGrn56StmRl42lb	00-00-0000	0	86	9.0	2.2	60.0	98.5
94	CrnHominy	00-00-0000	0	90	23.0	2.2	9.0	92
97	Molasses Beet	00-00-0000	0	77.9	0.0	0.0	0.0	0
98	Molasses Cane	00-00-0000	0	74.3	0.0	0.0	0.0	0
99	OatGrn32lb	00-00-0000	0	91	42.0	9.5	34.0	94.2
100	OatGrn38lb	00-00-0000	0	89	32.0	9.4	34.0	94.2
104	Rye Grain	00-00-0000	0	88	19.0	5.3	34.0	90
105	SorgGrn DryCrse	00-00-0000	0	89	23.0	6.1	60.0	90
106	SorgGrnDryFine	00-00-0000	0	89	23.0	6.1	30.0	90
107	SorgGrnDryMed	00-00-0000	0	89	23.0	6.1	40.0	90
108	SorgGrnDryRoll50lb	00-00-0000	0	89	23.0	6.1	80.0	90
109	SorgGrnFlkd22lb	00-00-0000	0	85	23.0	6.1	75.0	90
110	SorgGrnFlkd28lb	00-00-0000	0	87	23.0	6.1	80.0	90
111	SorgGrnHm22%	00-00-0000	0	76	23.0	6.1	40.0	90
112	SorgGrnHm26%	00-00-0000	0	74	23.0	6.1	60.0	90
113	SorgGrnHm30%	00-00-0000	0	70	23.0	6.1	80.0	90
114	Soybean Hulls	00-00-0000	0	91	66.3	3.0	20.0	89.5
115	Tallow	00-00-0000	0	99	0.0	0.0	0.0	0
119	WheatGrn DryHrdMed	00-00-0000	0	89	11.7	6.3	30.0	97
Protein concentrates								
298	Blood Meal	00-00-0000	0	90	37.75	0	0	0
299	BrewersGrn Dry	00-00-0000	0	92	48.7	13.04	35	85
300	BrewersGrn Wet	00-00-0000	0	21	42	9.52	35	95
301	Canola Meal	00-00-0000	0	90	29	12.76	4.8	81
302	CornDist Solubles	00-00-0000	0	91	23	4.35	4	95
303	CornDistGrn Dark	00-00-0000	0	91	46	13	4.1	75
304	CornDistGrn Inter	00-00-0000	0	91	46	11	4.1	71
305	CornDistGrn Light	00-00-0000	0	91	46	10	4.1	70
306	CornDistGrn Vdark	00-00-0000	0	91	46	15	4.1	76
307	CornDistGrn Wet	00-00-0000	0	50	40	10	4.1	70
308	Corngerm Meal	00-00-0000	0	91.15	9	1.7	48	70
309	CornGlut Feed	00-00-0000	0	90	36.2	1.7	36.2	78
310	CornGlut Meal	00-00-0000	0	91	8.9	1.7	36	90
311	Cottonsd DeLint	00-00-0000	0	92	40	18	60	76
312	Cottonsd Meal 41CpSolv	00-00-0000	0	92	28.9	28.9	36	75
313	Cottonsd WLint	00-00-0000	0	92	51.6	15	85	76
314	Feath Meal/+Bld	00-00-0000	0	94.12	10	0	23	0
315	Feath Meal/-Bld	00-00-0000	0	92.53	10	0	23	0
316	Feather Meal	00-00-0000	0	90	0	0	0	0
317	Fish Meal	00-00-0000	0	90	0	0	0	0
318	Linseed Mealsolv	00-00-0000	0	90	25	24	20	90
319	Lupins	00-00-0000	0	90	33	5.09	23	6.55
320	Meat Meal	00-00-0000	0	93.92	0	0	0	0
321	Meatbone Meal	00-00-0000	0	95	0	0	0	0
322	Peanut MealSolv	00-00-0000	0	92	14	10	30	93.3
323	Safflower Meal	00-00-0000	0	92.8	54.4	27.47	23	50
324	Soybean Meal44CpSolv	00-00-0000	0	90	14	3	23	93.4
325	Soybean Meal49CpSolv	00-00-0000	0	90	8	2.5	23	95.8
326	Soybean Whlextrd	00-00-0000	0	93.62	13	1.54	50	96
327	Soybean Whlraw	00-00-0000	0	90	13	1.54	50	96
328	Soybean Whlroast	00-00-0000	0	93	13	1.54	50	96
329	Sunflower MealSolv	00-00-0000	0	90	40	30	9	30
330	Urea 281Cp	00-00-0000	0	99	0	0	0	0

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
9.8	45.0	100.0	16.0	5.3		4.3	1.6	50	35	5	135	10	0.15
9.8	45.0	100.0	16.0	5.3		4.3	1.6	50	30	5	135	10	0.15
9.8	50.0	100.0	15.9	5.3		4.3	1.6	25	30	5	135	11	0.15
9.8	50.0	100.0	15.9	5.3		4.3	1.6	25	40	7	135	11	0.15
9.8	50.0	100.0	15.9	5.3		4.3	1.6	25	35	6	135	11	0.15
9.8	8.0	80.0	15.0	5.0		4.3	1.6	300	28	5	135	4	0.08
9.8	8.0	80.0	15.0	5.0		4.3	1.6	300	25	4	135	4	0.08
9.8	8.0	80.0	15.0	5.0		4.3	1.6	300	23	4	135	4	0.08
11.5	18.0	35.0	8.0	5.0		7.3	1.0	150	20	4	150	4	0.09
8.5	100.0	100.0	0.0	0.0		0.0	11.4	500	30	3	300	11	0.25
5.8	100.0	100.0	0.0	0.0		0.0	13.3	500	30	20	350	11	0.25
13.1	31.7	33.9	11.0	5.0		4.9	5.0	300	35	3	325	12	0.35
13.3	31.7	33.9	11.0	5.0		5.4	3.0	300	35	2	325	12	0.35
13.8	53.0	88.7	7.0	4.0		1.7	2.0	300	40	4	300	12	0.35
12.4	12.0	70.0	10.0	5.0		3.1	2.0	150	4	3	135	5	0.08
12.4	12.0	70.0	10.0	5.0		3.1	2.0	150	12	5	135	7	0.12
12.4	12.0	70.0	10.0	5.0		3.1	2.0	150	8	4	135	6	0.1
12.4	8.0	80.0	10.0	5.0		3.1	2.0	250	10	4	135	6	0.1
12.4	8.0	80.0	10.0	5.0		3.1	2.0	250	25	6	135	5	0.08
12.4	8.0	80.0	10.0	5.0		3.1	2.0	250	15	5	135	4	0.06
12.4	18.0	90.0	10.0	5.0		3.1	2.0	80	10	4.8	135	6	0.12
12.4	28.0	95.0	10.0	5.0		3.1	2.0	60	15	5.5	135	8	0.13
12.4	35.0	100.0	10.0	5.0		3.1	2.0	40	20	6	135	10	0.15
12.1	32.5	69.8	20.0	10.0		2.1	5.0	350	40	8	150	18	0.15
0.0	0.0	0.0	0.0	0.0		100.0	0.0	300	0	0	0	0	0
14.2	30.0	73.0	4.0	2.0		2.0	2.0	300	40	6	300	12	0.35
93	3.66	94.06	40.59	1		1.7	2.62	250	0	0	135	3	0.09
29.2	4	70.73	40	12		10.8	4.8	300	38	6	150	6	0.5
26	8	50	38	10		6.5	4.8	300	38	6	150	8	0.5
40.9	32.4	34.72	10.64	6.38		3.47	7.1	300	35	4	160	10	0.15
29.7	44	100	55	13		9.2	8	300	17	7	150	6	0.5
30.4	6	89	45	21		9.8	4	300	17	7	150	6	0.5
30.4	6	89	44	18		10.7	4.6	300	17	7	150	6	0.5
30.4	6	89	40	13		9.8	4	300	17	7	150	6	0.5
30.4	6	89	47	36		9.8	4	300	17	7	150	6	0.5
29.7	25	89	45	12		9.2	8	300	17	7	150	6	0.5
27.3	39.51	89.69	7.11	6.89		7.13	4.1	300	25	3	175	8	0.25
25.6	49	92.57	8	2		3.91	6.9	300	50	5	150	4	0.5
67.2	4	3	11	2		2.56	2.86	300	15	6	150	3	0.5
23	40	2	10	6		18.5	5	300	30	4	175	8	0.25
46.1	20	40	10	8		3.15	7	300	25	3	175	8	0.25
24.4	40	2	10	6		17.5	4.16	300	30	6	175	8	0.25
88.02	10.38	83.14	57.65	16.25		9.08	2.89	250	30	5	135	3	0.09
88.17	8.06	98.6	49.82	21.59		9.56	2.17	250	30	5	135	3	0.09
85.8	3.75	4.9	50	2.38		3.2	3.8	250	30	5	135	3	0.09
67.9	21	84	24.93	1		10.7	20.6	300	50	7	100	1	0.8
38.3	20	50	10	2.38		1.5	6.5	300	35	6	230	11	0.2
34	26	2.82	4.94	2		5.5	5.1	300	25	5	230	11	0.2
58.2	13.36	94.23	56.4	3.16		11	21.3	0	0	0	150	6	0.12
50.01	16.09	93.81	42.72	4.92		9.53	29.74	0	0	0	150	6	0.12
52	33	34.72	10	1		1.6	7.8	300	45	6	230	13	0.2
27.3	18	36.67	9.89	8.79		1.4	5.3	300	35	4	200	11	0.15
49	33	36.98	3.2	2		1.5	7.34	300	25	6	230	11	0.2
55	20	53.81	3.1	2		1	6.7	300	25	6	230	11	0.2
42.8	8	80	11	3		18.8	6	300	25	5	150	5	0.18
42.8	44	80	6.03	2		18.8	6	300	25	5	200	10	0.2
42.8	6	61	11.49	3.44		18.8	5.8	300	25	5	150	5	0.18
25.9	30	36.67	8	5		1.2	6	300	35	4	160	10	0.15
281	100	100	0	0		0	-181	0	0	0	400	0	0

