UNIT X - COTTON PRODUCTION

Lesson 1: Planning the Crop

Competency/Objective: Evaluate local growing conditions.

Study Questions

1. **What environmental conditions are necessary for cotton production?**

2. **What factors are considered when evaluating field history?**

3. **What are the fertilizer requirements for cotton?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.

2. Activity Sheet

   a) AS 1.1: Soil Nutrients Needed by Cotton

UNIT X - COTTON PRODUCTION

Lesson 1: Planning the crop

TEACHING PROCEDURES

A. ***Introduction***

Cotton is an economically important crop to agriculture and to Missouri. An important factor in growing cotton is the planning phase, the first step in producing a cotton crop. This lesson will discuss what conditions and factors need to be considered when planning the crop.

B. ***Motivation***

1. To prepare for AS 1.1, plant single cotton seeds in pots of soil containing approximately 2 pounds of soil (preferably a potting soil or soil that lacks nutrients) 3 to 4 weeks before the start of the lesson. The class will be separated into three student groups with each group receiving four potted plants each. Refer to AS 1.1 for detailed procedures to complete the activity.

2. The instructor should bring in samples of a cotton plant, a cotton boll, and products made from cotton. Students should then be asked how important cotton is to Missouri and where cotton can be grown. From this discussion students should discover that cotton needs specific conditions to grow well. These conditions will be examined in this lesson.

3. Show the video *Early Season Crop Assessment and Management*, Part 2 of the Cotton Crop Monitoring for Optimum Management video series, Ag Video 225, available for free loan from MRCCTE (formerly MVRC), University of Missouri-Columbia.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Cotton, like any other plant, requires specific conditions to grow well. Before a producer plants cotton, he or she should have a working knowledge of these necessary environmental conditions. Ask students what environmental conditions they think are necessary to grow cotton. Refer to Table 1.1 in the Student Reference for the average heat units (DD-60s) required for cotton.

   What environmental conditions are necessary for cotton production?

   a) Growing season
      1) Warm season crop - grows best during summer months in warm climates
      2) Requires frost-free period (the number of days from the last frost in the spring until the first frost in the fall)
         (a) Main reason not grown in northern climates
         (b) Mostly grown in southern regions of the United States including southeast Missouri
      3) Newer varieties - able to produce in climates with shorter growing seasons
      4) Growing season in Missouri - falls between early May and late October
      5) Temperature requirements
         (a) Planting and germination stages
            (1) Only planted in spring when average soil temperature at least 65°F for 3 consecutive days
            (2) Will not germinate unless the average air temperature at least 75°F, 85°F optimum

(3) Spring planting dates in Missouri - between May 5 and May 15
a. Before May 5
i. Risk cool soil temperatures
ii. May be able to establish a stand in some years
b. After May 15 but before May 20
i. Will probably not have significantly lower yields
ii. Can delay plant maturity and harvest
c. After May 20
i. Usually results in reduced yields
ii. Not recommended

(b) Cotton plant development
(1) Temperatures between 65 and 85°F - grows predictably
(2) Little or no development at temperatures below 60°F
(3) Heat units (DD-60s) - method of temperature measurement
a. Used to manage and monitor crop
b. Calculated by averaging the maximum and minimum temperatures for a day and subtracting the base temperature
c. [(max. temp. + min. temp.) ÷ 2] - 60 = DD-60s

6) Rainfall
(a) Impacts soil temperature
(1) Over 1 inch rainfall - drop soil temperature at least 5 degrees
(2) Delay warming of soil for 4 to 5 days
(b) During plant development
(1) Before first bloom - ¾ to 1 inch of water weekly
(2) During peak bloom - 1 to 1½ inch of water weekly
(3) Late bloom to early maturity - no water required
(c) Must be monitored
(1) Wilting (loss of strength or turgor) - needs water
(2) Increased vegetative growth and reduced reproductive growth - excessive water

7) Soil type
(a) Sandy soils
(1) Will not hold water as well as other types
(2) May need to be irrigated more often
(b) Clay soils
(1) Better water-holding capacity
(2) Restrict drainage
(3) Seldom need irrigation
(4) Excessive clay
a. Root growth resisted
b. Can stunt cotton plants
(c) Silty soils - compromise between clay and sand

2. Once the growing conditions have been evaluated, the field itself should be evaluated. Ask students if the field conditions and history will have any impact on growing cotton.

What factors are considered when evaluating field history?

a) Weeds
1) Previous weeds and current herbicide can impact cotton.
2) Severe weed problems affect germination and growth.
b) Soil fertility and soil nutrients - excessive nitrogen a potential problem in vegetative and reproductive growth
c) Insects
1) Insecticide used on previous crop could harm cotton.
2) Insect eggs could remain in soil.

3. Like many other plants, cotton has certain fertilizer requirements for varying levels of production. Ask students what soil nutrients they think cotton needs and why. Complete AS 1.1.

What are the fertilizer requirements for cotton?

a) Variables affecting fertilizer requirements
   1) Stress
      (a) Affects amount of nutrients plant absorbs from soil
      (b) Causes
         (1) Soil texture
         (2) Drainage
         (3) Field preparation
         (4) Weather
         (5) Variety of crop selected
         (6) Planting date
         (7) Planting and germination rate
         (8) Emergence rate
         (9) Previous crop
         (10) Nutrients and chemicals in soil
   2) Amount of nutrients needed
      (a) Varies throughout the plant's growing cycle
         (1) Spring and early summer when temperature is low - requires small amounts of nutrients
         (2) Temperatures and plant size increases - need for nutrients increases
      (b) Peak amounts of nutrients needed - late June and throughout July
   3) Soil pH - prefer 6.0 to 6.5

b) Nutrients required
   1) Nitrogen
      (a) Used in chlorophyll - the process of making new tissues in the plant
      (b) Nitrification
         (1) Changes the levels of each type of nitrogen in the soil
         (2) Excess water in soil
            a. Slows or stops nitrification
            b. Nitrogen given off in form of gas
      (c) Levels
         (1) Excessive nitrogen
            a. Delay plant maturity
            b. Slow flowering
            c. Cause excessive vegative growth
            d. Increase insect infestations
            e. Reduce resistance to diseases
            f. Increase the risk of boll rot disease and lint (boll fiber) quality
         (2) Young plant - little nitrogen needed
         (3) Flowering and forming the boll - large amounts of nitrogen needed
         (4) Common rate - 80 pounds per acre on irrigated fields
      (d) Application
         (1) 30 pounds at planting
         (2) 50 pounds before blooming
   2) Phosphorous
      (a) Does not move well through soil
      (b) Mycorrhizal fungi
         (1) Take food from plant
         (2) Help absorb phosphorous from areas around roots
      (c) Cold soils
         (1) Inhibit phosphorous intake
         (2) Slow root growth
   3) Potassium

(a) Needed in large amounts while bolls are setting
(b) Important to pH of plant
(c) Taken directly into roots - desired levels vary

4) Boron
   (a) Important in cell formation and production of fruit
   (b) Plentiful in southern soils
   (c) Less available in drier soils

5) Secondary macronutrients - may sometimes be applied in fertilizer if needed
   (a) Calcium
      (1) Strengthen cell wall
      (2) Increase plant growth
      (3) Produce protein
      (4) Move carbohydrates
      (5) Balance cell acidity
      (6) Calcium deficiency
         a. Makes plant more susceptible to plant diseases
         b. Leads to weaker plant stalks
   (b) Magnesium - used in making chlorophyll
   (c) Sulfur - produces amino acids

6) Micronutrients
   (a) Needed in very small amounts
   (b) Common micronutrients
      (1) Boron
      (2) Molybdenum
      (3) Zinc
      (4) Iron
      (5) Manganese
      (6) Copper
      (7) Chlorine

F. ***Other Activity***

Have the students evaluate a soil test report to determine levels of each nutrient in the soil, whether cotton would grow well on that soil as it is, or if fertilizer needs to be applied.

G. ***Conclusion***

Careful consideration and evaluation should be given to field history, previous cropping, moisture, irrigation, and soil fertility when considering planting cotton. A soil fertility test can accurately determine nutrient levels found in the soil and what nutrients should be applied to maximize cotton production.

H. ***Answers to Activity Sheets***

Answers will vary

I. ***Answers to Evaluation***

1. c
2. a
3. b
4. b
5. d
6. Nitrogen, phosphorous, potassium
7. Nitrate and ammonium nitrogen
8. Phosphorous
9. Making a boll
10. Cell formation, production of fruit

UNIT X - COTTON PRODUCTION Name_____

Lesson 1: Planning the Crop Date_____

EVALUATION

Circle the letter that corresponds with the best answer.

1. Cotton in Missouri is typically planted between _____ .

   a. May 1 and May 5
   b. May 1 and May 15
   c. May 5 and May 15
   d. May 15 and May 20

2. Cotton should be planted when the average soil temperature is at least _____ °F for three consecutive days.

   a. 65
   b. 75
   c. 85
   d. 45

3. During peak bloom period, cotton requires _____ inch of water per week.

   a. ½ to ¾
   b. 1 to 1½
   c. 1½ to 2½
   d. 0 to ½

4. Cotton prefers a soil pH of _____.

   a. 5.5 - 6.0
   b. 6.0 - 6.5
   c. 6.5 - 7.0
   d. 7.0 -7.5

5. The type of nutrients that the plant needs large amounts of are called _____.

   a. Secondary nutrients
   b. Important nutrients
   c. Micronutrients
   d. Macronutrients

Complete the following short answer questions.

6. Name three common macronutrients.

   a.

   b.

   c.

7. Name two common forms of nitrogen in soil.

   a.

   b.

