Unit C: Usage of Graphics in Agricultural Economics

Lesson 2: Creating Effective Graphics

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Distinguish factors to develop effective graphics.

2. Label the parts of graphics.

3. Develop 5 types of graphics.

Recommended Teaching Time: 2 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

http://nces.ed.gov/nceskids/help/user_guide/graph/whentouse.asp
http://www.graphicsserver.com/com_products/GraphChoiceLine.aspx

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Students' "Graphics and Statistics" Know Books
Copies of WS 2-1
Copies of LS 2-1

Terms:

Average
Best Fit Line
Data
Dependent Variable
Independent Variable
Legend
Point
Origin
Scale
Source
Title
X-Axis
Y-Axis

Interest Approach: *Begin by asking students to participate in an exercise Describe this exercise first by using only verbal cues, no pictures or demonstrations. Do not answer any additional questions that students may have regarding the exercise. Students should begin by standing up with their hands to their sides and their feet together while listening to your directions. Tell students that when you say "Go!" everyone at the same time will wave their arms in a vertical motion from the sides of their body to the top of their head. At the same time as waving their arms, they will jump moving their feet from the together position to apart then back together. Students will keep practicing this exercise for 30 seconds. Say "Go!", allow students to participate in the exercise, then ask students to be seated. Discuss this exercise. Some questions you might ask include:*
>*Did everyone complete the exercise in the same way? Why or why not?*
>*Were you confused about how to complete the exercise? Why or why not?*
Ask students to stand once again. This time explain the exercise with verbal cues and pictures or drawings. Say "Go!" and allow students to do this for 30 seconds. Discuss the differences between the first and the second time students completed the exercise.
>*Did everyone complete the exercise in the same way? Why or why not?*
>*Was the second time easier than the first? Why?*
Assist students in realizing that some explanations allow the audience a better understanding of the information. In the same way, some graphics give a better understanding to the audience than other graphics.

Summary of Content and Teaching Strategies

To assist students in understanding Objectives 1, 2, and 3, use the PowerPoint Presentation. Students should continue to write information in the Graphics and Statistics Know Book. Guide students in writing down this information with each lesson objective listed at the top of the page and content information written below.

Objective 1: Distinguish factors to develop effective graphics.

Anticipated Problem: What are the factors to be considered when developing effective graphics?

PowerPoint Slide #3
I. It is important to consider various factors that enhance the effectiveness of graphics. Graphics must be created in a manner that allow the reader to quickly and easily understand the data and important information.
  A. When creating graphics it is of utmost importance to transfer the collected data to the graphic accurately and correctly. Without information that is correct, readers may misunderstand the data or be confused about the relevance of the graphic.
PowerPoint Slide #4
  B. The type of data being used must also be considered when creating graphics.
    1. Many different types of data can be placed into each type of graphic.
      a. Data that compares items over time is best illustrated in a line or bar graph.
      b. Data that shows the relationship between two items is best illustrated in a scatter plot.
      c. Data that shows the parts that comprise a whole are best illustrated using a pie chart or cosmograph.
PowerPoint Slide #5
    2. The information that is most important should be clearly represented with the graphic. After viewing graphics, readers will draw conclusions from the given data. The creator of the graphic can affect the conclusions that readers make by carefully selecting the type of graphic to illustrate the data. The way in which the graphic is created also affects the conclusions that readers make.

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PowerPoint Slide #6

    a. Different colors should be used to show different data or highlight important information.

    b. A proper **scale** should be used to effectively illustrate data. A scale is a series of numbers to show how many things are being measured.

PowerPoint Slide #7

    i. The scale must be determined based upon the data. If the range of the scale is too large, the change in data may be difficult to see. If the range of the scale is too small, not all data will be shown properly on the graphic.

    ii. Typical scales may be measured by one's (0, 1, 2, 3, 4, etc.), five's (0, 5, 10, 15, etc.) or ten's (0, 10, 20, 30, 40, etc.)

    iii. Other scales may be used, but must be an equal pattern.

        a. An equal pattern is any set of numbers and equal distant apart. (Example: 0, 2, 4, etc.)

        b. Unequal patterns should not be used like 0, 1, 5, 8, etc.

