

Beef Cattle Library



Balancing Diets for Beef Cattle ¹

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Appendix 1 – Pearson Square

This technique can be used to determine the proportions of two feedstuffs that will yield a ration containing the desired nutrient concentrations. It can only be used for two feed materials at a time; however, one or both can be a mixture. In this example, a ration is developed for a 500 lbs heifer having a desired gain of 1.5 lbs/day. Her daily requirements and the feedstuffs to be used in developing the balanced ration are the same as in the main article (Table 1). Step by step, the procedure is as follows.

1. Balance for TDN. Draw a square and place 68.5 (the desired TDN level) in the center (Figure 1).
2. At the upper left corner of the square, write “meadow hay = 50,” and at the lower left corner write “ground barley = 75.” These numbers represent the TDN% in each feedstuff.
3. Subtract diagonally, smaller from larger ($68.5 - 50 = 18.5$; $75 - 68.5 = 6.5$) and write the answers on the right side of the square as in Figure 1.
4. Add the numbers on the right side of the square ($6.5 + 18.5 = 25$). These numbers indicate that a ration of 6.5 parts meadow hay and 18.5 parts ground barley, out of a total 25 parts, will provide a 68.5% TDN ration.
5. Divide the meadow hay and ground barley parts by 25 to get the preliminary percentages of hay ($6.5 \div 25 = 26\%$) and barley ($18.5 \div 25 = 74\%$).

6. Determine the CP concentration in the meadow hay and ground barley mixture. Multiply the percentage of each feedstuff in the mix by its CP content. Meadow hay is 26% of the mix and contains 6% CP. Ground barley is 74% of the mix and contains 11% CP. Add the results. Therefore, the CP concentration in the mix is:

Meadow hay	$0.26 \times 6 = 1.56\%$
Ground barley	$0.74 \times 11 = 8.14\%$
	9.70%

7. Determine whether CP is adequate. The CP concentration in the meadow hay/ground barley mix is 9.7%. The heifer requires 10.3% of CP. Therefore, the CP content needs to be increased by adding a protein supplement (cottonseed meal in this example).
8. Use the Pearson Square method again to balance for CP. Draw a square and put the requirement, 10.3, in the center (Figure 2).
9. Write “meadow hay:ground barley mix = 9.7” in the upper left corner, and “cottonseed meal = 41” in the lower left corner; these numbers indicate the CP% in each feedstuff.
10. Subtract diagonally, smaller from larger ($10.3 - 9.7 = 0.6$; $41 - 10.3 = 30.7$), and write the answers on the right side of the square.
11. Add the numbers on the right side of the square ($30.7 + 0.6 = 31.3$). These numbers indicate that a ration of 30.7 parts meadow hay/ground barley

1. This document is part of the Oregon State University – Beef Cattle Library. Published in June 2011. Prior to acceptance, this document was anonymously reviewed by two experts in the area. For further information, please visit the Beef Cattle Sciences website at <http://beefcattle.ans.oregonstate.edu>.

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mix and 0.6 part cottonseed meal out of a total 31.3 parts will provide a 10.3% CP ration.

- 12.** Divide the meadow hay/ground barley mix and cottonseed meal parts by 31.3 to get the preliminary percentages of meadow hay:ground barley ($30.7 \div 31.3 = 98\%$) and cottonseed meal ($0.6 \div 31.3 = 2\%$).
- 13.** Determine the pounds of dry matter (DM) that each feedstuff contributes to the total. Multiply pounds of **DM** required daily by the heifer (12.1) by the percentage for cottonseed meal (0.02 or 2%). Thus, the DM component made up by cottonseed meal is $12.1 \times 0.02 = 0.24$ lb. Subtract this amount (0.24) from the total DM intake (12.1) to determine how much DM will come from the meadow hay/ground barley mix ($12.1 - 0.24 = 11.86$ lb). There should be 11.86 lb of meadow hay:ground barley on a DM basis. To determine the amount of DM for meadow hay and ground barley, multiply 11.86 lbs by the percentages of meadow hay and ground barley obtained in the first square (step 5): 26% meadow hay and 74% ground barley. $11.86 \text{ lbs} \times 0.26 = 3.08$ lbs meadow hay and $11.86 \text{ lbs} \times 0.74 = 8.78$ lbs ground barley.
- 14.** Change each amount from a DM basis to an “as-fed” basis so that you know how much to feed. To do so, divide the lbs of DM for each feedstuff by the percentage of DM in each feed (see Table 1 in main article).

$$\text{Meadow hay} = 3.08 \text{ lb} \div 0.92 \text{ (92\% DM)} = 3.35 \text{ lb}$$

$$\text{Ground barley} = 8.78 \text{ lb} \div 0.88 \text{ (88\% DM)} = 9.98 \text{ lb}$$

$$\text{Cottonseed meal} = 0.24 \text{ lb} \div 0.90 \text{ (90\% DM)} = 0.27 \text{ lb}$$

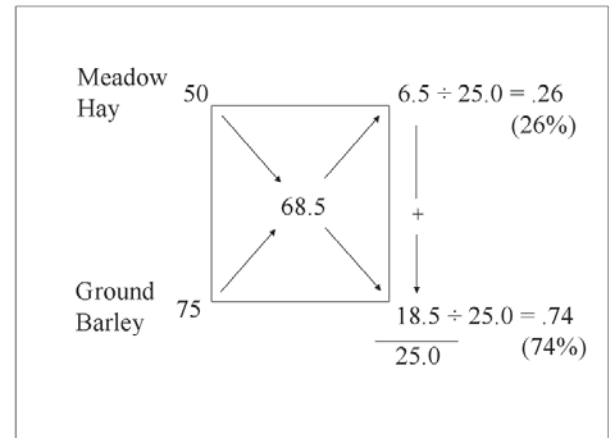


Figure 1. Balancing for TDN using a Pearson Square.

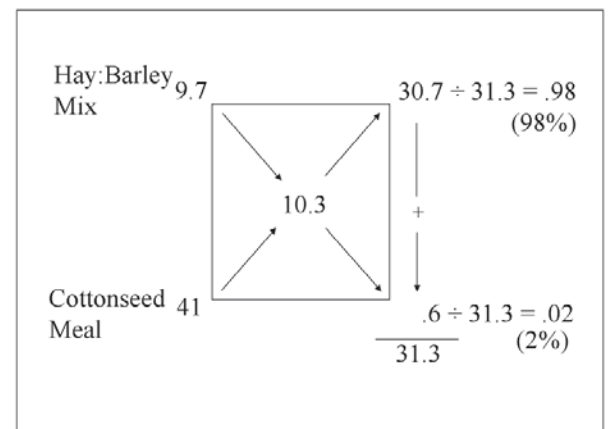


Figure 2. Balancing for CP using a Pearson Square.