8. The nutrient that does not move easily through soil is _____.

9. Potassium is needed by a cotton plant especially when the plant is _____.

10. Boron is used by the plant in _____.

Lesson 1: Planning the Crop Name_____

Soil Nutrients Needed by Cotton

Objective: Students will identify and compare the effect soil nutrients have on growing cotton.

Materials needed:

Four cotton plants per student group (seeded 3 to 4 weeks before the start of the lesson)
Pure fertilizer samples of nitrogen, phosphorus, and potassium
Measuring device to measure grams

Procedure:

1. Give each student group four cotton plants and assign one of the three nutrients to each group.

2. Give the plants varying levels of the assigned nutrient daily using the amounts listed below as the basic amount. Use one plant as a "control," where no additional fertilizer is applied. Add the nutrient assigned to your group per the following measurements.

   a. Plant 1: Group 1: 2 grams of nitrogen
   Group 2: 1.5 grams of phosphorus
   Group 3: 1 gram of potassium

   b. Plant 2: Use half of the amount used on plant 1.

   c. Plant 3: Double the amount used on plant 1.

   d. Plant 4: Control plant - no additional fertilizer applied.

3. Over a 2-week period, observe the cotton plants as varying amounts of each fertilizer is applied.

4. In your notebook, note any changes observed in the plant, including death.

5. After 2-3 weeks, compare your results with the rest of the class.

Questions to consider:

1. What changes did you observe in the plant at each level of fertilization and why?

2. How did the control plant compare to the other three plants and why?

3. Which nutrient seemed most important to plant growth and why?

UNIT X - COTTON PRODUCTION

Lesson 2: Selecting a Variety

Competency/Objective: Select cotton variety with a local cotton consultant.

Study Questions

1. **Why and how are consultants used in cotton production?**

2. **What factors are considered when selecting a cotton seed variety?**

3. **What diseases are prevalent to cotton locally (in Missouri)?**

References

1. *Advanced Crop Sciences* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.

2. Activity Sheet

   a) AS 2.1: Cotton Variety Seed Selection

UNIT X - COTTON PRODUCTION

Lesson 2: Selecting a Variety

TEACHING PROCEDURES

A. ***Review***

The previous lesson addressed factors involved in planning a cotton crop. This lesson will address factors to consider when selecting a cotton seed variety, the role of cotton consultants, and what diseases are found locally that may impact cotton seed selection.

B. ***Motivation***

Obtain a list of cotton varieties from a seed company or from Internet references. Show the list on the overhead projector or write on the chalk/whiteboard as students select the most appropriate variety of cotton seed for local growing conditions. Ask them why they chose a particular variety and how producers would know which variety to select for their fields.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Extensive research in cotton production and cotton-growing conditions has resulted in many varieties of cotton seed. Ask students how a producer might select seeds without knowing what varieties grow well in the local area.

   Why and how are consultants used in cotton production?

   a) Hired professionals - help make correct management decisions based on local conditions
      1) Give recommendations
         (a) Variety selection
         (b) Pest control
         (c) Irrigation and water management
         (d) Soil fertility determination
         (e) Cotton classification
         (f) Gin selection
         (g) Product marketing
      2) Evaluate fields during growing season
         (a) Insect infestations
         (b) Soil fertility problems
         (c) Irrigation scheduling
         (d) Other problems
      3) Offer solutions to problems, including alternative methods

2. There are a number of factors involved in selecting a variety of cotton seed. Producers work with consultants and evaluate local production data when selecting the appropriate variety of seed for their field conditions. Refer to the Motivation listing of the many varieties of cotton seed available. Ask students if any one variety would work in all situations and why or why not.

   What factors are considered when selecting a cotton seed variety?

   a) Yield ability - total production of a variety of saleable cotton
      1) Determines crop income

2) Varies
   (a) State to state
   (b) County to county
   (c) Depends on local growing conditions

b) Maturity - average number of growing days needed from seeding to harvest
   1) Variety selected to mature during hot, dry days based upon:
      (a) Local climate
      (b) Average planting date
      (c) Length of time required for variety to mature
      (d) Harvest date
   2) Rain stains cotton - bolls open in hot, dry days not during rain

c) Plant size - measure of how tall the cotton plant will grow upon maturity
   1) Too much vegetative growth (plant height)
      (a) Reduces boll production
      (b) Causes harvesting problems
   2) Growth regulators
      (a) Sometimes used to limit plant height
      (b) Cost reduced or eliminated by selecting a shorter variety

d) Hairiness - hairs growing on the leaves
   1) Can pose a problem in harvesting
      (a) Get into cotton fibers or lint
      (b) Decrease cotton's value
      (c) Not typical in varieties grown in Missouri
   2) Smooth or semi-smooth leaf varieties - reduce amount of trash in lint

e) Transgenes - varieties of cotton that have been developed that are resistant to particular herbicides
   1) Enable producers to kill weeds with the herbicides without affecting the health of the cotton plant
   2) More expensive
   3) Not readily available
   4) Varieties resistant to particular insects - reduce the cost of insect control

f) Fiber properties
   1) Staple length (fiber length)
   2) Color
   3) Cleanliness
   4) Uniformity
   5) Fiber strength
   6) Elongation
   7) Fiber diameter

g) Seed size
   1) Important in ginning process - difficult to separate very small seeds from lint
   2) Determines number of seeds per pound - important in purchasing seed

h) Herbicide program
   1) Used to kill weeds
   2) Transgenic varieties - resistant to certain herbicides
   3) Some varieties - do not compete as well with weeds
   4) Important to know weed history of field

i) Tolerance
   1) Some varieties - withstand damage from insects better
   2) Ability to withstand stresses during the growth stages

j) Cost
   1) Older varieties - less expensive
   2) New varieties - more productive
   3) Transgenic seeds
      (a) Cost more
      (b) Allow for different management practices in pest control

k) Insect resistance

1) Numerous insects that may infest cotton
2) Spraying for harmful insects
   (a) Often kills beneficial insects
   (b) Harmful insects return sooner after spraying than beneficial insects

3. Cotton is susceptible to a number of different diseases. Ask students if they can name any common cotton diseases and what the diseases do to the plant.

What diseases are prevalent to cotton locally (in Missouri)?

a) Causes
   1) Fungi
   2) Nematodes
   3) Bacteria
b) Most common diseases
   1) Seedling disease
   2) Boll rots
   3) Bacterial blight
   4) Leaf spots
   5) *Cercospora gossypina*
   6) *Asochyta gossypii*
   7) *Alternaria*
   8) Fusarium wilt
   9) Verticillium wilt
   10) Root knot nematode
   11) Reniform nematode
   12) Lance nematode
c) Symptoms
   1) Stunted plants
   2) Poor color
   3) Reduced vigor
   4) Lower yields
   5) Death
d) Resistance
   1) No varieties immune to all or most diseases
   2) Limited levels of resistance to certain cotton diseases
      (a) Root-knot nematode
      (b) Fusarium wilt
      (c) Verticillium wilt
e) Effects on plants
   1) Seedlings
      (a) Especially susceptible to diseases
      (b) Usually die
   2) Older plants
      (a) Able to survive some diseases
      (b) Reduced production
f) Ability to withstand - related to amount of stress on plant
g) Methods for managing cotton diseases
   1) Four most common
      (a) Rotating crops and crop varieties
      (b) Planting resistant varieties
      (c) Planting in warm, well-drained soil
      (d) Integration of all three most effective method
   2) Fungicide
      (a) Method of applying
         (1) Applied to seed
         (2) Sprayed onto plant

(3) Injected into the ground after plant is growing

(b) Fight several common diseases

F. ***Other Activity***

Invite a cotton consultant to speak to the class outlining what his or her job entails, what consultants need to know, and other pertinent information.

G. ***Conclusion***

Selecting a cotton seed variety is not a simple task. A number of factors need to be considered to select the variety most appropriate to the local setting. Diseases can cause major damage to the cotton and should be managed to reduce crop damage resulting in reduced production.

H. ***Answers to Activity Sheet***

Answers will vary.

I. ***Answers to Evaluation***

1. b
2. a
3. b
4. c
5. a
6. Applied to seed, sprayed on plant, injected into ground
7. Fungi, bacteria, nematodes
8. Rotating crops and crop varieties, planting resistant varieties, planting in warm, well-drained soil
9. Answers may include any four of the following: boll rots, bacterial blight, leaf spots, *Cercospora gossypina*, *Asochyta gossypii*, *Alternaria*, Fusarium wilt, Verticillium wilt, root knot nematode, Reniform nematode, Lance nematode.
10. Answers may include any three of the following: stunted plants, poor color, reduced vigor, lower yields, and death.

UNIT X - COTTON PRODUCTION Name_____

Lesson 2: Selecting a Variety Date_____

EVALUATION

Circle the letter that corresponds with the best answer.

1. A local expert trained to aid the producer in making cotton decisions is called a _____.

   a. Cotton buyer
   b. Cotton consultant
   c. Crop expert
   d. Cotton picker

2. When referring to cotton seed selection, yield refers to _____.

   a. Total production of saleable cotton
   b. Number of seeds in a pound
   c. Height of the plant
   d. Resistance to disease

3. Maturity is important in cotton seed selection in relation to _____.

   a. Total size of the plant
   b. Local climate information
   c. Seeding rate
   d. Amount of lint in bolls

4. Transgenes refer to varieties of cotton that have been developed to _____.

   a. Be fertile
   b. Be less expensive as a seed
   c. Resist herbicides
   d. Produce two crops a year

5. Insect resistance is important in a cotton variety because it _____.

   a. Eliminates the need for spraying that also kills beneficial insects
   b. Completely stops insect problems
   c. Sterilizes the soil
   d. Prevents diseases

6. List three methods of applying fungicides to a cotton field.

   a.

   b.

   c.

7. List three organisms that commonly cause cotton diseases.

   a.

   b.

   c.