Objective 2: Label the parts of graphics.

Anticipated Problem: What are the parts of a graphic?

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II. To properly display a graphic, these parts must be included to help the reader understand the data.

  A. The **title** gives a short description of the data within the graphic.

PowerPoint Slide #9

  B. The **data** informs the reader. This is the most important part of the graphic.

PowerPoint Slide #10

  C. The **legend** assists the reader in understanding the data. The legend defines the meaning of colors, shapes, and other objects within the graphic.

PowerPoint Slide #11

  D. The **source** is the place that the data was obtained. This must be included when the data was collected by another individual, business, or organization.

PowerPoint Slide #12

  E. Some graphics have an **x-axis** and a **y-axis**.

    1. The x and y axis meet together at the **origin** to form a 90 degree angle that looks like the corner of a box.

PowerPoint Slide #13

    2. The x-axis is the horizontal line located near the bottom of the graphic. On line and bar graphs, this axis lists dates of time or names of groups. On scatter plots, this axis includes a scale. A label must be included to describe the type of facts or scale that is listed. If needed, the unit of measurement should also be included.

PowerPoint Slide #14

    3. The y-axis is the vertical line located near the left side of the graphic. Usually along this axis, a scale includes numbers to show how many things are being measured. A label must be included to describe the scale that is listed. If needed, the unit of measurement should also be included.

    4. When appropriate, the scale can be shown on the x-axis while the names of groups are shown on the y-axis.

Objective 3: Develop 5 types of graphics.

Anticipated Problem: How do I draw each graphic?
PowerPoint Slide #15

III. Graphics are excellent illustrations that are used to more clearly convey information. These are particularly important tools when the information is complex. When developed and drawn properly, graphics assist writers communicate data and readers understand data.
  A. A line graph is a graphic that compares changes over time.
      1. Line graphs utilize ***points*** connected by lines to show changes over time. Points are dots placed on the graph using the values given by the data.

PowerPoint Slide #16

      a. To begin drawing a line graph, the x-axis and y-axis should be drawn.
      b. Develop and write the title above the line graph axes.
      c. If the data is taken from a specific source (book, periodical, website, etc) list the name of the organization or source below the line graph axes.

PowerPoint Slide #17

      d. Looking at the data, determine the scale that should be used for the x-axis and y-axis.
          i. The first number of the scale on each axis must begin at or below the data with the lowest value. Likewise, the last number of the scale on each axis must end at or above the data with the highest value.
          ii. The numbers on the scale must be in equal intervals. Scales may use any interval selected by the creator of the graph. Examples of scale intervals include: one's (0, 1, 2, 3, 4, etc.); two's (0, 2, 4, 6, 8, etc.); five's (0, 5, 10, 15, etc.); or ten's (0, 10, 20, 30, 40, etc.)
      e. Label each axis with a description of the type of data represented.

PowerPoint Slide #18

      f. Plot the points using the data.
      g. Draw a line connecting the points.
          i. A ***best fit line*** may drawn to show the ***average*** change over time. The average is a general summarization of the values.

PowerPoint Slide #19

      2. Several data sets can be plotted on one graph using different colors or types of lines (dashed, dotted, etc.)
          a. If this method is used, a legend must be added to describe each line.
      3. Example Problem: John wanted to compare his growth with his sister's growth. Both John and Jill have recorded their height each year from ages 10-15.