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
86	CrnGrn56Hm28%Fine	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
87	CrnGrn56Hm28%Med	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
88	CrnGrn56Hm32%Crse	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
89	CrnGrn56Hm32%Fine	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
90	CrnGrn56Hm32%Med	0.99	2.47	4.11	3.33	12.1	3.85	4.78	2.7	4.99	0.37
91	CrnGrn56StmRl34lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
92	CrnGrn56StmRl38lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
93	CrnGrn56StmRl42lb	1.12	1.65	1.82	2.8	10.73	2.69	3.75	2.06	3.65	0.37
94	CrnHominy	1.11	3.2	5.42	3.67	10.83	3.91	5.19	2.87	4.88	0.11
97	Molasses Beet	0	0	0	0	0	0	0	0	0	0
98	Molasses Cane	0	0	0	0	0	0	0	0	0	0
99	OatGrn32lb	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
100	OatGrn38lb	2.12	2.02	4.38	2.16	7.7	3.84	0	1.8	5.86	1.28
104	Rye Grain	1.38	3.47	4.42	2.97	5.8	3.84	4.64	2.1	4.64	0.94
105	SorgGrn DryCrse	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
106	SorgGrnDryFine	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
107	SorgGrnDryMed	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
108	SorgGrnDryRoll50lb	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
109	SorgGrnFlkd22lb	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
110	SorgGrnFlkd28lb	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
111	SorgGrnHm22%	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
112	SorgGrnHm26%	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
113	SorgGrnHm30%	1.07	3.17	3.44	2.94	12.82	4.23	4.87	2.06	4.95	0.75
114	Soybean Hulls	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	1.64
115	Tallow	0	0	0	0	0	0	0	0	0	0
119	WheatGrn DryHrdMed	0.98	3	4.33	2.82	13.64	3.98	4.5	2.23	4.84	1.06
Protein concentrates											
298	Blood Meal	1.07	9.34	5.01	4.73	13.4	0.88	9.08	6.45	7.86	1.88
299	BrewersGrn Dry	1.26	2.15	2.61	2.76	8.46	3.53	3.78	1.47	4.8	0.37
300	BrewersGrn Wet	1.7	3.23	4.69	3.43	9.18	5.71	5.95	1.9	5.31	1.36
301	Canola Meal	1.4	6.67	6.78	4.85	7.99	4.94	6.44	4.04	4.68	1.22
302	CornDist Solubles	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
303	CornDistGrn Dark	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
304	CornDistGrn Inter	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
305	CornDistGrn Light	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
306	CornDistGrn Vdark	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
307	CornDistGrn Wet	1.2	2.06	4.15	3.12	9.07	2.78	5.24	1.82	4.2	1.64
308	Corngerm Meal	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
309	CornGlut Feed	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
310	CornGlut Meal	2.09	1.24	3.17	2.93	16.22	4.34	5.04	2.45	6.48	0.37
311	Cottonsd DeLint	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
312	Cottonsd Meal 41CpSolv	0.99	4.5	10.59	3.39	6.31	3.62	5.02	3.45	5.47	1.74
313	Cottonsd WLint	0.63	3.85	10.4	3.45	6.33	3.77	5.27	3.14	5.85	1.74
314	Feath Meal/+Bld	0.49	2.57	7.42	4.17	8.31	4.6	7.95	0.94	5.21	0.8
315	Feath Meal/-Bld	0.49	2.57	7.42	4.17	8.31	4.6	7.95	0.94	5.21	0.8
316	Feather Meal	0.49	2.57	7.42	4.17	8.31	4.6	7.95	0.94	5.21	0.8
317	Fish Meal	2.84	7.13	7.19	4.17	7.01	4.53	4.81	2.3	4.33	1.52
318	Linseed Mealsolv	1.95	4.31	10.7	4.22	6.8	5.37	5.76	2.52	5.25	1.63
319	Lupins	1.01	7.06	9.37	3.53	6.93	4.08	4.62	2.48	4.62	0.76
320	Meat Meal	0.84	5.6	8.28	2.52	5.46	2.43	3.67	1.44	3.03	0
321	Meatbone Meal	0.84	5.6	8.28	2.52	5.46	2.43	3.67	1.44	3.03	0.52
322	Peanut MealSolv	1.1	3.14	10.88	2.53	6.06	3.16	3.82	2.18	4.92	0.98
323	Safflower Meal	1.98	3.55	9.73	3.69	7.56	4.34	6.09	2.81	5.07	1.25
324	Soybean Meal44CpSolv	1.01	5.36	6.55	3.52	7.23	4.65	5.09	2.82	4.94	1.64
325	Soybean Meal49CpSolv	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
326	Soybean Whlextrd	0.97	5.91	6.68	3.35	7.11	4.64	5.01	2.76	4.94	0
327	Soybean Whlraw	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	0
328	Soybean Whlroast	1.02	5.77	6.42	3.56	7.15	4.61	4.91	2.96	4.81	0
329	Sunflower MealSolv	2.15	4.29	9.87	4.51	6.86	4.29	6.87	2.36	4.94	1.93
330	Urea 281Cp	0	0	0	0	0	0	0	0	0	0

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	3
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	13
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	13
0.03	0.31	0.11	0.06	0.33	0.01	0.14	0.06	5	0.07	30	6	0.11	13
0.05	0.57	0.26	0.68	0.65	0.09	0.03	0.06	15	0	80	16	0	13
0.15	0.03	0.29	1.64	6.06	1.48	0.6	0.5	22	0	87	6	0	18
1	0.1	0.42	3.1	3.04	0.49	0.47	1.21	79	0	250	56	0.04	30
0.07	0.3	0.16	0.11	0.45	0.08	0.23	0.06	7	0.11	85	42	0.26	41
0.01	0.41	0.16	0.11	0.51	0.07	0.21	0.07	7	0	85	43	0.08	41
0.07	0.36	0.14	0.03	0.52	0.03	0.17	0	8	0	69	66	0.44	36
0.05	0.34	0.14	0	0.47	0.03	0.12	0.18	11	0	51	18	0.5	19
0.05	0.34	0.14	0	0.47	0.03	0.12	0.18	11	0	51	18	0.5	19
0.05	0.34	0.14	0	0.47	0.03	0.12	0.18	11	0	51	18	0.5	19
0.04	0.34	0.17	0	0.44	0.03	0.18	0.18	11	0	51	18	0.5	19
0.05	0.34	0.14	0	0.35	0.03	0.12	0.18	11	0	51	18	0.5	19
0.05	0.34	0.14	0	0.35	0.03	0.12	0.18	11	0	51	18	0.5	19
0.04	0.37	0.19	0	0.88	0.03	0.18	0.18	11	0	51	18	0.5	19
0.04	0.37	0.19	0	0.88	0.03	0.18	0.18	11	0	51	18	0.5	19
0.04	0.37	0.19	0	0.88	0.03	0.18	0.18	11	0	51	18	0.5	19
0.53	0.18	0.22	0	1.29	0.01	0.09	0.12	18	0	324	11	0	24
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.05	0.42	0.16	0.09	0.41	0.02	0.17	0.14	7	0	70	42	0.3	43
0.4	0.32	0.04	0.32	0.31	0.4	0.8	0.1	14	0	2281	12	0.8	33
0.29	0.7	0.27	0.17	0.58	0.15	0.4	0.4	11	0.07	221	44	0.76	82
0.29	0.7	0.27	0.13	0.58	0.15	0.34	0.1	11	0.07	270	41	0.76	106
0.7	1.2	0.57	0.05	1.37	0.03	1.17	0	8	0	211	56	0	72
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	84	0.09	560	78	0.4	95
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	84	0.09	560	78	0.4	95
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	84	0.09	560	78	0.4	95
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	84	0.09	560	78	0.4	95
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	84	0.09	560	78	0.4	95
0.32	1.4	0.65	0.28	1.83	0.24	0.4	0.18	84	0.09	560	78	0.4	95
0.73	0.04	0.34	0.04	0.31	0.08	0.33	0	5	0	370	4	0.32	114
0.07	0.95	0.4	0.25	1.4	0.26	0.47	0.1	7	0.07	226	22	0.3	71
0.07	0.61	0.15	0.07	0.48	0.06	0.9	0.09	5	0	159	21	0.3	61
0.16	0.62	0.35	0	1.22	0.03	0.26	0	54	0	151	12	0	0
0.2	1.16	0.65	0	1.65	0.05	0.42	0.17	20	0	197	24	0	69
0.17	0.62	0.38	0	1.24	0.31	0.27	0	54	0	151	10	0	0
1.19	0.68	0.06	0.3	0.2	0.24	1.85	0.13	14	0.05	702	12	0.98	105
1.19	0.68	0.06	0.3	0.2	0.24	1.85	0.13	14	0.05	702	12	0.98	105
1.19	0.68	0.06	0.3	0.2	0.24	1.85	0.13	14	0.05	702	12	0.98	105
5.46	3.14	0.16	0.6	1.37	0.43	0.58	0.17	12	1.19	524	37	2.4	2
0.43	0.89	0.66	0.04	1.52	0.15	0.43	0.21	29	0	354	42	0.91	0
0.26	0.44	0.11	0	0.91	0	0	0	0	0	0	0	0	0
9.13	4.34	0.27	1.27	0.49	1.37	0.51	0.14	10	0	470	10	0.47	85
11.6	5.48	1.09	0.8	1.43	0.77	0.27	0.19	2	1.41	735	14	0.28	96
0.32	0.66	0.17	0.11	1.25	0.08	0	0	0	0	0	32	0	22
0.3	0.8	0.4	0	1.2	0.05	0.3	0	25	0	308	80	0	112
0.4	0.71	0.31	0.05	2.22	0.03	0.48	0.07	22	0	148	41	0.11	61
0.29	0.71	0.33	0.05	2.36	0.03	0.48	0.07	22	0	148	41	0.11	61
0.27	0.65	0.29	0	1.82	0.13	0.24	0	20	0	175	39	0.12	62
0.27	0.65	0.27	0	2.01	0.02	0.24	0	20	0	91	39	0.12	62
0.27	0.65	0.29	0	1.82	0.13	0.24	0	20	0	175	39	0.12	62
0.45	1.06	0.7	0	1.27	0.27	0.33	0.1	41	0	180	31	0.1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0

