

Interactive Nutrient Calculator

Steve Hart

*E (Kika) de la Garza American Institute for Goat Research
Langston University
Langston, OK 73050*

Introduction

The E (Kika) de la Garza American Institute for Goat Research of Langston University is currently leading a consortium of institutions and producer groups in forming a web-based meat goat production certification program. The program will allow persons to study modules developed on all aspects of goat production. Those wishing for certification can pay a fee and take tests on each module. However, the information contained in the modules is available free to anyone; only those wishing certification will have any expense. What follows is taken from the goat nutrition module being developed for the certification program.

Ration balancing background

An early decision necessary in the ration balancing process is the period of time to be addressed. For example, in a 3-month post-weaning period for growing meat goats, should one ration be developed or should the period be divided into smaller segments such as 1 month?. From an efficiency of diet utilization standpoint, the smaller the interval the better. Long feeding periods should result in less than expected performance early in the period and possibly higher levels later, but with the degree of compensation not assumed complete and dependent on numerous factors. But from a practical view, longer periods are simplest. However, changing cost and availability of feedstuffs could also influence the number of different rations balanced within a production phase.

The term 'ration' denotes a daily amount, whereas diet refers to food consumed regardless of time. Animals require absolute amounts of energy and nutrients rather than concentrations. Hence, to balance a ration it is necessary to have an estimate of daily feed intake and express requirements as concentrations thereof. This intake estimate can be based on prior experience or established methods of prediction, although this is an insignificant consideration if feeding a set, limited amount. Although much nutrition and feeding research has dealt with rations, it would seem that relatively most small ruminants in normal settings of the world consume basal forage diets sometimes along with limited amounts of nutrient or energy dense feedstuffs. For goats, use of rations has been mainly restricted to confinement dairy units and 'show' farms.

Ration balancing must consider factors in addition to energy and nitrogen, most notably minerals and vitamins. A deficiency in any of these constituents can make supplying appropriate amounts of energy and nitrogen irrelevant. Moreover, there are other considerations, such as the nitrogen to sulfur ratio and dietary means of averting present or future metabolic and health conditions. For the former, sheep and goats are subject to urinary calculi, resulting in the common practice of dietary inclusion of ammonium chloride and sometimes additional salt in moderate to high concentrate diets. For the latter consideration, ruminants with high milk production potential are often limited in calcium intake in late gestation to metabolically prepare for calcium mobilization in early lactation.

To balance a ration, it is necessary to know nutrient and energy concentrations in available feedstuffs. Laboratory analyses are preferable but relatively less important for concentrates vs forages. For common concentrate feedstuffs, 'book' composition values from the region of interest can in many instances suffice. Conversely, forages are quite variable in nutrient composition. If book values are used, the forage of interest should be matched as closely as possible with those listed in the literature source, and there may be extrapolation necessary such as between forages of different stages of maturity. Byproduct feedstuffs also can vary appreciably in nutrient composition.

In order to decide which feedstuffs should be included in diets, costs per unit of most pertinent nutrient or energy should be compared. For example, feedstuffs such as soybean, cottonseed, peanut, and fish meals are typically added as sources of crude protein (CP), rumen undegraded intake protein, and(or) rumen degraded intake protein, whereas cereal grains are added for energy. Some feedstuffs supply appreciable energy and CP and, thus, cost relative to both should be computed. However, factors in addition to cost influence diet or ration inclusion, such as minimum fiber levels, palatability, associative effects, matching of rates of ruminal degradation of energy and CP sources, avoidance of urinary calculi, ease of handling, 'rule of thumb' limits such as inclusion of nonprotein nitrogen sources like urea, etc.

Associative effects between feedstuffs are very important considerations when balancing rations. That is, some feedstuffs may impair or enhance utilization of others when fed together. Typically associative effects are viewed as having influence via change in feed intake and(or) digestion, although influences on efficiency of metabolism are possible as well. Magnitudes of change in intake vs digestion depend on whether or not intake is ad libitum or limited such as with low forage availability. A common associative effect is when cereal grains rise above 30% of the diet, with further increases decreasing forage intake and(or) digestion; magnitude of change in digestion and intake are inversely and directly related to forage quality or digestibility. Another example of an associative effect is when a forage low in CP is supplemented with a feedstuff high in CP. Rate of fiber digestion is increased, with an increased extent of digestion with restricted forage intake; with ad libitum intake, total and possibly forage intake are elevated though the decrease in ruminal digesta residence time may restrict change in extent of digestion. Another type of potential associative effect is matching of carbohydrate and CP sources similar in rates of ruminal digestion.

Even though a feedstuff may be low in cost and, thus, highly desirable to be placed in a ration, low palatability can limit utility of inclusion. With such feedstuffs, allowing a period of slow adaptation can be very important. Moreover, anecdotal evidence suggests that goats when well accustomed to a certain diet or supplement require more time to become accustomed to even small dietary changes than at least cattle, even if not entailing introduction of particularly unpalatable feedstuffs.

Another feedstuff with a cost to nutrient concentration ratio that cannot always be directly extrapolated to a dietary inclusion level is urea or other nonprotein nitrogen sources. There are common recommendations for upper levels of urea in diets to avoid urea toxicity and ensure efficiency nitrogen utilization, such as supplying no more than one-third of CP in the concentration portion of the diet with the required total level of CP.

How do we adequately provide for the nutritional needs of our animals?