John's Height	Jill's Height
Age 10- 1m 57cm	Age 10- 1m 40cm
Age 11- 1m 60cm	Age 11- 1m 43cm
Age 12- 1m 64cm	Age 12- 1m 47cm
Age 13- 1m 68cm	Age 13- 1m 54cm
Age 14- 1m 71cm	Age 14- 1m 59cm
Age 15- 1m 79cm	Age 15- 1m 62cm

PowerPoint Slide #20

  B. A pie chart is a graphic that shows parts of a whole.
      1. Pie charts utilize a circle with divided sections that show different parts.
          a. To draw a pie chart, draw a circle.
          b. Develop and write the title above the pie chart

PowerPoint Slide #21

          c. If the data is taken from a specific source (book, periodical, website, etc) list the name of the organization or source below the pie chart.
          d. Using the data, divide the pie into representative sections for each category.
          e. Use a different color or pattern for each section to show them more clearly.

f. Draw the legend to one side of the pie chart to label the color or pattern assigned to each category.

PowerPoint Slide #22

2. Example Problem: Dave wants to better understand how he is using his time. On a typical day, he recorded the activities he completed and how much time they took.

Eating- 3 hours
Getting ready for school- 1 hour
School- 6 hours
Recreation- 3 hours
Homework- 1 ½ hours
Getting ready for bed- ½ hour
Sleeping- 9 hours

PowerPoint Slide #23

3. Fractions or percentages can also be added to the pie chart for a clearer understanding.

PowerPoint Slide #24

C. A bar graph is a graphic that compares things between different groups or changes over time.
1. Bar graphs utilize bars to compare or show changes over time.
   a. To begin drawing a bar graph, the x-axis and y-axis should be drawn.
   b. Develop and write the title above the bar graph axes.

PowerPoint Slide #25

   c. If the data is taken from a specific source (book, periodical, website, etc) list the name of the organization or source below the bar graph axes.
   d. Looking at the data, determine and draw the scale on the y-axis. Label the category names on the x-axis.
   e. Label each axis with a description of the type of data represented.

PowerPoint Slide #26

   f. Using the data, draw and shade the bar above the first category name. The bar should be shaded from the x-axis up to the value across from the y-axis. Repeat this step for all categories.
   g. If needed, draw a legend near the graphic to describe each shade.
2. A bar graph should not be used to compare items over time if more than 10 specific time periods are given. Instead, a line graph would more clearly represent this data.

PowerPoint Slide #27

3. Example Problem: Students in an animal husbandry wanted to find the most popular animal among people younger than age 10 and people age 11 and older. Their survey of 100 people found these results.

Age 10 and younger	Age 11 and older
Cow- 8	Cow- 11
Dog- 20	Dog- 25
Gerbil- 15	Gerbil- 7
Lynx- 1	Lynx- 11
Monkey- 17	Monkey- 16
Sheep- 4	Sheep- 1

PowerPoint Slide #28

D. An scatter plot is a graphic that shows how two things relate.
   *** **One way to explain dependent and independent variables is that the dependent variable *depends* upon the value of the independent variable.**
1. Scatter plots utilize points to show the how one variable affects the other variable.
   a. To begin drawing a scatter plot, the x-axis and y-axis should be drawn.

PowerPoint Slide #29

   i. The x-axis should show the ***dependent variable***, the item that is always constant.
      a. Dependent variables include percentages, prices, years, and other scales that tell how much or how many.

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ii. The y-axis should show the ***independent variable***, the item that changes because of the change in the dependent variable.

PowerPoint Slide #30

    b. Develop and write the title above the scatter plot axes.

    c. If the data is taken from a specific source (book, periodical, website, etc) list the name of the organization or source below the scatter plot axes.

    d. Looking at the data, determine and draw the scale on the x-axis and y-axis.

    e. Label each axis with a description of the type of data represented.

PowerPoint Slide #31

    f. Plot the points using the data.

      i. Several data sets can be plotted on one graph using different symbols for each point.

    g. If needed, draw a legend near the graphic to describe each line or symbol.

PowerPoint Slide #32

2. Example Problem: The physical education class recorded each person's height and weight to see if there was a strong pattern between the two variables.