ID	Feed Name	Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
		Minerals bioavailability													
86	CrnGrn56Hm28%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
87	CrnGrn56Hm28%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
88	CrnGrn56Hm32%Crse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
89	CrnGrn56Hm32%Fine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
90	CrnGrn56Hm32%Med	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
91	CrnGrn56StmRl34lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
92	CrnGrn56StmRl38lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
93	CrnGrn56StmRl42lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
94	CrnHominy	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
97	Molasses Beet	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
98	Molasses Cane	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
99	OatGrn32lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
100	OatGrn38lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
104	Rye Grain	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
105	SorgGrn DryCrse	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
106	SorgGrnDryFine	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
107	SorgGrnDryMed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
108	SorgGrnDryRoll50lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
109	SorgGrnFlkd22lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
110	SorgGrnFlkd28lb	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
111	SorgGrnHm22%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
112	SorgGrnHm26%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
113	SorgGrnHm30%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
114	Soybean Hulls	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
115	Tallow	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
119	WheatGrn DryHrdMed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Protein concentrates															
298	Blood Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
299	BrewersGrn Dry	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
300	BrewersGrn Wet	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
301	Canola Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
302	CornDist Solubles	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
303	CornDistGrn Dark	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
304	CornDistGrn Inter	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
305	CornDistGrn Light	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
306	CornDistGrn Vdark	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
307	CornDistGrn Wet	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
308	Corngerm Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
309	CornGlut Feed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
310	CornGlut Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
311	Cottonsd DeLint	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
312	Cottonsd Meal 41CpSolv	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
313	Cottonsd WLint	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
314	Feath Meal/+Bld	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
315	Feath Meal/-Bld	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
316	Feather Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
317	Fish Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
318	Linseed Mealsolv	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
319	Lupins	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
320	Meat Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
321	Meatbone Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
322	Peanut MealSolv	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
323	Safflower Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
324	Soybean Meal44CpSolv	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
325	Soybean Meal49CpSolv	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
326	Soybean Whlextrd	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
327	Soybean Whlraw	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
328	Soybean Whlroast	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
329	Sunflower MealSolv	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
330	Urea 281Cp	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	90	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	23	100	100	100	80	95	50
100	95	23	100	100	100	80	95	50
100	90	23	100	100	100	80	95	50
100	80	22	100	100	100	80	95	50
100	75	22	100	100	100	80	95	50
100	70	22	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	95	20	100	100	100	80	95	50
100	95	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	94	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	78	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	80	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
Food processing byproducts								
32	Almond Hulls	00-00-0000	0	89	33.8	36.7	50.0	95
33	Bakery Waste	00-00-0000	0	92	18.0	5.6	5.0	85
37	Beet Pulp Grnd	00-00-0000	0	91	44.6	3.7	40.0	85
38	Citrus Pulp Grnd	00-00-0000	0	91	23.0	13.0	35.0	64
95	Malt Sprouts	00-00-0000	0	93	46.0	6.5	34.0	80
101	Peanut Skins	00-00-0000	0	90	34.0	5.0	20.0	85
102	Potatoes	00-00-0000	0	23	6.0	2.0	30.0	100
103	Ricemill Feed	00-00-0000	0	90	33.0	13.0	0.5	90
116	Tapioca CasavaMeal	00-00-0000	0	89	8.0	1.0	2.0	96.5
117	Wheat Bran	00-00-0000	0	88.75	51.0	5.9	33.3	94.6
118	Wheat Middlings	00-00-0000	0	89	35.0	6.0	1.8	88.3
120	Whey Acid	00-00-0000	0	7	0.0	0.0	0.0	0
121	Whey Delact	00-00-0000	0	93	0.0	0.0	0.0	0
143	Almond Hulls	00-00-0000	100	89	33.8	36.7	50.0	95
144	Apple Pomace	00-00-0000	100	22	41.0	2.0	34.0	90
209	Cottonsd Hulls	00-00-0000	100	91	90.0	26.7	80.0	60
Mineral and vitamins								
96	Minvit	00-00-0000	0	95	0	0	0	0
251	Ammonium Chloride	00-00-0000	0	97	0	0	0	0
252	Ammonium PhosDibasic	00-00-0000	0	97	0	0	0	0
253	Ammonium PhosMono	00-00-0000	0	97	0	0	0	0
254	Ammonium Sulfate	00-00-0000	0	98	0	0	0	0
255	Bicarbonate Sodium	00-00-0000	0	100	0	0	0	0
257	Bone Charcoal	00-00-0000	0	90	0	0	0	0
258	Bone Meal Steamed	00-00-0000	0	97	0	0	0	0
259	Calcium Carbonate	00-00-0000	0	98	0	0	0	0
260	Calcium ChlorideAnhy	00-00-0000	0	98	0	0	0	0
261	Calcium ChlorideDi	00-00-0000	0	98	0	0	0	0
262	Calcium PhosMono	00-00-0000	0	97	0	0	0	0
263	Calcium Sulfate	00-00-0000	0	98	0	0	0	0
264	Cobalt Carbonate	00-00-0000	0	99	0	0	0	0
265	Copper Sulfate	00-00-0000	0	98	0	0	0	0
266	Dicalcium Phosphate	00-00-0000	0	97	0	0	0	0
267	Dynamate	00-00-0000	0	95	0	0	0	0
268	Edta	00-00-0000	0	98	0	0	0	0
269	Iron Sulfate	00-00-0000	0	98	0	0	0	0
270	Limestone Ground	00-00-0000	0	98	0	0	0	0
271	Limestone Magnesium	00-00-0000	0	99	0	0	0	0
272	Magnesium Carbonate	00-00-0000	0	98	0	0	0	0
273	Magnesium Chloride	00-00-0000	0	98	0	0	0	0
274	Magnesium Sulfate	00-00-0000	0	98	0	0	0	0
275	Magox	00-00-0000	0	98	0	0	0	0
276	Manganese Carbonate	00-00-0000	0	97	0	0	0	0
277	Manganese Oxide	00-00-0000	0	99	0	0	0	0
278	Minvit2	00-00-0000	0	95	0	0	0	0
279	Oystershell Ground	00-00-0000	0	99	0	0	0	0
280	Phosphate Defluorinate	00-00-0000	0	98	0	0	0	0
281	Phosphate MonoSodium	00-00-0000	0	97	0	0	0	0
282	Phosphate Rock	00-00-0000	0	98	0	0	0	0
283	Phosphate RocklowFl	00-00-0000	0	98	0	0	0	0
284	Phosphate RockSoft	00-00-0000	0	98	0	0	0	0
285	Phosphoric Acid	00-00-0000	0	75	0	0	0	0
286	Potassium Bicarbonate	00-00-0000	0	99	0	0	0	0
287	Potassium Carbonate	00-00-0000	0	95	0	0	0	0
288	Potassium Chloride	00-00-0000	0	98	0	0	0	0
289	Potassium Iodide	00-00-0000	0	98	0	0	0	0
290	Potassium Sulfate	00-00-0000	0	98	0	0	0	0
291	Salt	00-00-0000	0	98	0	0	0	0
292	Salt TMin	00-00-0000	0	98	0	0	0	0

CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	Degradation Rates CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
6.0	40.3	93.0	35.0	31.7		3.6	7.1	300	40	8	300	12	0.35
9.0	40.0	75.0	6.0	3.0		12.7	5.0	300	25	3	100	12	0.35
9.8	27.0	93.1	53.0	11.0		0.6	5.3	300	40	8	300	12	0.35
9.8	27.0	93.0	53.0	11.0		3.7	5.3	350	50	9	350	11	0.25
28.1	48.0	82.7	27.0	4.0		1.4	7.0	250	30	3	135	11	0.09
14.0	30.0	70.0	10.0	5.0		20.0	6.0	250	30	5	200	10	0.4
9.5	70.0	80.0	4.0	0.5		0.4	4.8	400	50	15	250	12	0.25
12.0	25.0	10.0	6.0	2.0		14.0	12.8	300	40	6	250	13	0.35
3.1	25.0	45.0	30.0	5.0		0.8	3.0	300	40	8	300	12	0.35
18.5	29.4	44.3	21.9	6.1		5.5	5.8	300	40	8	250	12	0.35
18.4	40.0	27.2	4.0	3.0		3.2	2.4	300	70	5	250	12	0.35
14.2	100.0	100.0	0.0	0.0		0.7	10.0	350	0	0	350	0	0
17.9	100.0	100.0	0.0	0.0		1.1	17.0	350	0	0	350	0	0
6.0	40.3	93.0	35.0	31.7		3.6	7.1	300	40	8	300	12	0.35
5.4	11.0	100.0	32.0	31.5		4.7	5.0	350	50	5	350	11	0.25
4.1	20.0	50.0	12.7	6.3		1.7	2.8	300	25	6	175	11	0.09
0	0	0	0	0		0	100	0	0	0	0	0	0
163.5	0	100	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
134.1	0	100	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
Food processing byproducts											
32	Almond Hulls	1.7	4.73	4.55	5.11	7.01	4.17	5.11	2.46	4.17	0
33	Bakery Waste	1.77	3.17	4.77	4.95	7.47	4.57	4.3	1.3	4.1	1
37	Beet Pulp Grnd	0.65	3	4.43	3.17	4.61	2.69	4.5	1.87	2.8	1.1
38	Citrus Pulp Grnd	0.65	3	4.43	3.17	4.61	2.69	4.5	1.87	2.8	1.1
95	Malt Sprouts	1.17	3.5	11.7	2.83	6.67	3.67	4.5	2.17	5.17	1
101	Peanut Skins	0.47	4.54	4.72	2.74	4.86	2.46	3.3	1.84	2.99	0
102	Potatoes	0	0	0	0	0	0	0	0	0	0
103	Ricemill Feed	0.75	3.67	7.76	3.71	6.56	3.68	5.4	2.96	4.53	0.88
116	Tapioca CasavaMeal	1.33	3.33	4.67	2.67	4.67	3	3.67	3	1	0.67
117	Wheat Bran	0.75	3.67	7.76	3.71	6.56	3.68	5.4	2.96	4.53	1.2
118	Wheat Middlings	1.02	3.77	6.96	3.67	7.37	4.09	5.79	2.41	4.74	1.2
120	Whey Acid	0	0	0	0	0	0	0	0	0	0
121	Whey Delact	0	0	0	0	0	0	0	0	0	0
143	Almond Hulls	1.7	4.73	4.55	5.11	7.01	4.17	5.11	2.46	4.17	0
144	Apple Pomace	0.67	2.83	2.83	2.83	5.49	2.83	3.83	1	3.5	4.5
209	Cottonsd Hulls	1.91	5.05	11.81	4.14	6.67	4.34	5.49	2.4	6.59	0.3
Mineral and vitamins											
96	Minvit	0	0	0	0	0	0	0	0	0	0
251	Ammonium Chloride	0	0	0	0	0	0	0	0	0	0
252	Ammonium PhosDibasic	0	0	0	0	0	0	0	0	0	0
253	Ammonium PhosMono	0	0	0	0	0	0	0	0	0	0
254	Ammonium Sulfate	0	0	0	0	0	0	0	0	0	0
255	Bicarbonate Sodium	0	0	0	0	0	0	0	0	0	0
257	Bone Charcoal	0	0	0	0	0	0	0	0	0	0
258	Bone Meal Steamed	0	0	0	0	0	0	0	0	0	0
259	Calcium Carbonate	0	0	0	0	0	0	0	0	0	0
260	Calcium ChlorideAnhy	0	0	0	0	0	0	0	0	0	0
261	Calcium ChlorideDi	0	0	0	0	0	0	0	0	0	0
262	Calcium PhosMono	0	0	0	0	0	0	0	0	0	0
263	Calcium Sulfate	0	0	0	0	0	0	0	0	0	0
264	Cobalt Carbonate	0	0	0	0	0	0	0	0	0	0
265	Copper Sulfate	0	0	0	0	0	0	0	0	0	0
266	Dicalcium Phosphate	0	0	0	0	0	0	0	0	0	0
267	Dynamate	0	0	0	0	0	0	0	0	0	0
268	Edta	0	0	0	0	0	0	0	0	0	0
269	Iron Sulfate	0	0	0	0	0	0	0	0	0	0
270	Limestone Ground	0	0	0	0	0	0	0	0	0	0
271	Limestone Magnesium	0	0	0	0	0	0	0	0	0	0
272	Magnesium Carbonate	0	0	0	0	0	0	0	0	0	0
273	Magnesium Chloride	0	0	0	0	0	0	0	0	0	0
274	Magnesium Sulfate	0	0	0	0	0	0	0	0	0	0
275	Magox	0	0	0	0	0	0	0	0	0	0
276	Manganese Carbonate	0	0	0	0	0	0	0	0	0	0
277	Manganese Oxide	0	0	0	0	0	0	0	0	0	0
278	Minvit2	0	0	0	0	0	0	0	0	0	0
279	Oystershell Ground	0	0	0	0	0	0	0	0	0	0
280	Phosphate Defluorinate	0	0	0	0	0	0	0	0	0	0
281	Phosphate MonoSodium	0	0	0	0	0	0	0	0	0	0
282	Phosphate Rock	0	0	0	0	0	0	0	0	0	0
283	Phosphate RocklowFl	0	0	0	0	0	0	0	0	0	0
284	Phosphate RockSoft	0	0	0	0	0	0	0	0	0	0
285	Phosphoric Acid	0	0	0	0	0	0	0	0	0	0
286	Potassium Bicarbonate	0	0	0	0	0	0	0	0	0	0
287	Potassium Carbonate	0	0	0	0	0	0	0	0	0	0
288	Potassium Chloride	0	0	0	0	0	0	0	0	0	0
289	Potassium Iodide	0	0	0	0	0	0	0	0	0	0
290	Potassium Sulfate	0	0	0	0	0	0	0	0	0	0
291	Salt	0	0	0	0	0	0	0	0	0	0
292	Salt TMin	0	0	0	0	0	0	0	0	0	0

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0.3	0.1	0.1	0.05	2.6	0.03	0.03	0	3	0	222	18	0	15
0.15	0.24	0.18	0.05	1.61	0	0.43	0	0	0	39	4	0	13
0.68	0.1	0.28	0.04	0.22	0.2	0.22	0	14	0	293	38	0	1
1.88	0.13	0.17	0.05	0.77	0.08	0.08	0	6	0	360	7	0	15
0.19	0.68	0.18	0.39	0.27	0.95	0.85	0	6	0	200	32	0.45	61
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.04	0.24	0.14	0.28	2.17	0.09	0.09	0	28	0	78	42	0	2
0.08	1.7	1.04	0	1.92	0.04	0.2	15	0	0	210	415	0.44	32
0	0.03	0	0	0.26	0	0	0	0	0	0	0	0	0
0.13	1.38	0.6	0.05	1.56	0.04	0.25	0.11	14	0.07	128	125	0.43	128
0.15	1	0.38	0.04	1.4	0.19	0.2	0.1	22	0.12	93	126	0.83	116
0.81	0.71	0	0	2.75	0	0	0	0	0	290	3	0	0
1.6	1.18	0.23	1.1	3.16	1.54	1.15	0	8	0	262	9	0.06	8
0.3	0.1	0.1	0.05	2.6	0.03	0.03	0	3	0	222	18	0	15
0.23	0.11	0.07	0.05	0.53	0.12	0.11	0	10	0	300	7	0	0
0.15	0.09	0.14	0.02	0.87	0.02	0.09	0.02	13	0	131	119	0.02	22
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	66.3	0	0	0	0	0	0	0	0	0	0
0.52	20.6	0.46	0	0.01	0.05	2.16	0	10	0	12400	400	0	100
0.28	24.74	0.46	0	0.01	0.06	1.46	10	10	0	17400	400	0	100
0	0	0	0	0	0	24.1	0	1	0	10	1	0	0
0	0	0	0	0	27	0	0	0	0	0	0	0	0
30.11	14.14	0.59	0	0.16	0	0	0	0	0	0	0	0	0
30.71	12.86	0.33	0	0.19	5.69	2.51	0	0	0	26700	0	0	100
39.39	0.04	0.05	0	0.06	0.06	0	0	0	0	300	300	0	0
36.1	0	0	63.9	0	0	0	0	0	0	0	0	0	0
27.3	0	0	48.2	0	0	0	0	0	0	0	0	0	0
16.4	21.6	0.61	0	0.08	0.06	1.22	10	10	0	15800	360	0	90
24	0	0	0	0	0	18.8	0	0	0	0	0	0	0
0	0	0	0	0	0	0.2	460000	0	0	500	0	0	0
0	0	0	0	0	0	12.84	0	254500	0	0	0	0	0
22	19.3	0.59	0	0.07	0.05	1.14	10	10	0	14400	300	0	100
0.05	0	11.1	0	18.4	0.6	22.2	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	803400	0	0	0	0
0	0	0	0	0	0	12.35	0	0	0	218400	0	0	0
34	0.02	2.06	0.03	0.12	0.06	0.04	0	0	0	3500	0	0	0
22.3	0.04	9.99	0.12	0.36	0	0	0	0	0	770	0	0	0
0.02	0	30.81	0	0	0	0	0	0	0	220	0	0	0
0	0	12	34.9	0	0	0	0	0	0	0	0	0	0
0	0	19.9	0	0	0	13	0	0	0	0	0	0	0
3.07	0	56.2	0	0	0	0	0	0	0	0	100	0	0
0	0	0	0	0	0	0	0	0	0	0	478000	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0.07	0.3	0.01	0.1	0.21	0	0	0	0	2870	100	0	0
32	18	0.42	0	0.08	4.9	0	10	20	0	6700	200	0	60
0	22.54	0	0	0	16.68	0	0	0	0	0	0	0	0
35	13	0.41	0	0.06	0.03	0	10	10	0	6700	200	0	100
36	14	0	0	0	0	0	0	0	0	0	0	0	0
17	9	0.38	0	0	0.1	0	0	0	0	19000	1000	0	0
0.05	31.6	0.51	0	0.02	0.04	1.55	10	10	0	17500	500	0	130
0	0	0	0	39.05	0	0	0	0	0	0	0	0	0
0	0	0	0	56.58	0	0	0	0	0	0	0	0	0
0.05	0	0.34	47.3	50	1	0.45	0	0	0	600	0	0	0
0	0	0	0	21	0	0	0	0	0	0	0	0	0
0.15	0.61	0.61	1.55	0	41.84	0.09	17	0	0	710	10	0	0
0	0	0	60.66	0	39.34	0	0	0	0	0	0	0	0
0	0	0	57.02	0	36.98	0	50	330	0	0	2000	0	0