8. List three important methods of managing cotton diseases.

   a.

   b.

   c.

9. List four common diseases of cotton found in Missouri.

   a.

   b.

   c.

   d.

10. List three common symptoms of diseased cotton.

    a.

    b.

    c.

Lesson 2: Selecting a Variety Name_____

Cotton Variety Seed Selection

Objective: Compare cotton varieties to determine their advantages and disadvantages in the local growing conditions.

Directions: Compare and evaluate cotton varieties' advantages and disadvantages. Evaluate the seed varieties using the guidelines presented below. Individually or in teams, evaluate a different variety of cotton.

Materials needed:

Cotton variety information sheets (can be found on the Internet - see references)

Procedure:

Determine the following information about your variety of cotton. When finished, compare information with your classmates (write information in table form on the board).

1. Ability to yield
2. Maturity
3. Plant size
4. Hairiness
5. Transgenes
6. Fiber properties
7. Seed size
8. Herbicide program to be used
9. Tolerance
10. Cost
11. Insects

Questions to consider:

1. Is there an ideal cotton variety? Why?

2. Which variety evaluated by your class seemed best? Why?

3. Would your answer be different if you lived in Alabama, and what might affect your decision?

UNIT X - COTTON PRODUCTION

Lesson 3: Tilling and Planting the Crop

Competency/Objective: Describe the tillage and planting method for cotton.

Study Questions

1. **What is considered proper seedbed preparation for cotton?**

2. **What is the proper plant population and row spacing?**

3. **How is a cotton planting calendar used?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.

2. Activity Sheet

   a) AS 3.1: Germination Percentages

UNIT X - COTTON PRODUCTION

Lesson 3: Tilling and Planting the Crop

TEACHING PROCEDURES

A. ***Review***

Previous lessons have included factors involved in planning the crop and in selecting the seed variety planted. This lesson will concentrate on the factors to consider in soil tillage, seeding rates, and the use of a cotton planting calendar.

B. ***Motivation***

1. Hypothetical situation: students are raising roses for sale. Weather conditions allow for the roses to be planted anytime during the year. Ask the students if they would plant the roses on a specific date or whenever they felt like it. Those who say on a specific date, ask them why. It is hoped that students will recognize that having the roses flowering and maturing at or near Valentine's Day would be ideal. Relate this to growing cotton. Instead of aiming for a specific date, producers are looking for optimal weather to produce and open bolls.

2. Show the video *Stand and Population Evaluation*, Part 1 of the Cotton Crop Monitoring for Optimum Management video series, available for loan from the Missouri Resource Center for Career & Technical Education (MRCCTE, formerly MVRC), Ag Video 224, University of Missouri-Columbia.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Preparing the soil for seeding is an important task in producing crops, and cotton is not any different. Ask students how the soil should be prepared before planting a garden and why those steps are taken.

What is considered proper seedbed preparation for cotton?

a) Correct seedbed preparation for cotton
   1) Bed that is firm, well drained, and free of vegetative growth like weeds
   2) Proper environment for the cotton seed to grow
b) Two main types of seedbed cultivation
   1) Conventional tillage
      (a) Plowing fields after fall harvest
         (1) Shredding stalks from previous crop
         (2) Mixing stalks into soil for use as fertilizer
      (b) Spring tillage
         (1) Deep subsoil chiseling to break up hardpan clay
         (2) Mixes any remaining residue and incorporates herbicides into the soil
      (c) Beds formed using "hipper" - specialized tillage implement that mounds soil in rows leaving an irrigation trough between the mounded rows
         (1) Seeds planted in peak of mounded rows
         (2) Beds raised to allow more sunshine
            a. Warms soil
            b. Increases germination

(3) Procedure done 2 to 3 weeks before planting - allows rainfall to settle the soil

(d) Table for advantages and disadvantages of various conventional tillage operations

Tillage	Purpose	Advantages	Disadvantages
Shred stalks in fall	Allows stalk to decompose and reduce insect overwintering sites	Can reduce insect pressure the following season	None
Disk in fall	Mixes residue into top layer of soil	Hastens decomposition of residue	Less residue on soil surface can allow blowing soil in spring
Deep subsoil	Breaks traffic pan layer	Can improve rooting and water infiltration	Costly operation and pan traffic may reform if soil is tilled while wet after subsoiling
Disk/chisel in spring	Mixes residue in top layer of soil and/or herbicide incorporation	Removes any winter weed growth	Less residue on soil surface can permit blowing soil; traffic pan can reform if disking occurs while soil is wet
Form beds with "hipper"	Provides a fresh bed to plant on	Allows the soil to warm up before planting	May reduce surface drainage and require water furrows in some poorly drained fields

2) Conservation or reduced tillage
   (a) Reduced tillage or no-till cotton
      (1) Labor and fuel savings
      (2) Fewer trips over field needed
      (3) Crop seeded directly into mounds from previous seasons
      (4) Fertilizer and herbicides applied at same time
   (b) No-till - special planter used
      (1) Cuts through crop residue
      (2) Places seed
      (3) Covers seed
      (4) Firms soil over seed
      (5) Stubble - protects seedlings from wind and sand

2. Once the seedbed has been prepared, the producer is ready to begin seeding. To seed the crop, the proper seeding rate and row spacing need to be determined. Ask students how far apart cotton rows should be, how far apart the plants should be, and why such distance is important.

What is the proper plant population and row spacing?

a) Row spacing for cotton
   1) Ranges from 30 to 38 inches apart
   2) Diminished yields on rows narrower than 30 inches
   3) Set by adjusting the planter units on the row crop planter
b) Seed spacing - 2 to 4 inches apart or 3 to 4 plants per foot
c) Seed germination - percentage of seeds that actually grow
   1) Typical germination about 80%
   2) One extra seed per foot dropped to make up for the germination percentage
   3) Adjust seeding rates higher if germination percentage is lower
d) Seeding rates
   1) Typical - 50,000 to 60,000 plants per acre

2) Overseeding
   (a) Too many plants grow
   (b) Competition for limited water, nutrients, and sunlight
   (c) Leads to lower cotton production
   (d) Lodging
   (e) Extreme cases - thin crop for maximum production

e) Proper seeding depth - 3/4 inch deep
   1) Emerges from soil 7 to 9 days after planting
   2) Cannot penetrate a heavy soil crust
      (a) Caused by rain occurring just after seeding
      (b) Leaves harder crust on top of soil
      (c) Seeding rate increased in anticipation of packing rain

f) Low germination
   1) May opt for reseeding directly over the first crop seedlings
   2) Second seeding planting rates adjusted to lower rate

3. Keeping accurate records is an important management tool in any area of agriculture. Cotton producers often use many records. Discuss with the students what a planting calendar is and how it is used.

How is a cotton planting calendar used?

a) Planting calendar allows the producer to pick a good planting date.
   1) Based on expected rainfall, temperatures, and other climate conditions
   2) Focuses on climate when cotton bolls are opening and later when the cotton is ready to be harvested

b) Use crop calendar to maximize cotton production.
   1) The earlier cotton is planted, the more frost-free days are available.
   2) Cotton should not be planted until soil temperature has reached at least 65°F.

c) Most cotton is planted in Missouri between May 5 and May 15.

d) Planting after May 20 generally shows diminished production due to the shorter growing season.

F. *Other Activity*

Tour recently tilled cotton fields to see methods of cotton tillage. Speak with the local producer and ask about tillage management concerns, preferred methods, etc. Ask the producer what dates crops are planted and why.

G. *Conclusion*

Preparing the field for seeding is very important for cotton production. Careful consideration of the factors affecting germination and seedling growth will result in higher-quality cotton and higher income later in the growing season. Seeding rates and row spacing also impact the production of a cotton field. Using a cotton planting calendar can assist producer to base planting and harvesting date on climatic conditions.

H. *Answers to Activity Sheet*

1. Answers will vary
2. Answers will vary
3. Seeding rates may need to be adjusted higher if fewer seeds germinate.

I. *Answers to Evaluation*

1. b
2. b

3. a
4. a
5. d
6. c
7. Answers may include any two of the following: reduced fuel, labor, or time.
8. The percentage of seeds that will actually grow. Impacts seeding rate.
9. Cotton planting calendar

UNIT X - COTTON PRODUCTION Name_____

Lesson 3: Tilling and Planting the Crop Date_____

EVALUATION

Circle the letter that corresponds to the best answer.

1. In addition to cultivation, what is the other main method for cultivating the land before tillage?

   a. Deep
   b. Reduced
   c. Chemical
   d. Continuous

2. How many inches apart should cotton rows be planted?

   a. 20 to 30
   b. 30 to 38
   c. 25 to 30
   d. 40 to 48

3. Why is shredding the stalks beneficial?

   a. Adds fertilizer to the soil
   b. Helps to pack the soil
   c. Reduces insect pressure the following season
   d. Increases weed growth

4. Why is deep subsoiling sometimes done?

   a. Breaks the traffic pan layer
   b. Decreases water movement in the soil
   c. Allows for deep seeding
   d. Allows for deep fertilization

5. What is used to seed cotton into a mound of soil?

   a. Mounder
   b. Disk plow
   c. Subsoiler
   d. Hipper

6. The proper seeding depth for cotton is _____-inch deep.

   a. ¼
   b. ½
   c. ¾
   d. 1

Complete the following short answer questions.

7. List two advantages of using reduced tillage.

   a.

   b.

8. What is germination percentage and what does it mean when determining seeding rate?

9. What type of record is recommended to determine the best planting date for cotton?

Lesson 3: Tilling and Planting the Crop Name_____

Germination Percentages

Objective: Students will determine germination percentage from a sample of seeds.

Directions: Determine germination percentage for a seed sample. Cotton seeds would be ideal, but soybeans, corn, oats, or other seeds can be used.

