UNIT VII - SOYBEAN PRODUCTION

Lesson 1: Planning the Crop

Competency/Objective: Evaluate local growing conditions and determine fertilizer needs for soybean production.

Study Questions

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

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

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

References:

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

2. *Missouri Soybean Handbook* (Manual 123). University of Missouri Extension publication, 1982.

UNIT VII - SOYBEAN PRODUCTION

Lesson 1: Planning the Crop

TEACHING PROCEDURES

A. ***Introduction***

Introduce the unit by giving a brief history on soybeans. Review the major uses of soybeans and alternative uses discussed in Unit I. Discuss the importance of soybeans in the state, country, and global markets. Explain that the first lesson covers factors to consider when planning a soybean crop: the necessary environmental conditions, the history of the field, and fertilizer requirements.

B. ***Motivation***

Obtain soil samples from several fields that are being prepared for soybean planting and from fields that have recently had soybeans harvested from them. Show the students the results of the soil samples. Point out what nutrients are going to be needed for the potential soybean crop and look at the variances for the field that recently had a soybean harvest.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Growing season, rainfall, field topography, and soil type are the most important environmental conditions affecting soybean production. Discuss each of these factors in respect to planning a soybean crop. Soybean maturity groups are discussed in detail in Lesson 2.

   What environmental conditions are necessary for soybean production?

   a) Growing season
      1) Average season for soybeans is 175 days from mid-April to end of October.
      2) Optimum temperature for soybean germination is 68°F.
      3) Late planting can result in reduction in yields.
      4) Soybeans flower in maturity stage in response to temperature and photoperiod (day length).
         (a) Photoperiod sensitive means to move from vegetative to flowering stage in response to day length.
         (b) Soybeans begin flowering after day lengths become shorter.
         (c) Warm and/or short days hasten flowering and maturity.

   b) Rainfall
      1) Optimum is 18 to 22 inches over the growing season.
         (a) Normal rainfall amounts are adequate during planting.
         (b) Normal rainfall amounts are inadequate during June, July, and August.
         (c) Reproductive growth stage needs 2.5 inches per week.
      2) Soybeans are most sensitive to moisture deficiency during flowering and pod development.
         (a) Lack of water will result in yield reduction and cause pods to abort.
         (b) Irrigation provides relief during dry weather but is costly to maintain.
      3) United Soybean Board (USB) continues research on genetically altered drought- and flood-resistant soybeans.

   c) Topography (drainage)
      1) Waterlogged soils
         (a) Delays planting date
         (b) Creates environment for fungus and bacteria to thrive

(c) Nitrogen fixation and nutrient uptake reduced
(d) Occurs in fine-textured, flatland soils with hardpans and claypans

2) Preventing or removing excess water
(a) Tillage methods
(b) Terracing systems

d) Soil

1) Ideal soil - well-drained, silty clay loam
(a) Adequate water-holding capacity
(b) Releases water to plants as needed

2) Sandy clay or heavy clay soils
(a) Neither too wet nor too dry
(b) Better adapted to clay soils than corn or cotton

3) Counties with high yields
(a) Have silty clay loam soil
(b) Utilize current technology and make sound decisions

2. Ask the students what factors should be considered about a field before planting a crop of soybeans. Discuss the importance of knowing the previous crop or activity of a field and how that can impact management decisions on fertilizer, pest control, and tillage and/or planting options.

What factors are considered when evaluating field history?

a) Previous crop

1) Soybeans develop better after grass-type crops, such as corn or grains.
(a) Leave nutrients for soybeans
(b) Reduces fertilizer costs

2) Knowing previous crop helps determine fertilizer needs.

b) Previous tillage and/or planting method

1) Helps project pest problems
(a) Test soil if SCN problem is suspected.
(b) SCN can cause severe yield loss.

2) Helps determine what tillage and/or planting method to use
(a) Conventional to no-till to reduce soil compaction
(b) CRP ground to no-till to maintain soil, water, and wildlife improvements gained

3. Ask the students to describe what nutrients and pH level are needed to produce soybeans. Describe to them the different deficiency symptoms that soybeans have when they lack certain nutrients. Then have the students indicate those nutrients that are needed to correct the deficiencies. Use Table 1.1 to show the amount of nutrients removed from a field in a 50-bushel crop yield.

What are the fertilizer requirements for soybeans?

a) Nutrient levels and soil pH

1) Soybeans less tolerant to acidity than other row crops
2) Require low soil acidity for nodulation, nitrogen fixation, and plant growth
3) Develop better with soil pH of 6.2 - 7.0
(a) Acidic subsoils (pH 4.0 - 6.0) need lime.
(b) In soil with a pH above 7.0, nutrients are tied up and unavailable, causing deficiencies.
4) Nutrients needed by soybeans
(a) Nitrogen
(1) Needs
a. The soybean plant is a legume that supplies its own needs from the atmosphere.
b. It is generally nonprofitable to apply; it can delay nodulation and reduce available nitrogen.
c. Small amounts can be applied on sandy or cold soils to stimulate

plant growth and nodulation until nitrogen fixation begins.

(2) Deficiencies
   a. Stressful environmental conditions - wet; very hot, dry conditions; or very acidic soils
   b. Inadequate supply of *Rhizobium japonicum* - bacterium needed for nitrogen fixation
      i. Adequate in fields previously planted with soybeans
      ii. Where inadequate, need to plant inoculated soybeans

(b) Phosphorus
   (1) Needs
      a. Large amounts are absorbed throughout the growing season.
      b. Greatest demand starts just before pods form to 10 days before seeds are fully developed.
      c. One bushel of soybeans removes 0.8 - 0.9 pound of phosphorus per acre.
      d. Recommendations are based on building levels over 8 years.
      e. Amounts vary due to previous crop history, seed variety, and soil type.
   (2) Deficiencies
      a. Phosphorus reduces nodule bacteria needed for nitrogen fixation and good root development.
      b. Symptoms are thin, dwarfed stem; lack of luster in leaves; early defoliation; and poor or nonefficient nodulation.

(c) Potassium
   (1) Needs
      a. Requires large amounts; 1 bushel of soybeans removes 1.4 pounds of potassium from the soil.
      b. Uptake peaks during rapid vegetative growth and slows when beans form.
      c. Soil levels can be high because it leaches very little (except in sandy soils), is not used in excess by soybeans, and is released every year in slowly available forms.
   (2) Deficiencies
      a. Symptoms are stunted growth with shortened internodes, edges of leaves scorched or yellow and curl downward (especially lower leaves).
      b. Severe symptoms are brown or black edges on leaves.

(d) Secondary macronutrients
   (1) Deficiencies are not as common as with major nutrients.
   (2) Soybeans contain more secondary nutrients than other grain crops, except for corn's sulfur content.
   (3) Limestone used to adjust pH provides adequate amounts of calcium and magnesium.
   (4) Magnesium deficiency will occur in lower leaves and appear as pale, green color between main veins.
   (5) Sulfur deficiency is visible in young leaves and veins appear pale.
      a. Similar to nitrogen deficiencies except in upper leaves
      b. Few cases in Missouri except on sandy-textured, low-organic soils

(e) Micronutrients
   (1) Adequate amounts maintained at proper soybean pH level
   (2) Iron deficiencies
      a. Occur in river bottom soils with pH levels of 7.5 or higher
      b. Yellowing of leaves between the veins
      c. Leaves almost white
   (3) Manganese deficiencies
      a. Occur in old lake beds, glacial outwashes, peat soil
      b. Sandy soils high in organic matter or heavily textured, acidic soils

c. White or yellow leaves with green veins *(Interveinal chlorosis)*

(4) Molybdenum deficiency
   a. Occurs on very acid, sandy soils
   b. Needed by legumes for nitrogen fixation
   c. Shortage of nitrogen with pale green or yellow plants

(5) Zinc deficiencies
   a. Soybeans are less sensitive to zinc deficiency than corn.
   b. Normal corn growth on same soil indicates adequate supply.
   c. Deficiencies are found in graded, severely eroded, or low-organic soils.
   d. Symptoms are stunted plants with interveinal areas of leaves becoming yellow.
   e. Distant field areas appear yellowish-brown.

F. ***Other Activity***

Visit the George Washington Carver National Monument near Diamond, MO (extreme southwest Missouri). This national park consists of 210 acres of the original Moses Carver farm. Students can experience Missouri's natural grass prairie vegetation by hiking the ¾ mile Carver Trail and learning about Carver's life and work at the park's Visitor's Center. Additional information can be found on the Internet at <http://www.nps.gov/gwal>.

G. ***Conclusion***

In order for soybeans to have productive yields, they require a suitable growing season, correct rainfall amounts, suitable drainage or topography, and appropriate soil type. Field history will determine what fertilizer, tillage, and planting methods should be used. Soil test recommendations will indicate the soil pH and nutrient levels and guide the producer in the fertility needs of the fields to be planted.

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

I. ***Answers to Evaluation***

1. b
2. a
3. b
4. Plants move from the vegetative to the flowering stage in direct response to day length.
5. Answers will vary but should include two of the following:
   a) Delays planting dates
   b) Creates environment for plant diseases
   c) Reduces nitrogen fixation
   d) Reduces nutrient uptake
6. Silty clay loam
7. Bacterium needed for nitrogen fixation
8. Grass-type crops
9. Tested, SCN
10. f
11. c
12. e
13. a
14. g
15. b
16. d

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EVALUATION

Circle the letter that corresponds to the best answer.

1. What is the optimum rainfall for soybeans?

   a. 10 to 20 inches
   b. 18 to 22 inches
   c. 20 to 32 inches
   d. Over 25 inches

2. Soybeans are most sensitive to moisture deficiency during _____.

   a. Pod development
   b. Nodulation
   c. Irrigation
   d. Harvest

3. The optimum temperature for soybeans to germinate is _____ °F.

   a. 86
   b. 80
   c. 76
   d. 68

Complete the following short answer questions.

4. Define photoperiod sensitivity.

5. List two problems caused by poor drainage.

   a.

   b.

6. The optimum soil for soybeans is a well-drained _____.

7. *Rhizobium japonicum* is _____.

8. Soybeans develop better when planted behind _____.

9. Soil should be _____ if there is a possibility of a _____ problem.

Match the term in the left column with the statement in the right column.

