

Course	Agricultural Science II
Unit	Crop Science
Lesson	Harvesting and Storing Forages
Estimated Time	Two 50-minute blocks

Student Outcome

The student will be able to describe factors related to harvesting and storing quality forages.

Learning Objectives

1. Describe the factors which determine the appropriate time to harvest forages.
2. Explain how forage quality is determined.
3. Identify when forages should be harvested.
4. Explain the methods which are used to harvest forages.
5. Explain what causes the quality of forages to deteriorate.
6. Describe how forage deterioration can be prevented.
7. Identify the basic storage requirements of forages.
8. Explain the ways to improve field drying.

Grade Level Expectations

SC/ME/1/G/09-11/a SC/ST/1/C/09-11/a

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slide
 - ☐ PPT 1 – Yield and Quality in Forages
2. *Crop Science* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1992.
3. *Crop Science Curriculum Enhancement*. University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ☐ Forage samples

Supplemental Information

1. Internet Sites
 - ☐ Crops Publications. University of Missouri Extension. Accessed January 16, 2008, from <http://extension.missouri.edu/explore/agguides/crops/>.
 - ☐ Dry Round Hay Bale Storage Costs. University of Wisconsin Extension. Accessed January 18, 2008, from http://www.uwex.edu/ces/crops/uwforage/LRB_StorageCosts-FOF.htm.
 - ☐ Hay Making and Handling Made Easier. AgrAbility Project. Accessed January 18, 2008, from <http://www.agrabilityproject.org/assistivetech/tips/HayHandlingTipSheet.pdf>.
 - ☐ Hay Storage – Planning and Design Guidelines. Alberta Agriculture and Food, Canada. Accessed January 18, 2008, from [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/eng2610](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/eng2610).

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- ❑ Managing Missouri's Hay Prairies. Missouri Department of Conservation. Accessed January 18, 2008, from <http://mdc.mo.gov/landown/grass/hay/>.
 - ❑ Preserving the Value of Dry Stored Hay. University of Minnesota Extension. Accessed January 18, 2008, from <http://www.extension.umn.edu/distribution/cropsystems/DC7404.html>.
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Interest Approach

Bring in several samples of forages. Have students inspect and identify them. Discuss the harvesting and storage methods used with each sample.

Communicate the Learning Objectives

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5. Explain what causes the quality of forages to deteriorate.
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Instructor Directions	Content Outline
<p>Objective 1</p> <p><i>As plants mature, yield increases but quality decreases. Selecting the appropriate time to harvest is an important factor influencing crop quality. In order to ensure high quality forages, harvesting must be completed at the appropriate time. Display PPT 1.</i></p> <p>☐ PPT 1 – Yield and Quality in Forages</p>	<p>Describe the factors which determine the appropriate time to harvest forages.</p> <ol style="list-style-type: none">1. Balance between quality and yield (appropriate time)2. Weather conditions – avoid rain, which leaches nutrients from cut forages
<p>Objective 2</p> <p><i>The quality of hay or silage is directly related to the level of milk production in dairy cattle and rate of gain in livestock production. Producing and harvesting quality forages is important to enable farmers to provide quality feed to livestock.</i></p>	<p>Explain how forage quality is determined.</p> <ol style="list-style-type: none">1. Physical appearance<ol style="list-style-type: none">a. Visual appearance<ul style="list-style-type: none">– Leafy– Fine texture– No foreign materialb. Color (bright green)c. Odor (pleasant)2. Chemical analysis<ol style="list-style-type: none">a. Crude protein contentb. Fiber contentc. Digestibilityd. Lignin content