Materials needed:

Seeds (at least 10 per student)
Paper towels
Water
Dark storage cabinet

Procedures:

1. Using the seeds provided in class, you will determine the germination percentage by actually germinating seeds.
2. Wet one paper towel down so the entire towel is wet.
3. Lay the moistened paper towel flat on the table.
4. Lay 10 seeds out on the paper towel, spacing the seeds evenly around the middle of the towel.
5. Wet another paper towel and lay over the seeds, forming a "seed sandwich."
6. Carefully place your towels and seeds in the dark place suggested by your instructor.
7. Check your seeds daily for the next 2 weeks and record how many seeds grow each day.

Questions to consider:

1. What day did your seeds start to sprout?

2. What was the final day you got seeds to sprout, and what was your final germination percentage? (Take the number of seeds that sprouted and divide by 10.)

3. How would the germination percentage affect your seeding rate?

UNIT X - COTTON PRODUCTION

Lesson 4: Selecting a Weed Control Program

Competency: Select a weed control program

Study Questions

1. **What factors influence a weed control program?**
2. **What weeds are specific to cotton?**
3. **What is the effect of weed pressure on cotton yields?**
4. **What weed control options are available?**

Reference

1. *Advanced Crop Sciences* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.

UNIT X - COTTON PRODUCTION

Lesson 4: Selecting a Weed Control Program

TEACHING PROCEDURES

A. ***Review***

Previous lessons have addressed planning the crop, selecting a seed variety, and tilling and planting the crop. This lesson will explore the factors to consider when selecting and implementing a weed control program, the effects of weeds on cotton yield, control options, and technological advances impacting weed control in cotton production.

B. ***Motivation***

Ask students why weeds are considered harmful to a family garden. (The average dandelion or other weed consumes as much or more water than a carrot or pea.) Then compare the family garden where total production is not measured in dollars or pounds to a cotton crop where the product is sold by total pounds. Discuss why weed control would be important to cotton production.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Unfortunately, whenever a crop of any kind is grown, weeds will also be present. There are a number of factors that influence what weed control program is selected and how successful the program will be. Ask students how weeds are commonly controlled (herbicides, pulling, mechanically cutting, etc.). Then ask the students which of those methods might work with cotton and why or why not.

   What factors influence a weed control program?

   a) Field history
      1) To evaluate what crops have been planted before
      2) Known weed problems
      3) Previous herbicide applications
      4) Use of transgenic varieties
   b) Soil type and structure to determine how well the herbicide moves through the soil
   c) Herbicides
      1) Limited number developed for cotton
      2) If designed to kill broadleaf weeds will also impact or kill the cotton plant
      3) Weeds - not taller than cotton plant
         (a) More difficult to spray weeds
         (b) Possibility of cotton plant damage
      4) Use of preplant and preemergence herbicides
      5) Selective over-the-top sprayed broadleaf herbicides not effective in controlling the weeds without harming the cotton plant
      6) Grass-type weeds effectively controlled and do not affect the cotton plant
   d) Method of application
      1) Some herbicides work well with only certain methods of application.
      2) Not all herbicides work well in a hooded type sprayer.
      3) Follow herbicide label directions.

2. By definition, a weed is any plant growing out of place. In a yard or garden, dandelions are considered weeds. Ask students what weeds are a specific problem in a garden and why that weed grows well in the garden.

What weeds are specific to cotton?

a) Common cotton weeds
   1) Signalgrass
   2) Barnyardgrass
   3) Bermudagrass
   4) Fall panicum
   5) Foxtails
   6) Goosegrass
   7) Jimsonweed
   8) Hemp sesbania
   9) Hophornbean copperleaf
   10) Lambsquarters
   11) Pigweed
   12) Crabgrass
   13) Nutsedge
   14) Johnsongrass
   15) Cockleburs
   16) Morning glory
   17) Velvetleaf
   18) Spurred anoda
   19) Prickly sida
b) Grass-type weeds
   1) Can be controlled with any herbicide that contains floumeturon
   2) Should be applied directly to the soil
c) Broadleaf weeds
   1) More difficult to control
   2) Include velvetleaf, prickly sida, and spurred anoda

3. Once weeds get established in a field, they will impact the crop. Ask students why weeds are removed from a crop, whether cotton or a garden.

What is the effect of weed pressure on cotton yields?

a) Weeds growing in a cotton field
   1) Compete with the cotton for the available nutrients
      (a) Fertilizer
      (b) Water
   2) Results in reduced yield by the cotton plant, less income for the producer
b) Amount of crop loss due to weeds
   1) Varies according to moisture levels
   2) Soil fertility
   3) Cotton's vegetative growth
      (a) Weeds with more leaves and other vegetative growth than the cotton absorb more sunlight.
      (b) Weeds will increase.
      (c) Cotton growth slows.
c) Keeping the weeds out of cotton - especially important just before harvesting
      (a) Keep weed seeds and other weed parts out of harvested cotton.
      (b) Avoid reducing crop value.

4. Controlling weeds in cotton is a complicated process involving a number of production decisions. Ask students how weeds are controlled in their garden. If they respond by saying they pull weeds or use a hoe, ask them why chemicals are not used.

What weed control options are available?

a) Different strategies and techniques
   1) Preplanting application of herbicide
      (a) Reduces weeds that would be a problem as the seedling begins to grow.
      (b) Application prior to planting will not impact the cotton.
   2) Burn-down
      (a) Using herbicides to kill growing plants before planting
      (b) Kills plants very quickly, leaving field barren
   3) Just after planting, before the seedling emerges
      (a) Weeds generally emerge from the soil first.
      (b) Applying herbicide after planting will reduce or kill the weed.

b) After the cotton plant grows
   1) Weed control becomes more difficult.
   2) Grass-type weed herbicide can be sprayed on the cotton plant without any effect.
   3) If broadleaf weed herbicide is used, care must be exercised to avoid spraying the cotton plant.
      (a) May cause injury or death to cotton plant
      (b) Hooded sprayer used to spray between rows

c) During growing season
   1) Scout the field for weeds.
      (a) Walk through the crop, looking for growing weeds.
      (b) Mark on a map where the weed infestations are found.
      (c) Monitor these areas.
      (d) Spray area when weed infestation becomes serious.
   2) Check between-row cultivation.
      (a) Killing weeds growing between the growing rows of cotton
      (b) Does not remove weeds growing close to the plant rows

d) Use of transgenic varieties - Use of herbicides developed for transgenic varieties more effectively controls weeds without concern of damage to cotton plant.

F. *Other Activity*

Invite a local crop chemical expert to speak to the class and outline a weed control program for a cotton crop.

G. *Conclusion*

Weeds can be a severe problem in cotton production. Developing a control program is crucial to maximize production and profit. A number of factors should be considered when selecting a weed control program. Applying chemicals to control the weeds is commonly done before planting, post-planting, and between rows. Transgenic varieties are capable of being sprayed with specific weed control chemicals without damaging the crop.

H. *Answers to Evaluation*

1. c
2. a
3. d
4. a
5. b
6. Preplanting, preemergence (post-planting), and hooded (between rows)

UNIT X - COTTON PRODUCTION Name_____

Lesson 4: Selecting a Weed Control Program Date_____

EVALUATION

Circle the letter that corresponds to the best answer.

1. Applying herbicides directly to cotton is harmful to the cotton because it is _____.

   a. A slow growing plant
   b. Shorter than most weeds
   c. A broadleaf plant
   d. Attracted to the herbicides

2. In relation to weed control, knowing what crops were planted in the field the season before is important because _____.

   a. Carryover effect of the herbicides used the previous year might affect the cotton
   b. Fewer weeds will be present if there was another crop
   c. Weeds will not return from previous years
   d. Previous fertilizer applications are needed by the cotton

3. There are fewer cotton herbicides available because _____.

   a. There are less problems with weeds
   b. There is less usage of chemicals by producers
   c. Chemicals used on other crops work very well
   d. Fewer total acres of cotton are planted compared to corn and soybeans

4. Herbicides designed to kill _____ will not affect cotton.

   a. Grasses
   b. Forbs
   c. Shrubs
   d. Broadleaf weeds

5. Weeds growing in a cotton field will result in lower cotton yields due to _____.

   a. Soil erosion
   b. Competition for nutrients
   c. Increased quality of lint
   d. Lower germination rates of the cotton

6. List the three common methods of applying herbicides.

   a.

   b.

   c.

UNIT X - COTTON PRODUCTION

Lesson 5: Scouting and Maintaining the Crop

Competency/Objective: Evaluate the growing crop and determine appropriate solutions.

Study Questions

1. **What plant condition factors are considered when evaluating the growing crop?**
2. **How does one determine if replanting is appropriate?**
3. **What amount of weed pressure justifies a herbicide treatment or mechanical removal?**
4. **What amount of insect pressure justifies a pesticide application?**
5. **Why is a growth regulator applied to cotton, and when is it applied?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.
2. *Cotton Plant Development and Plant Mapping* (G4268), University Extension, University of Missouri-Columbia.
3. Activity Sheet
    a) AS 5.1: Scouting a Crop

UNIT X - COTTON PRODUCTION

Lesson 5: Scouting and Maintaining the Crop

TEACHING PROCEDURES

A. ***Review***

Previous lessons have addressed planning the crop, selecting a crop seed variety, tilling and planting the crop, and selecting a weed control program. This lesson will address managing the growing crop and the decisions that must be made while the crop is growing. More so than many other crops, cotton must be carefully monitored and managed throughout the growing season.

B. ***Motivation***

1. Propose to students the following hypothetical situation: The cotton crop is planted, some weed control has been done, and the crop is now 3 weeks old. By looking at the crop, you notice that plant spacing is uneven, weeds are becoming more frequent, and you notice some insect damage. As a producer, you have two options: do nothing, or do something about your crop. What would you decide, and what would you need to consider before making your decision?