10.	_____ Occurs in very acid, sandy soil.	a.	Nitrogen
11.	_____ Peaks during rapid vegetative growth.	b.	Phosphorus
12.	_____ Occurs in sandy soils high in organic matter.	c.	Potassium
13.	_____ Extracts adequate supply from atmosphere.	d.	Iron deficiency
14.	_____ Found in graded, severly eroded, or low organic soils.	e.	Manganese deficiency
15.	_____ Greatest demand starts in the late reproductive stage.	f.	Molybdenum deficiency
16.	_____ Occurs in river bottom soils with high pH of 7.5 or higher.	g.	Zinc deficiency

UNIT VII - SOYBEAN PRODUCTION

Lesson 2: Selecting a Variety

Competency/Objective: Select a soybean variety suitable for your area.

Study Questions:

1. **What is the difference between indeterminate and determinate soybeans?**

2. **What factors should be considered when selecting a seed variety?**

3. **What diseases are prevalent locally?**

References:

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

2. *Missouri Soybean Handbook* (Manual 123). University of Missouri Extension agricultural publication, 1982.

3. Missouri Soybean Variety Performance Test Results available on the Internet at <http://agebb.missouri.edu/cropperf/soybean/index.htm>

4. *Soybean Diseases I and II* (PS103). University Extension. University of Missouri-Columbia Agricultural Picture Sheet.

5. Transparency Master

    a) TM 2.1: Missouri Soybean Maturity Groups

6. Activity Sheets

    a) AS 2.1: Selecting a Seed Variety
    b) AS 2.2: Identify Soybean Diseases

UNIT VII - SOYBEAN PRODUCTION

Lesson 2: Selecting a Variety

TEACHING PROCEDURES

A. ***Review***

Once the local growing conditions have been evaluated (considering the field history and current fertility needs), the producer must select a soybean variety to plant. Discuss with students the importance of soybean growth types (indeterminate and determinate) and the various factors that affect variety selection. Also discuss prevalent diseases of your area that may determine which resistant varieties can be planted. (Pages 44 and 45 of the *Missouri Soybean Handbook* can be used as a pictorial reference for most of the listed diseases.)

B. ***Motivation***

Describe a situation in which a local soybean producer is preparing to choose a variety of soybeans to grow. Ask the students what information the producer might need to make a decision and where the producer could get that information.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Discuss the role that ongoing research has on the development of new varieties of soybeans. Soybean varieties differ by their ability to grow under various environmental conditions and ability to survive pests that may be prevalent in the local areas.

   What is the difference between indeterminate and determinate soybeans?

   a) Indeterminate – plant continues to grow along with flowering and podding stages
      1) Doubles in height after first flowers appear
      2) Commonly grown in northern Missouri
      3) Some early-maturing varieties used with double cropping in southern Missouri
   b) Determinate – main stem stops growing when flowering begins
      1) Semi-dwarf – (true determinate) about half the height of normal varieties
      2) Semi-determinate – shorter flowering period, grow 6 to 10 inches less
         (a) Add only a small amount of vegetative grow after flowering.
         (b) May yield more in high productivity areas.
      3) Both - more lodging resistant than taller types

2. Discuss the five primary factors that need to be evaluated when selecting a seed variety. These are the factors that a producer should evaluate when choosing which variety to plant. Emphasize how these factors will affect profitablity. Complete AS 2.1 to familiarize students with variety performance test results.

   What factors should be considered when selecting a seed variety?

   a) Maturity
      1) Classified by ability to mature and be harvested within available growing season of a particular location
      2) Varieties matched to season by photoperiod (day length)
      3) Classified within 13 maturity groups (5 groups grown in Missouri)
         (a) Maturity Group II - extreme northern Missouri

(b) Maturity Group III - northern and central Missouri
(c) Maturity Group IV - central Missouri and southern Missouri
(d) Maturity Group V - southern Missouri and Missouri Bootheel
(e) Maturity Group VI – Missouri Bootheel counties of Dunkin and Pemiscot

4) Choosing maturity within a growing season
(a) Full season – generally more productive, use with small grain rotation in south Missouri
(b) Early season – use with winter wheat rotation or wet weather at harvest
(c) Mid-season – use with small grain rotation in central Missouri
(d) Late season – flower longer and grow taller, more competitive with weeds, have excessive growth, and lodge in highly fertile and moist soil

b) Standability
1) Lodging can decrease yields 20 to 30%.
2) Lodging is controlled genetically but altered by environment.
(a) Increased by high fertility, narrow row spacing, high plant population, and irrigation
(b) Reduced by semi-dwarf varieties

c) Pest resistance (insects, weeds, disease, and nematodes)
1) Some pests are difficult to recognize but may reduce yields as much as 15%.
2) Varieties are being developed to resist disease, nematodes, and nutrient problems.
3) Few varieties resist insects.
4) Many varieties carry resistance to Phytophthora root rot and soybean cyst nematode.

d) Additional considerations
1) Double-crop
(a) Best when wheat follows soybeans, except in northern counties
(b) Mid-season varieties best
(1) Produce necessary canopy to shade out weeds
(2) Mature fast enough to avoid frost losses
(c) Determinate semi-dwarf varieties not used
(1) Low height
(2) Short flowering period
(d) Sufficient soil moisture to ensure seed germination
(e) Variety that will mature before frost
2) Shatter resistance
(a) Common during dry conditions, especially in western Missouri
(b) Nonresistant varieties used only if other aspects are exceptional and early harvest expected
3) Seed cost
(a) Potential yield difference high enough to justify expense
(b) Find best price on highest quality seed of a given variety
(c) Smaller seeds - fewer pounds per acre, resulting in reduced cost
4) Seed quality
(a) Minimal cost per acre difference between good seed and poor seed
(b) Guarantees varietal purity, germination, freedom from weed and other crop seeds
(c) Free testing available at the Missouri Department of Agriculture
5) Availablity of seed and marketability of GMO crops
6) Intended use of the crop

e) Yield
1) Choose high-yield variety only if other necessary characteristics are available for specific planting location.
2) Information is available on variety testing results.
(a) *Missouri Crop Performance: Soybean*
(b) Agricultural Electronic Bulletin Board (AgEBB) at: <http://www.ext.missouri.edu/agebb/index.htm>

3. Review the various diseases, their causes, symptoms, and control methods. Refer to the tables in the Student Reference for a breakdown of each disease. Additional information, with full-colored photos of common diseases, is available from the University of Missouri Extension Agricultural picture sheet PS103, Soybean Diseases I and II. These photos may be used with AS 2.2 to help the students identify soybean diseases.

What diseases are prevalent locally?

a) Cost Missouri producers over $100 million annually in losses, more in wet years
b) Causes of disease
    1) Pathogenic fungi
    2) Bacteria
    3) Viruses
    4) Nematodes
c) Causes of injury that may be mistaken as disease
    1) Herbicides
    2) Environmental causes (excessive wind, rain, temperature, hail)
d) Classification of most serious diseases prevalent in Missouri
    1) Seedling diseases
        (a) Pythium
        (b) Phytophthora
        (c) Rhizoctonia
        (d) Fusarium
    2) Root and stem diseases
        (a) Phytophthora root and stem rot
        (b) Fusarium root rot
        (c) Charcoal rot
        (d) Southern blight
        (e) Sudden death syndrome (SDS)
    3) Pod and stem diseases
        (a) Pod and stem blight
        (b) Stem canker
        (c) Anthracnose
    4) Foliar (Leaf) diseases
        (a) Brown spot
        (b) Downy mildew
        (c) Bacterial blight
        (d) Frogeye leaf spot
    5) Virus diseases
        (a) Soybean mosaic
        (b) Bean pod mottle
        (c) Bud blight
    6) Nematodes
        (a) Soybean cyst nematode (SCN)
        (b) Root-knot nematode

F. ***Conclusion***

Producers need to consider many things when choosing a soybean variety that is appropriate for the specific location. New varieties of soybeans are always being developed to resist disease and still maintain a good crop yield. A producer needs to be familiar with and be able to identify diseases that affect the soybean crop and identify preventive measures to control the diseases.

G. ***Answers to Activity Sheet***

Answers will vary for both activities.

H. ***Answers to Evaluation***

1. Answers should include two of the following: other producers, seed dealers, University and extension variety trials, or the producer's own strip trial.

2. *Indeterminate:* the plant continues to grow along with flowering and podding stages, frequently doubling in height after the first flowers appear.
   Determinate: the main stem stops growing when flowering begins; shorter than indeterminate type.

3. *Semi-dwarf:* true determinates only half the height of normal determinate varieties.
   Semi-determinate: shorter flowering period and grow 6 to 10 inches less than determinate varieties; after flowering only a small amount of vegetative growth occurs.

4. Answers should include three of the following: maturity, standability, pest resistance, additional considerations, or yield.

5. Groups II through VI

6. Answers should include two of the following: high soil fertility, narrow row spacing, high plant population, or irrigation.

7. Phytophthora root rot and soybean cyst nematode

8. Answer should include one of the following:
   Double cropping – whatever crop is to follow or precede a soybean crop will determine whether a full-, early-, mid-, or late-season soybean variety should be planted.
   Shatter resistance – nonresistant varieties should be used only if they are exceptional in other aspects and an early harvest is expected.
   Seed cost – producers should be sure there is enough potential yield difference to justify the expense. Smaller seed size varieties need fewer pounds of seeds per acre and may reduce cost.
   Seed quality - there is very little difference in cost per acre of good seed versus poor seed or seed of unknown quality and the purchase of certified seed guarantees varietal purity, germination, and freedom from weed and other crop seeds.
   Use of herbicide-resistant varieties - producers are caught in the middle of the world-wide debate on the use of GMOs and they should stay current with developments in the market.
   Intended use of the crop - producers can focus on planting soybeans for a variety of uses.

9. When it also has other necessary characteristics (maturity, disease resistance, etc.) that are needed for the specific planting location.

10. c
11. a
12. d
13. e
14. a
15. d
16. b
17. e
18. b
19. b
20. c
21. d
22. a
23. d
24. e
25. a

UNIT VII - SOYBEAN PRODUCTION Name_____

Lesson 2: Selecting a Variety Date _____

EVALUATION

Complete the following short answer questions.

1. List two sources of information on soybean varieties.

   a.

   b.

2. What is the difference between indeterminate and determinate growth types?

3. What is the difference between semi-dwarf and semi-determinate varieties?

4. List three of the five factors that should be considered when selecting seed variety.

   a.

   b.

   c.

5. What maturity groups are adaptable to Missouri?

6. List two environmental conditions that can affect lodging.

   a.

   b.

7. What are the two diseases that most soybean varieties carry a resistance to?

   a.

   b.