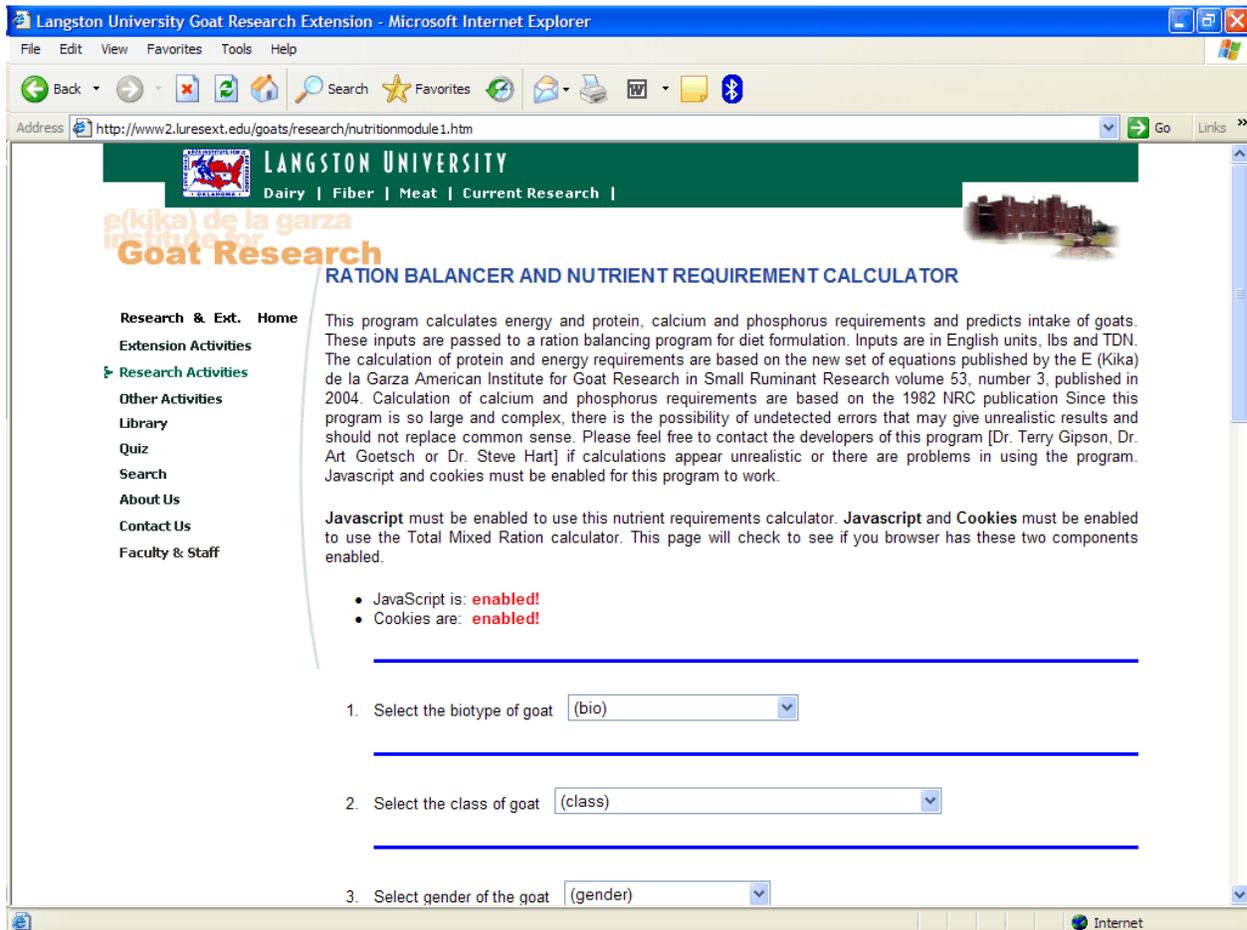
Firstly, we calculate the nutrient requirements. But how do we calculate nutrient requirements? In the past, calculating the nutrient requirements meant digging through technical manuals or scientific articles and looking up values in a table. Sometimes those values needed to be multiplied or divided by other value(s) or added to or subtracted from other value(s). Understanding the mathematics sometimes was complicated and difficult. The E (Kika) de al Garza American Institute for Goat Research has developed an Interactive Nutrient Calculator to facilitate the mathematical calculations necessary to determine nutrient requirements for various classes of goats. The Interactive Nutrient Calculator uses the equations derived from research conducted at the Institute to develop expressions of nutrient requirements of goats published in a special issue of *Small Ruminant Research* (2004, Volume 53, Number 3) published by Elsevier Science.

Secondly, we then utilize available feedstuffs, including pasture or hay, to fulfill those requirements. The Interactive Nutrient calculator also has a feed library and producers can select from various feedstuffs to create a ration that will meet nutrient requirements. The Interactive Nutrient Calculator also has capabilities for adding feedstuffs not found in the feed library.

To use the Langston Interactive Nutrient Calculator, you need to answer questions about your goats and your management practices. The Interactive Nutrient Calculator will then predict intake and requirements for energy, protein, calcium, and phosphorus. We will illustrate the use of the Interactive Nutrient Calculators using examples for a lactating dairy goat and another for a growing meat goat. It should be noted that the Interactive Nutrient Calculator is designed to cover all aspects of goat production and these two examples are for illustration purposes only.

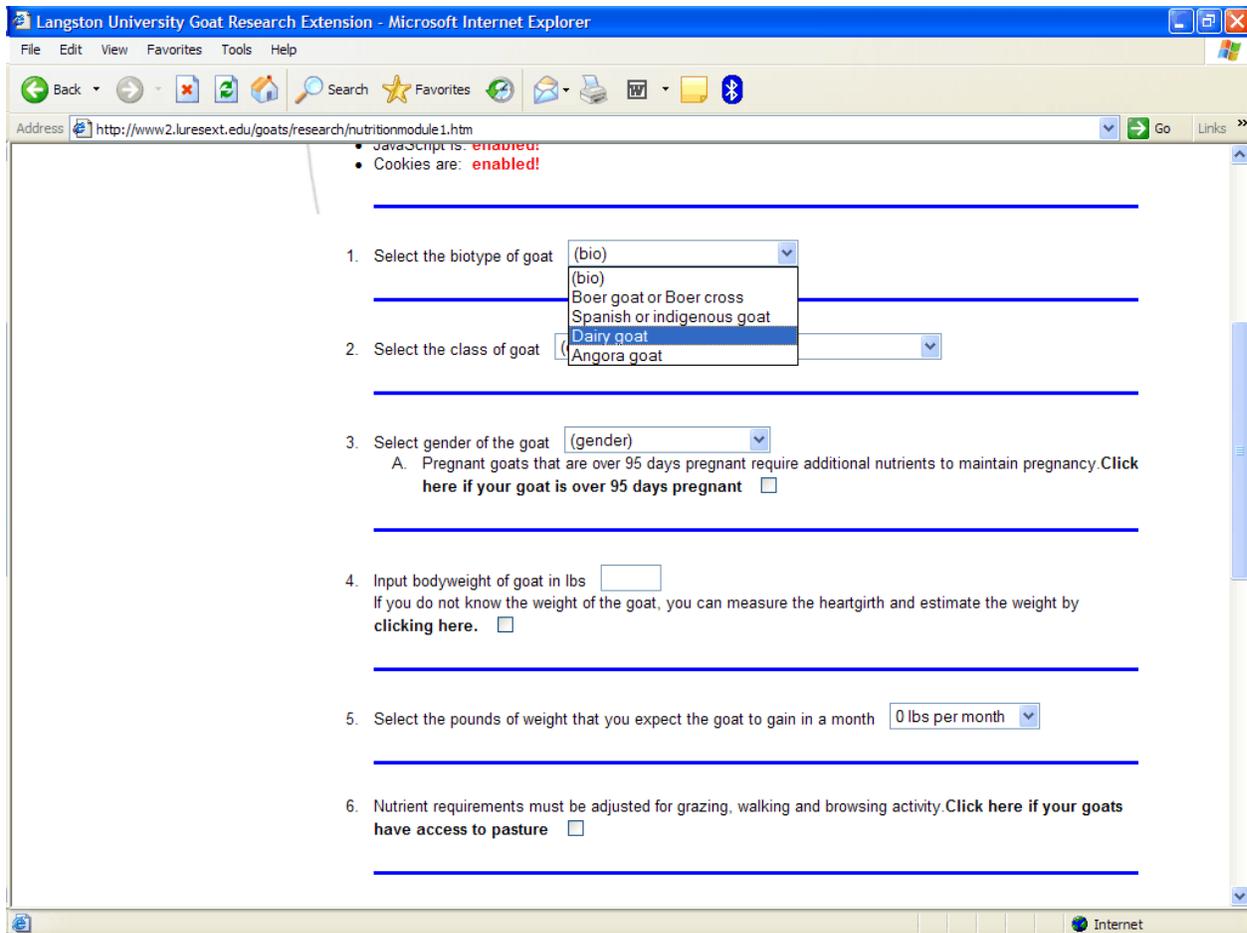
Lactating Dairy Goat Example

Step #1. Access the Interactive Nutrient Calculator by typing <http://www.luresext.edu/goats/research/nutritionmodule1.htm> in the address box of your web browser. The Interactive Nutrient Calculator is browser independent and will operate in Internet Explorer, Netscape, Firefox, Opera, or any browser of your choice.

