Balancing Ration for Meat Goat Using Pearson Square Method

By

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It is important to supply the required nutrients in the rations of meat goats. Nutrient deficiencies lead to reduced growth, low reproductive performance and poor animal health that can be costly. Ration can be balanced by the Pearson Square method, substitution formulation and the use of a computer. The use of Pearson square is most effective when only two feeds are being used. In addition, the animal requirement (the number in the center of the square must fall between the nutrient concentrations in both feeds. For example, if the animal requirement is 10% crude protein, then one feed must be greater than 10% and the other must be less than 10%.

A ration can be balanced for Total Digestible Nutrient (TDN) and crude protein (CP), fat (EE) etc. When balancing goat rations for these nutrients, the method requires their nutritive values which can be found in a farm's forage/feed analysis reports or from book values. Table 1. lists the ingredients that will used to balance a meat goat ration using coastal Bermuda hay, whole shelled corn and cottonseed meal.

Table 1. Nutritive Value of Feed Ingredients Used in Balancing Goat Ration

Feedstuff	**% Dry Matter**	**% TDN**	**% CP**
Coastal Bermuda hay	89	53	10
Whole shelled corn	88	88	9
Cotton seed meal	92	80	46

Apart from the feed analysis report, the nutrient requirements of the animal must be known as well. Requirements vary with the weight, sex, average daily gain etc. These are taken from the Nutrient Requirements of Small Ruminants (2006). A ration will be balanced for a 77 lb. growing doeling/castrated male (both have same requirements) with an average daily gain of 0.45 lb., requiring 67.1 % TDN and 16.2 % crude protein.

Table 2. Daily Gain, Dry Matter Intake ,Total Digestible Nutrient (TDN) and Crude Protein (CP) for doeling/castrated male

Growing Doeling/Castrated Male	**Daily gain**	**Dry Matter Intake**	**Total Digestible Nutrients**	**Crude Protein**
Live Weight (lb.)	Lb.	Lb.	%	%
77	0.45	2.43	67.1	16.2

Nutrient Requirements of Small Ruminants, NRC 2006

Steps in Balancing the Ration

Step 1. Firstly balance the TDN in the ration. Start by drawing a square and put 67.1 (the desired TDN) in the center of the square. Please refer to Figure 1.

Step 2. Write the TDN value for coastal bermuda hay (53) on the upper left corner of the square, and whole shelled corn (88) on the lower left corner.

Step 3. Write Coastal bermuda hay in the upper right side of the square and whole shelled corn on the lower right side of the square.

Step 4. Subtract diagonally the smaller number from the larger number (67.1-53 = 14.1; 88 – 67.1=20.9). Write the results on right side of square.

Step 5. Divide the results of the subtractions for coastal bermuda hay and the whole shelled corn by the total parts (20.9 + 14.1 = 35) to get their preliminary percentages. For coastal Bermuda hay it is (20.9 ÷ 35 = .597 = 59.7 % and for whole shelled corn it is (14.1 ÷ 35 = .403 = 40.3%)

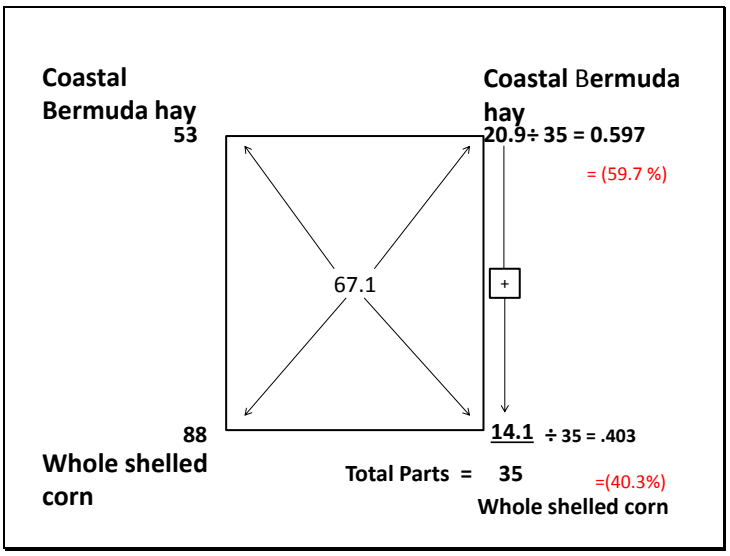

Figure 1. Balancing ration for TDN

Step 6. Next calculate the protein concentration in the coastal bermuda hay and the whole shelled corn by multiplying each feed ingredient percentage by its crude protein.

Table 3. Calculation the amount of crude protein supplied by coastal Bermuda hay & corn

Feedstuff		**Crude Protein**
Coastal bermuda hay	.597 X 10	5.97 %
Whole shelled corn	.403 X 9	3.63 %
Total		9.6 %

Step 7. Find out if the crude protein is adequate in the ration. The concentration in the Coastal bermuda hay and whole shelled corn is 9.6%. The doeling/castrated male requirement is 16.2 %. Therefore 6.6 % CP (16.2-9.6) is lacking in the ration. It can be increased by adding a protein supplement such as cotton seed meal.

Step 8. Once again use Pearson Square method to balance for crude protein as shown on Figure 2. The required crude protein in the rations is 16.2%. It goes in the center of the square.