8. List one additional consideration that might be used when selecting a variety and why it should be considered.

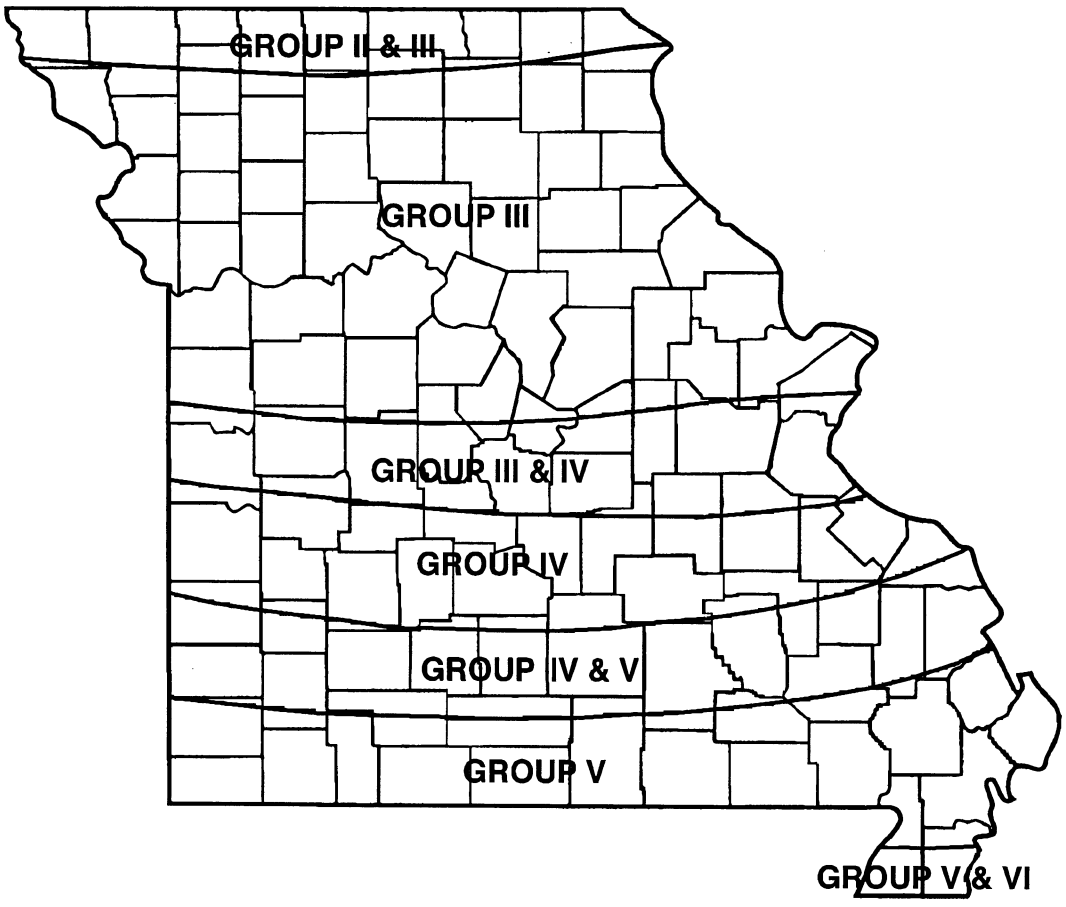
9. When should a producer choose the highest yielding variety?

Match each disease with its classification.

10.	Anthracnose	a.	Seedling disease
11.	Rhizoctonia	b.	Root and stem disease
12.	Bacterial blight	c.	Pod and stem disease
13.	Bud blight	d.	Leaf disease
14.	Fusarium	e.	Virus disease
15.	Brown spot		
16.	Charcoal rot		
17.	Soybean mosaic		
18.	Southern blight		
19.	Sudden death syndrome		
20.	Stem canker		
21.	Frogeye leaf spot		
22.	Pythium		
23.	Downy mildew		
24.	Bean pod mottle		
25.	Phytophthora		

TM 2.1

Missouri Soybean Maturity Groups



Lesson 2: Selecting a Variety Name _____

Selecting a Seed Variety

Objective: Students will research seed varieties appropriate for their particular area.

Directions: Compare and evaluate the seed varieties appropriate for the Maturity Group for your area. Your instructor will assign different varieties to research. Access the University of Missouri Variety Performance Tests available on the Internet at <http://agebb.missouri.edu/cropperf/soybeans/index.htm>. Locate the performance tests for your county. Answer the following questions.

Variety name _____

1. What date was the crop planted? _____
2. What was the previous crop planted at the test site? _____
3. What is the row spacing for the test site?
4. What is the soil type for the test site? _____
5. What is the maturity date for your variety? _____
6. What is the plant height for your variety?_____
7. What is the lodging score for your variety? _____
8. What is the yield for the most current year? _____(bu/acre)
9. What is the average plant height for your maturity group? _____
10. What is the average lodging score for your maturity group? _____
11. What is the average crop yield for the maturity group? _____
12. Is your variety above or below the average crop yield for the maturity group?_____
13. Would you recommend planting this variety based on the performance test results? _____

Locate the company web site for your seed variety on the Internet or obtain information from a local seed dealer. Compare the company information with the results of the performance tests. Write your findings in the space below.

Lesson 2: Selecting a Variety Name _____

Identify Soybean Diseases

Objective: Students will identify the distinguishing characteristics of major soybean diseases.

Directions: The instructor will provide photos of diseases for you to identify. Complete the table by answering at least one cause, symptom, or control method for each photo or specific disease.

Disease	Cause	Symptoms	Control
1.			
2.			
3.			
4.			
5.			
6.			

Disease	Cause	Symptoms	Control
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			

UNIT VII - SOYBEAN PRODUCTION

Lesson 3: Selecting a Tillage and Planting Method

Competency/Objective: Determine tillage and/or planting method.

Study Questions

1. **What are optional tillage methods?**
2. **What are optional planting methods?**
3. **What are the recommended seeding rates for each tillage and planting method?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Activity Sheet
   a) AS 3.1: Determining Planting Rates

UNIT VII - SOYBEAN PRODUCTION

Lesson 3: Selecting a Tillage and Planting Method

TEACHING PROCEDURES

A. ***Review***

As stated in Unit III, Lesson 5, tillage is the act of moving soil particles or cultivating the land. In this lesson students will be introduced to the types of tillage and planting methods used in Missouri. They will also be introduced to recommended seeding rates and the importance of making proper adjustments to planting equipment.

B. ***Motivation***

Obtain a 1-gallon glass jar. Fill the jar with soybean seeds. The jar will hold approximately 17,000 seeds. Have the students write down an estimate as to how many seeds are in the jar. You might consider a prize for the student with the most accurate estimate. This exercise should give the students a better spatial understanding of how many seeds it would take to plant an acre of soybeans (185,000 seeds).

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Discuss the tillage methods used in your area or region of the state and the advantages and disadvantages. In your discussion, include reasons why some tillage methods are not as suitable for your area.

What are optional tillage methods?

a) Conventional
   1) Advantages
      (a) Machinery is familiar and widely available.
      (b) It is adaptable to a wide range of soil and crop conditions.
      (c) It allows the use of cultivation for weed control throughout the growing season.
      (d) Soils warm faster when soil residues are incorporated into the soil.
   2) Disadvantages
      (a) Higher fuel and labor costs
      (b) Greater field traffic that can lead to soil compaction
      (c) High risk of erosion
      (d) Reduction in organic material

b) Minimum tillage
   1) Mulch-till
      (a) Advantages
         (1) Reduced soil erosion
         (2) Lower fuel and labor costs
         (3) Advantages of conventional tillage methods maintained
      (b) Disadvantages
         (1) Requires modifications to equipment
         (2) Warming of soil slowed
         (3) Less effective under wet conditions
         (4) May require a larger tractor

2) Ridge-till
   (a) Advantages
      (1) Reduced erosion
      (2) Lower fuel and labor costs
      (3) Controlled traffic reduces compaction
      (4) Inter-row cultivation controls weeds
   (b) Disadvantages
      (1) Inter-row cultivation is required to build ridges.
      (2) Ridges must be level.
      (3) Wheels of machinery must be modified to avoid damaging ridges.
3) No-till
   (a) Advantages
      (1) Lower cost
      (2) Greatly reduced erosion
   (b) Disadvantages
      (1) High residues slow the warming of soils.
      (2) Attachments must be added to equipment.
      (3) Weed control is dependent on herbicides.
      (4) High management by the producer is required.
4) Remedial tillage - used only under special conditions
   (a) Subsoiling - loosening soil in severely compacted soils
   (b) Land-leveling - leveling off the top layer of soil
      (1) Controlled - uses a laser to put a consistent slope on a flat field to move surface water
      (2) Uncontrolled - scraps the top layer of soil from high areas to fill in low areas

2. Discuss the different planting methods used in your area or region of the state. Include the advantages and disadvantages of each method.

What are optional planting methods?

a) Row cropping
   1) Consistently produces good stands
   2) Row widths based on environmental conditions and tillage methods used
   3) Does not require special equipment
   4) Convenient and familiar
b) Skip row
   1) Width based on size of equipment
   2) Manages soil compaction or field traffic
   3) Not typically used for soybeans in Missouri
c) Drilled or solid-seeding
   1) Wide use of no-till makes drilling method favorable in Missouri
   2) Weed control improvements increase crop yields
   3) Harvest loss is reduced because combine can operate closer to the ground
   4) Seed depth less uniform resulting in poorer emergence
d) Broadcast and aerial
   1) Require a firm, level seedbed to establish a stand
   2) Success rate lower because seeds are placed at random depths
   3) Not typically used in Missouri for soybeans

3. Recommended seeding rates are designed to provide a starting point. Many planters seed at different rates than indicated by most manufacturer charts. Discuss how the seeding rates differ for various row widths. Refer to Table 3.1 in the student reference.

What are the recommended seeding rates for each tillage and planting method?

a) Desired soybean plant population is 70,000 per acre (approximately 4 plants/ft of 30-inch rows and 1 plant/ft in drilled rows).
b) Plant populations
   1) Lower than 70,000
      (a) Yield reductions due to insufficient plant numbers
      (b) Affect low podding and excessive branching
      (c) Produce better lodging resistance
   2) Higher than 150,000
      (a) Produce increased lodging
      (b) Result in yield reduction due to overcrowding
      (c) Higher podding and less branching

F. ***Other Activity***

Instruct students to contact different equipment dealers and order manuals and specifications of several types of planters and drills. Have them try to obtain an actual planter or drill to practice making adjustments.

