Pearson's Square

Modified CASE Activity 5.5.2

These modified lessons are from the Curriculum for Agricultural Science Education (CASE). Each lesson has been modified to showcase how soybeans can be used for the applications/activities. The Nebraska Soybean Board supports the CASE model for Nebraska Agricultural Education and the majority of this lesson is copyrighted by CASE and its partnering affiliates.

Objectives:
It is expected that students will:
- List the steps in balancing a ration.
- Use the Pearson Square to balance a ration using two feedstuffs.
- Use the Pearson Square to balance a ration using multiple feed stuffs.
- Develop a balanced ration for their Producer's Management Guide

Anticipated Length:
Three 50-minute class periods

Lab Materials:
- *Modern Livestock and Poultry Production* textbook
- Calculator
- Pencil
- Agriscience Notebook

Teacher Notes:
Make sure all lab material are available

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Student Name: _____

Background

Feeding animals is not a chore livestock producers take lightly. The financial, health, and production gains from a good feeding program are essential to the long-term viability of an animal operation. Yet balancing a ration, or providing animals with all the nutrients each animal needs in the right proportions and amounts, can be an intimidating task. It is difficult to balance a ration by trial and error and can be costly if not done correctly.

There are times when a producer meets the nutritional requirements of an animal by using two feedstuffs. The Pearson Square is a useful tool for blending two feedstuffs with different nutrient concentrations into a mixture with a desired concentration. It is used to calculate the proportion of two feeds to be mixed together based on the percentage of a specific nutrient as you will learn in this activity

Procedure

In this activity, you will be formulating rations based on the nutritional needs of an animal.

Part One – How to use the Pearson Square
The following problem will be used to demonstrate how to use the Pearson Square method for blending two feedstuffs with different nutrient concentrations.

You are mixing a feed for your lactating sow herd. Using corn oats, and soybean meal, formulate 1 ton of a mixture that contains 16% crude protein (CP) on an as-fed basis.

Step 1 – *Write down the facts you know.*

%CP of yellow corn	= 9	}	From feed analysis completed in a lab. For average data see the NRC Composition Tables
%CP of oats	= 13		
%CP of soybean meal	= 44		
%CP desired in the ration	= 16	~	Protein need of hogs

Step 2 – *Drawing the Pearson Square.*
- Draw a one to two inch square.
- Draw diagonal lines from corner to corner, leaving a space in the middle (See Figure 1).

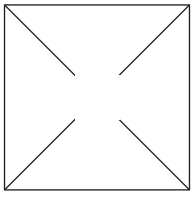

Figure 1. Pearson Square Template

Pearson's Square

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Step 3 – *Inputting the facts you know.*

- Write the % of the nutrient for which you are calculating in the center.
- On the left side of the square, write in the feeds and percentage of the nutrient supplied on the top and bottom corners.
- In this ration you are using a grain mixture of 2 parts corn and 1 part oats therefore you must determine the %CP of the mixture. To do this, you must multiply the % of the corn that makes up the mixture by the % protein in the corn, (67% corn X 9% protein) and then multiply the % of the mixture that is oats by the % protein in the oats, (33% oats X13%protein) and then add these sums together to determine the average protein of the grain mixture of oats and corn.

(67% X 9%) + (33% X 13%) =
6.03% + 4.29% = 10.3% average CP for the corn/oats mixture

Feedstuff with % of Nutrient	% of Desired Nutrient	Parts of Each Feed
Corn oats mixture 10.3%		
	16	
Soybean meal 44%		

Figure 2. Pearson Square Set-up

Step 4 – *Determining the proportion of each feed.*

- Subtract across the diagonal for each feedstuff.
- The result gives you the **parts** of each feedstuff in the ration.
- Read across the square to determine the proportion of each feed to use in the ration.

Feedstuff with % of Nutrient	% of Desired Nutrient	Parts of Each Feed
Corn oats mixture 10.3%		28 parts corn oats mixture (44-16=28)
	16	
Soybean meal 44%		(16-10.3=5.7) 5.7 parts soybean meal
		33.7 total parts

Rule: Subtract smallest numbers from larger numbers – all answers will be positive numbers.

Figure 3. Pearson Square Solved

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Step 5 – *Calculating the percentage of each feedstuff.*

- With these proportions, you are able to convert the parts of the ration to the percentage that should be used in the ration for desired nutrient concentration.
- Divide the parts of each ingredient by the total parts of the ration.
- Multiply by 100 to determine the percentage of each feedstuff needed in the ration.

(28 parts corn/oats / 33.7 total part * 100 = 83% corn/oats

(5.7 parts SBM/ 33.7 total parts) * 100 = 17% SBM

Step 6 – *Determining the quantity of each feedstuff in your ration.*

- Calculate the quantity of each feedstuff.
- To determine how many pounds of each feed ingredient are needed multiply the total pounds needed by the percent of the feedstuff in the ration.

(1 ton) 2000 lbs feed x ____% corn/oats = _____ lbs corn/oats

33% of the corn/oats mixture is oats = _____ lbs oats

67% of the corn/oats mixture is corn = _____ lbs corn

(1 ton) 2000 lbs feed x ____% SBM = _____ lbs SBM

Step 7 – *Check your work.*

_____ lbs corn x 9% CP = _____ lbs of CP

_____ lbs oats X 13% CP = _____ lbs of CP

_____ lbs SBM x 44% CP = _____ lbs of CP

Add the lbs of CP in each feed _____ lbs of CP/2000 lbs feed (16%CP)

If all math is correct your answer will be 320.

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Part Two – Practice Problems
Solve the following problems using the Pearson Square. Please show your work.

1. Formulate 100 pounds of a ration with 18% CP using yellow corn (10.1% CP) and soybean meal (42.5% CP).

Answer:_____lbs yellow corn _____ lbs soybean meal

Check your work (Step 7):

2. Formulate a 600 kg mixture with 20% protein of barley (13.5% CP) and canola meal (40.9% CP).

Answer:_____kg barley _____ kg canola meal

Check your work (Step 7):

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1. **Why is the use of the Pearson Square method an important tool for animal producers when determining rations?**

2. **Explain how the Pearson Square might be used in a ration that involves more than two feedstuffs.**

3. **What nutritional problem do you foresee using only the Pearson Square in order to balance a ration? Explain your reasoning.**