2. Show the video *Mid-Season Crop Management*, Part 4 of the Cotton Crop Monitoring for Optimum Management video series, available for loan from the Missouri Resource Center for Career & Technical Education (MRCCTE, formerly MVRC), Ag Video 227, University of Missouri-Columbia.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Once the crop is planted and growing, it is important to monitor the cotton field carefully. Ask students how often they check their family gardens and what they look for. Refer to *Cotton Plant Development and Plant Mapping*, G4268, for detailed information about plant mapping.

What plant condition factors are considered when evaluating the growing crop?

a) Factors that should be monitored
   1) Moisture level
      (a) Wilting plant - more water needed
      (b) Avoid overwatering
         (1) Can limit overall growth of the plant
         (2) Decreases amount of oxygen to the plant roots
   2) Plant spacing/density of the crop
      (a) Too closely spaced - competition for limited water and nutrients
      (b) Too widely spaced apart - replanting required
      (c) Emerging of cotton seedlings
         (1) Should emerge in approximately 5 days
         (2) Emerging in 5 days - better chance of survival than a crop that takes longer
         (3) Emerging in 10 days - will probably only produce about 1/3 of the 5-day crop
   3) Existing weeds and stage of growth and development
      (a) Light weed populations
         (1) Control and treatment are probably not necessary.

(2) Observe for changes throughout the growing season.
(b) Heavy weed populations - implement weed control program

4) Insect population
(a) Light insect populations - keep monitoring the crop
(b) Heavy insect populations - consider implementing an insect control program

5) Overall plant health condition - soil fertility issues
(a) Green and healthy plants - soil fertility probably not a concern
(b) Decreasing overall plant health - consider soil testing to determine what plants are lacking

6) Vegetative growth versus reproductive growth
(a) Too much vegetative growth - limit production of cotton lint
(b) Too little vegetative growth - indication of plant stress

b) Scouting program
1) Systematic and regular inspection of the cotton field for insects and their damage
2) Determining various levels of weeds, plant vigor, and water needs

c) Plant mapping
1) Effective technique to keep crop on schedule
2) Quantifies several growth parameters of the cotton plant
3) Measures five plants from four areas of a field
4) Sampling periods - prebloom, bloom, and postbloom

2. Once the plant begins to emerge from the ground, the main concern of producers is the quality of the stand. Ask students what a field should look like as plants begin to emerge. Tell students when answering the question to keep in mind cotton's expected germination percentage.

How does one determine if replanting is appropriate?

a) Quality of stand
1) Not all seeds will grow.
2) Field will still appear uneven due to irregular germination.

b) Determining replanting
1) Ideal seeding for cotton - 3 to 4 plants growing per foot
2) Field average slightly less - replanting probably not appropriate
3) Less than 3 to 4 plants per foot
(a) Consider replanting
(b) Added cost of reseeding
(1) May exceed added income from new plants
(2) Lack new plant growth
(3) Minor damage to existing plants
(4) Plant recovery

c) Replanting decisions - based on economic factors

d) Timing of replant - most important
1) Replant made too late - Crop will not have enough growing days.
2) Second seeding will be a waste of seed, time, and money.

e) Seeding time density
1) Field looks better later in the season when plants produce vegetative growth.
2) Thin spots in the field will not look as thin later.

3. Weeds compete with the cotton plant for nutrients and water. Ask students how they would determine when the weed pressure is out of control and removal by herbicide application or mechanical means is necessary. How would they justify their decision?

What amount of weed pressure justifies a herbicide application or mechanical removal?

a) Competition for nutrients and water
1) Competition is particularly harmful during the reproductive stage when the cotton bolls begin filling.

2) When the bolls begin to open - Amount of nutrients needed by the plant diminishes.

b) Factors to consider when eliminating weeds
   1) Weed height in relation to cotton plant height
      (a) Will the herbicide make more contact with the cotton than the weed?
      (b) Will the cotton plant be damaged?
   2) Weed density in relation to cotton density
   3) Impact on cotton plant if mechanically removed
   4) Stunted or diminished vegetative growth

4. As a crop, cotton can be damaged by a number of insects, reducing overall yield or production from 25 to 85%. Ask students what harmful insects they would expect to find around a cotton field and how they would determine when to take action in controlling the insects.

What amount of insect pressure justifies a pesticide application?

a) Determine amount of pest damage in a crop.
   1) Scout fields at least once a week.
   2) Scout more often during flowering stage of the plant.
      (a) Get an accurate estimate of the types and numbers of insects in the field by checking a limited number of the total plants.
      (b) Learn the type, number, and location of insects and damage within a field.

b) Follow field scouting guidelines
   1) At planting
      (a) Place boll weevil traps.
      (b) Set minimum number - 1 trap per 50 acres.
   2) Emergence until the plant makes the third true leaf
      (a) Check for thrips, cutworms, mites, and aphids.
      (b) Make initial stand counts.
      (c) Check boll weevil traps weekly.
   3) Third true leaf until the fifth node stage
      (a) Check terminals (end of plant stems) for eggs, larvae, and weevils.
      (b) Check for damage on plants by plant bugs and weevils.
      (c) Sweep borders of the field for plant bugs.
      (d) Record node height and position of pinhead squares.
   4) Fifth node to first bloom
      (a) Remove and store boll weevil traps.
      (b) Check terminals for eggs and larvae - minimum of 25 plants per field.
      (c) Calculate percent square set - minimum of 25 plants per field.
      (d) Begin sampling 100 green squares per field when 15% of squares reach one-third grown or larger. Check these squares for boll weevil, bollworm, or plant bug damage.
      (e) Assess weekly mean node height and mean number of squares per acre.
      (f) Count number of plant bugs and beneficials per 100 sweeps per field using sweep nets.
   5) Post first bloom
      (a) Pull one-third grown or larger squares for worm and weevil damage counts -100 per field minimum.
      (b) Check top 6 inches of plant for eggs and larvae.
      (c) Check whole plants (10 to 20 per field) for eggs, egg masses, and boll damage.
      (d) Check blooms for weevils, worms, and clouded plant bugs.
      (e) Assess weekly number of squares and bolls per acre.

c) Identify insects that can cause damage to the cotton plant.

d) Identify threshold level for each insect.
   1) Cutworms - cotton plant stand reduced to fewer than three plants per row foot
   2) Thrips
      (a) One or more thrips per plant found on seedling cotton

(b) Extremely hard to find due to size and mobility
(c) Large number of damaged plants

3) Fleahoppers - one plant bug found per 10 feet of row (not usually a problem in cotton in Missouri)
4) Boll weevils
   (a) With traps
      (1) One trap per 10 acres, clustered with other traps (four traps for 40 acres clustered together)
      (2) Threshold - two per trap per week prior to emergence
   (b) Without traps
      (1) 10% of squares damaged the first 2 weeks in July
      (2) 15% of squares damaged in the last 2 weeks of July
      (3) 20% of the squares damaged in August
5) Bollworms - 10% of bolls damaged by moth flight
6) Aphids - low populations start to increase
7) Spider mites - 50% of leaves are infested
8) Clouded plant bugs and Lygus Plant Bug
   (a) 1st week of squaring, 6 to 8 plant bugs per hundred squares
   (b) 2nd week of squaring, 8 to 10 plant bugs per hundred squares
   (c) 3rd week of squaring, 10 to 12 plant bugs per hundred squares
   (d) 4th week of squaring, 15 to 18 plant bugs per hundred squares
   (e) After 4th week squaring, not usually a problem
9) Armyworms - 5 egg masses and live larvae per 100 plants, or 4 or more worms in 100 blooms and bolls
10) Whiteflies - 50% or more of the plants are infested (usually not a problem in Missouri)
11) Root worm nematodes - found in the soil, retesting the soil is necessary

e) Integrated pest management (IPM) - use of natural predators of harmful insects to control pests
   1) IMP can reduce the cost of pesticides to the producer.
   2) Beneficial insects tend to be specific to a particular pest insect.
   3) Multiple beneficial insects may be needed and can be purchased (not practical in most cases).
   4) Insects are specifically targeted.
   5) If chemical control is also used, many of the beneficial insects are killed.

5. Cotton's growth is managed using growth regulators. Ask students why cotton's growth is not allowed to progress naturally.

Why is a growth regulator applied to cotton, and when is it applied?

a) Growth regulators
   1) Needed if plant is under stress
   2) Generally necessary because cotton is a semi-tropical plant, not preferring the climates found in cotton producing areas
   3) Speed up the flowering process
   4) Produce a more uniform flowering process
   5) Allow for a more uniform harvesting of the crop
   6) Generally used during early bloom

b) Common growth regulators used in cotton production
   1) PIX (Mepiquat Chloride) - used to shorten plants
   2) Used to help roots develop and bolls set
      (a) PGR IV
      (b) Maxxon
      (c) Cytokin

F. ***Other Activities***

1. Have students participate in scouting a cotton field with a crop consultant or the field's producer.

2. Show the video *Nitrogen and PIX Management*, Part 3 of the Cotton Crop Monitoring for Optimum Management video series, available for loan from the Missouri Resource Center for Career & Technical Education (MRCCTE), Ag Video 226, University of Missouri-Columbia.

G. ***Conclusion***

Cotton is a crop that requires intense management during the growing season. The crop must be regularly evaluated for many different factors, including moisture, plant spacing and stand, insects, and weeds. This can be done through scouting. Careful management of these factors will result in a quality crop, while mismanagement will result in disastrously low yields and crop quality. Finally, cotton growth regulators are used to force the plant to emphasize reproductive development over vegetative development, speeding up the flowering process and making the cotton blooms more uniform.