G. ***Conclusion***

Tillage systems used in Missouri soybean production are conventional, minimum, no-till, and remedial. No-till is the most widely used tillage method used in Missouri. Planting methods available to Missouri producers include row cropping, skip row, driller or solid-seeding, broadcast, and aerial. Plant populations under 70,000 plants per acre may result in yield reductions due to insufficient plant numbers. Populations above 150,000 plants per acre may result in yield reductions due to overcrowding. It is important for producers to become familiar with the method that works best in their particular area or region of the state.

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

Actual seeding rate: 212,750 seeds per acre

+10% for no-till	185,000 seeds/acre	185,000
+10% for rough seedbed	x 15%	+27,750
- 5% for high quality seed	27,750	212,750 seeds/acre
15% total increase		

I. ***Answers to Evaluation***

1. Conventional, minimum, no-till, remedial
2. No-till; Advantages - lower cost and erosion is reduced
3. Row cropping; skip row; drilled or solid-seeding; broadcast; aerial
4. Row cropping; consistency in producing good stands
5. 70,000 plants per acre
6. 150,000

UNIT VII - SOYBEAN PRODUCTION Name_____

Lesson 3: Selecting a Tillage and Planting Method Date_____

EVALUATION

1. List the four tillage methods used by Missouri soybean producers.

   a.

   b.

   c.

   d.

2. Which of the tillage methods listed above is the most commonly used in Missouri? What are two advantages to using this method?

3. List the five planting options available to Missouri soybean producers.

   a.

   b.

   c.

   d.

   e.

4. Which of the five planting methods listed above is the most cmmonly used in Missouri and why?

5. What is the desired plant population for soybeans?

6. Plant populations above _____ plants per acre may result in yield reductions due to overcrowding.

Lesson 3: Selecting a Tillage and Planting Method Name _____

Determining Planting Rates

Objective: Students will determine a soybean planting rate given specific conditions.

Directions: Determine the planting rates for the soybean situation below. Use the guidelines given in the Student Reference.

You will be planting with 20-inch rows and want to achieve a plant population of 125,000 plants per acre. The suggested seeding rate is 185,000 seeds per acre. What should the seeding rate be if you are using a no-till planter in a rough seedbed with high-quality seed (germination of 92%). Show your work below.

Actual seeding rate: _____ seeds per acre.

UNIT VII - SOYBEAN PRODUCTION

Lesson 4: Selecting a Weed Control Program

Competency/Objective: Select a weed control program.

Study Questions

1. **What factors determine a weed control program?**
2. **What weeds are specific problems in soybeans?**
3. **How does weed pressure affect yield?**
4. **What weed control options are available?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Activity Sheet
   a) AS 4.1: Matching Herbicides to Specific Weeds

UNIT VII - SOYBEAN PRODUCTION

Lesson 4: Selecting a Weed Control Program

TEACHING PROCEDURES

A. ***Review***

Weed control is one of the most expensive components and one of the most difficult decisions of soybean production. This lesson will address the factors and options to consider when making that decision. Refer to Unit IV for a review of weeds.

B. ***Motivation***

Take students out to collect different weeds. Use pictures to identify weeds that are troublesome to soybeans. (The *Missouri Soybean Handbook* provides some pictures.)

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Give examples of problems that can occur in a field that may carry over into the next year. Use pictures to identify the problem weeds in Missouri soybean fields.

   What factors determine a weed control program?

   a) Early planning and good execution
   b) Mechanical measures or chemical control measures or both
   c) Weed control program factors
      1) Annual recurrence of weeds in the field
      2) Previous weed control program
      3) Crop rotations used and planned for the field
      4) Variety of seed (herbicide-resistant varieties)
      5) Seed planting method
      6) Planting date
      7) Environmental conditions

2. Display posters or photos of weeds around the classroom for the duration of this lesson. Let the students become familiar with various types of weeds that cause problems in Missouri soybeans. Refer the students to Table 4.1 in the Student Reference.

   What weeds are specific problems in soybeans?

   a) Broadleaf
      1) Buckwheat, wild
      2) Cocklebur, common
      3) Jimsonweed
      4) Morningglory, ivyleaf
      5) Morningglory, pitted
      6) Lambsquarters, common
      7) Mustard, wild
      8) Nightshade, black
      9) Pigweed
      10) Ragweed, common

11) Ragweed, giant
12) Smartweed, Pennsylvania
13) Sunflower, wild
14) Velvetleaf

b) Annual grasses and perennial weeds
1) Barnyardgrass
2) Bindweed, field
3) Bindweed, hedge
4) Cane, wild
5) Crabgrass, large
6) Foxtail, giant
7) Foxtail, green
8) Foxtail, yellow
9) Hemp, dogbane
10) Horsenettle
11) Johnsongrass
12) Milkweed
13) Nutsedge, yellow
14) Panicum, fall
15) Proso millet, wild

3. Weed pressure affects growth because of competition for nutrients and moisture (review growth stages). The amount of damage caused by weed pressure varies depending on the growth stage of the soybean plant. For examples, refer to Tables 4.2 and 4.3 in the Student Reference to see the effect of weed pressure on yield.

How does weed pressure affect yield?

a) Weeds controlled 2 to 4 weeks after soybeans emerge result in little damage to yield.
b) Weed damage varies depending on the growth stage of soybeans.
c) Late growth stage of soybeans will shade the ground and damage from weeds is minimized.

4. Discuss the most common weed control options for soybeans and the advantages and disadvantages of each.

What weed control options are available?

a) Cultivation - mowing and removing weeds manually or mechanically
1) Advantages
(a) Environmentally safer
(b) More economic than chemical use
2) Disadvantages
(a) Low effectiveness on weeds growing directly in row or grass weeds
(b) Increased cost of labor and fuel
(c) Dependent on timing and severity of problem

b) Herbicide - chemicals applied either to prevent or destroy weed growth
1) Advantages
(a) Controls weeds throughout field
(b) No need to reapply during growing season
(c) Kills roots, slowing or preventing new growth
2) Disadvantages
(a) Toxic effects on the environment
(b) Cost of chemicals
(c) Chance of plant injury

c) Herbicide-tolerant system - planting herbicide resistant varieties
1) Advantages

(a) Less trips across field
(b) Reduced cultivation costs

2) Disadvantages
(a) No residual control through the growing season
(b) Damage to plant if applied incorrectly
(c) No spraying after V-6 stage

F. ***Other Activity***

(Consult with the biology teacher.) Have students make a weed collection and identify each, especially those associated with soybeans.

G. ***Conclusion***

Before ending this lesson students should understand the factors considered when selecting a weed control program. Weeds can be combated using either chemical or mechanical control. The effectiveness of each depends on environmental conditions of the area.

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

Answers will vary.

I. ***Answers to Evaluation***

1. Answers should include the following:
a) Knowledge of the annual recurrence of weeds in the field
b) Knowledge of what type of weed control program was used previously in the field
c) Crop rotations used and planned for the field
d) Variety of seed to be planted
e) How the seed is to be planted
f) Planting date
g) Environmental conditions

2. a) Broadleaf
b) Annual grasses and perennial weeds

3. Cultivation and herbicides
a) Cultivation advantages
1) Environmentally safer
2) Cheaper depending on acreage and amount of weed growth
b) Cultivation disadvantages
1) Ineffective for controlling weeds directly in the row
2) Not very effective on grass weeds
3) May need repeating often
c) Herbicides advantages
1) Controls weeds throughout field
2) No need to reapply during growing season
d) Herbicide disadvantages
1) Toxic effects on environment
2) Cost of chemicals
3) Chance of plant injury
e) Herbicide tolerant system advantages
1) Less trips across field
2) Reduced cultivation costs
f) Herbicide tolerant system disadvantages
1) No residual control through the growing season
2) Damage to plant if applied incorrectly
3) No spray after V-6 stage

4. Growth stage

UNIT VII - SOYBEAN PRODUCTION Name_____

Lesson 4: Selecting a Weed Control Program Date_____

EVALUATION

Complete the following short answer questions.

1. What factors should be considered before choosing a weed control program?

   a.

   b.

   c.

   d.

   e.

   f.

   g.

2. What types of weeds cause problems for Missouri farmers?

   a.

   b.

3. List the methods of weed control and discuss the advantages and disadvantages associated with them.

   a.

      Advantages

      Disadvantages

   b.

      Advantages

      Disadvantages

c.

Advantages

Disadvantages

4. The amount of damage caused by weed pressure varies depending on the _____ if the soybean plant.

Lesson 4: Selecting a Weed Control Program Name_____

Matching Herbicides to Specific Weeds

Objective: Students will select a herbicide that is recommended to control a specific weed in soybeans.

Directions: Secure a copy of the *Missouri Soybean Handbook*, Manual 123, from a University of Missouri Extension office or the MFA Agronomy Guide published by MFA Incorporated. Refer to the "Guide to Weed Response to Herbicides" chart in Chapter 10. Use this information to select the most recommended herbicide for a specific weed problem. You may select more than one if several have received the same high recommendation.

Weed Name	Herbicide Recommendation
Barnyardgrass	
Crabgrass	
Fall Panicum	
Foxtails	
Shattercane	
Volunteer Corn	
Yellow Nutsedge	
Cocklebur	
Ivyleaf Morningglory	
Pigweed	
Common Ragweed	
Velvetleaf	

UNIT VII - SOYBEAN 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 when replanting is appropriate?**
3. **How does one determine if weeds should be removed mechanically or by herbicide application?**
4. **What insects are prevalent locally?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Diseases and Pests of Field Crop Plants. Available from the University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
3. *Missouri Soybean Handbook*. Manual 123. University of Missouri-Columbia: Instructional Materials Laboratory, 1987.
4. Transparency Master
   a) TM 5.1: Levels of Soybean Leaf Defoliation
5. Activity Sheet
   a) AS 5.1: Soybean Replant Worksheet

UNIT VII - SOYBEAN PRODUCTION

Lesson 5: Scouting and Maintaining the Crop

TEACHING PROCEDURES

A. ***Review***

Scouting, or evaluating the crop, during the growing season is the only way to know when it is appropriate to incorporate management practices such as irrigation, IPM, herbicides, and pesticides. This unit addresses the factors to consider when scouting the growing crop. It may be necessary to review the lessons on soybean growth stages and weeds.

B. ***Motivation***

Take students on a field scouting trip. Explain the hula hoop method and have them try it.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Many factors should be considered when scouting the growing crop. Discuss these options with the students. Refer to TM 5.1 when discussing presence of insect damage.