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
Food processing byproducts															
32	Almond Hulls	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
33	Bakery Waste	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
37	Beet Pulp Grnd	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
38	Citrus Pulp Grnd	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
95	Malt Sprouts	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
101	Peanut Skins	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
102	Potatoes	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
103	Ricemill Feed	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
116	Tapioca CasavaMeal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
117	Wheat Bran	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
118	Wheat Middlings	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
120	Whey Acid	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
121	Whey Delact	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
143	Almond Hulls	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
144	Apple Pomace	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
209	Cottonsd Hulls	0.3	0.64	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Mineral and vitamins															
96	Minvit	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
251	Ammonium Chloride	0.55	0.8	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
252	Ammonium PhosDibasic	0.55	0.8	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
253	Ammonium PhosMono	0.55	0.8	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
254	Ammonium Sulfate	0.55	0.8	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
255	Bicarbonate Sodium	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
257	Bone Charcoal	0.95	0.8	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
258	Bone Meal Steamed	0.75	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
259	Calcium Carbonate	0.95	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
260	Calcium ChlorideAnhy	0.83	0.75	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
261	Calcium ChlorideDi	0.8	0.75	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
262	Calcium PhosMono	0.7	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
263	Calcium Sulfate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
264	Cobalt Carbonate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
265	Copper Sulfate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
266	Dicalcium Phosphate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
267	Dynamate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
268	Edta	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
269	Iron Sulfate	0.7	0.7	0.2	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
270	Limestone Ground	0.55	0.7	0.2	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
271	Limestone Magnesium	0.6	0.7	0.3	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
272	Magnesium Carbonate	0.6	0.7	0.7	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
273	Magnesium Chloride	0.6	0.7	0.7	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
274	Magnesium Sulfate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
275	Magox	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
276	Manganese Carbonate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
277	Manganese Oxide	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
278	Minvit2	0.7	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
279	Oystershell Ground	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
280	Phosphate Defluorinate	0.55	0.65	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
281	Phosphate MonoSodium	0.55	0.3	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
282	Phosphate Rock	0.55	0.3	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
283	Phosphate RocklowFl	0.3	0.3	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
284	Phosphate RockSoft	0.5	0.3	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
285	Phosphoric Acid	0.55	0.9	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
286	Potassium Bicarbonate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
287	Potassium Carbonate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
288	Potassium Chloride	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
289	Potassium Iodide	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
290	Potassium Sulfate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
291	Salt	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
292	Salt TMin	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	95	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	80	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	70	20	100	100	100	80	95	50
100	65	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	85	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50

ID	Feed Name	IFN	Forage %DM	DM %AF	NDF %DM	Lignin %NDF	pef %NDF	Starch %NSC
293	Sodium Bicarbonate	00-00-0000	0	98	0	0	0	0
294	Sodium Selenite	00-00-0000	0	98	0	0	0	0
295	Sodium SulfateDeca	00-00-0000	0	97	0	0	0	0
296	Zinc Oxide	00-00-0000	0	98	0	0	0	0
297	Zinc Sulfate	00-00-0000	0	99	0	0	0	0
Commercial feeds								
1	Alimet	00-00-0000	0	88	0.0	0.0	0.0	0
2	Biochlor	00-00-0000	0	85	30.0	3.0	5.0	10
3	Ener GII	00-00-0000	0	98	0.0	0.0	0.0	0
4	Energy Booster	00-00-0000	0	99	0.0	0.0	0.0	0
5	Fermenten	00-00-0000	0	90	25.0	3.0	5.0	10
6	Griffen Blood Meal	00-00-0000	0	92.97	44.2	0.0	0.0	0
7	Griffin Porcine Meat Meal	00-00-0000	0	95.22	18.6	0.0	0.0	0
8	Megalac	00-00-0000	0	98	0.0	0.0	0.0	0
9	Megalac Plus	00-00-0000	0	98	0.0	0.0	0.0	0
10	Mepron	00-00-0000	0	98	0.0	0.0	13.0	0
11	Met Plus	00-00-0000	0	98	0.0	0.0	0.0	0
12	Met Plus with Talc	00-00-0000	0	98	0.0	0.0	0.0	0
13	Mopac 74/74	00-00-0000	0	93.64	25.6	0.0	2.0	40.5
14	Mopac 75/76	00-00-0000	0	94.23	23.1	0.0	2.0	31.95
15	Mopac Multi-60%	00-00-0000	0	92.55	31.0	0.0	2.0	31.5
16	Mopac RenPlus-68%	00-00-0000	0	93.28	23.9	0.0	2.0	25.43
17	Mopac RenPride-70%	00-00-0000	0	91.51	29.7	0.0	2.0	38.25
18	Mopac RenSupreme-73%	00-00-0000	0	94.34	24.1	0.0	2.0	32.4
19	Pro Peak-70	00-00-0000	0	91.94	23.9	0.0	12.1	41.75
20	Pro Peak-75	00-00-0000	0	91.2	16.2	0.5	14.8	65.6
21	Pro Peak-80	00-00-0000	0	90.2	11.5	1.3	24.4	96.45
22	Prolak	00-00-0000	0	93.32	17.7	0.0	0.0	0
23	Sea Lac	00-00-0000	0	90.54	0.0	0.0	0.0	0
24	Smartamine M	00-00-0000	0	98	0.0	0.0	0.0	0
26	Soy Best	00-00-0000	0	88.92	35.8	11.9	23.0	95.8
27	Soy Pass	00-00-0000	0	90.14	30.6	7.9	10.0	94
28	Soy Plus	00-00-0000	0	90.1	21.2	18.7	23.0	94
28	Homer Meal	00-00-0000	0	88.66	20.6	17.1	23.0	94
29	Zinpro 100	00-00-0000	0	95	36.9	0.0	10.0	100
30	Zinpro 40	00-00-0000	0	95	34.2	0.0	10.0	100
31	Zinpro 4-Plex	00-00-0000	0	95	54.0	0.0	10.0	100
256	Biophos	00-00-0000	0	95	0.0	0.0	0.0	0
999	AT88	00-00-0000	0	88	0.0	0.0	0.0	0

								Degradation Rates					
CP %DM	Sol-P %CP	NPN %Sol-P	NDFIP %CP	ADFIP %CP	UIP-1X %CP	Fat %DM	Ash %DM	CHO-A %/h	CHO-B1 %/h	CHO-B2 %/h	Prot-B1 %/h	Prot-B2 %/h	Prot-B3 %/h
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
0	0	0	0	0		0	100	0	0	0	0	0	0
100.0	100.0	0.0	0.0	0.0		0.0	0.0	300	30	6	10.35	0	0
50.0	70.0	40.0	7.0	0.8		3.7	10.0	300	40	8	100	5	0.18
0.0	0.0	0.0	0.0	0.0		85.0	15.0	300	30	6	0	0	0
0.0	0.0	0.0	0.0	0.0		99.0	1.0	300	30	6	0	0	0
50.0	70.0	40.0	7.0	0.8		3.7	10.0	300	40	8	100	5	0.18
98.2	5.7	94.1	45.0	1.1		0.3	2.0	250	0	0	135	3	0.09
60.9	15.4	94.2	50.3	7.6		13.0	25.2	0	0	0	150	6	0.12
0.0	0.0	0.0	0.0	0.0		84.5	15.5	300	30	6	0	0	0
6.1	0.0	0.0	0.0	0.0		79.9	14.0	300	30	6	0	3.8	0
85.0	15.0	100.0	0.0	17.0		0.0	2.0	300	30	6	300	0	0
67.0	10.0	0.0	0.0	5.0		29.5	3.5	0	0	0	7	7	7
66.0	5.0	0.0	0.0	10.0		29.0	5.0	0	0	0	3	3	3
79.7	11.0	47.4	34.5	16.2		8.9	7.6	263.88	28.61	4.45	180.79	4.94	0.18
79.8	11.0	39.5	31.5	13.1		7.9	9.0	267	28.55	4.36	189.1	5.29	0.2
67.5	15.0	47.5	43.4	14.5		11.6	14.1	272	25.88	3.6	231.75	7.2	0.28
73.1	12.6	36.0	33.4	11.2		9.1	12.7	264.75	26.83	3.89	207.28	6.17	0.25
71.3	12.5	50.1	40.8	16.2		10.8	10.5	263.13	26.49	3.88	205.91	6.12	0.23
77.8	12.0	40.0	33.1	13.1		8.5	10.6	270.38	28.59	4.29	197.24	5.63	0.23
76.5	9.0	43.1	35.3	12.4		7.2	11.5	295.3	30	3	202.2	3.65	0.31
80.2	7.2	38.2	22.3	8.5		6.2	8.5	294.2	38.37	3	169.3	3.38	0.28
85.2	5.7	41.6	13.9	8.1		4.8	4.9	250	41.42	5	135.8	3.18	0.09
76.9	10.0	50.0	23.1	6.6		9.7	13.7	300	25	3	106.72	2.52	0.21
71.0	9.6	83.8	24.9	2.0		8.4	21.1	300	50	7	130	2.4	1
70.0	10.0	0.0	0.0	10.0		0.0	30.0	300	30	6	300	0	0
45.0	9.6	53.8	45.5	6.0		6.3	8.1	300	25	6	230	11	0.2
49.9	5.8	50.0	48.8	7.5		1.2	6.7	300	25	6	230	2.12	2.12
48.3	9.1	65.0	19.8	5.0		7.1	7.6	300	25	6	150	5	0.18
46.6	6.8	65.0	12.5	2.1		7.9	6.2	300	25	6	150	5	0.18
11.8	100.0	0.0	0.0	0.0		0.0	20.0	250	30	8	1	1	0.1
5.4	100.0	0.0	0.0	0.0		0.0	51.5	250	30	8	1	1	0.1
11.5	100.0	0.0	0.0	0.0		1.5	26.5	250	30	8	1	1	0.1
0.0	0.0	0.0	0.0	0.0		0.0	100.0	0	0	0	0	0	0
100.0	100.0	0.0	0.0	0.0		0.0	0.0	300	30	6	500	0	0

