



The Mystery Ration

Grade Level: 6-12

Essential Skills: 1, 3, 4, 9

Math: 6.NS.2, 7.RP.2c, N-Q.2,

Time: 90 minutes

Materials:

- 4 Escape Boxes*
- 6 Group Scenario Cards*
- 18 Box Cards*
- 8 3-Digit Locks*
- Treat for the final box *

***Materials Available from Oregon Agriculture in the Classroom.**

Vocabulary:

Ration: a nutrient balance meal for animals.

Dry Matter (DM): feed with the water content removed to reduce the dilution of nutrients.

Crude Protein(CP): the amount of nitrogen in feed.

Total Digestible Nutrients (TDN): the total amount of nutrients absorbed including protein, fiber, starch and sugars and fat.

More Lessons:

- At Home on the Range
- Beef: Making the Grade
- Carbon Hoofprints: Cows and Climate Change
- Double the Muscle:
- Probabilities and Pedigrees
- The Remarkable Ruminant

Description:

Discover the nutrient requirements of dairy cows! Students will collaborate in teams to unlock feed examples through a series of escape boxes. As students work to unlock each escape box, they will be tasked with calculating rations using the Pearson Square method to provide a balanced meal for dairy cows to enjoy!

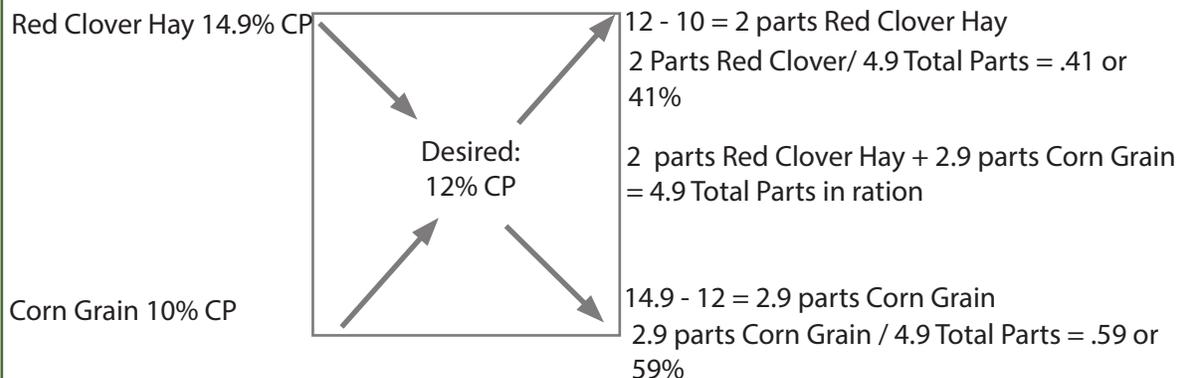
Background:

According to the USDA Census of Agriculture, in 2017 there were 54,599 dairy farms with over 9.5 million dairy cows in the United States. In 2018, dairy products ranked 4th in the top agricultural commodities in the United States with over \$35 billion in cash receipts. In Oregon, dairy products are ranked 6th, with a value of over \$70 million for exports in 2017. As one of our highest valued industries, caring for their animals is a top priority for dairy farmers.

Oregon dairy farmers care for their animals providing for their essential needs and collaborate with highly trained professionals such as nutritionists among others to ensure they are providing a well balanced meal for their cows to produce a nutritious wholesome product. 45-55% of a dairy farms operating cost goes to purchasing feed. This is one of the reasons producers pay special attention to ensure their herd’s needs are met through the formulated ration’s ingredients.

In this lesson, students will explore simple ration balancing through the Pearson Square method. In this mathematical computation, two feeds on a dry matter basis are balanced for one nutrient need. This can be helpful when grains are mixed for a ration or supplement to determine the amount of each ingredient needed to achieve your desired nutrient rate. In this method, you can calculate crude protein (CP), energy or total digestible nutrients (TDN). When using the Pearson Square method, there should be one feed with a nutrient concentrate above the desired rate and one with a lower rate. Begin by writing the desired nutrient rate in the center of the square, this rate is often set based on the National Research Council’s Nutrient Requirement tables or by an experienced producer and their nutritionist. The two feeds are then placed on the corners of the left side (see diagram below). After the square is set up, begin by subtracting the smaller number from the larger number diagonally, follow the arrows below for reference, this will result in parts per ration. Total the sum of parts in the ration. Then using the dry matter parts on the right side, create a percentage of each feed’s presence in the ration.

Example: Balance a ration for a desired Crude Protein (CP) rate of 12% using Red Clover Hay 14.9% CP and Corn Grain 10% CP



In summary, with a desired rate of 12% Crude Protein using Red Clover Hay and Corn Grain, the ration should be 41% Red Clover Hay and 59% Corn Grain.

Check your work: $41(.149) + 59(.10) = 12$

Directions:

Part I: Watch the Rickreall Dairy Virtual Farm Field Trip

Watch the virtual field trip on our website called *Rickreall Dairy - The Scoop on Cow Nutrition*. This tour will provide students with background knowledge of a dairy cow's diet and how this relates directly to their production of milk and capability of producing a wholesome nutritious product that we can enjoy!

After watching the video, use these guiding questions to transition students into the next activity.

- a. Why is dairy cow nutrition an important aspect of managing a dairy farm?
- b. How do dairy farmers ensure that their animals are receiving adequate nutrition?
- c. When developing rations for their animals, what considerations would farmers use to determine the types of feeds that go into their animal's ration?