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

   a) Insect or disease presence and/or damage
      1) Amount of injury exceeds tolerance of the plant (injury threshold).
      2) Defoliation is the most common and visible form of chewing insect damage.
   b) Herbicide and insecticide effectiveness
      1) Contact chemical representative if problems exist or become present.
      2) Correct early by a tillage method such as rotary hoeing.
   c) Moisture management
      1) Water must be provided to the roots when needed by the plant to produce most economical yield.
      2) Overly wet soils may need drainage practices employed.
      3) Irrigation may be a consideration for moisture deficiency.
   d) Plant nutrition practices and outcomes
   e) Crop readiness for harvest

2. Discuss the factors that must be considered when making the decision to replant. Identify the methods for evaluating plant stands and the costs that can be incurred with replanting. Use the seeding chart from Lesson 3 to see the expected plant stand rates. Also, mention that seed companies provide recommended seeding rates on the package label. Identify that filing a crop insurance claim is an option. Use AS 5.1 to help students determine when replanting is necessary. A University Extension interactive replant worksheet can be found on the Internet at <http:muextension.missouri.edu/xplor/agguides/crops/g04091.htm>.

   How does one determine when replanting is appropriate?

   a) Determine cause of damage
      1) Poor seed quality
      2) Planting too deep or too shallow
      3) Herbicide injury

4) Insect or disease problems
5) Cold, wet soils or hot, dry soils
6) Soil crusting

b) Evaluate stand density
1) To estimate live plant populations
2) Row crops - count plants equal to 1/1000th acre
3) Hula hoop method for drilled soybeans (Refer to Table 5.1.)
4) May be necessary to replant
(a) Remaining stand at 40% or less
(b) 3 weeks or less since planting

c) Predict yield potential
1) Estimated yield at various populations (Refer to Table 5.2.)
2) Effect of planting date on yield (Refer to Table 5.3.)

d) Determine income - multiply yield by predicted market price

e) Total loss - more profitable to file insurance claim

f) Replanting costs
1) Cost of seed
2) Fuel and machinery costs
3) Additional pesticides and herbicides
4) Labor
5) Interest on loans
6) Late harvesting costs

3. Explain to students that the decisions producers make prior to planting regarding row width and cultivation methods will determine how weeds will be removed.

How does one determine if weeds should be removed mechanically or by herbicide application?

a) Cultural methods
1) Deep plowing in the fall or spring will reduce most perennial weed problems.
2) Wide rows (greater than 20 inches) allows for cultivation between rows.
3) Cultivation is ineffective for controlling weeds growing directly in the row.
4) Drilled soybeans - depend on herbicides for weed control and are more competitive with weeds due to early canopy

b) Herbicides
1) Primary method of weed control
2) Species specific

4. Discuss some of the major soybean pests. Emphasize that pesticides should not be applied until the economic threshold is reached. Economic thresholds are always changing and it is important to obtain current information from the University Extension Centers.

What insects are prevalent locally?

a) Most soybean insects do not pose a threat to profitability but a few can significantly reduce yields if their numbers are high.

b) Insect problems are low early in the season, until late July or early August.

c) Thesholds have been established for most major insect pests and for several minor pests.

d) Insecticides should be applied only when pest levels reach economic thresholds.

e) Some of the more common soybean insects are as follows.
1) Bean leaf beetle
(a) Overwinter under debris
(b) Attack germinating soybeans
(c) 1/4 inch long
(d) Vary in coloration and markings
(e) Black triangle at base of forewings

(f) Two generations per year in Missouri

2) Stink bugs
   (a) Overwinter as adults underneath leaf litter, tree bark, and other materials in areas not used for crops
   (b) Attack primarily the seeds and pods
   (c) Feed on plant stems, foilage, and blooms
   (d) Small brown or black spots - indicate feeding punctures
3) Corn earworm
   (a) Attack soybean foliage and pods, especially in southern counties
   (b) Newly hatched larvae
      (1) Feed on terminal foliage for a few days
      (2) Move down to small pods and eventually to larger pods
   (c) Three generations annually - last generation most likely to cause damage
4) Grasshoppers
   (a) Feed on leaves and pods, especially during dry summers
   (b) Overwinter as eggs in the soil
   (c) Mate during May and June
   (d) Move into crops during July and August when surrounding vegetation becomes scarce and matures

f) Economic thresholds are always changing to include the following factors.
   1) Stage of development of the crop
   2) Stage of development of pest(s)
   3) Weather
   4) Yield potential
   5) Market price of commodity
   6) Cost of pesticide and its application

F. ***Other Activity***

Using the Soybean Replant Worksheet, Activity Sheet 5.1, give the students various scenarios for determining replanting profitability margins.

G. ***Conclusion***

Scouting the growing crop is a crucial step for the producer. Factors such as the stand, moisture, insect, weed, and disease damage warn producers when to implement management practices. If the crop is damaged, steps such as determining the cause of damage and evaluating the stand density, yield potential, and potential income are used to decide if replanting is necessary. Pesticides should be applied only when the economic thresholds for insect pests are reached.

H. **Answers to Activity Sheet**

1. 40,000 plants per acre
2. 35 bushels per acre
3. 88%
4. 31 bushels per acre
5. $4.50 per bushel
6. $396 per acre
7. $70 per acre
   a) $25
   b) $10
   c) $25
   d) $10
8. 94%
9. 33 bushel per acre
10. $149 per acre
11. $79 per acre

12. $61 per acre
13. Yes

I. ***Answers to Evaluation***

1. Presence of insect or disease damage; herbicide and insecticide effectiveness; moisture availability
2. 40%; 3 weeks
3. Hula hoop
4. Answers should include three of the following: cause of damage, stand density, yield potential, potential income, replanting costs.
5. Answers should include three of the following: cost of seed, fuel and machinery costs, additional pesticides and herbicides, labor, interest on loans, late harvesting costs.
6. Before planting
7. Herbicides
8. Economic threshold

UNIT VII - SOYBEAN PRODUCTION Name_____

Lesson 5: Scouting and Maintaining the Crop Date_____

EVALUATION

Complete the following short answer questions.

1. What are the three primary factors to consider when scouting the growing crop?

   a.

   b.

   c.

2. It may be necessary to replant when _____% or less of the stand remains, and it has been _____ weeks or less since planting.

3. To determine plant populations in drilled soybeans, the _____ method can be used.

4. Name three factors that should be considered when deciding to replant.

   a.

   b.

   c.

5. Name three factors that should be considered when determining replanting costs.

   a.

   b.

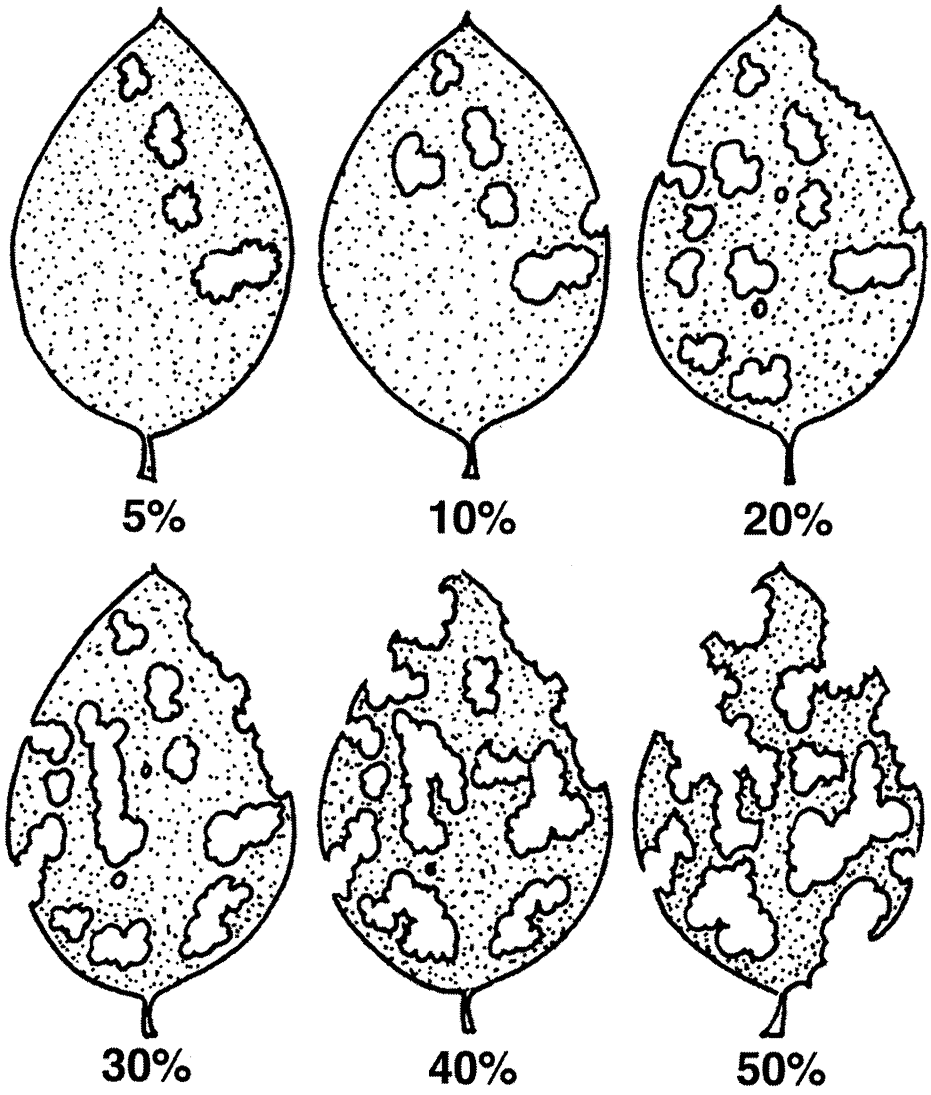
   c.

6. When are weed control methods determined?

7. What is the primary method of weed control in soybean production?

8. Apply insecticides only when pest numbers reach or exceed _____ _____ levels.

Levels of Soybean Leaf Defoliation



Lesson 5: Scouting and Maintaining the Crop Name_____

Soybean Replant Worksheet

Objective: Students will be able to determine when replanting is necessary.

Directions: Use the following worksheet and the tables in the Student Reference to determine if replanting is appropriate for the following situation. An interactive worksheet can be found on the Internet at <http://muextension.missouri.edu/xplor/agguides/crops/g04091.htm>.

Assume a weak stand of soybeans was replanted on May 30 in 30-inch rows. Estimated normal yield is 35 bushels per acre. Soybean price is estimated to b $4.50 per bushel. Plant populations is 40,000. Expenses: seed - $25; fuel - $10; chemicals - $25; other - $10. Round up the results to the nearest whole number.

