Basic Ration Balancing

Balancing a ration to meet an animal's requirements can sometimes become a time consuming task. However, the time may be well spent if it produces healthy fast growing animals. Balancing rations can also save you money by preventing overfeeding of expensive nutrients such as protein.

Balancing a ration begins with looking at the minimum amount of a nutrient which an animal needs to maintain its body weight or grow at a certain rate. Nutrients which you should balance for include protein, TDN (energy), calcium, and phosphorus. When balancing rations for adult animals begin with the TDN requirement and when balancing for young growing animals begin with the protein requirement. You may feed more than the requirement for some nutrients. As long as the extra amount is not excessive the ration will meet the needs of the animal.

Computer programs now available can really speed up the process of balancing a ration, but you do need to remember the "garbage in, garbage out" problem. If you put incorrect information (garbage) into the computer, the computer will give you incorrect calculations (garbage).

How to balance a ration for mature does

Below is an example of how you might balance a ration for mature does using orchard grass hay. Requirements for a 110 lb doe in the last four weeks of pregnancy.

Daily DM (lb.)*	**Crude Protein (lb.)**	**TDN (lb.)**	**Calcium (lb.)**	**Phosphorus (lb.)**
3.5	.38	2.3	.01	.01

* DM stands for dry matter

Nutrient content of Orchardgrass hay (sun cured, early bloom)

89% dry matter

12 % crude protein

60 % TDN

.27% calcium

.34% phosphorus

Step 1 Calculate the amount of hay dry matter needed to meet the TDN requirement.
Divide lbs of TDN required by the amount in the hay
2.3÷ .60 = 3.8 lbs of hay dry matter

Step 2 Calculate the amount of crude protein provided by the hay dry matter.
Multiply the percent of protein in the hay by the number of pounds of hay dry matter.
3.8 X .12 = .456 pounds of crude protein

Step 3 Compare the crude protein requirement of the ewe to the amount provided by the hay.
The hay will provide more protein than the doe requires. Therefore the doe needs no further supplement to the hay to meet her nutritional needs. (This is one example where balancing a ration can help you save money. If you have any hay in the barn that was harvested at a later maturity or was weather damaged, you can feed this to your does and save the better quality hay for the younger animals which have a higher requirement for protein.)

Step 4 Compare the nutrient requirements for calcium and phosphorus to what the doe will receive from the hay.
Multiply the percent of the nutrient in the hay by the amount of the hay dry matter fed.
3.8 X .0027 = .01 pound calcium
3.8 X .0034 = .01 pound phosphorus

Step 5 Compare the amounts of calcium and phosphorus provided in the ration to the amounts required by the animal.
The hay provides .01 pound of phosphorus and .01 pound of calcium. The doe requires .01 pound of phosphorus and .01 pound of calcium. Therefore, the hay meets the requirement for phosphorus and calcium.

Step 6 Compare the amount of hay being fed to the amount of dry matter required each day.
The hay dry matter needed to meet the TDN requirement is slightly above the required DM requirement. You can meet the needs for the doe by over feeding the hay, however you will probably want to feed slightly less hay and add about one half pound of grain to increase the energy in the ration. Although the hay could meet the nutritional needs, you will want to keep in mind that the doe will need added energy if the temperature is below freezing. Also, don't forget that if you feed 3.8 pounds of dry matter, your actual amount you feed goes up to 4.3 pounds. (3.8 lbs dry matter ÷ .89 (89 % dry matter) = 4.3 lbs as fed).

How to balance a ration for growing kids

Not all rations will balance this easily: you should need to include some type of grain in rations for younger animals. Below is an example for balancing a ration for a doe kid eating the same orchard grass hay described above. Requirements for a 66 lb doe kid gaining .23 pounds a day

Daily DM (lb.) *	Crude Protein (lb.)	TDN (lb.)	Calcium (lb.)	Phosphorus (lb.)
2.1	.20	1.44	.006	.005

* DM stands for dry matter

Step 1 Calculate the amount of hay dry matter needed to meet the crude protein requirement.
Divide lbs of crude protein required by the amount in the hay.
0.2÷ .12 = 1.7 lbs of hay dry matter

Step 2 Calculate the amount of TDN provided by the hay dry matter.
Multiply the number of pounds of dry matter needed to meet the crude protein requirement by the percent of TDN in the hay.
1.7 X .6 = 1.02 pounds of TDN

Step 3 Compare the TDN requirement of the doe kid to the amount provided by the hay.
The hay provides 1.02 lbs of TDN and the doe kid requires 1.44 lbs of TDN so the hay does not meet the requirement for the TDN. Therefore, we need to supplement with a high energy feed or in other words a grain to meet the requirement.

Step 4 Calculate the difference between the amount of TDN supplied by the hay and the amount required by the animal.
1.44 pounds required – 1.02 pounds in hay = .42 pounds needed supplemented

Step 5 Choose a feed to supplement the hay.
For this example we will use ground ear corn to make up the difference in TDN. The nutrient values of ground ear corn are listed below.
87% dry matter
83% TDN
9 % crude protein
.10% calcium
.29% phosphorus

Step 6 Calculate the amount of ear corn needed to meet the TDN requirement.
Divide the pounds of TDN needed by the percent of TDN in the ground ear corn to get the amount of ear corn needed to meet the TDN requirement.
.42 ÷ .83 = .5 pounds of ground ear corn

Step 7 Compare the amounts of calcium and phosphorus provided in the ration to the amounts required by the animal.
Multiply the dry matter of each feed by the percent of the nutrient found in the feed. Add the amounts of each nutrient from each feed to get the total amount of calcium or phosphorus supplied by the two feeds.
1.7 X .0027 + .5 X .0010 = .005 pound calcium
1.7 X .0034 + .5 X .0029 = .007 pound phosphorus
You will notice that the hay and corn do not meet the requirement for calcium, but are over for the phosphorus. This makes a calcium:phosphorus ratio of .7:1 which is not within an acceptable limit. In general, the ration should be between 1:1 and 2:1
Adding .01 pounds of ground limestone to the ground ear corn will increase the calcium in the ration to an acceptable level. You may also want to add some molasses to the grain mix to prevent the limestone from sifting out of the corn.

Step 8 Compare the amount of dry matter fed from the hay and the corn to the amount of dry matter required by the doe kid.
1.7 pounds hay + .5 pounds ground ear corn = 2.2 pounds of dry matter supplied by the ration. The doe kid requires 2.1 pounds of dry matter each day. This will supply adequate dry matter as well as nutrients to the doe kid.

Step 9 Convert the dry matters of each feed to the actual amounts fed.
Divide the dry matter amount of each feed by the dry matter percent in each of the feeds.
1.7÷ .89 = 1.9 pounds of hay fed each day
.5 ÷ .87 = .6 pounds of ground ear corn fed each day

Ration adjustments for cold weather

For rations that you are formulating in winter, you will also want to increase the amounts you feed to compensate for the animals needing extra energy for keeping themselves warm. A general rule of thumb is to increase the amount fed by 1% for each degree of coldness below 32 degrees F. Remember to include the wind chill when determining how much to increase the feed.

Example: The temperature is 20 degrees F and the wind chill is 15 mph. The effective temperature would then be 5 degrees F (20 - 15 = 5). You would need to increase the amount fed by 27%. (32 - 5 = 27).

For a complete listing of requirements for goats, refer to the National Research Council's book titled "Nutrient Requirements of Small Ruminants." This book is available through the National Academy Press. Other books dealing with Goat Production may also contain nutrient requirement tables.

http://extension.psu.edu/courses/meat-goat/nutrition/basic-ration-balancing