Part II: Introduction to Pearson Squares

1. Distribute the The Mystery Ration Activity Worksheet to students.
2. As a class, read through the background information provided at the top of the worksheet.
3. Explain to students that today we will be acting as a dairy farmer and determining the amount of different feeds to include in our cow's ration based on the desired rate of nutrients.
4. Using the example provided on the worksheet show students how to calculate rations using the Pearson Square method.
5. After demonstrating the Pearson Square method, have students practice this concept by completing the practice problems in Part 1 of the worksheet.
6. When students have completed the practice problems, have a few student volunteers show their work on the board to help reinforce the concepts of calculating the rations using the Pearson Square method.

Part III: The Escape Box Ration Challenge!

1. Place the escape boxes spaced out around the classroom in numerical order.
2. Divide students into 6 groups, distribute one Scenario Card to each group containing their desired nutrient rate that they will use in their Pearson Square math problems as they unlock each box.
3. Students will use Part II on their worksheet as they discover the contents of each box to do their Pearson Square math.
4. Each box will have two locks on it that students will unlock as they solve Pearson Squares. Each box will contain 6 cards and a feed example. Each group will take their designated card that's labeled with their group letter. Then each group will solve their Pearson Square using the information on the card. On the bottom of their card it provides instructions for which number students will use to unlock the next box. Each group's answer will be needed to unlock the locks on each box.

Reference materials used in creating this lesson:

Kellems, Richard O., and D. C. Church. Livestock Feeds and Feeding. Prentice Hall, 2010.

Nutrient Requirements of Dairy Cattle. National Academy Press, 2001.

Tisch, David. Animal Feeds, Feeding and Nutrition, and Ration Evaluation: with CD-ROM. Thomson Delmar Learning, 2006.



The Mystery Ration

Student Name: _____

Dairy producers pay special attention to feed components that are included in their cow's Total Mixed Ration (TMR) to ensure their cow's nutritional needs are met through the formulated rations ingredients. The health of their herd is crucial in the overall productivity of their farm. Dairy cow's nutrient needs change depending on their age and stage of production (producing milk or not producing milk) similar to the changes in a human's nutritional needs. On a dairy farm, feed costs account for 45-55% of the farms operating cost. This means that farmers make critical decisions on the type of feed, the cost and the nutrient levels provided to determine the most palatable and nutritious rations for their animals.

Today, you will explore simple ration balancing through the Pearson Square method. In this mathematical computation, two feeds on a dry matter basis are balanced for one nutrient need. This can be helpful when grains are mixed for a ration or supplement to determine the amount of each ingredient needed to achieve your desired nutrient rate. In this method, you can calculate crude protein (CP), energy or total digestible nutrients (TDN).

How to Calculate using the Pearson Square Method

When using the Pearson Square method, there should be one feed with a nutrient concentrate above the desired rate and one with a lower rate.

Step 1: Begin by writing the desired nutrient rate in the center of the square, this rate is often set based on the National Research Council's Nutrient Requirement tables or by an experienced producer and their nutritionist.

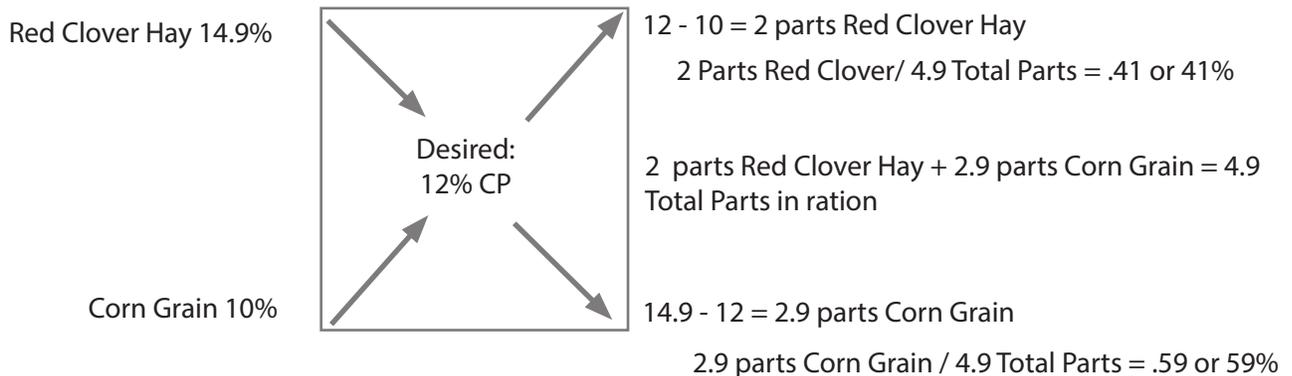
Step 2: The two feeds are then placed on the corners of the left side (see diagram below).

Step 3: After the square is set up, begin by subtracting the smaller number from the larger number diagonally follow the arrows below for reference. This will result in parts per ration.

Step 4: Total the sum of the parts in ration.

Step 5: Using the dry matter parts on the right side, create a percentage of each feed's presence in the ration.

Example: Balance a ration for a desired Crude Protein (CP) rate of 12% using Red Clover Hay 14.9% CP and Corn grain 10% CP



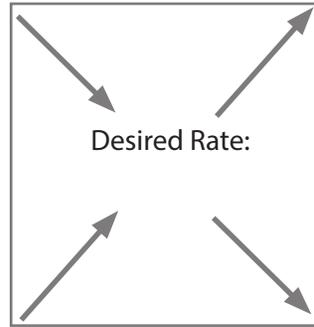
In summary, with a desired rate of 12% Crude Protein using Red Clover Hay and Corn Grain, the ration should be 41% Red Clover Hay and 59% Corn Grain.