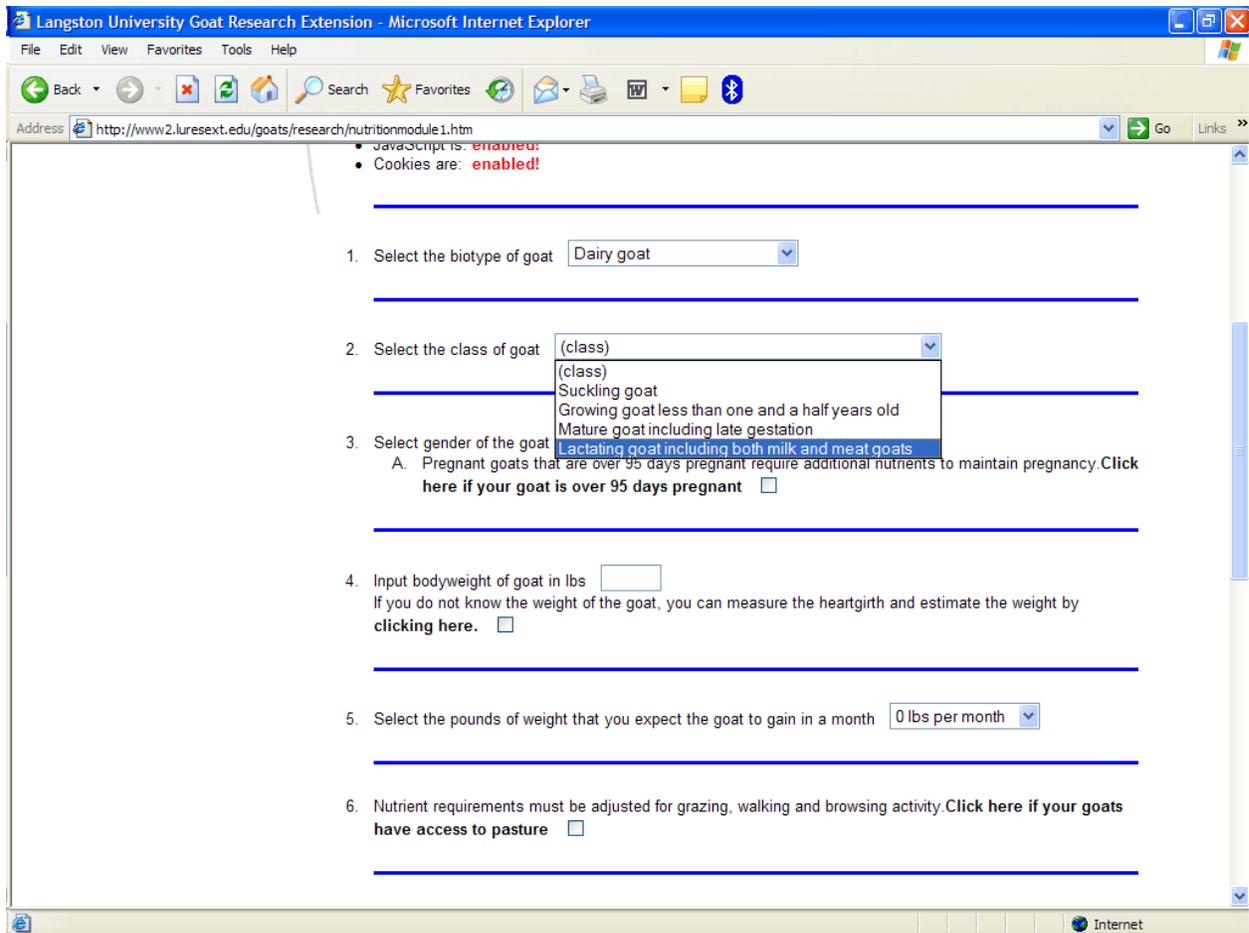


The Interactive Nutrient Calculator requires the functionality of Javascript and cookies. If these two browser components have been disabled, you will need to enable them before using the Interactive Nutrient Calculator. The Interactive Nutrient Calculator will automatically test for the functionality of these two components and will inform you of their functionality, as illustrated in Figure 1 above with the message that javascript and cookies are enabled with “enabled” appearing in bright red letters.

Step #2. Answer questions about your dairy goat and management.



Select the biotype of goat. You select “Dairy goat” from the drop down menu for biotype of goat. Other biotype options include Boer goat or Boer cross, Spanish or indigenous (native) goat, and Angora goat.



Select the class of goat. You select “Lactating goat including both milk and meat goats” from the drop down menu for class of goat. Other options include suckling, growing goat less than a year and a half old, or mature goat including late gestation.

Langston University Goat Research Extension - Microsoft Internet Explorer

Address: <http://www2.luresext.edu/goats/research/nutritionmodule1.htm>

JavaScripts are: **enabled!**
 Cookies are: **enabled!**

1. Select the biotype of goat

2. Select the class of goat

A. input breed

B. input parity

C. input week of lactation

D. input litter size

E. Predicted yield and composition per day is:

milk yield: lbs

fat percentage: %

protein percentage: %

You may edit predicted yield and composition, if you feel these values are incorrect.

3. Select gender of the goat

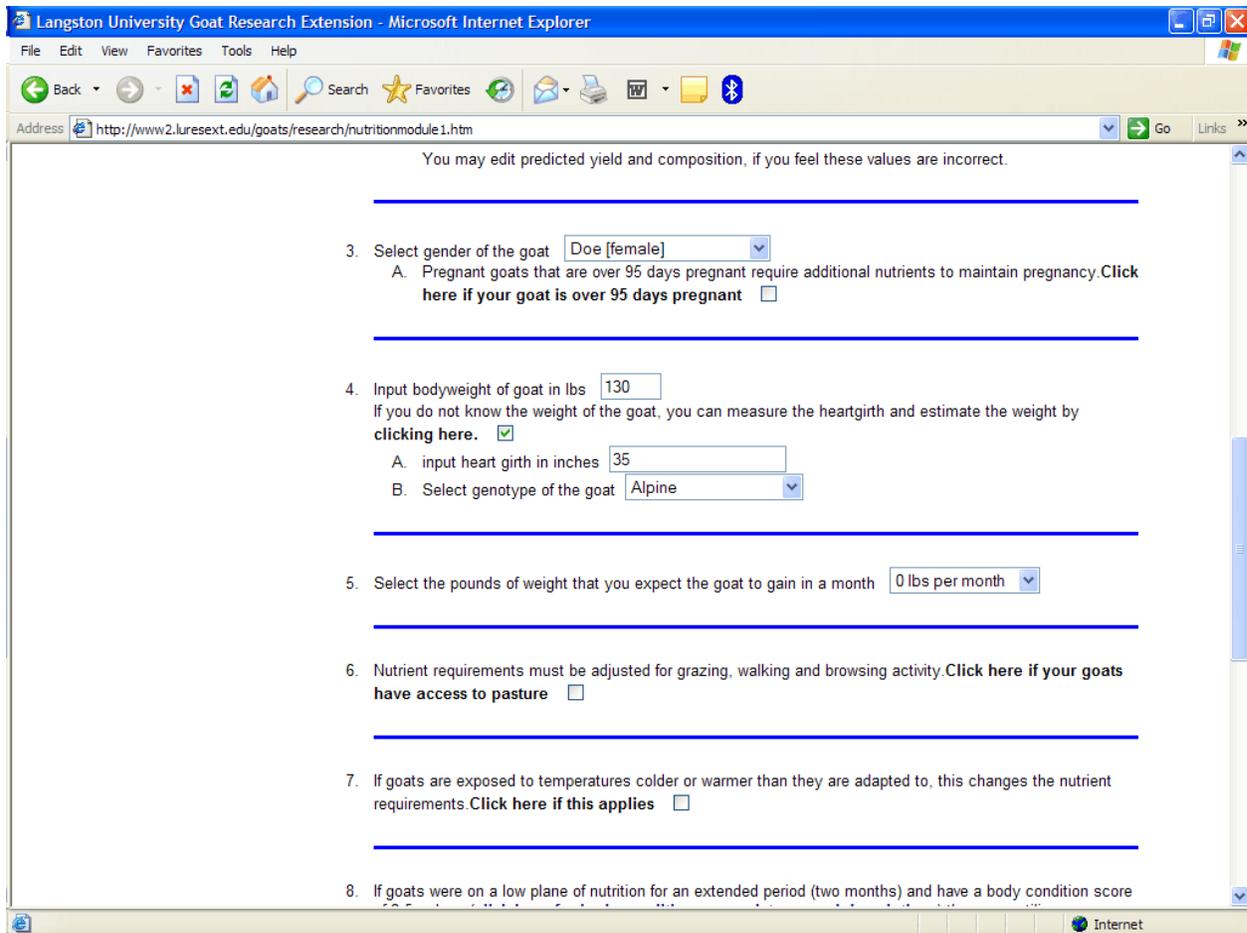
A. Pregnant goats that are over 95 days pregnant require additional nutrients to maintain pregnancy. [Click here if your goat is over 95 days pregnant](#)