Step 9. We now have to use coastal bermuda hay/whole shelled corn mix as a feedstuff (9.6 %) which goes on the upper left corner, and cotton seed meal (46%) which goes on the lower left corner.

Step 10. Subtract diagonally the small number from the large number (16.2 – 9.6) = 6.6; (46-16.2) = 29.8. Then write the numbers on the right side of the square as before.

Step 11. Add the CP values on the right side of the square (29.8 + 6.6 = 36.4) to get total parts. Then divide the results of the subtractions for coastal bermuda hay/whole shelled corn and cotton seed meal by total of the parts to obtain the preliminary percentages (29.8 ÷ 36.4 = .819 = 81.9%) and (6.6 ÷ 35.4 = .045) = .181 =18.1%).

Step 12. The result shows that 81.9% of coastal bermuda hay/whole corn and 18.1 % of cotton seed meal make up a ration consisting of 16.2 CP.

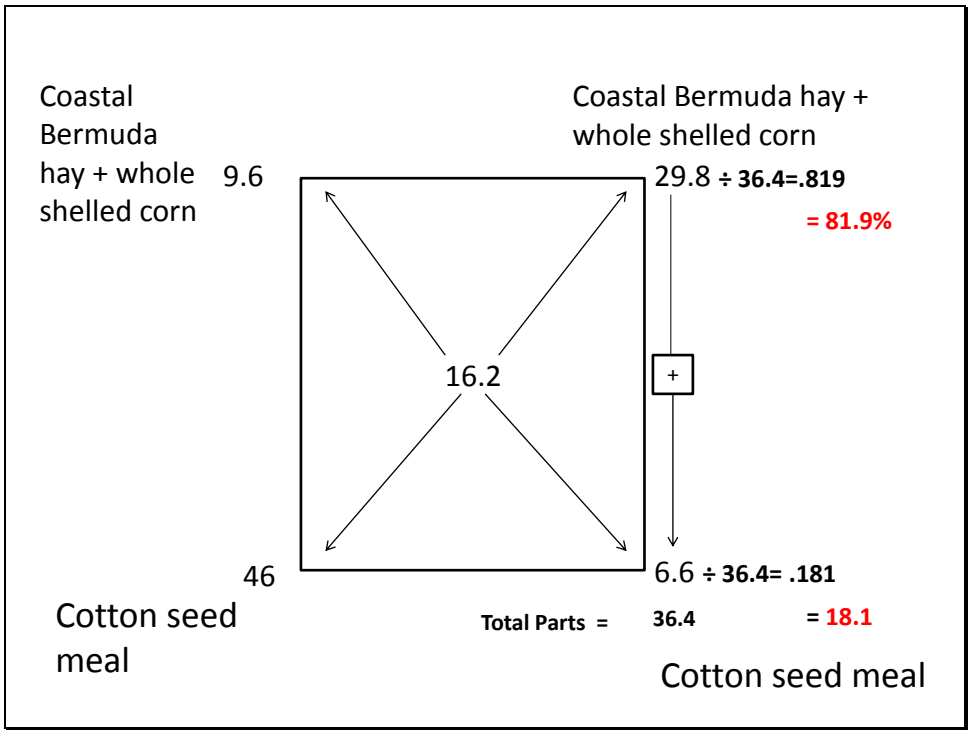

Figure 2. Balancing ration for Crude Protein

Step 13. Calculate the pounds of dry matter that each feedstuff contributes to the total ration. Multiply pounds of dry matter required on a daily basis (2.43) by the percentage of the cotton seed meal. The dry matter component made up by cotton seed meal is (2.43 X .181) = 0.1935 pound. Therefore, the amount of dry matter that should come for coastal bermuda hay/whole shelled corn is (2.43 - .1935) = 2.236 pounds.

Step 14. In order to calculate the amount of dry matter from coastal bermuda hay and whole shelled corn, multiply 2.236 by the percentage of coastal bermuda hay and whole shelled corn that were obtained in **Step 5.** We calculated Coastal Bermuda hay was 59.7 % and whole shelled corn was 40.3 % as shown in Figure 1.

Table 4. Calculating the amount of each ingredient

Feedstuff		**(Lbs.)**
Coastal bermuda hay	2.236 X 0.597	1.335
Whole shelled corn	2.236 X 0.404	0.901
Cotton seed meal		0.1955
Total		2.43

Step 15. Feed requirements are expressed on a 100% dry matter, and so the feed supplied must be expressed on a 100% dry matter basis. But Coastal Bermuda hay, whole shelled corn and cotton seed meal have 89, 88 and 92 % DM respectively. Consequently, each feed stuff must be increased in the ration to meet the 100% dry matter requirement. This is done by dividing the amounts for each feed by its respective dry matter percent.

Table 5. Calculating the amounts of ingredients to meet 100% of the animal nutrient requirements

Feedstuff		**(Lbs.)**
Coastal Bermuda hay	1.335 ÷ 0.89	1.5
Whole shelled corn	0.903 ÷0 .88	1.026
Cotton seed	0.195 ÷0 .92	.212
Total		2.738

Table 6. Making a 1000 lbs. of feed

Feedstuff		**(Lbs.)**
Coastal Bermuda hay	1.5/2.738 X 1000	547.84
Whole shelled corn	1.026/2.738 X 1000	374.72
Cotton seed meal	.212/2.738 X 1000	77.42
Total		1000