Check your work: $41(.149) + 59(.10) = 12$

Part I: Practicing with Pearson Squares

1. Balance a ration with a desired rate of 10% CP using Ground Corn 9% CP and Soybean Seeds 42.8% CP.

Feed 1:



Feed 1:

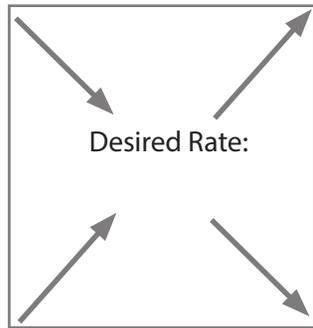
Feed 2:

Feed 2:

Check your work:

2. Balance a ration with a desired rate of 58% TDN using Corn Distillers Grain 86% TDN and Fescue Hay 48% TDN.

Feed 1:



Feed 1:

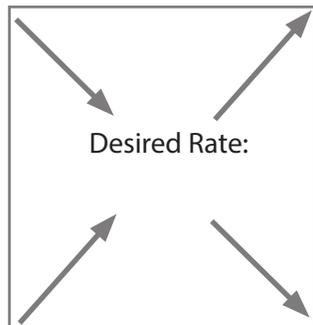
Feed 2:

Feed 2:

Check your work:

3. Balance a ration with a desired rate of 10% CP using Soybean Seeds 42.8% CP and Fescue Hay 9.5% CP.

Feed 1:



Feed 1:

Feed 2:

Feed 2:

Check your work:

Part II: The Escape Box Ration Challenge

With your assigned group, your teacher will provide you a Scenario Card. Read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card, create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

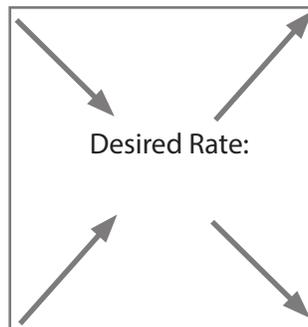
Combination for Box 1 (Using your Desired Rates to unlock the first box): The first three digits (Group A, Group B, Group C) will unlock the lock labeled #1 and the second three (Group D, Group E, Group F) will unlock the lock labeled #2. After you unlock the first box, get your group's card and start calculating the amount of each feed ingredient needed in a ration to achieve your group's desired rate. Use the Pearson Square method to determine amounts of each feed, these numbers will unlock the next box.

Group A	Lock #1 Group B	Group C	Group D	Lock #2 Group E	Group F
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Box 1

Feed 1:

Feed 2:



Feed 1:

Feed 2:

Check your work:

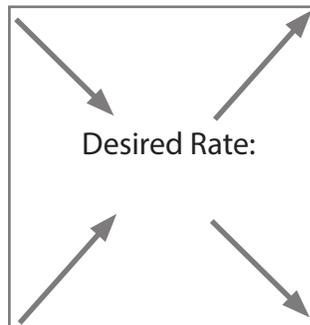
Combination for Box 2 (Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

Group A	Lock #3 Group B	Group C	Group D	Lock #4 Group E	Group F
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Box 2

Feed 1:

Feed 2:



Feed 1:

Feed 2:

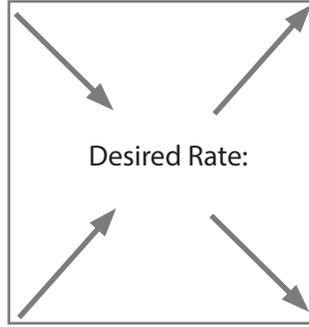
Check your work:

Combination for Box 3 (Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

Group A	Lock #5 Group B	Group C	Group D	Lock #6 Group E	Group F
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Box 3

Feed 1:



Feed 1:

Feed 2:

Feed 2:

Check your work:

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A

**Lock #7
Group B**

Group C

Group D

**Lock #8
Group E**

Group F

Box 4

Enjoy your treat!



Scenario Card: Group A

Farmer Joe is working with his nutritionist to determine the cost of different feed options that meet the nutritional needs of his dairy cow herd.

Your group will calculate each boxes feed options to determine the amount needed in the ration of each feed based on the desired nutrient rate below. Use a Pearson square to determine the amounts needed of each feed.

DESIRED RATE: 17% Crude Protein

To unlock the first box with the first feed combination option, you will use the digit in the ones location of your desired rate.



Scenario Card: Group B

Farmer Joe is working with his nutritionist to determine the cost of different feed options that meet the nutritional needs of his dairy cow herd.

Your group will calculate each boxes feed options to determine the amount needed in the ration of each feed based on the desired nutrient rate below. Use a Pearson square to determine the amounts needed of each feed.

DESIRED RATE: 68% Total Digestible Nutrients

To unlock the first box with the first feed combination option, you will use the digit in the ones location of your desired rate.



Scenario Card: Group C

Farmer Joe is working with his nutritionist to determine the cost of different feed options that meet the nutritional needs of his dairy cow herd.

Your group will calculate each boxes feed options to determine the amount needed in the ration of each feed based on the desired nutrient rate below. Use a Pearson square to determine the amounts needed of each feed.

DESIRED RATE: 17.9% Crude Protein

To unlock the first box with the first feed combination option, you will use the digit in the ones location of your desired rate.



Scenario Card: Group D

Farmer Joe is working with his nutritionist to determine the cost of different feed options that meet the nutritional needs of his dairy cow herd.

Your group will calculate each boxes feed options to determine the amount needed in the ration of each feed based on the desired nutrient rate below. Use a Pearson square to determine the amounts needed of each feed.

DESIRED RATE: 78% Total Digestible Nutrients

To unlock the first box with the first feed combination option, you will use the digit in the ones location of your desired rate.



Scenario Card: Group E

Farmer Joe is working with his nutritionist to determine the cost of different feed options that meet the nutritional needs of his dairy cow herd.