4. Input bodyweight of goat in lbs

If you do not know the weight of the goat, you can measure the heartgirth and estimate the weight by [clicking here](#).

Input Milk Production Data. Once you have selected “Lactating goat including both milk and meat goats” from the drop down menu for class of goat, a submenu appears and asks questions about factors affecting predicted milk production. These factors are breed, parity, week of lactation (weeks since kidding), and litter size (number of kids) for lactating dairy goats. For lactating meat and Angora goats, factors are litter size, week of lactation, and age of doe at kidding in years. For dairy does, the options for breed are Alpine, LaMancha, Nigerian Dwarf, Nubian, Oberhasli, Toggenberg, Saanen, or Experimental. For dairy does, parity options are 1st or 2nd or later. For dairy, meat, and fiber producing goats the options for litter size are single, twins, or triplets or greater. For non-dairy goats, the options for age of doe at kidding are 2 to 3 year old or younger, 4 year old, 5 year old, or 6 year old or older. Once these factors have been selected, the Interactive Nutrient Calculator will then predict the amount of milk produced and fat and protein percentages.

For our lactating dairy goat example, we will use an Alpine doe, 2nd or later parity, 3rd week of lactation, and delivered twins. Given our inputs, the Interactive Nutrient Calculator, predicted a milk yield of 10.4 lbs with 4.0% fat and 3.1% protein. These values can be edited, especially for producers who know the amount of milk and fat and protein of their milk.



Select gender of the goat. In our example, this menu item is automatically chosen as “Doe [female]” because we selected “Lactating goat including both milk and meat goats” from the drop down menu for class of goat. Other gender options include Buck [male] or Wether [castrated male]. For our example of a lactating dairy goat, doe is the obvious choice; however, under other scenarios, we would need to choose the gender.

Input body weight of goat in lbs. You can either input actual or estimated weight in the text box or you can have the Interactive Nutrient Calculator estimate the body weight for you using heart girth and breed information. Other options in the breed drop down menu include Angora, Boer, ½ or less Boer, ¾ or 7/8 Boer, LaMancha, Nigerian dwarf, Oberhasli, Saanen, Toggenberg, or Spanish. This body weight estimation can also be useful for calculating body weight for medicines if a scale is not available.

For our lactating dairy goat example, we inputted 35 inches for heart girth and chose Alpine from the Breed drop down menu. The Interactive Nutrient Calculator estimated a body weight of 130 lbs for our Alpine doe.

Langston University Goat Research Extension - Microsoft Internet Explorer - [Working Offline]

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Address <H:\research\nutritionmodule1.htm> Go Links

B. Select genotype of the goat

5. Select the pounds of weight that you expect the goat to gain in a month

6. Nutrient requirements must be adjusted for grazing, walking and browsing activity. [Click here if your goats have access to pasture](#)

7. If goats are exposed to temperatures colder or warmer than they are adapted to, this changes the nutrient requirements. [Click here if this applies](#)

8. If goats were on a low plane of nutrition for an extended period (two months) and have a body condition score of 2.5 or less ([click here for body condition score pictures and descriptions](#)) they may utilize energy more efficiently when they are fed adequately. [Click here if this applies](#)

9. Enter estimated tdn level of the diet.

10. Enter estimated crude protein level (%) of the diet.

My Computer

Select the pounds of weight that you expect the goat to gain in a month. You select the amount of expected weight gain for your goats. Options for this drop down menu range from 0 to 30 lbs per month. For our lactating dairy goat example, we will assume a mature doe that is not losing weight; therefore, we will accept the default value of 0 lbs per month.

Nutrient requirements must be adjusted for grazing, walking, and browsing activity. Nutrient requirements may need adjusting for the physical activity of the animals, such as for the energy expended during grazing. The drop down menu options include stable feeding, intensive management (will fit most Oklahoma goats), semi-arid grazing (goats on extensive ranges out West), and arid (desert) grazing.

For our lactating dairy goat example, we will leave this option unchecked.

If goats are exposed to temperatures colder or warmer than they are adapted to, this changes the nutrient requirements. This is an advanced feature modeled after other species where animals require more energy if they are exposed to a temperature much warmer or much colder than that to which they are accustomed or require less energy if the converse.

For our lactating dairy goat example, we will leave this option unchecked.

If goats were on a low plane of nutrition for an extended period (e.g., two months) and have a body condition score of 2.5 or less, they may utilize energy more efficiently when they are fed adequately. This question relates to the phenomena of compensatory growth that has been well described in cattle. If the box is checked, two questions will appear. Select how long it has been, in weeks, since the animal changed from a low to adequate plane of nutrition and the body condition score at the beginning of improved nutrition. Click to follow a link for body condition score pictures and descriptions.

For our lactating dairy goat example, we will leave this option unchecked.

Enter estimated TDN level of the diet. A default TDN percentage of 60% is used for non-dairy goats. Adjust according to the planned level in the diet. For dairy goats, the default value is 65%.

For our lactating dairy goat example, we will leave this TDN value unchanged.

Enter estimated crude protein level (%) of the diet. The default protein percentage is 10%. Again, adjust according to your planned diet. For dairy goats, the default changes to 15%.

For our lactating dairy goat example, we will leave this TDN value unchanged.

At the bottom of the Interactive Nutrient Calculator, you will see a table with the rows under **Trait** labeled metabolizable energy requirements, metabolizable protein requirements, dry matter intake, calcium requirements, and phosphorus requirements. The rows under **Requirements** are blank.