H. ***Answers to Activity Sheet***

Answers on both sets of questions will vary.

I. ***Answers to Evaluation***

1. b
2. a
3. b
4. c
5. d
6. Four of the following - cutworms, thrips, fleahoppers, boll weevils, bollworms, aphids, spider mites, clouded plant bugs, armyworms, whiteflies, nematodes

7. The use of natural predators of harmful insects to control pests
8. To speed up the flowering process, generally used during early bloom

UNIT X - COTTON PRODUCTION Name_____

Lesson 5: Scouting and Maintaining the Crop Date_____

EVALUATION

Circle the letter that corresponds to the best answer.

1. Cotton seedlings should emerge from the ground in about _____ days.

   a. 3
   b. 5
   c. 7
   d. 14

2. What should the producer consider first when deciding to replant the crop?

   a. The economic and financial factors
   b. The crop looks thin
   c. There are only three to four plants per foot
   d. Too many weeds are present

3. Weed pressure on a cotton plant is least desirable when _____.

   a. Bolls are opening
   b. Bolls are filling
   c. Seedlings are beginning to emerge
   d. Bolls are filled

4. The most effective method of determining insect levels in a field is _____.

   a. Spraying
   b. Observing plants at the perimeter of the field
   c. Scouting
   d. Plant sampling

5. If using boll weevil traps, there should be at least one trap per _____ acres.

   a. 20
   b. 30
   c. 40
   d. 50

Complete the following short answer questions.

6. List four common insect problems in cotton.

   a.

   b.

   c.

   d.

7. What is integrated pest management (IPM)?

8. When and why are growth regulators used on cotton?

Lesson 5: Scouting and Maintaining the Crop Name_____

Scouting a Crop

Objective: Students will be able to identify insect problems in a cotton crop.

Materials needed:

Sweep nets
Clipboards
Insect identification resources

Procedure:

In this activity, you will be scouting a growing cotton crop with a local producer. Before actually scouting the crop, ask the producer the following questions and record your answers.

1. What insects have you had problems with in the past?

2. What do you expect to find in today's scouting?

3. How often do you scout your fields?

4. What control program do you use on insects?

After obtaining these answers, go into the field with the producer and scout the field. Using your sweep nets, collect insects from the field. With the producer and your instructor's assistance, identify and count the number of insects you collected. Once identified and collected, answer the following questions.

1. What insects were found and how many?

2. Are these levels high enough to warrant insect control (producer input!!)?

3. Are these conditions normal for this part of the growing season?

UNIT X - COTTON PRODUCTION

Lesson 6: Harvesting the Crop

Competency/Objective: Identify factors to determine harvesting and postharvesting management.

Study Questions

1. **What factors determine harvest timing?**
2. **What is the most common method of harvesting cotton?**
3. **What are the major reasons for crop loss during harvest?**
4. **What is a short-term storage method before ginning?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.
2. Activity Sheet
   a) AS 6.1 Evaluating Harvested Cotton

UNIT X - COTTON PRODUCTION

Lesson 6: Harvesting the Crop

TEACHING PROCEDURES

A. ***Review***

Previous lessons have addressed scouting and maintaining the crop, weed control programs, tilling and planting the crop, selecting a variety, and planning the crop. This lesson will focus on those issues relevant to harvesting the cotton crop and management decisions made at harvest time during the growing season.

B. ***Motivation***

1. Once again, compare the cotton crop to a garden crop. Ask students how they determine when to pick or harvest crops from a garden. Then ask students if they harvest the garden on the same date each year, and if not, what causes the variations from year to year.

2. Show the video *Late Season Crop Management*, Part 5 of the Cotton Crop Monitoring for Optimum Management video series, available for loan from the Missouri Resource Center for Career & Technical Education (MRCCTE, formerly MVRC), Ag Video 228, University of Missouri-Columbia.

3. Show the video *Crop Management for Defoliation*, Part 6 of the Cotton Crop Monitoring for Optimum Management video series, available for loan from MRCCTE, Ag Video 229, University of Missouri-Columbia.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Knowing when to harvest the cotton crop is an important management decision. Ask students what factors they think will determine when cotton is harvested. Then ask students if all plants are at the same level of maturity when harvested.

What factors determine harvest timing?

a) Cool weather and frost
   1) Speeds up cotton harvesting
   2) Causes leaves to fall off the plant - defoliation
   3) Reduces the amount of trash and green leaf stain in the harvested lint
      (a) Chopped-up leaves
      (b) Vegetative parts of the plant

b) Chemicals
   1) Defoliate plants
   2) Called crop harvest aids
   3) Suppress further growth
   4) Help open the cotton bolls

c) Defoliation timing
   1) Crucial to ensure ideal lint quality and optimum yield
   2) Applications timed so harvesting keeps up with defoliation
   3) Defoliating too early

(a) Reduces the oil content of the seed
(b) Reduces seed viability
(c) Reduces total yield

4) Defoliating too late
   (a) May result in diminished results
   (b) Defoliating compounds - more effective in warmer temperatures
5) Typically done when at least 60% of the bolls are open
   (a) Sprayed directly onto the plants
   (b) Correct timing of defoliation
      (1) Plant mapping techniques
         a. Analyze and record the growth of the plant.
         b. Apply defoliant when plant has at least four nodes above the lowest cracked boll or boll starting to show visible lint.
         c. Number of nodes decreases to three in fields where there are less than two plants per foot per row.
      (2) Number of nodes above the white flower (NAWF)
         a. NAWF occurs at or near the eighth or ninth node.
         b. NAWF of five occurs around August 10 to 12 and indicates correct timing for defoliation.
6) Generally takes the boll approximately 4 to 6 weeks or 750 to 850 heat units to mature
7) Other factors determining defoliation timing
   (a) Firmness of the boll
   (b) Percent of open bolls
   (c) Seed coat coloration
   (d) Heat unit accumulation
   (e) Visual assessment

d) Harvesting of the cotton crop
1) Once-over method
   (a) All cotton bolls are harvested at the same time.
   (b) This method results in reduced cost in time, fuel, labor.
2) Two-harvest method
   (a) Early harvest of ready bolls
   (b) Later harvest of the rest of the bolls
   (c) More expensive but potential return may justify cost

2. There are several methods of harvesting cotton. Ask students to list historical methods of harvesting cotton in our country and how that has changed in today's cotton production.

What is the most common method of harvesting cotton?

a) Machines to harvest cotton
1) Mechanical cotton picker
   (a) It is used in most areas of the United States.
      (1) Pulls the fiber from the boll
      (2) Removes the trash and lint
      (3) Cuts the fibers away from the seeds
      (4) Ginning process - removes and processes seeds
   (b) Row-crop harvester harvests each row separately.
   (c) Picker is limited in width.
   (d) Two row pickers are usually used together.
2) Cotton stripper
   (a) Used in areas of Oklahoma and Texas where stalks do not grow very tall
   (b) Plucks the entire boll
   (c) All bolls - open
   (d) Stem destroyed - unopened bolls lost

b) Issues of harvesting cotton

1) Moisture
   (a) Harvest when dew leaves field.
   (b) Stop when dew returns in evening.
   (c) Moisture content lower than 12% can be harvested and stored without mold damage.
2) Measuring moisture
   (a) Moisture monitor on machine
   (b) Biting cotton seed - if seed cracks, moisture low enough to harvest

3. As with harvesting any crop, reducing crop loss is an important consideration. Ask students where crop loss could occur in the harvesting process.

   What are the major reasons for crop loss during harvest?

   a) Improper cotton picker condition
      1) Worn or damaged spindles
      2) Misalignment and misadjustment of the spindles to moisture pads and doffers
         (a) Reduces the efficiency of the picker
         (b) Results in crop loss
      3) Improperly adjusted spindles
         (a) Leaves some of the cotton on the spindle
         (b) Twists and damages the fibers
   b) Excessive trash
      1) Incomplete defoliation resulting in leaves taken into the picker with the lint
      2) Picking units and basket grates should be cleaned regularly of trash

4. Once the cotton is harvested, the lint is usually stored for a short time before ginning. Discuss with the students how the lint is commonly stored.

   What is a short-term storage method before ginning?

   a) Modules
      1) Storage for short periods of time before ginning
      2) Bundled lint, covered with water-resistant tarps
      3) Stored in the field
   b) Monitoring moisture content
      1) If too high, internal temperature will begin to rise.
      2) Rapid and continuous rise indicates too much moisture.
         (a) Rise of 15 to 20 degrees - gin as soon as possible
         (b) Internal temperature of module exceeds 110°F - gin immediately
   c) Storage location
      1) In a field relatively free of gravel, stalks, and other debris
      2) On well-drained sites accessible during wet weather

F. ***Other Activity***

Arrange for students to observe a local producer harvesting cotton. In addition to the harvesting process, observe modules and their placement.

G. ***Conclusion***

After spending a growing season managing the cotton, the final step in the production of cotton is harvesting. Carefully plan defoliation and harvesting. Observe the bolls to determine the proper time to harvest. If careful management is practiced, an optimal quality crop is harvested, resulting in optimal income for the producer.

H. ***Answers to Activity Sheet***

Answers will vary.

I. ***Answers to Evaluation***

1. a
2. c
3. d
4. Cotton picker and cotton stripper
5. Biting the cotton seed - if the seed cracks, the moisture is probably low enough for the crop to be harvested

6. a. Worn or damaged spindles
   b. Misalignment and misadjustment of the spindles to moisture pads and doffers
   c. Excessive trash in the lint

7. Modules are bundled lint, covered with water-resistant tarps, stored in the field.

8. Monitor moisture levels in modules during the first 5 to 7 days.

UNIT X - COTTON PRODUCTION Name_____

Lesson 6: Harvesting the Crop Date_____

EVALUATION

Circle the letter that corresponds to the best answer.