Your group will calculate each boxes feed options to determine the amount needed in the ration of each feed based on the desired nutrient rate below. Use a Pearson square to determine the amounts needed of each feed.

DESIRED RATE: 14.1% Crude Protein

To unlock the first box with the first feed combination option, you will use the digit in the ones location of your desired rate.



Scenario Card: Group F

Farmer Joe is working with his nutritionist to determine the cost of different feed options that meet the nutritional needs of his dairy cow herd.

Your group will calculate each boxes feed options to determine the amount needed in the ration of each feed based on the desired nutrient rate below. Use a Pearson square to determine the amounts needed of each feed.

DESIRED RATE: 78% Total Digestible Nutrients

To unlock the first box with the first feed combination option, you will use the digit in the ones location of your desired rate.



Group A

Box 1:

Cottonseed 23.9% CP

Alfalfa Hay 13% CP

Calculate the amount of each ingredient needed to reach your desired rate using the Pearson Square method. To unlock box 2, use the number in the **tens** spot of the percentage of **alfalfa** needed to reach your desired crude protein rate.



Group B

Box 1:

Cottonseed 96% TDN

Alfalfa Hay 50% TDN

Calculate the amount of each ingredient needed to reach your desired rate using the Pearson Square method. To unlock box 2, use the number in the **tens** spot of the percentage of **alfalfa** needed to reach your desired Total Digestible Nutrients rate.



Group C

Box 1:

Cottonseed 23.9% CP

Alfalfa Hay 13% CP

Calculate the amount of each ingredient needed to reach your desired rate using the Pearson Square method. To unlock box 2, use the number in the **tens** spot of the percentage of **alfalfa** needed to reach your desired crude protein rate.



Group D

Box 1:

Cottonseed 96% TDN

Alfalfa Hay 50% TDN

Calculate the amount of each ingredient needed to reach your desired rate using the Pearson Square method. To unlock box 2, use the number in the **tens** spot of the percentage of **alfalfa** needed to reach your desired Total Digestible Nutrients rate.



Group E

Box 1:

Cottonseed 23.9% CP

Alfalfa Hay 13% CP

Calculate the amount of each ingredient needed to reach your desired rate using the Pearson Square method. To unlock box 2, use the number in the **tens** spot of the percentage of **alfalfa** needed to reach your desired crude protein rate.



Group F

Box 1:

Cottonseed 96% TDN

Alfalfa Hay 50% TDN

Calculate the amount of each ingredient needed to reach your desired rate using the Pearson Square method. To unlock box 2, use the number in the **tens** spot of the percentage of **alfalfa** needed to reach your desired Total Digestible Nutrients rate.



Group A

Box 2:

Soybean Meal 49.9% CP
Ground Corn 3.2% CP

To unlock box 3, use the number in the **tens** spot of the percentage of **soybean meal** needed to reach your desired Crude Protein rate.



Group B

Box 2:

Soybean Meal 84% TDN
Ground Corn 50% TDN

To unlock box 3, use the number in the **tens** spot of the percentage of **soybean meal** needed to reach your desired Total Digestible Nutrients rate.



Group C

Box 2:

Soybean Meal 49.9% CP
Ground Corn 3.2% CP

To unlock box 3, use the number in the **tens** spot of the percentage of **soybean meal** needed to reach your desired Crude Protein rate.



Group D

Box 2:

Soybean Meal 84% TDN
Ground Corn 50% TDN

To unlock box 3, use the number in the **tens** spot of the percentage of **soybean meal** needed to reach your desired Total Digestible Nutrients rate.



Group E

Box 2:

Soybean Meal 49.9% CP
Ground Corn 3.2% CP

To unlock box 3, use the number in the **tens** spot of the percentage of **soybean meal** needed to reach your desired Crude Protein rate.



Group F

Box 2:

Soybean Meal 84% TDN
Ground Corn 50% TDN

To unlock box 3, use the number in the **tens** spot of the percentage of **soybean meal** needed to reach your desired Total Digestible Nutrients rate.



Group A

Box 3:

Dried Distillers Grain 29.7% CP

Grass Hay 10.6% CP

To unlock box 4, use the number in the **tens** spot of the percentage of **grass hay** needed to reach your desired Crude Protein rate.



Group B

Box 3:

Dried Distillers Grain 79.5% TDN

Grass Hay 56.3% TDN

To unlock box 4, use your the number in the **tens** spot of the percentage of **grass hay** needed to reach your desired Total Digestible Nutrients rate.



Group C

Box 3:

Dried Distillers Grain 29.7% CP

Grass Hay 10.6% CP

To unlock box 4, use the number in the **tens** spot of the percentage of **grass hay** needed to reach your desired Crude Protein rate.



Group D

Box 3:

Dried Distillers Grain 79.5% TDN

Grass Hay 56.3% TDN

To unlock box 4, use your the number in the **tens** spot of the percentage of **grass hay** needed to reach your desired Total Digestible Nutrients rate.



Group E

Box 3:

Dried Distillers Grain 29.7% CP

Grass Hay 10.6% CP

To unlock box 4, use the number in the **tens** spot of the percentage of **grass hay** needed to reach your desired crude protein rate.



Group F

Box 3:

Dried Distillers Grain 79.5% TDN

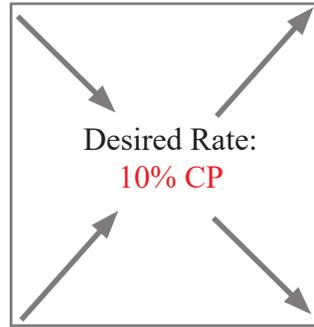
Grass Hay 56.3% TDN

To unlock box 4, use your the number in the **tens** spot of the percentage of **grass hay** needed to reach your desired Total Digestible Nutrients rate.