Instructor Directions	Content Outline
<p>Objective 3</p> <p><i>In order to store and feed hay, silage, or haylage of high quality, the forage crop must be of quality. Harvesting must be done at the appropriate time to produce a quality feed product.</i></p>	<p>Identify when forages should be harvested.</p> <p>Harvest when the crop is fully mature</p> <ol style="list-style-type: none"> 1. Alfalfa – first flower to 1/10 bloom 2. Alsike clover – 1/2 to full bloom 3. Bird’s-foot trefoil – 1/10 bloom 4. Cowpeas – when first pods have started to ripen 5. Corn silage – harvest when kernels are fully dented and glazed 6. Crimson clover – 1/2 bloom 7. Fescue – boot to early heading 8. Ladino clover – full bloom 9. Lespedeza – early bloom 10. Medium red clover – 1/4 to 1/2 bloom 11. Small grains – boot stage to early dough stage 12. Soybeans – when beans in the pod are half developed 13. Sweet clover – when first blooms appear 14. Brome grass – early bloom (anthesis) 15. Orchard grass – fully headed but before bloom 16. Reed canary grass – when first heads appear 17. Timothy – early bloom (anthesis)
<p>Objective 4</p> <p><i>Mechanization has improved forage harvesting and handling. Forage harvesting methods vary depending upon how the forage will be stored and used.</i></p>	<p>Explain the methods which are used to harvest forages.</p> <ol style="list-style-type: none"> 1. Grazing 2. Dry hay systems <ol style="list-style-type: none"> a. Conventional bales b. Large round bales c. Large rectangular bales d. Portable haystack e. Field cubes 3. High moisture systems <ol style="list-style-type: none"> a. Green chopped b. Haylage (40-60%) c. Silage (60-70%) 4. Special forage processing systems <ol style="list-style-type: none"> a. Stationary cubers b. Pelletizing machines
<p>Objective 5</p> <p><i>Forage deterioration can be a costly problem. Deterioration of forages decreases quality and profit. Deterioration in some</i></p>	<p>Explain what causes the quality of forages to deteriorate.</p> <ol style="list-style-type: none"> 1. Improper harvest time (early or late) 2. Improper baling time (wet or too dry) 3. Improper harvesting methods 4. Improper storage

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<i>forage crops can be harmful to animal health.</i>	
Objective 6 <i>Forages provide an excellent source of nutrients to livestock. If deterioration of forages is permitted, the feed value decreases. Measures to prevent forage deterioration should be taken in order to ensure quality.</i>	Describe how forage deterioration can be prevented. <ol style="list-style-type: none"> 1. Harvest at proper time 2. Use proper harvest methods 3. Ensure proper moisture content at harvest 4. Maintain proper storage facilities
Objective 7 <i>Proper storage techniques are just as important to forages as to grains. If storage is improper, deterioration of forages due to mold, heat damage, rotting, and spoilage will occur.</i>	Identify the basic storage requirements of forages. <ol style="list-style-type: none"> 1. Dry hay <ol style="list-style-type: none"> a. Protection from weather b. Protection from insects, animals, and birds c. Adequate ventilation 2. Silage and haylage <ol style="list-style-type: none"> a. Protection from weather b. Protection from insects, animals, and birds c. Air tight facility d. Provisions for proper filling, emptying, monitoring, and cleaning
Objective 8 <i>Most forage crop deterioration is caused by excessive moisture content, which leads to reduction in quality, heat damage, and molding. Methods of drying forages can reduce moisture levels, improve storage, and ensure quality.</i>	Explain the ways to improve field drying. <ol style="list-style-type: none"> 1. Swath drying 2. Windrow drying 3. Crushing or conditioning 4. Chemical additives
Application	Other activities <ol style="list-style-type: none"> 1. Take a class field trip to a local farm to observe a forage harvesting operation (e.g., cutting, baling, or storing). 2. Display samples of several grades of forages that have been baled. Discuss the quality (e.g., color, odor, leafiness, and stems) of each. 3. Display a bale that was baled at too high a moisture content. Break open the bale and discuss the molding

Instructor Directions	Content Outline
	and heat damage along with the possible hazard from fires caused by improperly stored hay.
Closure/Summary	Forage crops are vital feedstuffs for livestock and dairy operations in the U.S. Quality forages are an excellent source of essential nutrients that increase weight gain in livestock and milk production in dairy cattle. Harvest time, method of harvesting, and proper storage are all important factors in producing quality forages.
Evaluation: Quiz	<p>Answers:</p> <ol style="list-style-type: none"> 1. True 2. True 3. False 4. False 5. False 6. c 7. d 8. c 9. b 10. d