10. Enter estimated crude protein level (%) of the diet.

| Trait | Requirements |
|------------------------------------|----------------------|
| metabolizable energy requirements | <input type="text"/> |
| metabolizable protein requirements | <input type="text"/> |
| dry matter intake | <input type="text"/> |
| calcium requirements | <input type="text"/> |
| phosphorus requirements | <input type="text"/> |

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Address <http://www2.luresext.edu/goats/research/nutritionmodule1.htm> Go

Calculate Requirements Reset Form

| Trait | Requirements |
|------------------------------------|--------------|
| metabolizable energy requirements | 8.42 Mcal |
| metabolizable protein requirements | 0.52 lb |
| dry matter intake | 7.21 lbs |
| calcium requirements | 18.84 g |
| phosphorus requirements | 14.07 g |

Select Feed Ingredients

You may now proceed to the Mixed Ration Balancer by clicking on the above "Select Feed Ingredients" button. Then click on the feedstuffs to be included in the diet. If feedstuffs other than those in the library will be used, then these should be entered into the library. In the second window, enter the percentages on a DM basis and cost for each feedstuff. The total of the DM percentage should be 100. Any changes to library composition values for particular feedstuffs should be made in the second window. It should be noted that only the last formulation is available. If you plan on formulating several diets, it would be a good idea to print each formulation.

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Click on the *Calculate Requirements* button. The nutrient requirements are now estimated. A value of 8.42 Mcal for metabolizable energy requirements, 0.52 lb for metabolizable protein requirements, 7.21 lbs for dry matter intake, 18.84 g for calcium requirements, and 14.07 g for phosphorus requirements were estimated using the inputs from our lactating dairy goat example. You will also notice that a section under the nutrient requirements table has appeared. It is the link to the feed library. You have successfully completed the first part mentioned in the Introduction above. You are ready to move to the second part of selecting available feedstuffs to formulate a ration that will meet the nutrient requirements that you just calculated.

Before continuing with this example, we will calculate the nutrient requirements for our growing meat goat example beginning with Step #2 as outlined above.

Growing Meat Goat Example

The screenshot shows a Microsoft Internet Explorer browser window titled "Langston University Goat Research Extension - Microsoft Internet Explorer". The address bar displays "http://www2.luresext.edu/goats/research/nutritionmodule1.htm". The page content includes status messages for JavaScript and Cookies, both marked as "enabled!". Below these are six numbered steps for form completion:

1. Select the biotype of goat: A dropdown menu is set to "Boer goat or Boer cross".
2. Select the class of goat: A dropdown menu is set to "Growing goat less than one and a half years old".
3. Select gender of the goat: A dropdown menu is set to "Wether [castrated male]". Below it, a sub-item "A. Pregnant goats that are over 95 days pregnant require additional nutrients to maintain pregnancy. Click here if your goat is over 95 days pregnant" has an unchecked checkbox.
4. Input bodyweight of goat in lbs: A text box contains the value "45". Below it, a note says "If you do not know the weight of the goat, you can measure the heartgirth and estimate the weight by clicking here." with an unchecked checkbox.
5. Select the pounds of weight that you expect the goat to gain in a month: A dropdown menu is set to "15 lbs per month".
6. Nutrient requirements must be adjusted for grazing, walking and browsing activity. Click here if your goats have access to pasture: An unchecked checkbox.

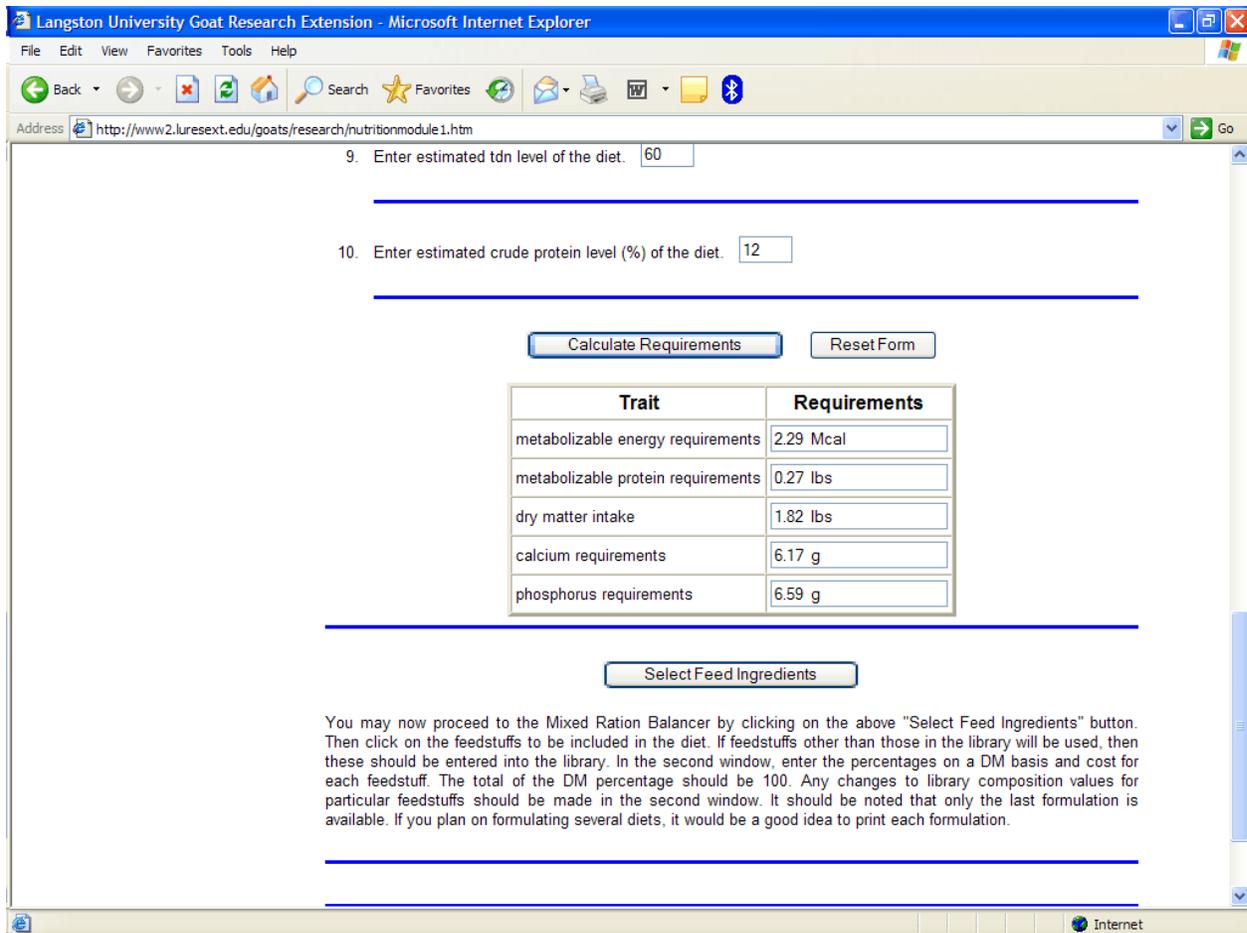
Select the biotype of goat. You select “Boer goat or Boer cross” from the drop down menu for biotype of goat.

Select the class of goat. You select “Growing goat less than a year and a half old” from the drop down menu for class of goat.

Select gender of the goat. You select “Wether [castrated male]” from the drop down menu for gender.

Input body weight of goat in lbs. For our growing meat goat example, we will assume a body weight of 45 lbs. Type this value into the text box.

Select the pounds of weight that you expect the goat to gain in a month. For our growing meat goat example we desire an average daily gain of 0.5 lb/day. Therefore, you select 15 lbs per month from the drop down menu for weight gain in a month.