Part I: Practicing with Pearson Squares - Answer Key

1. Balance a ration with a desired rate of 10% CP using Ground Corn 9% CP and Soybean Seeds 42.8% CP.

Feed 1:
Ground Corn 9% CP



Feed 1:

$$42.8 - 10 = 32.8 \text{ parts Ground Corn}$$
$$32.8 / 33.8 = .97 \text{ or } 97\% \text{ Ground Corn}$$

32.8 parts Ground Corn + 1 part Soybean Seed = 33.8 total parts in ration

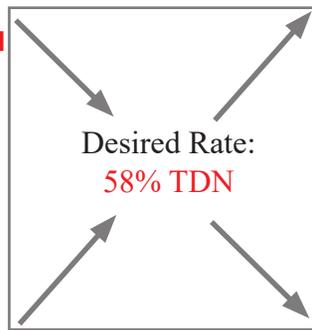
Feed 2:

$$10 - 9 = 1 \text{ part Soybean Seed}$$
$$1 / 33.8 = .029 \text{ or } 3\% \text{ Soybean Seed}$$

Check your work: $97 (.09) + 3 (.428) = 10$

2. Balance a ration with a desired rate of 58% TDN using Corn Distillers Grain 86% TDN and Fescue Hay 48% TDN.

Feed 1:
Corn Distillers Grain 86% TDN



Feed 1:

$$58 - 48 = 10 \text{ parts Corn Distillers Grain}$$
$$10 / 38 = .26 \text{ or } 26\% \text{ Corn Distillers Grain}$$

28 parts Fescue Hay + 10 parts Corn Distillers Grain = 38 total parts in ration

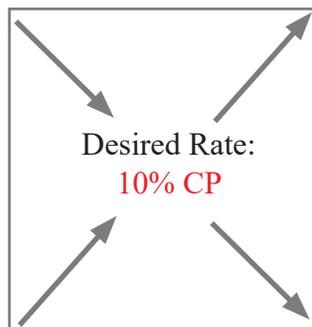
Feed 2:

$$86 - 58 = 28 \text{ parts Fescue Hay}$$
$$28 / 38 = .74 \text{ or } 74\% \text{ Fescue Hay}$$

Check your work: $26 (.86) + 74 (.48) = 58$

3. Balance a ration with a desired rate of 10% CP using Soybean Seeds 42.8% CP and Fescue Hay 9.5% CP.

Feed 1:
Soybean Seeds 42.8% CP



Feed 1:

$$10 - 9.5 = .5 \text{ parts Soybean Seeds}$$
$$.5 / 33.3 = .02 \text{ or } 2\% \text{ Soybean Seeds}$$

32.8 parts Fescue Hay + .5 parts Soybean Seeds = 33.3 total parts in ration

Feed 2:

$$42.8 - 10 = 32.8 \text{ parts Fescue Hay}$$
$$32.8 / 33.3 = .98 \text{ or } 98\% \text{ Fescue Hay}$$

Check your work: $2 (.428) + 98 (.095) = 10$

Part II: The Escape Box Ration Challenge - Answers for Group A

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

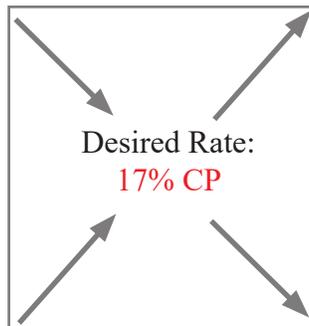
Combination for Box 1 (Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

Group A Lock #1 Group B Group C Group D Lock #2 Group E Group F

Box 1 7 _____ _____ _____ _____ _____

Feed 1:
Cottonseed 23.9% CP

Feed 2:
Alfalfa Hay 13% CP



Feed 1:
17 - 13 = 4 parts Cottonseed
4 / 10.9 = .366 or 37% Cottonseed
6.9 parts Alfalfa Hay + 4 parts Cottonseed = 10.9 total parts in ration

Feed 2:
23.9 - 17 = 6.9 parts Alfalfa Hay
6.9 / 10.9 = .633 or 63% Alfalfa Hay

Check your work: 37 (.239) + 63 (.13) = 17

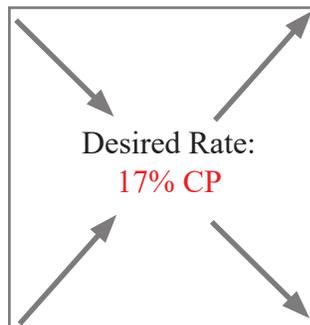
Combination for Box 2 (Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

Group A Lock #3 Group B Group C Group D Lock #4 Group E Group F

Box 2 6 _____ _____ _____ _____ _____

Feed 1:
Soybean Meal 49.9% CP

Feed 2:
Ground Corn 3.2% CP



Feed 1:
17 - 3.2 = 13.8 parts Soybean Meal
13.8 / 46.7 = .295 or 30% Soybean Meal
13.8 parts Soybean Meal + 32.9 parts Ground Corn = 46.7 Total parts in ration

Feed 2:
49.9 - 17 = 32.9 parts Ground Corn
32.9 / 46.7 = .704 or 70% Ground Corn

Check your work: 30 (.499) + 70 (.032) = 17

Combination for Box 3 (Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

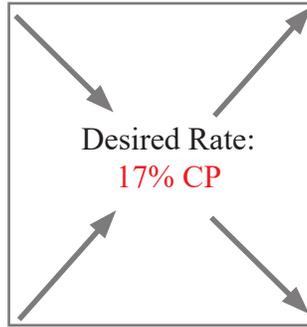
Group A Lock #5 Group B Group C Group D Lock #6 Group E Group F