Height	Weight
182 cm	95 kg
155 cm	73 kg
143 cm	45 kg
167 cm	77 kg
166 cm	80 kg
150 cm	52 kg
171 cm	60 kg
177 cm	87 kg
160 cm	50 kg

PowerPoint Slide #33

3. If all the points on a scatter plot show a similar trend, a best fit line may be drawn to show the average relationship between the two items.

PowerPoint Slide #34

E. A cosmograph is a graphic that uses a picture to show parts of a whole.

    1. Cosmographs utilize a picture or map to show data for different parts.

      a. To create a cosmograph, draw or trace the picture or map.

      b. Develop and write the title above the picture.

PowerPoint Slide #35

    c. If the data is taken from a specific source (book, periodical, website, etc) list the name of the organization or source below the picture.

    d. Using the data, shade the picture appropriately.

    e. Draw a legend near the graphic to describe each shade.

PowerPoint Slide #36

2. Example Problem: Mr. Smith obtained the nutritional information for ¼ liter goat's milk. He created a cosmograph as a simple way to show his students.

        Total Fat- 10 grams

        Total Sugars- 11 grams

        Total Protein- 9 grams

        Minerals- 1.99 grams

        Vitamins- 1.01 grams

        Water- 211 grams

Review/Summary: Guide students as they complete WS 1-1. An answer key is provided; however, other answers are possible. Accept any other correct answers and graphics. When finished, ask 12 students to draw graphics on the writing surface. 3 students should draw bar graphs, 3 other students should draw line graphs, 3 other students should draw pie charts, and 3 students should draw other types of graphics. Discuss the graphics and worksheet questions with the group. Be sure to make the following points during the discussion:

>Graphics of the same type can be drawn differently to help readers come to different conclusions. (Example: A bar graph that lists crops on the x-axis will look different than a bar graph that lists the years on the x-axis.)

>The scales on a graph effects the representation of the data and can effect the reader's conclusions from the graphic.

>Most effective graphic for highlighting different information

-Most effective for showing which crop has the most hectares in production each year-
Bar Graph

-Most effective for showing the change in the number of hectares for each crop-
Line graph

-Most effective for comparing number of hectares of each crop-
Pie Chart or Cosmograph

Application: Assign each student a topic to research and collect data. These topics can be developed by the instructor or as a group in class. Some topic ideas include comparing 12th, 11th, and 10th grade students' favorite class or test score improvement (or decline) since the beginning of the course. Students should complete LS 1-1.

Evaluation: A sample written test is attached.

Answers to Test:

Part One: Matching

1 = c, 2 = f, 3 = e, 4 = b, 5 = d, 6 = g, 7 = h, 8 = a

Part Two: Completion

1 = scale
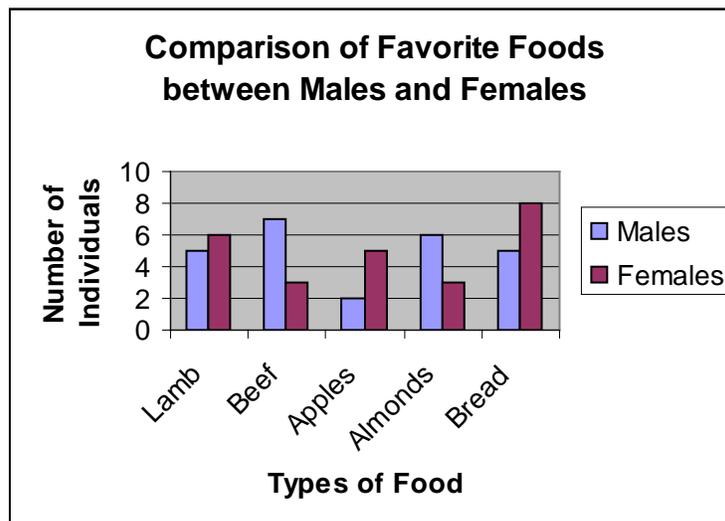
2 = Fractions, percentages

3 = correctly or accurately

4 = inventory

Part Three: Short Answer

Answers may vary. Use Objectives 1, 2, and 3 to score this question.   Below are suggested graphics.