9. Estimated stand density of weak stand _____ plants/acre

10. "Normal" yield in bushels per acre _____ bushels per acre

11. Effect of weak stand on yield potential from Table 5.2 _____ %

12. Estimated yield from weak stand;
multiply line 2 by line 3, divide by 100 _____ bushels per acre

13. Estimate market value of crop $_____ per bushel

14. Estimated income from weak stand;
multiply line 5 by line 4 $_____ per acre

15. Estimated cost to replant: total of 7.1+7.2+7.3+7.4 $_____ per acre
    1. Seed _____
    2. Fuel, machinery, labor _____
    3. Pesticides _____
    4. Other costs _____

16. Effect of planting date on yield from Table 5.3 _____ %

17. Estimated yield from replanted stand;
multiply line 2 by line 8, divide by 100 _____ bushels per acre

18. Estimated income from replanted stand;
multiply line 5 by line 9 $_____ per acre

19. Net income from replanted stand;
subtract line 7 from line 10 $_____ per acre

20. Profit or loss from replanting;
subtract line 6 from line 11 $_____ per acre

21. Is replanting appropriate? _____

UNIT VII - SOYBEAN 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 are the major causes of crop loss during harvest?**
3. **What factors should be considered when harvesting soybeans for seed?**
4. **What are local storage options?**
5. **What are storage problems associated with soybeans?**
6. **What factors affect grain quality during storage?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000. Unit VII.
2. *Missouri Soybean Handbook*. (Manual 123). University Extension. University of Missouri-Columbia. 1982.
3. Transparency Master
   a) TM 6.1: Moisture Migration in a Grain Bin
4. Activity Sheet
   a) AS 6.1: Measuring Harvest Loss

UNIT VII - SOYBEAN PRODUCTION

Lesson 6: Harvesting the Crop

TEACHING PROCEDURES

A. ***Review***

This lesson discusses soybean harvesting and storage methods. Determining when to harvest to reduce crop loss is important to ensure profitability. This lesson will also examine why crop losses occur and how they can be avoided. Once the crop is harvested, appropriate storage methods need to be implemented to maintain the appropriate moisture level of the soybean.

B. ***Motivation***

Introduce the lesson and then ask students what problems would they expect to face during harvesting and storage. Discuss the reasons given and how they would reduce crop loss. At the end of the lesson, go through this same discussion.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. When discussing soybean maturity, a review of seed varieties may be necessary. Show pictures or an actual sample of a soybean plant that has reached maturity. Discuss the climatic conditions that are favorable to harvesting soybeans.

   What factors determine harvest timing?

   a) Mature beans, leaves fallen off, and brown stalks and pods
   b) Maturity level
      1) Based on seed variety - long season and short season
      2) Moisture content
         (a) 13% ideal level for short-term storage
         (b) 11 or 12% for long-term storage
   c) Climatic conditions
      1) Soybeans give up and reabsorb moisture (hygroscopic).
      2) Low moisture levels can cause shattering losses.
      3) High humidity of the air can reduce shattering.
      4) Harvest after first frost reduces problems with green weeds.

2. Discuss the two categories of harvest loss—preharvest and harvest loss. Explain the importance of moisture levels of the soybean both during the maturation process and the harvesting process. If this lesson is taught during harvest season, use Activity Sheet 6.1 to demonstrate how to measure crop losses.

   What are the major causes of crop loss during harvest?

   a) Preharvest loss
      1) Influenced by variety, weather, and timeliness of harvest
      2) Lodging of plants
      3) Shattering of pods
   b) Harvest loss
      1) Shatter loss

(a) Occurs when crop tends to shatter easily
(1) Increase with crop dryness
(2) Reduce loss - properly adjusted header
(b) Occurs when the header is operated improperly
(1) Fast reel speed
(2) Reel positioned too far forward
(3) Set according to operator manual guidelines

2) Stubble loss
(a) Occurs when pods are missed by the cutter bar and left on the stalk
(b) Level seedbed with cutter bar at proper level

3) Lodged or loose stalk loss
(a) Occurs when beans are left in the pods on downed stalks or cut but do not pass through the combine
(b) Pickup reel with pickup guards on the cutter bar
(c) Sharp combine knives
(d) Correct reel height

4) Cylinder loss
(a) Occurs when beans are left in the pods after passing through combine
(b) Moisture content too high and incorrect cylinder-concave settings
(c) Cylinder speeds - according to manual guidelines and moisture levels

5) Separation loss
(a) Occurs when loose beans pass out of the combine
(b) Blower and sieve settings - according to operators' manual

3. Soybean seeds kept for planting the following year should be handled with special attention in order to produce a high-quality, good-germinating seed. Include in the discussions the reasons producers keep beans for reseeding purposes. Refer to Missouri Extension publication G04410.

What factors should be considered when harvesting soybeans for seed?

a) Genetically altered seeds cannot be saved because of patents on the original product.
b) Consider genetic purity, freedom from weed seeds, and overall quality.
1) Certified seed growers must use foundation, or registered, seed.
2) Certified seed ensures varietal purity.
c) Plant on land not previously planted in soybeans unless same variety planted.
d) Avoid early planting to ensure better quality seed.
e) Control weeds.
f) Harvest at 13% moisture to avoid cracked seed coats and splits.
g) Use foliar-applied fungicide during reproductive stages.
h) Maintain combine adjustments.
i) Avoid harvesting during hot, dry afternoons when pods and beans are brittle.
j) Avoid dropping beans frequently and at great distances to reduce seed coat cracks.
k) Avoid using auger elevators.

4. Discuss the various storage options available to producers. Include how these options may vary depending on the area of the state the soybeans are harvested.

What are local storage options?

a) Grain bins located on the farm
b) Local grain elevators
c) Grain-buying stations
d) Processing plants
e) Regional transport facility

5. Explain the importance of the moisture levels in harvesting soybeans and how this affects storage. Discuss the various factors that can affect the equilibrium of soybeans.

What are storage problems associated with soybeans?

a) High oil content and ability to absorb moisture require beans to be kept at equilibrium.
b) Equilibrium describes the ratio between relative humidity and moisture content of beans.
c) Soybeans can be dried with high temperature driers or natural air.
d) Storage bins should not be overloaded.
    1) Excessive depths of wet grain increase drying costs and delay harvest.
    2) Do not add new grain to old grain in storage.
e) Avoid accumulation of trash that will affect drying.
f) Insects are not typically a problem unless stored for longer periods.

6. Discuss the factors involved with maintaining the temperature levels after the soybeans are stored. Maintaining the moisture levels once the soybeans have been harvested is vital to crop quality. Explain how condensation can form within the storage bin as temperatures fluctuate.

What factors affect crop quality during storage?

a) Temperature and moisture levels must be controlled.
b) Aeration controls moisture in soybeans.
    1) Keeps soybeans at seasonally cool temperature, within 10 degrees of the average monthly, ambient air temperature
    2) Maintains relatively uniform temperature within the soybean mass, preferably no more than a 10-degree difference from one part of the bin to another
c) Control mass temperature of soybeans throughout the year.
    1) Run fan continuously if grain is above 16% moisture.
    2) Let fan run during periods of rain or bad weather.
    3) Cool beans to 40°F in the fall and warmed to 60°F in the early spring.
    4) Maintain no more than 15-degree difference between beans in storage and average outdoor temperature.
    5) Start fans for cooling in the spring when the outdoor temperatures are about 10 degrees warmer than grain temperatures.

F. *Other Activity*

To familiarize students with the various grain storage bins and drying systems, have them research different types and compile an analysis of the various storage bins available. They can contact equipment dealers, research farm magazines and brochures, or search the Internet for information.

G. *Conclusion*

Preharvest losses are caused by lodging of plants and shattering of pods and are beyond the producers' control. Harvesting loss occurs during combining. Observing the appropriate combine settings will reduce harvest loss. Storage of soybeans after harvest requires close monitoring of the moisture levels to maintain a quality crop.

H. *Answers to Activity Sheet*

Answers will vary depending on the crop evaluated.

I. *Answers to Evaluation*

1. a) Maturity level
    b) Climatic conditions
2. 13% or lower
3. Hygroscopic
4. Harvesting at moisture levels that are too low

5. e
6. c
7. a
8. b
9. f
10. d
11. Quality of seed produced is better with later plantings.
12. Drop the beans as few times and as short a distance as possible.
13. Yes, so that the soybeans mature at different times.

14. Any of the following are correct: grain bins on the farm, local grain elevators, grain buying stations, processing plants, regional transport facility

15. The ratio between a relative humidity and the moisture content in soybeans
16. Trash can cause even moisture levels and cause hot spots.

17. a) To keep the soybeans at a seasonally cool temperature
    b) To maintain relatively uniform temperature within the soybean mass

18. 40°F, 60°F
19. 16
20. 10

UNIT VII - SOYBEAN PRODUCTION Name_____

Lesson 6: Harvesting the Crop Date_____

EVALUATION

Complete the following short answer questions.

1. What two factors determine when to harvest soybeans?

   a.

   b.

2. What is the ideal moisture level at harvest if short-term storage is used?

3. What is the term that means to give up and reabsorb moisture?

4. What causes high shattering losses?

Match the term in the right column with the statement in the left column.

5. ____ Occurs when beans are left in the pods after passing through the combine.
6. ____ Occurs when pods are left on the stalk because they were missed by the cutter bar.
7. ____ Caused by lodging of plants and shattering of pods.
8. ____ Occurs when the header is operated improperly.
9. ____ Occurs when loose beans pass out of the combine.
10. ____ Occurs when beans are left in the pods on downed stalks.

a. Preharvest loss
b. Shatter loss
c. Stubble loss
d. Lodged or loose stalk loss
e. Cylinder loss
f. Separation loss

Answer the following short answer questions.

11. When harvesting soybeans for reseeding, why should early planting be avoided?

12. When moving and storing soybeans for reseeding, what should be done to reduce seed coat cracks?

13. Should the planting dates for the same variety have staggered planting dates? Why?

14. What are three storage options for soybeans?

    a.

    b.

    c.

15. Explain the term equilibrium.

16. How does trash in the soybeans affect drying?

17. What are the primary objectives of aeration?

    a.

    b.