Box 3 3 _____ _____ _____ _____ _____

Box 3

Feed 1:
Dried Distillers Grain 29.7%CP

Feed 2:
Grass Hay 10.6% CP



Feed 1:
 $17 - 10.6 = 6.4$ parts Dried Distillers Grain
 $6.4 / 19.1 = .335$ or 34% Dried Distiller Grain

6.4 parts Dried Distillers Grain + 12.7 parts Grass Hay
= 19.1 total parts in ration

Feed 2:
 $29.7 - 17 = 12.7$ parts Grass Hay
 $12.7 / 19.1 = .664$ or 66% Grass Hay

Check your work: $34 (.297) + 66 (.106) = 17.0$

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7 Group B	Group C	Group D	Lock #8 Group E	Group F
6	_____	_____	_____	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group B

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

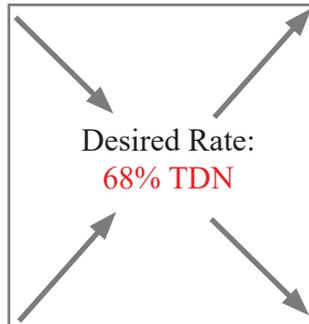
Combination for Box 1 (Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1			Lock #2	
Group A	Group B	Group C	Group D	Group E	Group F
_____	8	_____	_____	_____	_____

Box 1

Feed 1:
Cottonseed 96% TDN

Feed 2:
Alfalfa Hay 50% TDN



Feed 1:
 $68 - 50 = 18$ parts Cottonseed
 $18 / 46 = .391$ or 39% Cottonseed
 18 parts Cottonseed + 28 parts Alfalfa Hay = 46 total parts in ration
Feed 2:
 $96 - 68 = 28$ parts Alfalfa Hay
 $28 / 46 = .608$ or 61% Alfalfa Hay

Check your work: $39 (.96) + 61 (.50) = 68$

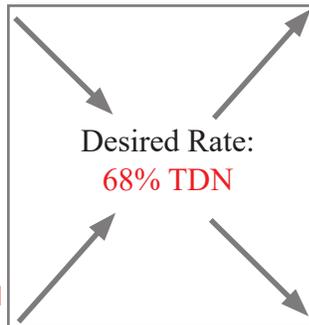
Combination for Box 2 (Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3			Lock #4	
Group A	Group B	Group C	Group D	Group E	Group F
_____	6	_____	_____	_____	_____

Box 2

Feed 1:
Soybean Meal 84% TDN

Feed 2:
Ground Corn 50% TDN



Feed 1:
 $68 - 50 = 18$ parts Soybean Meal
 $18 / 34 = .529$ or 53% Soybean Meal
 18 parts Soybean Meal + 16 parts Ground Corn = 34 total parts in ration
Feed 2:
 $84 - 68 = 16$ parts Ground Corn
 $16 / 34 = .470$ or 47% Ground Corn

Check your work: $47 (.5) + 53 (.84) = 68$

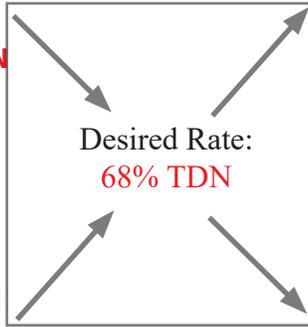
Combination for Box 3 (Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5			Lock #6	
Group A	Group B	Group C	Group D	Group E	Group F
_____	5	_____	_____	_____	_____

Box 3

Feed 1:
Dried Distillers Grain 79.5% TDN

Feed 2:
Grass Hay 56.3% TDN



Feed 1:
 $68 - 56.3 = 11.7$ parts Dried Distillers Grain
 $11.7 / 23.2 = .504$ or 50% Dried Distillers Grain

11.7 parts Dried Distillers Grain + 11.5 parts Grass Hay
= 23.2 total parts in ration

Feed 2:
 $79.5 - 68 = 11.5$ parts Grass Hay
 $11.5 / 23.2 = .495$ or 50% Grass Hay

Check your work: $50 (.563) + 50 (.795) = 67.9$

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7 Group B	Group C	Group D	Lock #8 Group E	Group F
_____	5	_____	_____	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group C

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

Combination for Box 1 (Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1				Lock #2	
Group A	Group B	Group C		Group D	Group E	Group F

Box 1

	7	
<p>Feed 1: Cottonseed 23.9% CP</p> <p>Feed 2: Alfalfa Hay 13% CP</p>		<p>Feed 1: 17.9 - 13 = 4.9 parts Cottonseed 4.9 / 10.9 = .449 or 45% Cottonseed</p> <p>6 parts Alfalfa hay + 4.9 parts Cottonseed = 10.9 total parts in ration</p> <p>Feed 2: 23.9 - 17.9 = 6 parts Alfalfa Hay 6 / 10.9 = .550 or 55% Alfalfa Hay</p>

Check your work: $45 (.239) + 55 (.13) = 17.9$

Combination for Box 2 (Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3				Lock #4	
Group A	Group B	Group C		Group D	Group E	Group F

Box 2

	5	
<p>Feed 1: Soybean Meal 49.9% CP</p> <p>Feed 2: Ground Corn 3.2% CP</p>		<p>Feed 1: 17.9 - 3.2 = 14.7 parts Soybean Meal 14.7 / 46.7 = .314 or 31% Soybean Meal</p> <p>32 parts Ground Corn + 14.7 parts Soybean Meal = 46.7 total parts in ration</p> <p>Feed 2: 49.9 - 17.9 = 32 parts Ground Corn 32 / 46.7 = .685 or 69% Ground Corn</p>

