Course	Agricultural Science I
Unit	Introduction to Animal Nutrition
Lesson	Balancing a Ration
Estimated Time	60 minutes

Student Outcome

Demonstrate the procedure for balancing a ration for crude protein.

Learning Objectives

1. List why a balanced ration is important for nutrition.
2. Demonstrate how a ration is balanced.
3. Identify the factors that influence the ingredients used to balance a ration.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slide
   - PPt 1 – Pearson Square Method
2. Activity Sheet
   - AS 1 – Balancing Rations
3. *Introduction to Animal Nutrition (Student Reference).* University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Nutrition Curriculum Enhancement.* University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplemental Information

1. Internet Sites
   - ❑ Bohnert, David, and David Chamberlain. *Beef Cattle Nutrition Workbook*. Oregon State University Extension Service. Accessed May 10, 2007, from http://oregonstate.edu/dept/EOARC/abouthome/scientists/documents/DWB26.pdf.
   - ❑ Lalman, David L., and Homer B. Sewell. Rations for Growing and Finishing Beef Cattle. MU Extension. University of Missouri-Columbia. Accessed May 9, 2007, from http://extension.missouri.edu/explore/agguides/ansci/g02066.htm.
   - ❑ Milk Standardization Calculator for Confirming That Pearson Square Calculations Are Correct. Dairy Science and Food Technology. Accessed May 10, 2007, from http://dairyscience.info/pearson.asp .
   - ❑ Pearson Square Calculator. Agri-Publications, Inc. Accessed May 10, 2007, from http://www.agdownload.com/html/P00091.asp.
   - ❑ Pearson Square (interactive lesson). Smart Farm. Accessed May 10, 2007, from http://www.farmschool.com/smartfarm/tools/pearson.php.
   - ❑ Spreadsheets for calculating rations. Accessed May 10, 2007, from http://agebb.missouri.edu/download/index.htm.
   - ❑ Wagner J., and T. L. Stanton. Formulating Rations with the Pearson Square. CSU

Cooperative Extension. Colorado State University. Accessed May 10, 2007, from http://www.ext.colostate.edu/PUBS/livestk/01618.html.

2. Electronic Media
   - ❑ *Animal Nutrition Interactive PowerPoints*. University of Missouri-Columbia: Instructional Materials Laboratory, 2006.

Interest Approach

- ❑ Ask students what they think would happen if they ate only bread for every meal. What effect would it have on their health? How could they correct this problem? Compare this example to meeting the nutritional needs of a cattle herd. Ask students what would happen if cattle were fed only carbohydrates. Then ask how using a balanced feed ration could improve the herd.
- ❑ The following example from Dr. Dan Netermeyer can be used to illustrate the importance of putting together a ration that not only has the necessary nutrients but also includes quality ingredients. The ration has 10 percent protein, 6.5 percent fat, 2.4 percent fiber, and 68 percent moisture, but it consists of 4 pairs of worn-out work shoes, 1 gallon of waste oil, 1 pail of crushed coal, and 68 pounds of water (from "OK, Feed Prices Are High, but Watch How You Save," *Today's Farmer*, February 1996, p. 18).

Communicate the Learning Objectives

1. List why a balanced ration is important for nutrition.
2. Demonstrate how a ration is balanced.
3. Identify the factors that influence the ingredients used to balance a ration.

Instructor Directions	Content Outline
Objective 1 *Ask students what a balanced ration is. Discuss the importance of balancing a ration.*	**List why a balanced ration is important for nutrition.** 1. Meets the nutrient needs for health and each life stage 2. Prevents nutritional deficiencies 3. Promotes maximum growth and production
Objective 2 *Ask students what the methods of balancing a ration are. Discuss the methods. Use PPt 1 to illustrate how to use the Pearson Square method by doing an example balancing a ration for crude protein. If available, a computer method may also be used.* ❒ PPt 1 – Pearson Square Method	**Describe methods used to balance a ration.** Computer programs 1. They are able to check whether multiple nutrients in a ration are balanced at one time. 2. The computer does all figuring. 3. It requires complete information. 4. The operator needs to have a knowledge of nutrition. Trial and error method 1. A combination of feeds is selected. 2. The nutrient content is calculated and compared to the animal's nutritional needs. 3. The process is repeated if its needs are not met. 4. This method meets all the nutritional needs of the animal. Pearson square method 1. This method balances for only one nutrient at a time;

Instructor Directions	Content Outline
	it is mostly used for protein. 2. Draw a square. 3. Write the percent of the nutrient required by the animal in the middle of the square. 4. Write the percent nutrient of each of the two feed items on its own corner on the left side. 5. Find the diagonal differences and place the results on the right corners. Always subtract the smaller number from the larger. 6. Add the two values and place the total at the bottom. 7. Find the percentage of the ingredients by dividing the diagonal difference of each feed ingredient by the total. 8. Find the number of pounds of each feed ingredient used by multiplying the percentage by the total number of pounds in the ration. 9. Check to ensure that other nutritional requirements are met.
Objective 3 *Ask students what factors influence the choice of ingredients used to balance the ration. Discuss the factors. Have students complete AS 1 on balancing rations and least cost.* ☐ AS 1 – Balancing Rations	**Identify the factors that influence the ingredients used to balance a ration.** Least cost - The goal is to get the desired performance at the least cost to the producer. 1. Balance a ration to determine the amount of each feed ingredient used. 2. Find the total cost for each ration by multiplying the amount of each ingredient by its cost and adding to find the total cost. 3. Compare the costs of balanced rations using different ingredients. 4. Choose the ration with the least cost. Ingredient availability - Geographical areas have different available feeds, depending on what is grown there and the manufacturing byproducts that are available.
Application: ☐ AS 1 – Balancing Rations *Answers are based on University of Missouri Extension agricultural publications, using the Missouri recommended allowances.*	Answers to AS 1 1. Corn - 87 lbs. Supplement - 13 lbs. 2. Soybean meal - .74 lbs. 3. Grain sorghum - 897 lbs. Supplement - 103 lbs.

Instructor Directions	Content Outline
	4. Yellow dent corn - 836 lbs. Supplement - 164 lbs. 5. Answers will vary depending on the current prices for grain sorghum, yellow dent corn, and supplement. Other activities 1. Visit a local COOP, feed mill, or Extension service. Have an employee demonstrate balancing a ration using their computer program.
Closure/Summary:	A ration needs to be balanced to provide the proper amounts and proportions of nutrients for an animal. It is important to balance a ration to meet the animal's nutritional needs for health and the requirements of each life stage, to prevent nutritional deficiencies, and to promote maximum growth and production. Many methods may be used to balance a ration, such as computer programs, trial and error, and the Pearson Square method. Least cost and ingredient availability are factors to consider when balancing a ration.
Evaluation: Quiz	Answers: 1. c 2. a 3. b 4. b 5. c 6. Corn - 857 lbs. Supplement - 143 lbs. 7. Answers will vary depending on current prices for corn, wheat, and supplement.