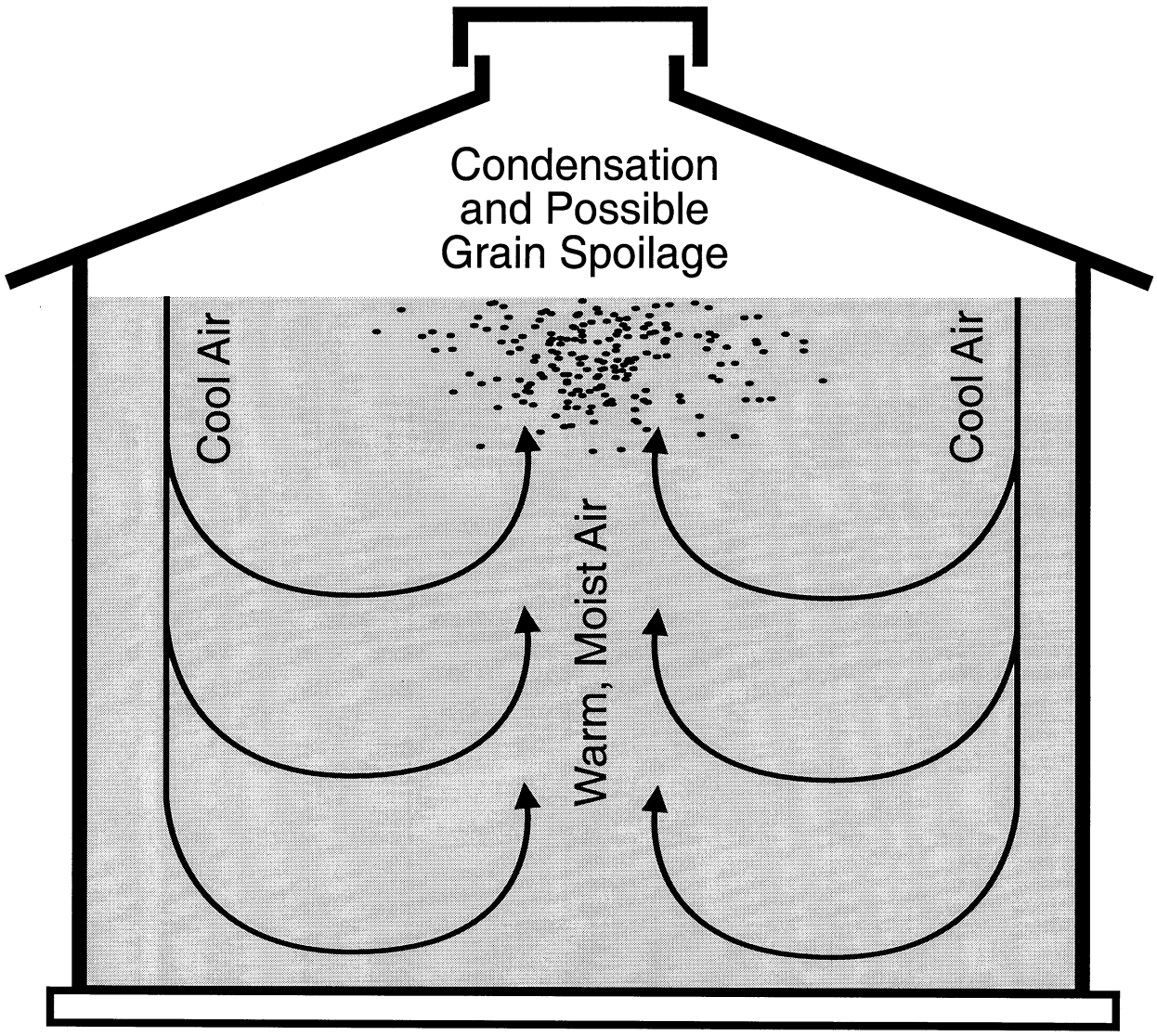
18. Beans should be cooled to _____°F in the fall and warmed to _____°F in the early spring.

19. The fan should be run continuously if the grain is above _____ % moisture.

20. Cooling fans should be started in the spring when the outdoor temperature reaches _____ degrees warmer than grain temperatures.

TM 6.1

Moisture Migration in a Grain Bin



Lesson 6: Harvesting the Crop Name_____

Measuring Harvest Loss

Objective: Students will identify and measure crop loss during preharvest and harvest from combine.

Directions: To determine losses, count the unharvested beans in an area of 10 square feet. An average of four beans per square foot equals one bushel per acre loss. Make the area of 10 square feet equal in width to the combine header. (See Table 1.) A plastic clothesline and four pins made from No. 9 wire make excellent material for forming the rectangle.

Table 1 - Dimensions for Rectangular Frame

Machine Swath (feet)	Frame (inches)
8	15
10	12
12	10
13	9.25
14	8.6
15	8
16	7.5
20	6
22	5.45
24	5

Before checking for losses, disconnect the straw spreader or chopper in order to get a more accurate count. Stop the combine where the crop is representative of the entire field. Stop the header and threshing mechanism. Back the combine a distance equal to its length. Shut off the engine.

Place the rectangular frame across the machine swath and make counts for total crop loss, preharvest loss, and header loss.

Procedures:

1. Total Crop Loss

Place the rectangular frame across the swath harvested at the rear of the combine. Count all loose beans, as well as the beans in loose and missed pods. Enter the number of beans per 10 square feet in Table 2, line 1. A total crop loss of 3% of the crop yield is average. If losses are greater than 3%, locate the source of the losses to determine where adjustments are needed.

2. Preharvest Loss

Place the rectangular frame in standing beans. Count the loose beans on the ground and the beans in loose pods on the ground. Enter the number of beans per 10 square feet in Table 2, line 2.

3. Machine Loss

Subtract the preharvest loss from the total crop loss. Enter this number in Table 2, line 3. A machine loss of 3% is average. If the loss is greater than 3%, check the header losses.

4. Header Loss

Place the rectangular frame across the swath harvested in front of the parked combine. Place it over an area where there has been no discharge from the rear of the combine. Then make bean counts as follows and enter the number in Table 2.

a. Shatter loss. Count all loose beans on the ground and beans in loose pods on the ground. Enter the number of beans per 10 square feet in line 4a.
b. Loose stalk loss. Count all the beans in pods attached to soybean stalks that were cut but not gathered into the machine. Enter the number of beans per 10 square feet in line 4b.
c. Lodged stalk loss. Count all the beans in pods attached to soybean stalks that were lodged and are still attached to the ground. Enter the number of beans per 10 square feet in line 4c.
d. Stubble loss. Count all the beans in pods still attached to stubble. Enter the number of beans per 10 square feet in line 4d.

Obtain the total header loss by adding lines 4a - 4d. Enter the total header loss in line 4.

5. Cylinder and Separation Loss

Subtract the total header loss from the machine loss. Enter this difference in Table 2, line 5.

Table 2 - Loss Data Table

Source of Loss	Beans found in 10 sq. ft. area	Number of beans = 1 bu./acre	Bean loss in bu./acre	Acceptable loss in bu./acre (40 bu. yield)
1. Total crop loss		40		1.3
2. Preharvest loss		40		0.1
3. Machine loss		40		1.2
4. Gather unit loss		40		1.1
a. Shatter		40		0.4
b. Loose stalk		40		0.2
c. Lodged stalk		40		0.2
d. Stubble		40		0.3
5. Cylinder and separation loss		40		0.1

UNIT VII - SOYBEAN PRODUCTION

Lesson 7: Marketing the Crop

Competency/Objective: Describe marketing opportunities.

Study Questions:

1. **What options are available for marketing soybeans?**
2. **How do producers determine when to sell or store soybeans?**
3. **How does grain quality affect price?**
4. **What are soybean checkoff dollars and how are these funds used?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Activity Sheet
   a) AS 7.1: Figuring Soybean Returns

UNIT VII - SOYBEAN PRODUCTION

Lesson 7: Marketing the Crop

TEACHING PROCEDURES

A. ***Review***

Previous lessons have discussed the production and harvesting of the soybean crops. The final step is selling the crop to obtain the most profit margin. Producers can improve their marketing decisions by properly using and analyzing market information. This lesson covers marketing options, grain quality, and checkoff dollars.

B. ***Motivation***

1. Introduce the lesson by asking students what risks they believe are associated with marketing soybeans.

2. Invite a marketing specialist from the extension service to speak with the class. Ask the specialist to focus on the marketing options available to producers in the futures markets.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Explain the marketing options available to the soybean producer, specifically the futures market. Ag Video 74, *Introduction to the Futures Market* and Ag Video 75, *Futures Market - Hedging* are available for free loan from MRCCTE at the University of Missouri-Columbia.

What options are available for marketing soybeans?

a) Sell for cash at harvest
   1) Transport grain from combine directly to the grain elevator.
   2) Sell grain upon delivery at that day's cash market price.
   3) Receive payment from the elevator.

b) Store at harvest and sell for cash later
   1) Cash market unseasonably low at harvest
   2) Expectation and forecast of increased prices in near future
   3) Transport grain when cash price at greatest profit level

c) Forward price
   1) Contracting with a grain elevator or on futures market
   2) Established in advance
   3) Locks prices in place
   4) Uncertainty of market prices - may rise above price locked in

d) Hedging
   1) Use of futures market as temporary substitute for cash purchase or sale made at later date
   2) Reduces some risk of holding investments

e) Options
   1) Put option
      (a) Gives buyer right, but not obligation, to sell commodity
      (b) Market fails - producer protected
      (c) Market rises - loss suffered
   2) Call option
      (a) Gives buyer right, but not obligation, to buy commodity

(b) Valuable if market rises

f) Delayed pricing or cash contracts
   1) Price is delayed until product delivery.
   2) Buyer can inspect the product and pay according to quality after arrival.

g) Grain pooling agreements
   1) Producers join in agreement to combine their harvest.
   2) Increase in volume allows bargaining directly with exporter for highest price.

h) Combination of all options

i) Government programs
   1) Price support programs offer loans in return for pledging the grain crop as loan collateral.
   2) Defaulting on the loan allows producers to keep the loan money and forfeit ownership of the grain to the government.
   3) Producers will benefit from defaulting on the loan if market prices are below the loan rate.

2. Ask students if they can tell what factors may be taken into consideration when determining whether to store or sell a soybean crop. How does the production of other countries affect their decision?

How do producers determine when to sell or store soybeans?

a) Decision is made by the producer after becoming more informed of the soybean pricing structure.

b) Soybean pricing structure has two segments.
   1) Supply, demand, and governmental programs
   2) Market forces that change pricing behavior

c) Factors may alter supply and demand causing variations in price.
   1) A decline in Brazil's crop can result in a significant increase in U.S. export markets for soybean products.
   2) This will ultimately increase soybean prices.
   3) Price is the hub of the system, regardless of whether soybeans are sold in the domestic or foreign markets.

d) Decision can be made only by the producer.
   1) Learn how to analyze and use market information.
   2) Have knowledge of the marketing alternatives (options).
   3) Use marketing information services.