As in the lactating dairy goat example, we will accept the default values for *Nutrient requirements must be adjusted for grazing, walking, and browsing activity; If goats are exposed to temperatures colder or warmer than they are adapted to, this changes the nutrient requirements; If goats were on a low plane of nutrition for an extended period (two months) and have a body condition score of 2.5 or less, they may utilize energy more efficiently when they are fed adequately; Enter estimated TDN level of the diet; and Enter estimated crude protein level (%) of the diet.* The default values for these last two options for growing meat goats are 60% and 12%, respectively.

Click on the Calculate Requirements button. The nutrient requirements are now estimated. A value of 2.29 Mcal for metabolizable energy requirements, 0.27 lb for metabolizable protein requirements, 1.82 lbs for dry matter intake, 6.17 g for calcium requirements, and 6.59 g for phosphorus requirements were estimated using the inputs from our growing meat goat example. As in the lactating dairy goat example, you will notice that the link to the feed library under the nutrient requirements table has appeared.

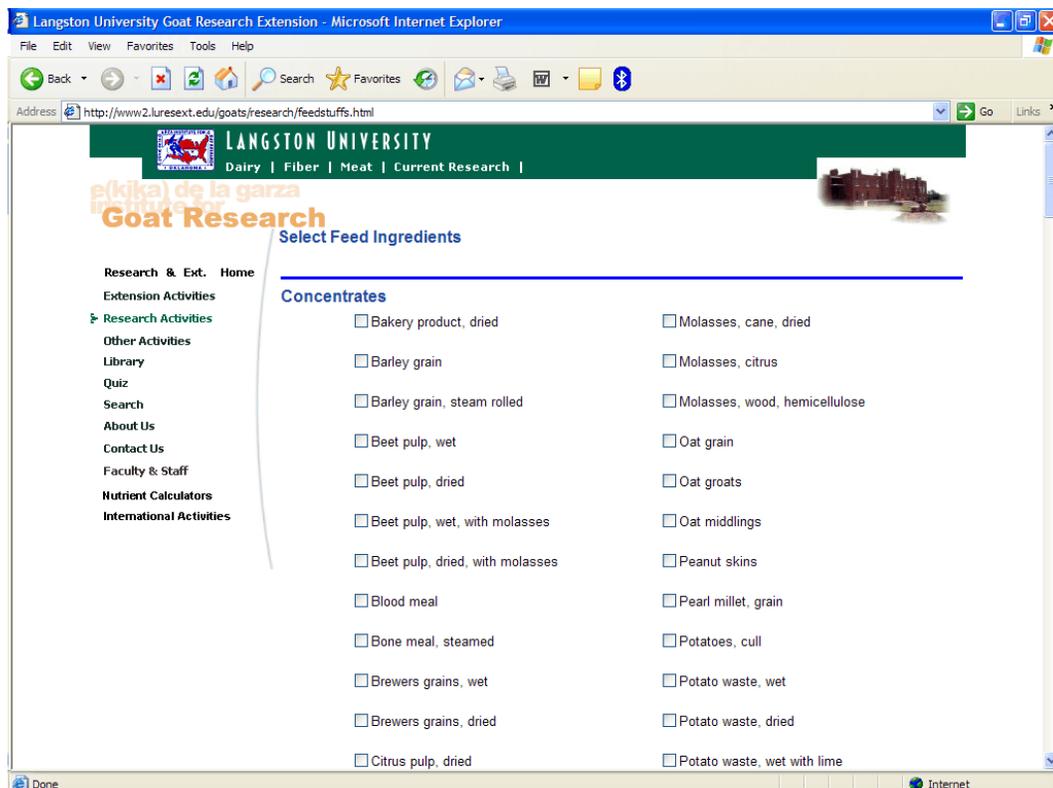
We will use the lactating dairy goat example to illustrate the feed library and subsequent ration formulation.

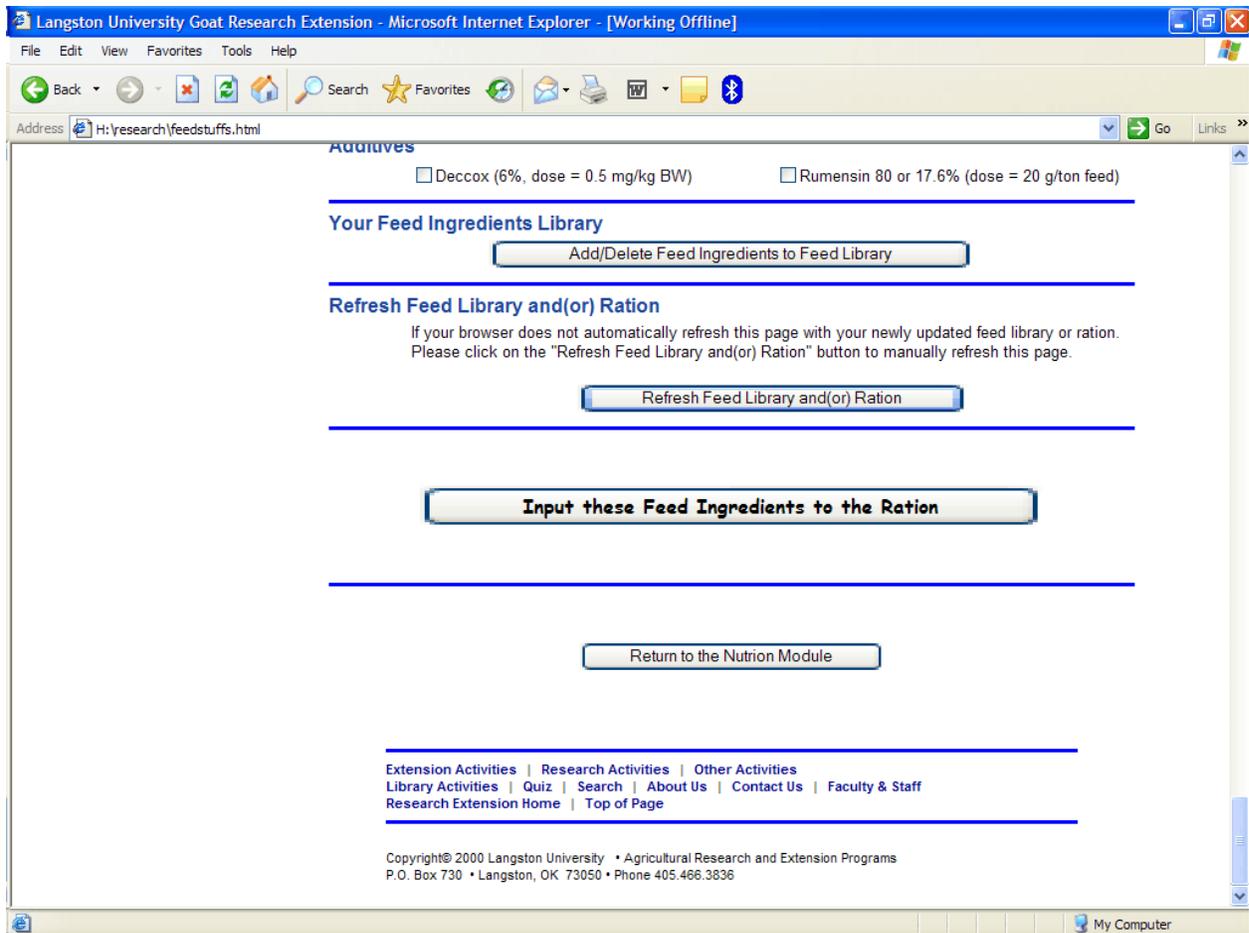
Feed Library and Ration Formulation

You can enter the feed library by clicking on the Select Feed Ingredients button. The feed library has 91 feed ingredients under the category of Concentrates, 94 feed ingredients under the category of Forages, 14 feed ingredients under the category of Minerals, 5 feed ingredients under the category of Vitamins, and 2 feed ingredients under the category of Additives. The feed library has the flexibility of adding feed ingredients if none of these 206 feed ingredients is exactly the feed ingredient that is available to you.