ID	Feed Name	Amino Acids MET %UIP	LYS %UIP	ARG %UIP	THR %UIP	LEU %UIP	ILE %UIP	VAL %UIP	HIS %UIP	PHE %UIP	TRP %UIP
293	Sodium Bicarbonate	0	0	0	0	0	0	0	0	0	0
294	Sodium Selenite	0	0	0	0	0	0	0	0	0	0
295	Sodium SulfateDeca	0	0	0	0	0	0	0	0	0	0
296	Zinc Oxide	0	0	0	0	0	0	0	0	0	0
297	Zinc Sulfate	0	0	0	0	0	0	0	0	0	0
Commercial feeds											
1	Alimet	100	0	0	0	0	0	0	0	0	0
2	Biochlor	2.8	8.2	6.96	5.59	7.51	5.88	6.16	2.69	5.16	1.63
3	Ener GII	0	0	0	0	0	0	0	0	0	0
4	Energy Booster	0	0	0	0	0	0	0	0	0	0
5	Fermenten	2.8	8.2	6.96	5.59	7.51	5.88	6.16	2.69	5.16	1.63
6	Griffen Blood Meal	0.97	9.06	5.03	4.77	12.04	2.19	9.08	5.9	6.67	1.36
7	Griffin Porcine Meat Meal	1.29	6.82	8.43	4.27	6.91	3.66	4.38	1.95	4.13	1.29
8	Megalac	0	0	0	0	0	0	0	0	0	0
9	Megalac Plus	100	0	0	0	0	0	0	0	0	0
10	Mepron	100	0	0	0	0	0	0	0	0	0
11	Met Plus	100	0	0	0	0	0	0	0	0	0
12	Met Plus with Talc	100	0	0	0	0	0	0	0	0	0
13	Mopac 74/74	0.88	5.27	7.01	3.88	8.93	3	7.08	2.7	5.37	1.02
14	Mopac 75/76	1.24	6.24	7.07	4.32	9.68	3.18	7.28	3.13	5.66	1.17
15	Mopac Multi-60%	1.26	4.87	7.82	3.56	7.03	3.61	5.48	1.62	4.01	0.72
16	Mopac RenPlus-68%	1.44	6.13	7.23	4.13	8.73	3.35	6.4	2.7	4.97	1.05
17	Mopac RenPride-70%	1.42	5.33	7.6	4.3	8.44	4.06	6.55	2	4.79	0.95
18	Mopac RenSupreme-73%	1.26	6.05	7.24	4.17	9.18	3.25	6.92	2.88	5.35	1.1
19	Pro Peak-70	0.92	5.33	6.39	4.1	9.24	3.01	7.27	2.85	5.49	1.04
20	Pro Peak-75	1.05	5.95	5.72	4.17	11.11	2.6	7.63	3.77	6.27	1.21
21	Pro Peak-80	1.09	6.03	5.36	4.26	12.5	2.52	8.06	4.21	6.88	1.31
22	Prolak	1.57	6.05	5.82	4.22	8.66	3.06	6.51	3.49	5.35	1.08
23	Sea Lac	3.13	8.39	5.97	4.27	7.68	4.13	4.69	2.28	3.84	1
24	Smartamine M	100	0	0	0	0	0	0	0	0	0
26	Soy Best	1.59	6.15	7.42	4.22	8.88	5.25	5.88	2.9	5.84	1.46
27	Soy Pass	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
28	Soy Plus	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
28	Homer Meal	0.83	6.08	7.69	3.03	6.13	4.25	3.79	2.27	3.88	1.64
29	Zinpro 100	20	0	0	0	0	0	0	0	0	0
30	Zinpro 40	8	0	0	0	0	0	0	0	0	0
31	Zinpro 4-Plex	8.21	3.8	0	0	0	0	0	0	0	0
256	Biophos	0	0	0	0	0	0	0	0	0	0
999	AT88	100	0	0	0	0	0	0	0	0	0

Macrominerals							Microminerals						
Ca %DM	P %DM	Mg %DM	Cl %DM	K %DM	Na %DM	S %DM	Co mg/kg	Cu mg/kg	I mg/kg	Fe mg/kg	Mn mg/kg	Se mg/kg	Zn mg/kg
0	0	0	0	0	27	0	0	0	0	0	0	0	0
0	0	0	0	0	26.6	0	0	0	0	0	0	456000	0
0	0	0	0	0	0	14.27	10	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	780000
0.02	0	0	0.02	0	0	17.67	0	0	0	10	10	0	363600
0	0	0	0	0	0	21.33	0	0	0	0	0	0	0
0.18	1.17	0.43	8.8	1.51	1.5	2.44	0	9	0	252	105	0	74
9	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.18	1.17	0.43	0.2	1.51	1.5	2.44	0	9	0	252	105	0	74
0.09	0.27	0.04	0.32	0.35	0.4	0.65	0	5	0	2137	5	0	35
8.67	4.35	0.22	0	0.58	0.6	0.44	0	11	0	382	18	0	132
12	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.03	1.28	0.48	0.43	0.91	0.37	0.75	0.11	6	0.37	892	13	0.48	64
3.18	1.59	0.42	0.42	0.32	0.32	0.74	0.13	6.58	0.58	844	14	0.64	76
5.4	2.43	0.54	0.59	0.3	0.49	0.76	0.12	3.67	0.76	324	13	0.49	92
4.29	2.14	0.43	0.59	0.32	0.48	0.75	0.13	6.65	0.59	852	14	0.64	77
3.82	2.19	0.42	0.5	0.33	0.51	0.73	0.13	6	1.09	680	16	0.71	75
3.18	1.8	0.23	0.42	0.33	0.35	0.79	0	9	1	943	14	1	123
3.59	1.78	0.11	0.6	0.35	0.55	0.68	0	14	0	256	12	0	77
1.54	0.89	0.07	0.44	0.28	0.45	0.68	0	12	0	242	7	0	53
0.17	0.3	0.05	0.26	0.24	0.37	0.67	0	11	0	235	4	0	36
3.71	1.89	0.16	0.55	0.52	0.77	0.99	2	12	11	984	14	0	77
6.3	3.7	0.2	0	0.7	0.5	0.49	0	5	1	726	0	2	122
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.43	0.67	0.34	0.05	2.21	0	0.35	0	16	0	199	39	0	54
0.3	0.76	0.29	0.02	2.45	0.08	0.4	0	13	0	100	34	0	44
0.29	0.7	0.32	0	2.3	0.03	0.48	0	22	0	148	41	0	61
0.29	0.7	0.32	0	2.3	0.03	0.48	0	22	0	148	41	0	61
0	0	0	0.73	0	0.47	0	0	0	0	0	0	0	1000000
8.5	0	0	1.7	0	1.1	0	0	0	0	0	0	0	40000
0	0	0	0	0	0	0	1800	8800	0	0	14000	0	25300
16	21.2	0.7	0	0.04	0.08	1	0	0	0	0	0	0	0
0	0	0	0	0	0	21.33	0	0	0	0	0	0	0

ID	Feed Name	Minerals bioavailability													
		Ca	P	Mg	Cl	K	Na	S	Co	Cu	I	Fe	Mn	Se	Zn
293	Sodium Bicarbonate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
294	Sodium Selenite	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
295	Sodium SulfateDeca	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
296	Zinc Oxide	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
297	Zinc Sulfate	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
Commercial feeds															
1	Alimet	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
2	Biochlor	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
3	Ener GII	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
4	Energy Booster	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
5	Fermenten	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
6	Griffen Blood Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
7	Griffin Porcine Meat Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
8	Megalac	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
9	Megalac Plus	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
10	Mepron	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
11	Met Plus	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
12	Met Plus with Talc	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
13	Mopac 74/74	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
14	Mopac 75/76	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
15	Mopac Multi-60%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
16	Mopac RenPlus-68%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
17	Mopac RenPride-70%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
18	Mopac RenSupreme-73%	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
19	Pro Peak-70	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
20	Pro Peak-75	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
21	Pro Peak-80	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
22	Prolak	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
23	Sea Lac	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
24	Smartamine M	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
26	Soy Best	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
27	Soy Pass	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
28	Soy Plus	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
28	Homer Meal	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
29	Zinpro 100	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
30	Zinpro 40	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
31	Zinpro 4-Plex	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
256	Biophos	0.95	0.8	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15
999	AT88	0.6	0.7	0.16	0.9	0.9	0.9	1	1	0.04	0.85	0.1	0.01	1	0.15