1. The best graphic to represent this data and show the comparison between males and females is a bar graph. Students may utilize a different scale and have slightly different titles and labels. Check to ensure that all parts are labeled correctly on their graphic.
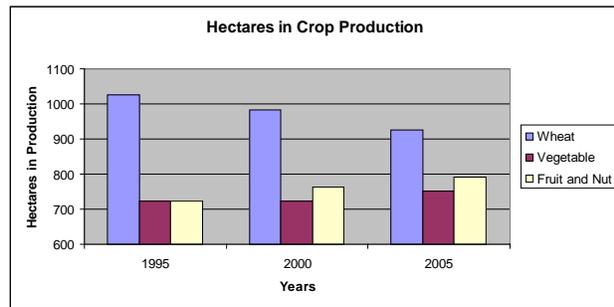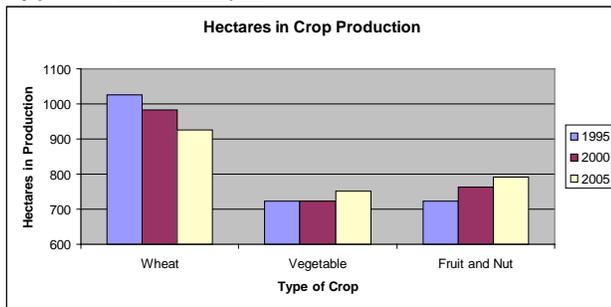
Creating Effective Graphics

Instructions. Using the data below to create 3 different types of graphics. Then answer the questions using complete sentences.
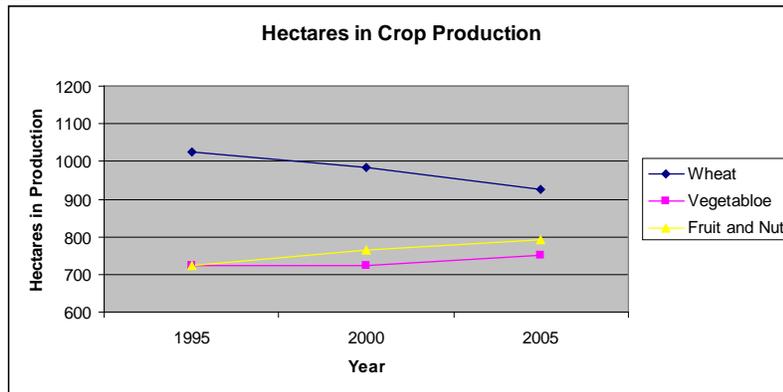
Farmers were surveyed three different years on the production of their crops.

	Total Hectares	Hectares of Wheat	Hectares of Vegetable Crops	Hectares of Fruit and Nut Crops
1995	2470	1025	723	722
2000	2470	983	723	764
2005	2470	927	752	791

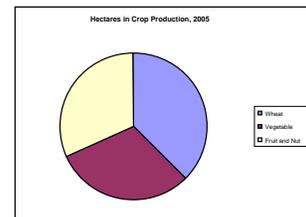Graphic 1   Type:_____

Graphic 2   Type:_____

Graphic 3   Type:_____

How are each of the graphics similar?

How are each of the graphics different?

What conclusion is easily made from the Graphic 1?

What conclusion is easily made from Graphic 2?

What conclusion is easily made from Graphic 3?

Name_____

Creating Effective Graphics

Instructions. Using the data below to create 3 different types of graphics. Then answer the questions using complete sentences.

Farmers were surveyed three different years on the production of their crops.