1. The removal of leaves from the plant is called _____.

   a. Defoliation
   b. Deleafing
   c. Delimbing
   d. Harvesting

2. Defoliation is typically done when _____% of the bolls are open.

   a. 40
   b. 50
   c. 60
   d. 70

3. Once defoliation occurs, the bolls need another _____ weeks to mature and fully open.

   a. 2 to 4
   b. 4 to 6
   c. 5 to 7
   d. 6 to 8

Complete the following short answer questions.

4. Name two common types of mechanical cotton harvesters used today.

   a.

   b.

5. Describe how to determine correct moisture content of the crop without a moisture monitor.

6. List three major causes of crop losses during harvest.

   a.

   b.

   c.

7. Explain what modules are.

8. In what time period should moisture content levels be monitored in harvested cotton?

Lesson 6: Harvesting the Crop Name_____

Evaluating Harvested Cotton

Objective: Students will evaluate harvested cotton and identify possible corrective measures to improve the quality of the cotton.

Directions: Examine cotton from a module that has been recently harvested.

Procedure:

1. From the module, select a small sample of cotton to evaluate.
2. Examine your sample of cotton. Look for uniformity, trash, gravel, and any other foreign material.
3. Compare your sample with several of your classmates' samples.
4. After evaluating the samples, answer the following questions.

Questions to consider:

1. What faults or defects (if any) did you find in the cotton samples?

2. What are possible causes of these faults?

3. What management recommendations would you make to the producer?

UNIT X - COTTON PRODUCTION

Lesson 7: Marketing the Crop

Competency/Objective: Describe marketing opportunities.

Study Questions

1. **What procedures are used in marketing cotton?**

2. **How does cotton quality affect price?**

3. **What are cotton checkoff dollars and how are these funds collected and used?**

References

1. *Advanced* Crop Science (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit X.

2. Activity Sheet

   a) AS 7.1: Cotton Quality and Effect on Price

UNIT X - COTTON PRODUCTION

Lesson 7: Marketing the Crop

TEACHING PROCEDURES

A. ***Review***

This lesson will address the common methods used to market cotton. Previous lessons have discussed cotton harvesting, scouting and maintenance, weed control, tilling and planting, selecting a variety, and planning the crop.

B. ***Motivation***

Compare raw cotton with cotton that has been processed. Ask students to compare the quality of each sample. Ask the students to list possible factors affecting the quality of the cotton and the price received.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Agricultural crops are sold in many different ways. Ask students to list the major methods other crops are sold and compare with how cotton is sold.

   What procedures are used in marketing cotton?

   a) Schedule a gin
      1) Call the local processor
      2) Negotiate
         (a) Transportation of the modules
         (b) Schedule time
         (c) Price
      3) Deliver and process cotton
   b) Pricing
      1) Cash market pricing
         (a) Relies strictly on the current market price
         (b) Cotton prices generally lowest during harvest due to the excess supply
      2) Forward pricing
         (a) Contracting crop
            (1) Contracted before the actual processing and delivery
            (2) Sale price firmly established, does not reflect fluctuations in the cash market at harvest time
            (3) Disadvantages
               a. Market moves upward to higher prices - only negotiated price received
               b. Crop disasters or failures - purchase cotton to meet the contract
         (b) Hedging (futures market)
            (1) Sells contracts, or a set quality and quantity of cotton
            (2) Buys the same number of contracts back later, hopefully at a lower price, to get out of the futures market
            (3) Allows the producer to use basis (difference between futures and cash price)
            (4) Involves great risks

2. The price established at the point of sale on any agricultural product is dependent upon the quality of the crop. Cotton price is particularly dependent upon quality. Ask students to identify factors that would determine cotton quality. Complete AS 7.1 to expand the students' knowledge of the importance of cotton quality. If a field trip is not possible, obtain samples of cotton that has been graded and have the students compare the differences.

How does cotton quality affect price?

a) Standards are established by the USDA.
   1) Ensure uniformity in grade
   2) Resulting in standard quality and pricing

b) Cotton quality is measured in a variety of ways.
   1) Color grade - the degree of whiteness and yellow in the lint
      (a) White
      (b) Light-spotted
      (c) Spotted
      (d) Tinged
      (e) Yellow-stained
   2) Fiber length - measured by computerized machines
      (a) Given in thirty-seconds and hundredths of an inch
      (b) Longer fibers - more desirable
         (1) More efficient in spinning
         (2) Stronger
         (3) More uniform yarn
   3) Cotton fiber diameter or fineness - determined by using micronaire measurements
      (a) Yarn appearance
      (b) Yarn uniformity
      (c) Yarn strength
      (d) Finer diameters - preferable
   4) Fiber strength
      (a) Relative to the variety of cotton raised
      (b) Reported in grams per tex - equal to the weight in grams of 1,000 meters of fiber
      (c) Relates to yarn and fabric strength
      (d) Affects spinning efficiency
   5) Length uniformity - uniformity of the length of the fibers in a sample
      (a) Related to uniformity of the yarn
      (b) Affects spinning efficiency
      (c) Involved overall yarn strength
   6) Trash - amount of debris on the surface of the cotton
      (a) Measurement taken with a video trashmeter
      (b) Highly undesirable

3. Like other crops, cotton is supported by money from the federal farm bill. Ask students if they know what checkoff dollars are and how they are used.

What are cotton checkoff dollars and how are these funds collected and used?

a) Origins
   1) U.S. Farm Bill
   2) First inclusion in the Farm Bill of 1967

b) What they are
   1) Funds raised from sale of cotton in the United States
   2) Set amount of money charged against the sale each time cotton is sold
   3) Funds collected by a controlling agency
   4) Funds administered by U.S. Cotton Board

c) Funds used
    1) Advertise and market cotton
        (a) Help cotton compete with artificial fibers
        (b) Maintain and expand domestic and foreign markets
    2) Research
        (a) Develop seed varieties
        (b) Develop herbicides and pesticides
        (c) Develop methods of processing

F. ***Other Activity***

While conducting the student activity sheet, also tour the gin to provide students with additional information about cotton processing.

G. ***Conclusion***

Once the cotton crop has been harvested, the final step in completing the year's crop cycle is marketing. Marketing determines the income for the producer and directly impacts his or her profit. Raw cotton is scheduled for a gin and processed according to schedule. The price received for the cotton depends upon the cotton quality that is measured by color, length, diameter or micronaire, strength, amount of trash in the lint, and uniformity of the cotton fiber. The cotton checkoff program strives to develop and maintain cotton markets domestically and internationally with a small amount of money taken out from each individual sale.

H. ***Answers to Activity Sheet***

Answers will vary.

I. ***Answers to Evaluation***

1. a
2. b
3. c
4. c
5. b
6. Affects yarn appearance, uniformity, strength
7. At the time of sale, as a percentage of the value of the crop sold
8. Promotion of the cotton industry, enhance and maintain cotton markets, research

UNIT X - COTTON PRODUCTION Name_____

Lesson 7: Marketing the Crop Date_____

EVALUATION

Circle the letter that corresponds to the best answer.

1. What type of market relies strictly on the current market price?

   a. Cash market
   b. Futures market
   c. Forward pricing
   d. Hedging

2. What type of market allows the producer to agree to a price before the actual sale?

   a. Cash market
   b. Forward pricing
   c. Futures market
   d. Hedging

3. What market relies on the buying and selling of contracts?

   a. Cash market
   b. Forward pricing
   c. Futures market
   d. Contract market

4. What do micronaire measurements on cotton determine?

   a. Color
   b. Trash content
   c. Fiber diameter
   d. Fiber length

5. When evaluating cotton quality, one tex is equal to the weight in grams of _____ meters of fiber.

   a. 500
   b. 1000
   c. 1500
   d. 2000

Complete the following short answer questions.

6. Give three reasons cotton fiber diameter is important.

   a.

   b.

   c.

7. How are cotton checkoff dollars assessed?

8. What is the purpose of the cotton checkoff program?

Lesson 7: Marketing the Crop Name_____

Cotton Quality and Effect on Price

Objective: Students will determine the quality of cotton from procedures performed by the cotton grader.

Directions: As a field trip, go to a cotton gin and observe the cotton being graded. Fill in the following blanks with information gained from observing and asking the cotton grader questions about cotton samples.

Procedure:

In the spaces provided, determine the following cotton quality factors by asking the cotton grader to describe grading results associated with the following factors. How do those factors impact the cash price for the particular cotton module or lot?

Factor	**Grader's comments**
Color	
Fiber length	
Micronaire/diameter of fiber	
Strength of fiber	
Length uniformity	
Trash	

Questions to consider:

1. Of the factors listed, which most negatively affected the price of that sample?

2. Which factors were very good on the sample?

3. What impact did these factors have on the overall price of the cotton?

UNIT X - COTTON PRODUCTION

Lesson 8: Figuring Crop Costs

Competency/Objective: Calculate cost per acre.

Study Questions

1. **What variable costs are associated with cotton production?**
2. **What fixed costs are associated with cotton production?**
3. **How is cost per acre calculated?**
4. **What factors determine an acceptable return on an investment?**
5. **How do government programs affect return?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia. Instructional Materials Laboratory, 2000, Unit X.
2. Activity Sheet
   a) AS 8.1: Figuring Cost per Acre for Cotton

UNIT X - COTTON PRODUCTION

Lesson 8: Figuring Crop Costs

TEACHING PROCEDURES

A. ***Review***

Previous lessons have addressed planning the crop, selecting a variety, tilling and planting the crop, selecting a weed control program, scouting and maintaining the crop, harvesting the crop, and marketing the crop. This lesson will address the financial aspects of producing a cotton crop.