Intestinal digestibility								
CHO-A1 %	CHO-B1 %	CHO-B2 %	Prot-A %	Prot-B1 %	Prot-B2 %	Prot-B3 %	Fat %	Ash %
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
100	75	20	100	100	100	80	95	50
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6. GLOSSARY OF TERMS

a is intermediate rate constant.
a1 is thermal neutral maintenance requirement for fasting metabolism, Mcal/day/kg $SBW^{0.75}$.
a2 is maintenance adjustment for previous temperature effect, Mcal/day/kg $SBW^{0.75}$.
AAA_{si} is the total amount of the i^{th} absorbed amino acid supplied by dietary and bacterial sources, g/day.
AABCWi is the i^{th} amino acid content of rumen bacteria cell wall protein, g/100g.
AABNCWi is the i^{th} amino acid content of rumen bacteria non-cell wall protein, g/100g.
$AAINSP_{ij}$ is the i^{th} amino acid content of the insoluble protein for the j^{th} feedstuff, g/100g.
$AALACT_i$ is the i^{th} amino acid content of milk true protein, g/100g.
$AATISS_I$ is amino acid composition of tissue.
ACADG is after calving target ADG, kg/day.
ACT is activity requirement for standing, changing position, horizontal and slope walking.
$ADFIP_j$(%CP) is percentage of the j^{th} feedstuff that is acid detergent insoluble protein.
ADG is average daily gain, kg/day.
ADTV is feed additive adjustment factor for DMI.
AF is proportion of empty body fat.
age is age of cow, years.
AP is proportion of empty body protein.
APADG is postpregnant target ADG, kg/day.
ASHj is the ash composition of the jth feedstuff, g/day.
AU is animal units (Body weight, kg / 454).
$BACT_j$ is yield of bacteria from the j^{th} feedstuff g/day.
BACTNBAL is bacterial nitrogen balance, g/day.
$BACTN_j$ is bacterial nitrogen, g/day.
Balance is the total absorbed mineral intake (Intake × TAC) - total mineral requirement for maintenance, lactation, growth and pregnancy.
BCS is body condition score.
BE is breed effect on NEm requirement.
BEN is excess bacterial nitrogen.
BFAF is body fat adjustment factor.
BFN is bacterial fecal nitrogen, primarily bacterial cell wall.
BI is breed adjustment factor for DMI.
BNA is bacterial nucleic acids.
BPADG is prepregnant target ADG, kg/day.
BW is body weight, kg.
CA_j(%DM) is percentage of DM of the j^{th} feedstuff that is sugar.
$CB1_j$(%DM) is percentage of DM of the j^{th} feedstuff that is starch.
$CB2_j$(%DM) is percentage of DM of the j^{th} feedstuff that is available fiber.
CBW is expected calf birth weight, kg.
CC_j(%DM) is percentage of DM in the j^{th} feedstuff that is unavailable fiber.
CETI is current month's effective temperature index, °C.
CHO_j(%DM) is percentage of carbohydrate of the j^{th} feedstuff.
CI is calving interval, days.
COMP is compensation effect for previous plane of nutrition.
CPIA is crude protein intake per animal unit, kg/day.
CP_j(%DM) is percentage of crude protein of the j^{th} feedstuff.
CW is conceptus weight, g
$DIGBAA_I$ is the amount of the i^{th} absorbed bacterial amino acid, g/day.
$DIGBC_j$ is digested bacterial carbohydrate produced from the j^{th} feedstuff, g/day, and
$DIGBF_j$ is digestible bacterial fat from the j^{th} feedstuff, g/day.
$DIGBNA_j$ is the digestible bacterial nucleic acids produced from the j^{th} feedstuff, g/day.
$DIGBTP_j$ is the digestible bacterial true protein produced from the j^{th} feedstuff, g/day.
$DIGC_j$ is digestible carbohydrate from the j^{th} feedstuff, g/day.

$DIGFAA_I$ is the amount of the i^{th} absorbed amino acid from dietary protein escaping rumen degradation, g/day.
$DIGFC_j$ is intestinally digested feed carbohydrate from the j^{th} feedstuff, g/day.
$DIGFF_j$ is digestible feed fat from the j^{th} feedstuff, g/day.
$DIGF_j$ is digestible fat from the j^{th} feedstuff, g/day.
$DIGFP_j$ is the digestible feed protein from the j^{th} feedstuff,g/day.
$DIGPB1_j$ is the digestible B1 protein from the j^{th} feedstuff, g/day.
$DIGPB2_j$ is the digestible B2 protein from the j^{th} feedstuff, g/day.
$DIGPB3_j$ is the digestible B3 protein from the j^{th} feedstuff, g/day.
$DIGP_j$ is the digestible protein from the j^{th} feedstuff, g/day.
Distance flat is distance traveled daily on flat surface, meters.
Distance sloped is distance traveled daily on sloped surface, meters.
DMI is dry matter intake, kg/day.
DMI_g is dry matter intake, grams/day.
DMIA is dry matter intake per animal unit, kg/day.
DMIAF is dry matter intake adjustment factor for temperature $<20^0$C.
DMIAFC is dry matter intake adjustment factor with night cooling, %.
DMIAFMUD is DMI adjustment factor for mud depth.
DMIAFN is dry matter intake adjustment factor with no night cooling, %.
e is the base of the natural logarithms.
$EAAG_I$ is efficiency of use of the i^{th} amino acid for growth, g/g.
$EAAL_i$ is efficiency of use of the i^{th} amino acid for milk protein formation, g/g.
$EAAP_i$ is efficiency of use of the i^{th} amino acid for gestation, g/g.
EBG is empty body gain, kg.
EBG_g is empty body gain, g/day.
EBW is empty body weight, kg.
EI is external insulation value, °C/Mcal/m^2 /day.
EN is nitrogen in excess of rumen bacterial nitrogen and tissue needs (endogenous nitrogen), g/day.
eNDF is % effective NDF in ration.
$eNDF_i$ is effective NDF concentration of i^{th} feedstuff, percent (decimal form).
EQEBW is equivalent empty body weight, kg.
EQSBW is kg equivalent shrunk body weight.
ER is energy reserves, Mcal.
FAT is fat composition of the j^{th} feedstuff, g/day.
FBW is full body weight.
$FCBACT_j$ is yield of fiber carbohydrate bacteria from the j^{th} feedstuff g/day.
FCBACTNj is fiber carbohydrate bacterial nitrogen, g/day.
FDM is % dry matter of feces.
$FEASH_j$ is the amount of ash in feces from the j^{th} feedstuff, g/day, and
$FEBACT_j$ is the amount of bacteria in feces from the j^{th} feedstuff, g/day.
$FEBASH_j$ is the amount of bacterial ash in feces from the j^{th} feedstuff, g/day, and
$FEBC_j$ is the amount of bacterial carbohydrate in feces from the j^{th} feedstuff, g/day.
$FEBCP_j$ is the amount of fecal bacterial protein from the j^{th} feedstuff, g/day.
$FEBCW_j$ is the amount of fecal bacterial cell wall protein from the j^{th} feedstuff, g/day.
$FEBF_j$ is the amount of bacterial fat in feces from the j^{th} feedstuff, g/day.
$FECB1_j$ is the amount of feed starch in feces from the j^{th} feedstuff, g/day.
$FECB2_j$ is the amount of feed available fiber in feces from the j^{th} feedstuff, g/day.
$FECC_j$ is the amount of feed unavailable fiber in feces from the j^{th}feedstuff, g/day.
$FECHO_j$ is the amount of carbohydrate in feces from the j^{th} feedstuff, g/day.
$FEDM_j$ is the amount of fecal DM from the j^{th} feedstuff, g/day.
$FEENGA_j$ is the amount of endogenous ash in feces from the j^{th} feedstuff, g/day, and

$FEENGF_j$ is the amount of endogenous fat in feces from the j^{th} feedstuff, g/day.

$FEENGP_j$ is the amount of endogenous protein in feces from the j^{th} feedstuff, g/day.

$FEFA_j$ is the amount of undigested feed ash in feces from the j^{th} feedstuff, g/day.

$FEFAT_j$ is the amount of fat in feces from the j^{th} feedstuff, g/day.

$FEFC_j$ is the amount of feed carbohydrate in feces from the j^{th} feedstuff, g/day.

FEFF is the amount of undigested feed fat in feces from the j^{th} feedstuff, g/day.

$FEFP_j$ is the amount of feed protein in feces from the j^{th} feedstuff, g/day.

$FEPB3_j$ is the amount of feed B3 protein fraction in feces from thej^{th} feedstuff, g/day.

$FEPC_j$ is the amount of feed C protein fraction in feces from the j^{th} feedstuff, g/day.

$FEPROT_j$ is the amount of fecal protein from the j^{th} feedstuff, g/day.

FFN is fecal nitrogen from indigestible feed.

FMF is fecal mineral flow from feed, g/day.

FORAGE is forage concentration in the diet, %.

FPN is metabolic fecal protein, g/day.

FSBW is actual final shrunk body weight at the body fat endpoint selected for feedlot steers and heifers, at maturity for breeding heifers or at mature weight × 0.6 for breeding bulls.

GU is grazing unit, ha.

HAIR is effective hair depth, cm.

HE is heat production, Mcal/m^2/day.

HIDE is hide adjustment factor for external insulation .

HRS is hours per day exposed to direct sunlight.

I is insulation value, °C/Mcal /m^2/day.

IDM_j is the indigestible dry matter, g/day.

I_m is DMI for maintenance (no stress).

IMP_j is percent improvement in bacterial yield, %, due to the ratio of peptides to peptides plus non-structural CHO in j^{th} feedstuff.

Intake is total mineral element intake from feedstuffs, grams/head/day.

k is intermediate rate constant.

Kd is feed specific degradation rate of available fiber fraction (decimal form), which must be ≥ $0.02h^{-1}$.

Kd' is pH adjusted feed specific degradation rate of available fiber fraction (decimal form).

KD_{4j} is growth rate of the sugar fermenting carbohydrate bacteria, h^{-1}.

Kd_{4j} is the rumen rate of sugar digestion of the j^{th} feedstuff, h^{-1}.

KD_5j is growth rate of the starch fermenting carbohydrate bacteria,h^{-1}.

Kd_{5j} is the rumen rate of starch digestion of the j^{th} feedstuff, h^{-1}.

KD_{6j} is growth rate of the fiber carbohydrate bacteria, h^{-1}.

Kd_{6j} is the rumen rate of available fiber digestion of the j^{th} feedstuff, h^{-1}.

k_m is diet NEm/diet ME.

KM_1 is the maintenance rate of the fiber carbohydrate bacteria, 0.05 g FC/g bacteria/hour.

KM_2 is the maintenance rate of the non-fiber carbohydrate bacteria,0.15 g NFC/g bacteria/hour.

Kp is passage rate of feedstuff

L is lactation effect on NEm requirement in beef breeds.

LCT is animal's lower critical temperature, °C.

LE is metabolizable energy (net energy) required for lactation, Mcal/day.

