Navigating to a Balanced Ration

Part 1: Balancing for Energy

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Knowing how to feed your sheep or goats is one of the most important pieces of knowledge held by a producer. Making sure a flock/herd has the proper nutrition is necessary for a high percentage lamb or kid crop, heavy weaning weights for the growing offspring, a high rebreeding percentage in the mothers and last, but not least, the development of satisfactory replacement females. Feeding a balanced ration will support optimum reproduction, minimize problems at or near birth, minimize health issues in the newborn and be economical.

Nutrients

The beginning point of feeding is knowing what nutrients your animals need for growth and reproduction. Five nutrients are necessary: water, vitamins, minerals, protein and energy.

Water

Water is the nutrient given the least consideration, but may be the most important. It is the primary nutrient in the body and is necessary for digestion, regulation of body temperature and excretion of metabolic waste. Most importantly, it controls feed intake. As water intake decreases, feed dry matter intake decreases. Water must be adequate for animals to eat enough feed to meet their needs.

Vitamins

Small ruminants require vitamins A, D, E, K and all of the B vitamins. Fortunately, the animals can make most of these. Vitamin K and the B vitamins are made by the rumen bacteria during fermentation of feed intake. The animal has the ability to make vitamin D from a chemical reaction in the skin when exposed to direct sunlight. High quality forages contain beta carotene and the animal can convert this precursor to vitamin A. Vitamin E is generally supplied in abundance in high quality, leafy, green forage. Deficiencies of vitamins are rare but they do occur occasionally. Beta carotene drops when forage is allowed to become too mature before harvesting for hay and when hay rolls are left out in the winter to weather and lose quality. Drought will result in a loss of leafy, green forage available for grazing and can cut down on vitamin intake. Good insurance is to use a mineral product as a supplier of vitamins and have it available free choice.

Minerals

Minerals should be considered in one of two categories. Macro minerals are those needed in larger quantities and consist of calcium, phosphorus, magnesium, potassium, sodium, chlorine and sulfur. Trace minerals (micro) are those needed only in small quantities and consist of cobalt, iodine, iron, manganese,

selenium, zinc, molybdenum and copper. Small ruminants do not require large amounts of any mineral, but this does not make them any less essential for growth, reproduction and health. However, when choosing mineral for small ruminants, one major difference between sheep and goats must be considered. Goats require more copper than sheep and are not as sensitive to this mineral excess as sheep. Copper toxicity can occur readily with sheep when too much is supplied.

Protein

Small ruminants actually have two requirements for protein. First, protein is needed to supply nitrogen to the rumen bacteria to maximize fermentation of feed intake. Without maximizing rumen fermentation, bacterial energy and protein production will be limited to the animal. Secondly, protein is needed to supply amino acids to the small intestine of the animal to be absorbed for tissue growth and repair. Due to the two requirements, feed proteins may be considered as two types. First is rumen degradable protein (RDP). This type breaks down in the rumen and supplies nitrogen to the rumen bacteria. The second type is rumen undegradable protein (RUP). This type escapes ruminal breakdown, but can still be digested and absorbed in the small intestine to supply the needed amino acids to the animal. Together, both sources are known as metabolizable protein representing the total protein needs of the rumen bacteria and the animal.

Energy

Energy is the nutrient needed in greatest abundance in the feeds consumed. It is composed primarily of carbohydrate and fat intake. Rumen bacteria ferment the complex carbohydrates in forage and the simple carbohydrates, such as starch, in grains and produce fatty acids which the animal uses as a primary energy source. The more mature the complex carbohydrates or fiber in forages, the slower and less complete rumen fermentation will be and the less energy the animal will receive. Energy is the most common limiting nutrient. Less than optimum energy intake will result in decreased production, decreased reproduction and increased lamb/kid morbidity, mortality and parasite infection.

Nutrient Requirements

After understanding *what* nutrients are needed, the next step is finding out *how much* of each nutrient is needed. Nutrient requirements for small ruminants are shown in the following tables.

Table 1: Nutrient Requirements, 150 Pound Mature Female, % of Ration Dry Matter

Stage	DMI, lbs	CP %	TDN %	Calcium %	Phosphorus %
Maintenance	2.6	8.6	54	.2	.17
Early Gest. Twins	3.7	8.5	53	.38	.27
Late Gest. Twins	4.0	11	66	.48	.29
Lactation twins	4.4	15.5	66	.4	.35
NRC 2007					

Table 2: Nutrient Requirements for Small Ruminant Replacement Females, % of Ration Dry Matter

Weight, lbs	DMI, lbs	CP %	TDN %	Calcium %	Phosphorus %
66	**2.6**	**15.8**	**65**	**.54**	**.23**
88	3.1	12.8	65	.42	.19
110	3.3	9	57	.33	.15
132	3.3	9	57	.3	.15
154	3.3	9	57	.3	.18

Table 3: Nutrient Requirements for Finishing Small Ruminants, % of Ration Dry Matter

Weight, lbs	ADG, lbs	DMI, lbs	CP %	TDN %	Calcium %	Phosphorus %
66	.72	2.9	15.1	78	.51	.24
88 to 130	.88	3.5	14.5	78	.55	.24

Feed and Forage Analysis

The next step is to get a feed or forage analysis and compare the nutrient content of what you have with what the animals need. An example forage analysis is shown in Table 4. The forage is a grass legume mixture. The analysis is shown as both an "as fed basis" and a "dry matter basis". "As fed" takes into account an average of 10% moisture in the feed. "Dry matter" does not take into account any moisture levels in the feed. When evaluating a feedstuff or balancing a ration, **always** use the data from the dry matter column. By comparing the analysis with the needs shown in the above tables, it is obvious that forage alone will meet the needs of the mature female for maintenance and early gestation- even with twins! However, supplementation of energy, protein, minerals and vitamins will be necessary for other life stages and maximum production.