For our lactating dairy goat example, we will use a ration consisting primarily of cracked corn, cottonseed hulls, alfalfa hay, and fish meal and with lesser percentages of soybean meal, molasses, and fat. We will also add minerals and vitamins to the ration. We begin by clicking on the checkboxes associated with “Corn grain, rolled or ground or cracked”, “Fish meal”, “Fat, animal, poultry, vegetable”, “Molasses, cane” and “Soybean meal, solvent, 49% CP” from the Concentrates category and “Alfalfa hay, early bloom” and “Cottonseed hulls” from the Forages category. Under the Minerals category, you can add the minerals by clicking on “Ammonium sulfate”, “Calcium bicarbonate”, “Magnesium oxide”, and “Trace mineralized salt 1 (9-10% Ca, 6% P, 35-40% NaCl, 1% Mg, 1% K, 1% S, 125 mg/kg Co, 150 mg/kg I, 5,000 mg/kg Fe, 10 mg/kg Se, 160,000 IU/lb A, 40,000 IU/lb D, 150 IU/lb E)”. Also you can click on “Vitamin premix 1 (18,000 IU/lb A, 3,920 IU/lb D, 2.45 IU/lb E)” under the Vitamins category.

We have now selected all the feed ingredients that we desire for our lactating dairy goat example.





After you have selected the desired feed ingredients, you must scroll to the bottom of the feed library page and locate the “Input these Feed Ingredients to the Ration” button.

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Address http://www2.luresext.edu/goats/research/feedstuffsp.html

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| Feed Class | Feed Ingredient | Percentage (% as fed) | Percentage (% DM) | Cost | TDN | CP |
|-------------|---|-----------------------|-------------------|-------|-----|----|
| Concentrate | Corn grain, rolled or ground or cracked | <input type="text"/> | 38.54 | 0.067 | 87 | 9 |
| Concentrate | Fat, animal, poultry, vegetable | <input type="text"/> | 3 | 0.190 | 205 | 0 |
| Concentrate | Fish meal | <input type="text"/> | 9 | 0.520 | 74 | 66 |
| Concentrate | Molasses, cane | <input type="text"/> | 3 | 0.070 | 75 | 5 |
| Concentrate | Soybean meal, solvent, 49% CP | <input type="text"/> | 4.04 | 0.116 | 87 | 54 |
| Forage | Alfalfa hay, early bloom | <input type="text"/> | 20 | 0.050 | 59 | 19 |
| Forage | Cottonseed hulls | <input type="text"/> | 20 | 0.043 | 45 | 4 |
| Minerals | Ammonium sulfate | <input type="text"/> | 0.24 | 0.280 | | |
| Minerals | Magnesium oxide | <input type="text"/> | 0.18 | 0.290 | | |
| Minerals | Sodium bicarbonate | <input type="text"/> | 1 | 0.186 | | |
| Minerals | Trace mineralized salt 1 (9-10% Ca, 6% P, 35-40% NaCl, 1% Mg, 1% K, 1% S, 125 mg/kg Co, 150 mg/kg I, 5,000 mg/kg Fe, 10 mg/kg Se, 160,000 IU/lb A, 40,000 IU/lb D, 150 IU/lb E) | <input type="text"/> | 0.5 | 0.083 | | |
| Vitamins | Vitamin premix 1 (18,000 IU/lb A, 3,920 IU/lb D, 2.45 IU/lb E) | <input type="text"/> | 0.5 | 0.520 | | |
| | Running total for percentage | <input type="text"/> | 100 | | | |

Done Internet

The next step is to input the percentage of each feed ingredient as it will appear in the ration in the table. This can be on an as fed basis or a dry matter basis. The ration balancer will use the dry matter basis in calculating the nutritional basis of the ration. If you enter the percentages on an as fed basis, the ration balancer will automatically calculate the dry matter basis for you. Both the as fed and dry matter bases should equal 100%. A running total for as fed and dry matter is located at the bottom of the table. You may add the feed cost in this table, which can either be in absolute or relative amounts. Feed costs should be on an as fed basis, and in the same units (e.g., dollars per as fed lb). This might require dividing \$210 per ton of soybean meal by 2,000 lbs/ton to arrive at \$0.105 per as fed lb, and \$2.67 per bushel of corn by 56 lbs/bushel to obtain \$0.048 per as fed lb. Some example costs have been added. You may change the total digestible nutrients (TDN) percentage and crude protein (CP) percentage of any feed ingredient listed in the table. At the bottom of the page is a "Continue" button. Click on this button to proceed to the analysis of the ration.

Langston University Goat Research Extension - Microsoft Internet Explorer

Address: <http://www2.luresext.edu/goats/research/rationbalancer2.html>

Contact us
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- Lactating Goats
 - dairy
 - body weight: 59 kg (130 lbs)
 - tissue gain: 0 g/day (0.00 lbs/day)
 - milk production: 4.7 kg (10.4 lbs)
 - milk concentration of fat: 4%
 - milk concentration of protein: 3.1%

| Ingredient | Percentage (DM) | Percentage (as fed) | Unit cost | TDN (%) | CP (%) | CP (supp) | ME (supp) |
|---|-----------------|---------------------|--------------|---------|--------|--------------|--------------|
| Corn grain, rolled or ground or cracked | 38.54% | % | 0.067 | 87 | 9 | 3.47 | 5.06 |
| Fat, animal, poultry, vegetable | 3% | % | 0.190 | 205 | 0 | 0.00 | 0.93 |
| Fish meal | 9% | % | 0.520 | 74 | 66 | 5.94 | 1.01 |
| Molasses, cane | 3% | % | 0.070 | 75 | 5 | 0.15 | 0.34 |
| Soybean meal, solvent, 49% CP | 4.04% | % | 0.116 | 87 | 54 | 2.18 | 0.53 |
| Alfalfa hay, early bloom | 20% | % | 0.050 | 59 | 19 | 3.80 | 1.78 |
| Cottonseed hulls | 20% | % | 0.043 | 45 | 4 | 0.80 | 1.36 |
| Ammonium sulfate | 0.24% | % | 0.280 | 0 | 132 | 0.32 | 0.00 |
| Magnesium oxide | 0.18% | % | 0.290 | | | 0.00 | 0.00 |
| Sodium bicarbonate | 1% | % | 0.186 | | | 0.00 | 0.00 |
| Trace mineralized salt 1 (9-10% Ca, 6% P, 35-40% NaCl, 1% Mg, 1% K, 1% S, 125 mg/kg Co, 150 mg/kg I, 5,000 mg/kg Fe, 10 mg/kg Se, 160,000 IU/lb A, 40,000 IU/lb D, 150 IU/lb E) | 0.5% | % | 0.083 | | | 0.00 | 0.00 |
| Vitamin premix 1 (18,000 IU/lb A, 3,920 IU/lb D, 2.45 IU/lb E) | 0.5% | % | 0.520 | | | 0.00 | 0.00 |
| | | | 0.110 | | | 16.66 | 11.01 |