3. Discuss how a quality crop affects the price a producer will get for the soybean crop. Soybeans that violate grading factors result in price discounts or deductions from gross weight. Review the federally established classes and grades of soybeans. Table 7.1 shows soybean grading factors.

How does grain quality affect price?

a) Classes
   1) Yellow soybeans
      (a) Yellow or green seed coats with cross sections of yellow or yellow tinge
      (b) Not more than 10.0% of other colors
   2) Mixed soybeans - any soybean that does not meet class Yellow soybean requirements

b) Grade standards - five grades, 1 - 4 and sample grade
   1) Amount of damaged kernels due to heat or other means
   2) Amount of foreign material
   3) Amount of splits
   4) Amount of soybeans of other colors
   5) Sample grade

(a) Do not meet requirements for U.S. Nos. 1, 2, 3, 4
(b) Have a musty, sour, or commercially objectionable foreign odor (except garlic odor)
(c) Are heating or otherwise of distinctly low quality

4. Explain the national checkoff program and how the funds are used for marketing and research projects designed to improve the demand for soybeans.

What are soybean checkoff dollars and how are these funds used?

a) Producers charged 0.5% of the market price per bushel when crop is sold.
b) Half of all checkoff funds remain in the states where collected and are used as directed by producer-controlled boards.
c) Other half of the checkoff funds are forwarded to the United Soybean Board, which uses funds on national level.
    1) Fund marketing and research projects
    2) Designed to improve demand for U.S. soybeans - home and overseas
    3) Invested in four major program areas
        (a) International marketing
        (b) Domestic marketing
        (c) Production
        (d) New uses

F. ***Other Activities***

1. During the introduction of this lesson, split the class into teams and put on mock investments. Give each team a certain amount of crops to invest. The instructor should serve as the broker and have the class follow the market using the various means, e.g., Internet, DTN, newspaper, television, radio.

2. Have the students research the weather and climate in Brazil. Successful Farming sponsors a web site <www.agriculture.com> that contains weather maps for Brazil. Use this as a means for the students to develop an understanding of how international weather and markets affect the prices in the United States.

G. ***Conclusion***

Students should gain an understanding of what risks are involved with marketing and how to manage those risks. An understanding of the classes and grading standards established by the U.S. Department of Agriculture is necessary to determine the price received for the crop. Checkoff funds that go toward marketing the soybean crop will benefit the producer by creating higher demands for the products.

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

1. $5.90
2. $8.54 - $6.55 = $1.99
3. $5.90 + $1.99 = $7.89
4. $7.89 - $ .06 = $7.83

I. ***Answers to Evaluation***

1. Sell for cash at harvest, store at harvest and sell for cash later, use forward pricing in the futures market, or use delayed pricing
2. Put
3. Call
4. Hedging

5. Price determination involves supply, demand, and governmental programs shaping the pricing behavior of the market. Price discovery is the market forces that change and direct pricing behavior.

6. Yellow and Mixed
7. Price discounts or deductions

8. Amount of damaged kernels due to heat or other means, amount of foreign material, amount of splits, amount of soybeans of other colors

9. Fund marketing and research projects designed to improve demand for U.S. soybeans

UNIT 7 - SOYBEAN PRODUCTION Name _____

Lesson 7: Marketing the Crop Date _____

EVALUATION

Complete the following short answer questions.

1. What are the four most common marketing options available for soybeans?

   a.

   b.

   c.

   d.

2. Using the _____ option gives the buyer the right, but not the obligation, to sell the commodity.

3. Using the _____ option give the buyer the right, but not the obligation, to buy the commodity.

4. Using the futures market as a temporary substitute for a cash purchase or sale to be made later is referred to as _____.

5. Explain the difference between price determination and price discovery.

6. What are the two classes of soybeans?

   a.

   b.

7. Soybeans that violate grading factors result in _____ from gross weight.

8. What four standards determine the grade of a soybean?

   a.

   b.

   c.

   d.

9. How does the United Soybean Board (USB) use with their portion of funds from the national checkoff program?

Lesson 7: Marketing the Crop Name _____

Figuring Soybean Returns

Objective: Students will determine the effect of forward pricing a soybean harvest.

Directions: Read the scenario below and answer the following questions. Determine the gross price received per bushel for a 5,000 bushel soybean futures contract with the Chicago Board of Trade.

The cash price for a bushel of soybeans on November 24 at the local elevator was $8.46 per bushel. The producer stored his soybeans on the farm and sold one (5,000-bushel) November soybean contract on the Chicago Board of Trade for $8.54. One year later, the cash price for soybeans at the local elevator was $5.90 per bushel. At that time, the producer sold his soybeans at the elevator and bought back one 5,000-bushel contract on the Board of Trade for $6.55 per bushel. The commissions and interest amounted to 6¢ per bushel. Answer the questions below and show your work in the spaces provided.

1. What was the cash price the producer received per bushel when selling his soybeans at the local elevator?

2. What was the gain (per bushel) from the futures market forward pricing trade?

3. What was the gross price received per bushel?

4. After subtracting the cost of commission and interest, what was the net price the producer received per bushel for his soybeans?

UNIT VII - SOYBEAN PRODUCTION

Lesson 8: Figuring Crop Cost

Competency/Objective: Calculate cost per acre.

Study Questions:

1. **What variable costs are associated with soybean production?**
2. **What fixed costs are associated with soybean production?**
3. **How is cost per acre calculated?**
4. **What factors do producers consider when determining an acceptable return on investment?**

References

1. *Advanced Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit VII.
2. Activity Sheet
   a) AS 8.1: Determining Soybean Costs

UNIT VII - SOYBEAN PRODUCTION

Lesson 8: Figuring Crop Costs

TEACHING PROCEDURES

A. ***Review***

This lesson addresses the costs and returns associated with soybean production. After completing this lesson, students should be able to determine what are variable costs and fixed costs. Students should also be able to calculate the break-even point and profitability of the crop. Explain how this information is used to calculate returns and how it is used in planning for the next crop.

B. ***Motivation***

Ask students how they would determine profitability. What items would they include in costs of production? Ask for an estimate about how large the returns would be per acre of soybeans.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Explain that variable costs change each year depending on the level of production. Review each item that would be considered a variable cost. Refer to Table 8.1 in the Student Reference to show average variable costs.

   What variable costs are associated with soybean production?

   a) Seed
   b) Fertilizer and lime
   c) Chemicals and materials
   d) Machinery fuel, oil, and repair
   e) Machinery hire and services
   f) Average labor costs
   g) Taxes and insurance
   h) Miscellaneous
   i) Operating interest

2. Explain to students that fixed costs remain constant. Review the costs that would be considered fixed in a soybean operation. Refer to Table 8.1 in the Student Reference for average fixed costs.

   What fixed costs are associated with soybean production?

   a) Depreciation and interest on machinery
   b) Interest, taxes on land and other land costs
   c) Possible labor costs

3. Explain to the students how to figure cost per acre.

   How is cost per acre calculated?

a) Total (operating) variable cost
+ Total (ownership) fixed cost
Total cost of production

Total returns
- Total fixed cost
Return above variable cost

4. Ask students what they would expect as an acceptable return per acre of soybean production? What factors did they consider when arriving at their answer? Use AS 8.1 to determine soybean costs.

What factors do producers consider when determining an acceptable return on investment?

a) Total variable cost
b) Total fixed cost
c) Total cost
d) Total returns

F. ***Other Activity***

Invite a guest speaker to the class to discuss soybean production in their area. A nonproducer such as an Extension agronomist would be a good selection. This person could present some information on how costs of production vary in his/her county.

G. ***Conclusion***

One of the hardest things to do in the production of a crop such as soybeans is to determine the crop's profitability. True returns to management must include all variable and fixed costs. The skill of the producer and level of production may increase or decrease these costs, thereby changing the profit picture.

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

Answers will vary.

I. ***Answers to Evaluation***

1. b
2. b
3. b
4. a
5. b
6. b
7. b
8. b
9. a
10. b
11. b
12. $1,183
13. b ($1183 ÷ $4.80 = $246.46 or 247 bushel)
14. c (320 bu. x $4.80 = $1536 - $1183 = $353)

UNIT VII - SOYBEAN PRODUCTION Name _____

Lesson 8: Figuring Crop Costs Date _____

EVALUATION

Match the cost factor in the left column with the correct term from the right column on the right.

1. _____ Miscellaneous
2. _____ Seed
3. _____ Chemicals and materials
4. _____ Land costs, taxes, and interest
5. _____ Machinery hire and services
6. _____ Machinery fuel, oil, and repairs
7. _____ Operating interest
8. _____ Fertilizer and lime
9. _____ Machinery depreciation and interest
10. _____ Taxes and insurance
11. _____ Labor costs

a. Fixed cost

b. Variable cost

Answer the following questions using the data provided. (A calculator may be used for these questions.)

Seed	$100.00
Fertilizer	200.00
Chemicals	250.00
Machinery	45.00
Repairs	10.00
Fuel	50.00
Interest	12.00
Labor	36.00
Miscellaneous	10.00
Real Estate Taxes	320.00
Depreciation	100.00
Machinery Interest	50.00

12. What is the total cost of production? _____

13. Using the above information calculate how many bushels of soybeans, valued at $4.80 per bushel, would have to be produced to break even (cover the cost of production). Round the answer to the next whole number.

    a. 233
    b. 247
    c. 259
    d. 280

14. Using the above information, what would be the profit (return to labor) if the producer harvested 320 bushels of soybeans and sold them on the cash market for $4.80 per bushel?

a. $284
b. $326
c. $353
d. $419

Lesson 8: Figuring Crop Costs Name _____

Determining Soybean Costs

Objective: Students will determine the cost of production for an acre of soybeans.

Directions: Survey a soybean producer in your area and determine the costs listed below, per acre. After the costs are determined, figure the profit or loss per acre and the profit or loss per bushel with the given levels of production.

1. Variable costs: Per Acre

Seed	_____
Fertilizer	_____
Chemicals	_____
Machinery costs (fuel, oil, and repair)	_____
Machinery hire	_____
Miscellaneous	_____
Operating interest	_____
Total Variable Costs	_____

2. Fixed costs:

Machinery depreciation	_____
Land costs	_____
Interest on investment	_____
Taxes	_____
Total Fixed Costs	_____

3. Labor costs per acre _____

4. Total all costs (variable, fixed, and labor) _____

Use the following levels of production and determine the total costs per bushel using the figures above.

30 bushels per acre $ _____ per bushel

40 bushels per acre $ _____ per bushel

50 bushels per acre $ _____ per bushel

If soybeans were $5.25 per bushel, what would be the profit on 1 acre of soybeans that produced 40 bushels per acre?

_____