Table 4: Example Forage Analysis, Percent

	As Received Basis	Dry Matter Basis
Moisture	12.0	
Dry Matter	88.0	100
Crude Protein	12.5	**14.2**
RDP, % of CP		55
TDN	51	**58**
Calcium	.44	.50
Phosphorus	.26	.30

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Balanced Ration continued from pg. 23

Putting It All Together

As an example, the following shows how to balance a simple ration for a 66 pound replacement female. She requires a ration that is 15.8% crude protein and 65% TDN (**Table 2**). The feeds include the hay **(Table 4**) and a purchased concentrate supplement. The **purchased supplement is 24% protein and 80% TDN** on a dry matter basis.

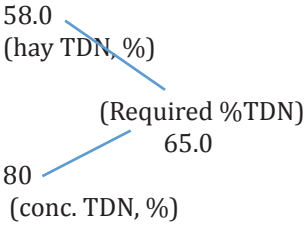
We will use a Pierson Square to *balance for energy* first.

Step 1: Place the TDN values of the two feeds (58% from the hay analysis- **Table 4** and 80% from the purchased conc. feed) on the left diagonals

58.0
(hay TDN, %)

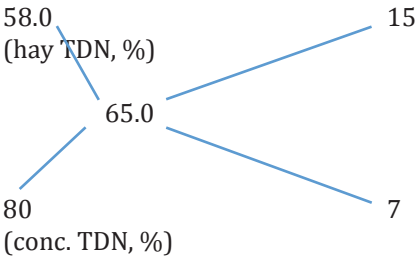
80
(conc. TDN, %)

Step 2: Place the required TDN value in the center of the square (65.0 %TDN from **Table 2**)



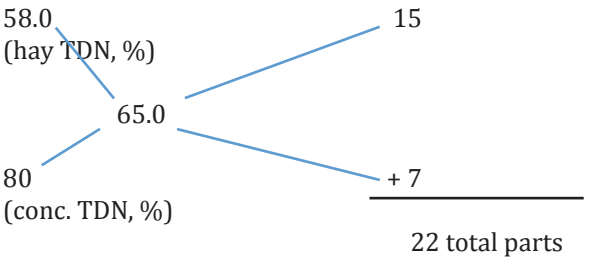
Step 3: Subtract across the diagonal placing the differences on the right diagonals.

80 (conc. TDN, %) - 65= 15
65.0 - 58.0 (hay TDN, %)=7

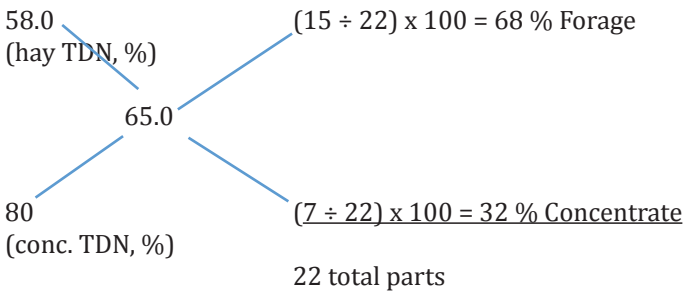


Step 4: Add the values on the right diagonals and this is the total parts of the ration.

15 + 7= 22 total parts



Step 5: Now calculate the percent hay and concentrate for the ration.
(15 ÷ 22) x 100= 68% forage
(7 ÷ 22) x 100= 32% concentrate



On a dry matter basis, the ration will be 68% forage and 32% concentrate to meet her energy requirements (roughly a 2:1 ratio).

Now you need to convert the 68% forage and 32% concentrate into the pounds of feed that will be fed each day. From the table, we know the animal will eat 2.6 pounds of dry matter (**DMI/lb from Table 2**).

To covert the DMI to an as-fed basis, divide the required DMI from **Table 2** by the average dry matter content of feedstuffs as they are fed, which is 90%.

2.6 lbs DMI from **Table 2** ÷ .9= 2.9 lbs of as-fed feed, rounded to 3.0 lbs of total feed/head/day

This means we feed 2 pounds of hay and 1 pound of the concentrate daily to meet the energy needs of the animal.

The Next Step

As mentioned in the beginning of this article, energy is just one nutrient that is required by small ruminants. The second largest nutrient required is crude protein. To actually complete a balanced ration, you must determine if your forage and concentrate meet the crude protein requirements.

The steps to balance a ration for crude protein will be presented in the Navigating to a Balanced Ration – Part 2: Balancing for Crude Protein in the April 1, 2017 issue of HoofPrint.

Remember

Providing a balanced ration to our animals in any stage of production will ensure they do the best their genetics will allow, will optimize production and minimize the cost.

Dr. John Johns *received his Bachelors in Science form Western Kentucky University and earned his Masters Degree and Ph.D. from Michigan State University. Dr. Johns taught at the University of Kentucky as an Extension Professor from 1974 until his recent retirement. Upon retirement from the University of Kentucky, Dr. Johns has joined his expertise with the Burkmann nutrition family.*