Check your work: $31 (.499) + 69 (.032) = 17.9$

Combination for Box 3 (Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5				Lock #6	
Group A	Group B	Group C		Group D	Group E	Group F

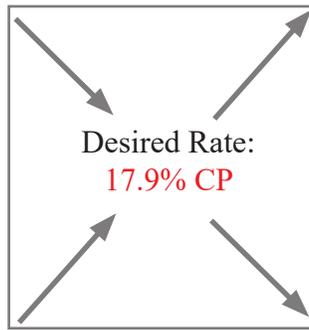
Box 3

	3	
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Box 3

Feed 1:
Dried Distillers Grain 29.7% CP

Feed 2:
Grass Hay 10.6% CP



Feed 1:
 $17.9 - 10.6 = 7.3$ parts Dried Distillers Grain
 $7.3 / 19.1 = .382$ or 38% Dried Distillers Grain

7.3 parts Dried Distillers Grain + 11.8 parts Grass Hay
= 7.7 total parts in ration

Feed 2:
 $29.7 - 17.9 = 11.8$ parts Grass Hay
 $11.8 / 19.1 = .617$ or 62% Grass Hay

Check your work: $38 (.297) + 62 (.106) = 17.85$

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7 Group B	Group C	Group D	Lock #8 Group E	Group F
_____	_____	6	_____	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group D

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

Combination for Box 1 (Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.



Box 1

<p>Feed 1: Cottonseed 96% TDN</p> <p>Feed 2: Alfalfa Hay 50% TDN</p>		<p>Feed 1: 78 - 50 = 28 parts Cottonseed 28 / 46 = .608 or 61% Cottonseed</p> <p>28 parts Cottonseed + 18 parts Alfalfa Hay = 46 total parts in ration</p> <p>Feed 2: 96 - 78 = 18 parts Alfalfa Hay 18 / 46 = .391 or 39% Alfalfa Hay</p>
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Check your work: $61 (.96) + 39 (.50) = 78$

Combination for Box 2 (Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.



Box 2

<p>Feed 1: Soybean Meal 84% TDN</p> <p>Feed 2: Ground Corn 50% TDN</p>		<p>Feed 1: 78 - 50 = 28 parts Soybean Meal 28 / 34 = .823 or 82% Soybean Meal</p> <p>28 parts Soybean Meal + 6 parts Ground Corn = 34 total parts in ration</p> <p>Feed 2: 84 - 78 = 6 parts Ground Corn 6 / 34 = .176 or 18% Ground Corn</p>
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Check your work: $82 (.84) + 18 (.50) = 78$

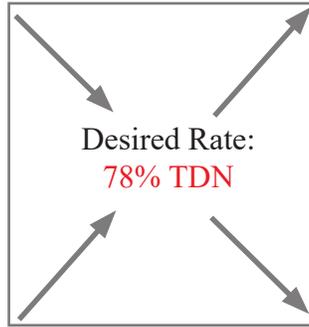
Combination for Box 3 (Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.



Box 3

Feed 1:
Dried Distillers Grain 79.5% TDN

Feed 2:
Grass Hay 56.3% TDN



Feed 1:
 $78 - 56.3 = 21.7$ parts Dried Distillers Grain
 $21.7 / 23.2 = .935$ or 94% Dried Distillers Grain

21.7 parts Dried Distillers Grain + 1.5 parts Grass Hay
= 23.2 total parts in ration

Feed 2:
 $79.5 - 78 = 1.5$ parts Grass Hay
 $1.5 / 23.2 = .064$ or 6% Grass Hay

Check your work: $6 (.563) + 94 (.795) = 78.10$

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7 Group B	Group C	Group D	Lock #8 Group E	Group F
_____	_____	_____	0	_____	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group E

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

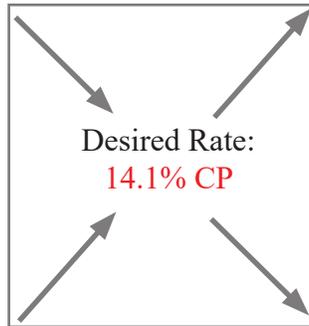
Combination for Box 1 (Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1				Lock #2	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	4	_____

Box 1

Feed 1:
Cottonseed 23.9% CP

Feed 2:
Alfalfa Hay 13% CP



Feed 1:
14.1 - 13 = 1.1 parts Cottonseed
1.1 / 10.9 = .100 or 10% Cottonseed

1.1 parts Cottonseed + 9.8 parts Alfalfa = 10.9 total parts in ration

Feed 2:
23.9 - 14.1 = 9.8 parts Alfalfa Hay
9.8 / 10.9 = .899 or 90% Alfalfa Hay

Check your work: 10 (.239) + 90 (.13) = 14.1

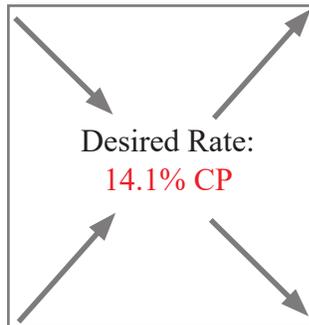
Combination for Box 2 (Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3				Lock #4	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	9	_____

Box 2

Feed 1:
Soybean Meal 49.9% CP

Feed 2:
Ground Corn 3.2% CP



Feed 1:
14.1 - 3.2 = 10.9 parts Soybean Meal
10.9 / 46.7 = .233 or 23% Soybean Meal

35.8 parts Ground Corn + 10.9 parts Soybean Meal = 46.7 total parts in ration

Feed 2:
49.9 - 14.1 = 35.8 parts Ground Corn
35.8 / 46.7 = .766 or 77% Ground Corn