$LIGNIN_j$(%NDF) is percentage of lignin of the j^{th} feedstuff's NDF.

Ln is the natural logarithm.

LP is metabolizable protein required for lactation, g/day.

$LPAA_i$ is metabolizable requirement for lactation for the i^{th} absorbed amino acid, g/day.

Mcal is megacalorie

ME is metabolizable energy.

ME_{aj} is metabolizable energy available from the j^{th} feedstuff, Mcal/day.

MEC is metabolizable energy concentration of the diet, Mcal/kg.

MEC_j is metabolizable energy concentration of the j^{th} feedstuff, Mcal/kg.

ME_{cs} is metabolizable energy required for cold stress, Mcal/day.
MEI is metabolizable energy supplied by the diet, Mcal/day
MF is peak milk fat, %,
MFN is metabolic fecal nitrogen.
Milk is daily milk production, kg/day. This value is entered for dairy cattle and calculated for beef cattle.
MILKA is milk production per animal unit, kg/day.
ML is milk lactose on the TLth day of lactation, %.
MP is peak milk protein, %.
MP_a is metabolizable protein available in the diet, g/day.
$MPAA_i$ is metabolizable requirement for the i^{th} absorbed amino acid, g/day.
MP_{aj} is metabolizable protein from the j^{th} feedstuff, g/day.
MP_g is metabolizable protein requirement, g/day.
MP_{maint} (XP) is metabolizable protein requirement for maintenance, g/day.
MP_{mm} is metabolizable protein requirement for mammogenesis, g/day.
MP_{preg} is MP for pregnancy, g/day.
MPRYD is milk true protein yield, kg/d
MUD1 is mud adjustment factor for DMI
MUD2 is mud adjustment factor for external insulation.
MW is mature weight, kg.
$NDFIP_j$(%CP) is percentage of the crude protein of the j^{th} feedstuff that is neutral detergent insoluble protein.
NDF_j(%DM) is percentage of the j^{th} feedstuff that is neutral detergent fiber.
NEga is net energy content of diet for gain, Mcal/kg.
$NEga_j$ is net energy for gain content of the j^{th} feedstuff, Mcal/kg.
NEm is net energy required for maintenance adjusted for acclimatization, activity, and excess N.
NEma is net energy value of diet for maintenance, Mcal/kg.
$NEma_{ct}$ is activity effect on NEm requirement, Mcal/day.
$NEma_j$ is net energy for maintenance content of the j^{th} feedstuff, Mcal/kg.
NEm_{cs} is net energy required for cold stress, Mcal/day.
NEm_{hs} is NEm adjustment for heat stress, %.
NEU is metabolizable nitrogen supply - net nitrogen use (i.e., inefficiency of use).
$NFCBACT_j$ is yield of non-fiber carbohydrate bacteria from the j^{th} feedstuff, g/day.
$NFCBACTN_j$ is non-fiber carbohydrate bacterial nitrogen, g/day.
NFC_j(%DM) is percentage of the DM in the j^{th} feedstuff that isnonfiber carbohydates.
NP_g is net protein requirement, g/day.
NPN_j(%soluble protein) is percentage of soluble protein in the crude protein of the j^{th} feedstuff that is non-protein nitrogen times 6.25.
PA_j(%DM) is percentage of crude protein in the j^{th} feedstuff that is non-protein nitrogen.
PB is protein content of empty body gain, g/100g.
$PB1_j$(%DM) is percentage of crude protein in the j^{th} feedstuff that is rapidly degraded protein.
$PB2_j$(%DM) is percentage of crude protein in the j^{th} feedstuff that is intermediately degraded protein.
$PB3_j$(%DM) is percentage of crude protein in the j^{th} feedstuff that is slowly degraded protein.
PC_j(%DM) is percentage of crude protein in the j^{th} feedstuff that is bound protein.
PCM is milk production corrected to 3.3% crude protein.
PEPBAL is peptide balance, g nitrogen/day.
PEPUPj is bacterial peptide from the j^{th} feedstuff, g/day.
$PEPUPN_j$ is bacterial peptide nitrogen from the j^{th} feedstuff, g/day.
PKYD is peak milk yield, kg/day.
PKMK is the month post-calving when peak milk yield occurs.
Position changes is number of changes between lying and standing per day.

PP is milk protein on a particular d of lactation, %,

PQ is milk fat for a particular d of lactation, %,

$Ratio_j$ is the ratio of peptides to peptide plus NFC in the j^{th} feedstuff.

RD is a proportion of component of a feedstuff degraded in the rumen

$RDCA_j$ is the g NFC in the A (sugar) fraction of the j^{th} feedstuff ruminally degraded.

$RDCB1_j$ is the g NFC in the B1 (starch and pectins) fraction of the j^{th} feedstuff ruminally degraded.

$RDCB2_j$ is the g fiber (FC) in the B2 (available fiber) fraction in the j^{th} feedstuff ruminally degraded.

$RDPEP_j$ is the peptides in the j^{th} feedstuff.

RE is net energy retained, Mcal/day.

$REBAA_i$ is the amount of the i^{th} bacterial amino acid appearing at the duodenum, g/day.

$REBASH_j$ is the amount of bacterial ash passed to the intestine by the j^{th} feedstuff, g/day.

$REBCHO_j$ is the amount of bacterial carbohydrate passed to the intestine by the j^{th} feedstuff, g/day.

$REBCW_j$ is the bacterial cell wall protein appearing at the duodenum as a result of fermentation of the j^{th} feedstuff, g/day.

$REBFAT_j$ is the amount of bacterial fat passed to the intestine by the j^{th} feedstuff, g/day.

$REBNA_j$ is the amount of bacterial nucleic acids passed to the intestine by the j^{th} feedstuff, g/day.

$REBTP_j$ is the bacterial non-cell wall protein appearing at the duodenum as a result of fermentation of the j^{th} feedstuff, g/day

$RECA_j$ is the amount of ruminally escaped sugar from the j^{th} feedstuff, g/day.

$RECB1_j$ is the amount of ruminally escaped starch from the j^{th} feedstuff, g/day.

$RECB2_j$ is the amount of ruminally escaped available fiber from the j^{th} feedstuff, g/day, and

$RECC_j$ is the amount of ruminally escaped unavailable fiber from the j^{th} feedstuff, g/day.

$REFAA_i$ is the amount of i^{th} dietary amino acid appearing at the duodenum, g/day.

$REFAT_j$ is the amount of ruminally escaped fat from the j^{th} feedstuff, g/day.

$REPB1_j$ is the rumen escaped B1 protein from the j^{th} feedstuff, g/day.

$REPB2_j$ is the amount of ruminally escaped B2 true protein in the j^{th} feedstuff, g/day.

$REPB3_j$ is the amount of ruminally escaped B3 true protein in the j^{th} feedstuff, g/day, and

$REPC_j$ is the amount of rumen escaped bound C protein from the j^{th} feedstuff, g/day.

RESC is a proportion of component of feedstuff escaping ruminal degradation

RHC is current month's average relative humidity %.

RHP is previous month's average relative humidity, %.

$RPAA_i$ = growth requirement for the i^{th} absorbed amino acid, g/day.

RPN is net protein required for growth, g/day.

SA is surface area, m^2.

SBW is shrunk body weight, kg. which is defined as 96% of full weight.

$SOLP_j$(%CP) is percentage of the crude protein of the $_j^{th}$ feedstuff that is soluble protein.

SPA is scurf protein, g/d,

SRW is standard reference weight, kg.

Standing is time spent standing, h/day.

$STARCH_j$ (%NFC) is percentage of starch in the non-structural carbohydrate of the j^{th} feedstuff.

SWG is shrunk weight gain, kg.

t is day of pregnancy

T is week of peak lactation.

TAC is true absorpton coefficient.

T_{age} is heifer age, days.

Tc is current mean daily (24 h) temperature, °C.

Tc is current month's average temperature, °C.

TCA is target calving age in days

TCW1 is target first calving weight, kg.

TCW2 is target second calving weight, kg.

TCW3 is target third calving weight, kg.

TCW4 is target fourth calving weight, kg.

TCWx is current target calving weight, kg.
TCWxx is next target calving weight, kg.
$TDNAPP_j$ is apparent TDN from the j^{th} feedstuff, g/day.
TEMP1 is temperature adjustment factor for DMI
TF is total body fat, kg.
TFDM is total fecal dry matter from indigestible feed, g/day.
TI is tissue (internal) insulation value. °C/Mcal/m^2/day.
TL is day of lactation,
TN is degraded tissue nitrogen.
Tp is previous month's average temperature, °C.
TP is total body protein, kg.
TPA is target pregnant age in days
TPW is target pregnant weight, kg.
U is urea N recycled, percent of N intake.
UPA is urinary protein, g/day.
UREA is cost of excreting excess nitrogen, Mcal ME.
W is current week of lactation.
WIND is wind speed, kph.
WS is wind speed, meters/second.
X is diet CP, as a percent of diet dry matter.
Y_{1j} is yield efficiency of FC bacteria from the available fiber fraction of the j^{th} feedstuff, g FC bacteria/g FC digested.
Y_{2j} is yield efficiency of NFC bacteria from the sugar fraction ofthe j^{th} feedstuff, g NFC bacteria/g NFC digested.
Y_{3j} is yield efficiency of NFC bacteria from the starch fraction of the j^{th} feedstuff, g NFC bacteria/g NFC digested.
YE is net energy required for pregnancy, Mcal/day.
YG_1 is the theoretical maximum yield of the fiber carbohydrate bacteria, 0.4 g bacteria/g FC/h.
YG_2 is the theoretical maximum yield of the non-fiber carbohydrate bacteria, 0.4 g bacteria/g NFC/h.
Yn is calculated daily milk yield at week of lactation, kg/day.
Ypn is net protein retained as conceptus, g/day.