B. ***Motivation***

Review with students the grading and processing steps discussed in the previous lesson. From these factors, students should recognize the impact on price due to the various quality factors. Then ask students how they can determine if a profit was made from that price.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. A good manager of any crop should have accurate and detailed records of all income and expenses concerning the whole farm and each individual crop. Ask students to list costs they would pay only if the crop was actually produced.

   What variable costs are associated with cotton production?

   a) Variable costs
      1) Inputs necessary to produce a specific crop yield
      2) Calculated on a cost-per-acre basis
         (a) Allows producers to realize a profit or loss from a particular field
         (b) Helps producers to decide if another crop should be considered for a particular field

   b) Cotton variable costs
      1) Seed costs
         (a) Seeding rate
         (b) Number of times the field was seeded
         (c) Seed variety purchased
            (1) "Older" varieties are less expensive.
            (2) Newer, transgenic varieties are more expensive.
         (d) Quality of cotton produced by the particular variety
      2) Fertilizer costs
         (a) Costs vary depending on field conditions.
         (b) Soil tests should be taken to determine need.
         (c) Use test recommendations to estimate costs.
      3) Crop chemicals costs recorded separately to realize exact expenses for each
         (a) Insecticides
            (1) Significant insect problems dramatically add to the total variable costs.
            (2) Thorough scouting program and timely applications reduce costs.
         (b) Herbicides
            (1) Costs vary from field to field.
            (2) Weed problems are determined at the same time as insect scouting.
            (3) Applications are timed to gain production value and control costs.

(c) Fungicides
  (1) Generally only applied before or at seeding time
  (2) Occasionally warrant another application to growing crop
(d) Growth regulators
  (1) Used to control the vegetative growth
  (2) Speed up plant blooming
  (3) Helps retain bolls
  (4) Number of applications
    a. Depends on crop management plans and the weather
    b. Costs figured into variable costs of crop
(e) Harvest aids
  (1) Defoliants - used to chemically remove the leaves from the plant
  (2) Boll openers - force uniform opening of the bolls
  (3) Usually applied once
  (4) Critical to short-season production
  (5) Combination use can save $30/acre using once-over harvest

4) Fuel and oil costs
  (a) Keep records of all fuel and oil used in crop operations.
  (b) Divide costs by the number of acres determines the cost per acre.
  (c) Other regular maintenance of machinery should also be figured.
5) Cost of labor
  (a) Include costs of hired labor.
    (1) Crop consultants or scouting services
    (2) Other hired services
  (b) Include producer's own time into the costs.
  (c) Recognize producer's time is worth as much, or more, than hired services.
6) Harvesting cost
  (a) Cost should be included whether using the producer's machinery or hiring someone else's.
  (b) Include wear and tear and any needed repairs on producer's machinery.
7) Ginning the cotton
  (a) Ginning costs are generally charged to the producer by weight, not acreage.
  (b) An average yield should be determined.
  (c) Divide the total cost of ginning by the number of acres. Method does not allow them to know the costs per field.
  (d) Transporting the cotton from the field to the gin is included in the ginning fee.
8) Storing cotton
  (a) Raw or ginned cotton is stored until later dates to maximize profits.
  (b) Crop may diminish in value due to storage.
9) Operating loan expenses
  (a) Crop income - only once or a few times a year
  (b) Interest on borrowed money - considered a variable cost
10) Other costs incurred due to producing the crop - also variable costs

2. Variable costs are what first come to mind when people consider the costs of an agricultural operation, but there are also fixed costs. Ask students what costs a producer would have to pay even if a crop was not produced.

What fixed costs are associated with cotton production?

a) Fixed costs
  1) Does not vary with the level of production
  2) Generally regarded as whole farm, or whole enterprise costs
  3) Not normally charged on a per-acre basis
  4) Divided by the number of acres
  5) Can amount to more cost per acre than variable costs
b) Examples of fixed costs

1) Taxes
   (a) Must be paid regardless of production
   (b) Most obvious type - property taxes
2) Insurance
   (a) Carried on the entire operation
   (b) Liability insurance
   (c) Fire insurance
   (d) Hail/disaster insurance
   (e) Earthquake or hurricane insurance
3) Loan payments
   (a) Money borrowed to purchase land or machinery
   (b) Must be made regardless of production
4) Rental fees
   (a) Equipment or land
   (b) Rental charges - still paid even if crop not produced
5) Farmstead utilities
   (a) Electricity
   (b) Sewer
   (c) Water
   (d) Other services used on the farmstead
   (e) At times utilities are a variable expense
6) Depreciation expense
   (a) Depreciation is the decline in value of a piece of machinery or other equipment due to wear, tear, usage, or aging.
   (b) Money should be set aside in a bank account yearly so the machine can eventually be replaced with a new model.
   (c) Provide for later equipment replacement.

3. After figuring fixed and variable costs, calculating total costs is relatively simple. Ask students how the information regarding total costs is used.

How is cost per acre calculated?

a) Total cost value
   1) Total fixed plus variable costs
   2) Gives total amount of money spent on the crop
   3) Not useful to determine break-even price for crop
b) Cost per acre
   1) Divide the total cost by the number of acres planted.
   2) Determine the break-even price.
      (a) Divide cost per acre by total pounds produced per acre.
      (b) Determine an acceptable return on investment.

4. Once the income and expenses are known, the producer can calculate a profit or loss from the crop or the whole farm. With agricultural prices lower than most producers would like, a determination must be made as to an acceptable level of profit. Ask students how they would determine an acceptable level of return.

What factors determine an acceptable return on an investment?

a) Return on investment
   1) Money received above costs and used for farmstead improvements or investments
   2) Commonly used as profit - supports the farm family through the coming year
   3) Overall return on investment - support the family and its lifestyle
b) Several factors to consider
   1) Money borrowed to produce the crop - return on investment needs to cover the cost
   2) Consider alternative uses for the money compared to investing in a growing crop

3) Alternative crop - raise return on investment
   (a) If another crop has lower costs and a higher income, producer may need to switch.
   (b) If a switch is being considered, the producer must reconfigure expenses.
4) Exceptions
   (a) First cotton crop
      (1) One season may not be enough to evaluate the return on investment accurately.
      (2) Succeeding years may result in higher returns on investment.
   (b) Abnormal weather conditions
      (1) Drought year
      (2) Following years - closer to normal
      (3) Return on investment higher

5. Cotton is impacted by governmental regulations and subsidies. Discuss with the students how governmental policy and programs affects a crop.

How do government programs affect return?

a) Cotton production in the Farm Bill
   1) Designed to increase production and competition with foreign markets
   2) Addresses increased production and paying producers to raise more cotton to compete with foreign markets
b) Producers enrolled in the cotton program
   1) Receive an incentive payment from the government
   2) Increases overall crop income

F. ***Other Activity***

Obtain sample financial information from a cotton producer (keep his or her identity anonymous). Review the information with the students, calculate fixed and variable costs, income, and return on investment. Determine the financial status of that operation's cotton enterprise.

G. ***Conclusion***

Once the crop has been harvested, some financial analysis is important to determine the success or failure of that year's crop. Determining the acceptable return on the investment will compare the return to interest rates, return from other possible crops, and other factors. Government programs increase the income of the cotton enterprise, with payments made to encourage producers to grow cotton.

H. ***Answer to Activity Sheet***

Answers will vary according to local data.

I. ***Answers to Evaluation***

1. a
2. a
3. d
4. b
5. d
6. Dividing total cost by the number of acres
7. Money received by the producer above costs, which can be used for farmstead improvements or investments

8. Three of the following: sufficient to cover cost of borrowing money, alternative investments giving higher return, alternative crop, first crop, abnormal weather conditions

UNIT X - COTTON PRODUCTION Name_____

Lesson 8: Figuring Crop Costs Date_____

Evaluation

Circle the letter that corresponds to the best answer.

1. What are costs that are associated with inputs used to produce a specific yield of crop?

   a. Variable
   b. Fixed
   c. Long term
   d. Growing

2. What are seed costs considered?

   a. Variable cost
   b. Fixed cost
   c. Long term cost
   d. Growing

3. What is the most commonly overlooked cost when calculating costs of a crop?

   a. Fertilizer
   b. Growth regulators
   c. Crop chemicals
   d. Labor

4. What type of cost are taxes, insurance, rent payments, and depreciation?

   a. Variable
   b. Fixed
   c. Long term
   d. Growing

5. What is the term for a decline in value of an asset due to wear, tear, usage, and becoming out-of-date?

   a. Amortization
   b. Aging
   c. Declination
   d. Depreciation

Complete the following short answer questions.

6. How would cost per acre be calculated?

7. What is return on investment?

8. List three factors to consider when determining acceptable return on investment.

   a.

   b.

   c.

Lesson 8: Figuring Crop Costs Name_____

Figuring Cost per Acre for Cotton

Objective: Students will calculate the cost per acre from a sample set of data collected on a cotton crop.

Directions: Determine variable, fixed, and total costs for a cotton crop, using data provided by your instructor. This data represents a typical crop in your community, using local prices. This problem will be calculated using a field that has _____ acres.

Variable Costs	**Price per Unit**	**Total Cost**
Seed		
Fertilizer		
Insecticides		
Herbicides		
Fungicides		
Growth regulator		
Defoliant		
Fuel and oil		
Labor - total hours		
Harvesting cost		
Ginning		
Grading		
Storage		
Interest on borrowed money		
Amount Borrowed _____		
Length of Loan _____		
Interest Rate _____		
Total Variable Cost		_____
		Total Cost

Fixed Costs

Taxes

Insurance

Loan payments

Land rental

Equipment rental

Utilities

Depreciation expense

Total Fixed Costs _____

Total Costs (total variable costs + total fixed costs) _____

Cost per Acre (total costs / number of acres) _____