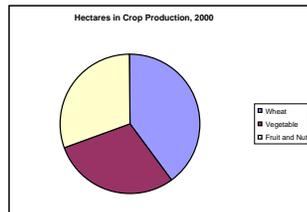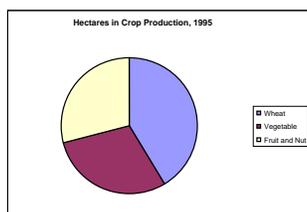|	Total Hectares	Hectares of Wheat	Hectares of Vegetable Crops	Hectares of Fruit and Nut Crops
1995	2470	1025	723	722
2000	2470	983	723	764
2005	2470	927	752	791

Type:___Bar Graph_____

Type:___Line Graph_____
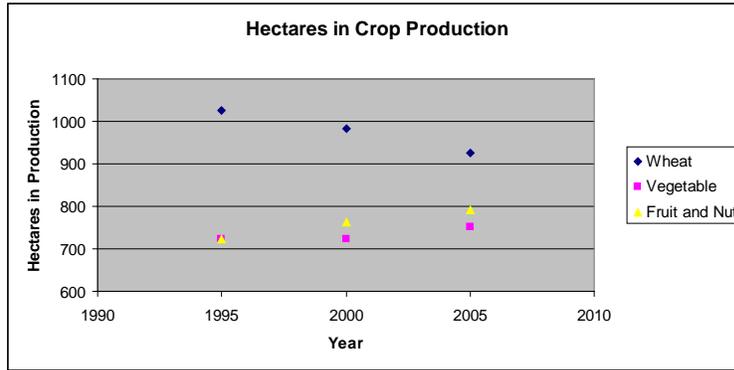

Type:___Pie Chart_____

Type:___Cosmograph_____
These will vary greatly among students. Check to ensure students have accurately used the data and all parts are labeled correctly.

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Creating Effective Graphics

Type:___Scatter Plot_____

Hectares in Crop Production

How are each of the graphics similar? *All graphics utilize the same data*

How are each of the graphics different? *They illustrate the data in a different way, they highlight the data differently, readers may make different conclusions depending upon which graphic they see.*

What conclusion is easily made from a bar graph? *Each year, wheat has the most production.*

What conclusion is easily made from a line graph? *The number of hectares producing wheat has decreased, but the number of hectares producing vegetables and fruits and nuts has increased.*

What conclusion is easily made from a pie chart? *Of all the hectares in production, wheat is produced on the largest number of those hectares.*

What conclusion is easily made from a cosmograph? *Of all the hectares in production, wheat is produced on the largest number of those hectares.*

What conclusion is easily made from a scatter plot? *The number of hectares producing wheat has decreased, but the number of hectares producing vegetables and fruits and nuts has increased.*

Test   Name_____

Test
Creating Effective Graphics

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

a. legend
b. average
c. data
d. points

e. independent variable
f. pie chart
g. origin
h. scatter plot

_____ 1. This part of the graphic illustrates the collected information.
_____ 2. A graphic that shows parts of a whole.
_____ 3. The item that changes because of the change in the dependent variable.
_____ 4. A general summarization of all the values.
_____ 5. Dots placed on the graph using the values given by the data.
_____ 6. The place where the x-axis and the y-axis meet.
_____ 7. A graphic that shows the relationship between two variables.
_____ 8. This part of the graphic defines the meaning of colors, shapes, and other objects.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. Determined by the data, _____ show how many things are being measured.
2. _____ or _____ are sometimes added to pie chart to assist readers in understanding the information.
3. The most important factor in creating graphics is transferring data _____.
4. Different _____ can be used to show different data or highlight important information.

Part Three: Short Answer

Instructions. Create a graphic to best represent the data.

1. 25 males and 25 females were surveyed to compare the differences of favorite foods between males and females. Create a graphic highlighting the comparison between males and females.

Creating Effective Graphics
Lab Sheet

Part One

Instructions. Collect the assigned data and record it in the space below.

Part Two

Instructions. Develop a graphic to effectively illustrate the data.

Part Three

Instructions. Write a paragraph to describe the data as shown in the graphic. This paragraph should assist the reader in drawing conclusions about the data.