This next page is divided into three parts. The top part gives the class and production level of the goat, which is a lactating dairy goat in our example. This is followed by a table of the feed ingredients in the ration, the as fed and dry matter percentages, feed cost, if entered previously, TDN and crude protein percentages of the feed ingredient, and the amount of crude protein and metabolizable energy supplied by each feed ingredient at its given dry matter percentage. At the bottom of the table, total crude protein percentage and metabolizable energy in megajoules (MJ) for the ration is presented. The ration balancer has converted your metabolizable energy requirement from Mcal to MJ, and metabolizable protein requirement and predicted dry matter intake from pounds to grams (g) and kilograms (kg), respectively (1 Mcal = 4.1839 MJ; 1 lb = 454 g; 1000 g = 1 kg). This conversion is necessary for the functionality of the page, which is also used by a more complex version of the nutrient requirement calculator and that complex version requires values to be expressed in MJ, g, and kg. A button is below the table that will allow you to return to the previous page and change as fed and/or dry matter percentages, feed costs, crude protein percentage, or TDN percentage of individual feed ingredients.

Langston University Goat Research Extension - Microsoft Internet Explorer

Address: <http://www2.luresext.edu/goats/research/ratibalancer2.html>

A, 3,920 IU/lb D, 2.45 IU/lb E

| | | | |
|--|-------|-------|-------|
| | 0.110 | 16.66 | 11.01 |
|--|-------|-------|-------|

Change Feed Percentages

| | |
|---|-------|
| crude protein (% of DM) | 16.66 |
| rumen undegraded intake protein (% of CP) | 38.93 |
| metabolizable protein (% of DM) | 11.79 |
| total digestible nutrients (% of DM) | 72.90 |
| metabolizable energy (MJ/kg of DM) | 11.01 |
| acid detergent fiber (% of DM) | 22.18 |
| neutral detergent fiber (% of DM) | 31.31 |
| effective NDF (% of NDF) | 53.33 |
| fat (ether extract; % of DM) | 6.19 |
| ash (% of DM) | 6.40 |
| calcium (% of DM) | 0.86 |
| phosphorus (% of DM) | 0.49 |
| potassium (% of DM) | 1.14 |
| chlorine (% of DM) | 0.26 |
| sulfur (% of DM) | 0.28 |
| zinc (mg/kg DM) | 28.67 |
| % DM | 89.3 |

| | | | |
|--------|-------------|--|---|
| Energy | Maintenance | ME requirement for maintenance = 10.7 MJ. From 3.27 kg (DM basis) of feed, there is 36.0 MJ. This is adequate for maintenance. | ✓ |
| | Gain | ME requirement for gain = 0.0 MJ. From 3.27 kg (DM basis) of feed and after subtracting maintenance ME requirement, there is 25.4 MJ left for other functions. | ✓ |
| | | ME requirement for lactation = 24.5 MJ. From 3.27 kg (DM basis) of feed and | ✓ |

The middle section provides the nutritional breakdown of the ration in tabular form. Values for crude protein and metabolizable energy are repeated. Metabolizable protein is a calculated and reported. This value will be used in the bottom section to ascertain if the ration is adequate in metabolizable protein or not. TDN, ADF, NDF, fat percentage, ash (total minerals) several individual minerals, and dry matter percentage is also calculated for the ration.

| | | | |
|-----------------|-------------|--|---|
| zinc (mg/kg DM) | | 20.07 | |
| % DM | | 89.3 | |
| Energy | Maintenance | ME requirement for maintenance = 10.7 MJ. From 3.27 kg (DM basis) of feed, there is 36.0 MJ. This is adequate for maintenance. | ✓ |
| | Gain | ME requirement for gain = 0.0 MJ. From 3.27 kg (DM basis) of feed and after subtracting maintenance ME requirement, there is 25.4 MJ left for other functions. | ✓ |
| | Lactation | ME requirement for lactation = 24.5 MJ. From 3.27 kg (DM basis) of feed and after subtracting maintenance ME requirement, there is 25.4 MJ left for other functions. This is adequate for lactation. | ✓ |
| | Total | Total ME requirement = 35.2 MJ. From 3.27 kg (DM basis) of feed, there is 36.0 MJ. | ✓ |
| Protein | Maintenance | MP requirement for maintenance = 24.3 g. From 3.27 kg (DM basis) of feed, there is 385.6 g. This is adequate for maintenance. | ✓ |
| | Gain | MP requirement for gain = 0.0 g. From 3.27 kg (DM basis) of feed and after subtracting maintenance MP requirement, there is 361.3 g left for other functions. | ✓ |
| | Lactation | MP requirement for lactation = 210.2 g. From 3.27 kg (DM basis) of feed and after subtracting maintenance ME requirement, there is 361.3 MJ left for other functions. This is adequate for lactation. | ✓ |
| | Total | Total MP requirement = 234.5 g. From 3.27 kg (DM basis) of feed, there is 385.6 g. | ✓ |

The bottom section checks the ration and determines if it will meet the nutrient requirements when consumed at the predicted rate. The upper half of this table checks the ration for adequacy in metabolizable energy. This half gives the metabolizable energy requirements for maintenance plus any appropriate stage of production such as gain, gestation, lactation, or fiber production. The total amount of metabolizable energy is calculated by multiplying the predicted dry matter intake by the metabolizable energy level in the ration, which can be found at the bottom of the table in the upper section or in the upper part of the table in the middle section. If an adequate amount of metabolizable energy is available for maintenance or appropriate stage of production then a green check mark will appear. If the ration is inadequate, then a red X will appear. The bottom half of the table gives the metabolizable protein requirements, and protein adequacy is calculated in an analogous fashion to energy. The metabolizable protein percentage can be found in the upper part of the table in the middle section, and this value along with predicted dry matter intake is used to calculate available metabolizable protein.

If the ration is inadequate in either metabolizable energy or protein, then you may use the “Change Feed Percentages” button located in the upper section to modify the percentages until you have formulated a ration that does meet the metabolizable energy and protein requirements. In some cases, it may be necessary to return to the feed library and choose new feed ingredients for a ration that will meet metabolizable energy and protein requirements. Or a producer can accept that the desired level of growth (gain) or milk production (lactation) may not be met with a desired ration.

Conclusions

There are many different methods balancing rations. This can be done in a very simplistic fashion such as with a hand calculator. Spreadsheets are often used as well, which greatly increases the speed with which formations can be changed. Typically effectiveness of these methods are dependent on knowledge of the balancer. Alternatively, there are software packages and the Institute's Interactive Nutrient Calculator available that have incorporated requirements. Some such packages and programs have capabilities of determining least cost rations; however, factors such as feedstuff availability, ease of handling, minimum fiber levels, etc., still need consideration. Regardless of the method used, most appropriate requirement expressions and feedstuff composition values are usually deemed of relatively greater importance.

The Langston Interactive Nutrient Calculator is a powerful tool that will aid the goat producer in more efficiently managing his/her animals. Goat rations can be formulated to exactly meet the nutrient requirements of any class of goat in any stage of production. This will prevent underfeeding, which will decrease desired production levels, and will prevent overfeeding, which will decrease profitability due to feed losses.

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