Check your work: 23 (.499) + 77 (.032) = 14

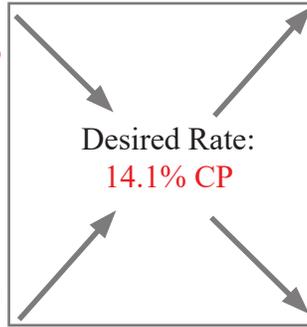
Combination for Box 3 (Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5				Lock #6	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	2	_____

Box 3

Feed 1:
Dried Distillers Grain 29.7% CP

Feed 2:
Grass Hay 10.6% CP



Feed 1:
 $14.1 - 10.6 = 3.5$ parts Dried Distillers Grain
 $3.5 / 19.1 = .183$ or 18% Dried Distillers Grain

Feed 2:
 3.5 parts Dried Distillers Grain + 15.6 Grass Hay =
 19.1 total parts in ration

Feed 2:
 $29.7 - 14.1 = 15.6$ parts Grass Hay
 $15.6 / 19.1 = .816$ or 82% Grass Hay

Check your work: $18 (.297) + 82 (.106) = 14.038$

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7	Group C	Group D	Lock #8	Group F
_____	_____	_____	_____	8	_____

Box 4

Enjoy your treat!

Part II: The Escape Box Ration Challenge - Answers for Group F

With your assigned group, open the envelope distributed by your teacher. You will find a scenario card, read the scenario and determine your desired rate for the Pearson Square calculations. Each of the first three boxes contains a card for each group and feed examples, using the information on your group's card to create a Pearson Square and determine how much of each of the feeds listed on the box card would be required in a ration to reach your group's desired nutrient rate. After each group has finished their calculations for a box, you will use the answer the box card tells you to unlock the next locked box. The fourth and final box contains a delicious treat for your class to enjoy!

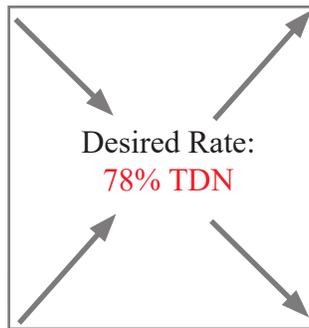
Combination for Box 1(Using your Desired Rates to unlock the first box): The first three digits will unlock the lock labeled #1 and the second three will unlock the lock labeled #2.

	Lock #1				Lock #2	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	8

Box 1

Feed 1:
Cottonseed 96% TDN

Feed 2:
Alfalfa Hay 50% TDN



Feed 1:
 $78 - 50 = 28$ parts Cottonseed
 $28 / 46 = .608$ or 61% Cottonseed

28 parts Cottonseed + 18 parts Alfalfa Hay = 46 total parts in ration

Feed 2:
 $96 - 78 = 18$ parts Alfalfa Hay
 $18 / 46 = .391$ or 39% Alfalfa Hay

Check your work: $61 (.96) + 39 (.50) = 78$ or 78%

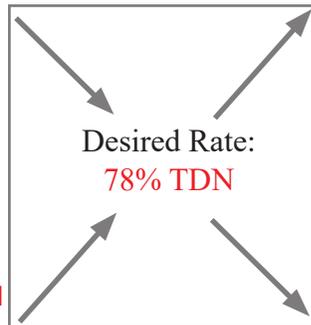
Combination for Box 2(Using the directions at the bottom of the card from box 1 to determine the digit): The first three digits will unlock the lock labeled #3 and the second three will unlock the lock labeled #4.

	Lock #3				Lock #4	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	3

Box 2

Feed 1:
Soybean Meal 84% TDN

Feed 2:
Ground Corn 50% TDN



Feed 1:
 $78 - 50 = 28$ parts Soybean Meal
 $28 / 34 = .823$ or 82% Soybean Meal

28 parts Soybean Meal + 6 parts Ground Corn = 34 total parts in ration

Feed 2:
 $84 - 78 = 6$ parts Ground Corn
 $6 / 34 = .176$ or 18% Ground Corn

Check your work: $82 (.84) + 18 (.50) = .778$ or 78%

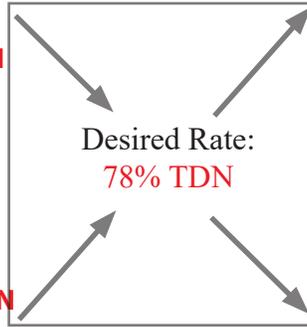
Combination for Box 3(Using the directions at the bottom of the card from box 2 to determine the digit): The first three digits will unlock the lock labeled #5 and the second three will unlock the lock labeled #6.

	Lock #5				Lock #6	
Group A	Group B	Group C		Group D	Group E	Group F
_____	_____	_____		_____	_____	8

Box 3

Feed 1:
Dried Distillers Grain 79.5% TDN

Feed 2:
Grass Hay 56.3% TDN



Feed 1:
 $78 - 56.3 = 21.7$ parts Dried Distillers Grain
 $21.7 / 23.2 = .935$ or 94% Dried Distillers Grain

21.7 parts Dried Distillers Grain + 1.5 parts Grass Hay = 23.2 total parts in ration

Feed 2:
 $79.5 - 78 = 1.5$ parts Grass Hay
 $1.5 / 23.2 = .064$ or 6% Grass Hay

Check your work: $6 (.563) + 94 (.795) = 78.10$

Combination for Box 4(Using the directions at the bottom of the card from box 3 to determine the digit): The first three digits will unlock the lock labeled #7 and the second three will unlock the lock labeled #8.

Group A	Lock #7 Group B	Group C	Group D	Lock #8 Group E	Group F
_____	_____	_____	_____	_____	0

Box 4

Enjoy your treat!