

<b>Course</b>	Agricultural Science II
<b>Unit</b>	Introduction to Grassland Management
<b>Subunit</b>	Grassland Management Practices
<b>Lesson</b>	Harvesting and Storing Forage Crops
<b>Estimated Time</b>	Two 50-minute blocks
<b>Student Outcome</b>	

Determine methods for harvesting and storing forage crops.


### Learning Objectives

1. Describe why forages would be mechanically harvested.
2. Identify the two main methods of mechanically harvesting forage crops.
3. Identify the different methods of storing harvested forage crops.
4. Identify factors that affect the quality of stored forage crops.
5. Determine the stage of growth grassland should be mechanically harvested to optimize quality and quantity.

### Grade Level Expectations

### Resources, Supplies & Equipment, and Supplemental Information

#### Resources

1. Activity Sheet
  -  AS 1 – Sampling Hay
2. *Introduction to Grassland Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
3. *Introduction to Grassland Management Curriculum Enhancement*, “Unit III – Grassland Management Practices.” University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

#### Supplies & Equipment

- ☐ Samples of silage and hay
- ☐ See AS 1 for materials and equipment needed to complete the Activity Sheet.

#### Supplemental Information

1. Internet Sites
  - ☐ Forage Resources: Harvesting and Storage. University of Wisconsin Extension. Accessed February 18, 2008, from <http://www.uwex.edu/ces/crops/uwforage/storage.htm>.
  - ☐ Selecting Fans and Determining Airflow for Crop Drying, Cooling, and Storage. University of Minnesota Extension. Accessed February 18, 2008, from <http://www.extension.umn.edu/distribution/cropsystems/DC5716.html>.


## Interest Approach

Ask students to share any experiences that they have had with harvesting and storing forages. Bringing in samples of silage and hay may help to spur discussion. If students do not have experience with harvesting, discuss what information they do know about storing forages.

## Communicate the Learning Objectives

1. Describe why forages would be mechanically harvested.
2. Identify the two main methods of mechanically harvesting forage crops.
3. Identify the different methods of storing harvested forage crops.
4. Identify factors that affect the quality of stored forage crops.
5. Determine the stage of growth grassland should be mechanically harvested to optimize quality and quantity.

Instructor Directions	Content Outline
<b>Objective 1</b>  <i>Grazing meets the nutritional needs of the herd while the forage is in the vegetative state. Ask students why a grassland might be mechanically harvested instead of grazed.</i>	<b>Describe why forages would be mechanically harvested.</b>  <ol style="list-style-type: none"><li>1. To preserve the quality of the forage by maintaining the vegetative state</li><li>2. To optimize forage utilization during times when forage production is greater than the herd can consume, maximizing yield</li><li>3. To meet the nutritional needs of the herd when pastures are dormant</li><li>4. To sell the forage if it is not needed by the herd</li></ol>
<b>Objective 2</b>  <i>Two main methods of harvesting forages may be used; have students name the two methods. Point out that hay and silage vary in the amount of moisture they contain and the storage methods used for each.</i>	<b>Identify the two main methods of mechanically harvesting forages crops.</b>  <ol style="list-style-type: none"><li>1. Harvesting for hay: The green forage is harvested at low moisture levels and cured by drying.</li><li>2. Harvesting for silage: The green forage is converted into moist, succulent livestock feed through fermentation that takes place during storage.</li></ol>
<b>Objective 3</b>  <i>When forages are stored, maintaining the quality of the forage and controlling costs are of the utmost importance. Ask students to describe the different</i>	<b>Identify the different methods of storing harvested forage crops.</b>  <ol style="list-style-type: none"><li>1. Hay: formed into stacks, square bales, or round bales<ol style="list-style-type: none"><li>a. Barn: provides the most weather protection</li><li>b. Temporary cover: prevents water penetration and is inexpensive; used for large round bales or loose stacks</li></ol></li></ol>

Instructor Directions	Content Outline
<p><i>methods of storing harvested forage crops.</i></p>	<ul style="list-style-type: none"> <li>c. Field: provides the least expensive storage, but weather exposure can cause excessive loss of quality</li> <li>2. Silage: stored in silos to prevent spoilage and quality loss due to leaching of nutrients               <ul style="list-style-type: none"> <li>a. Vertical: have low storage losses, can be located near livestock, and adapt to automatic feeding                   <ul style="list-style-type: none"> <li>- Conventional: made of metal, concrete, or tile</li> <li>- Oxygen-limited: sealed or lined with fused glass; have even lower storage losses but cost more per cubic foot</li> </ul> </li> <li>b. Horizontal: easier to construct and cost less than vertical silos, but are also subject to more leaching of nutrients and require extensive packing of silage                   <ul style="list-style-type: none"> <li>- Bunker: consists of a concrete floor with concrete or plank walls above ground level</li> <li>- Trench: dug into well-drained ground or hillside; may have soil or concrete for floor and walls</li> <li>- Stack: used for temporary or emergency storage; consists of a compacted pile of silage placed on the ground or concrete floor; usually has high spoilage losses, so silage should be used as soon as possible</li> </ul> </li> </ul> </li> </ul>
<p><b>Objective 4</b></p> <p><i>Forage quality is dependent on many different factors. Ask students to list these factors. Have students complete AS 1.</i></p> <p> AS 1 – Sampling Hay</p>	<p><b>Identify factors that affect the quality of stored forage crops.</b></p> <ul style="list-style-type: none"> <li>1. Moisture content: can cause mold in hay if it is too high or leaf loss if it is too low; can cause mold in silage if it is too low</li> <li>2. Losses in storage: caused by improper storage and lack of protection from the environment</li> <li>3. Species composition: have different storage qualities as well as different palatability and nutritional benefits to livestock</li> <li>4. Stage of growth at harvest</li> </ul>
<p><b>Objective 5</b></p> <p><i>The production goal of all harvesting is to produce the forage with the highest nutritional value</i></p>	<p><b>Determine the stage of growth grassland should be mechanically harvested to optimize quality and quantity.</b></p> <p>Optimum forage harvesting takes place during the boot (grasses) and early bloom (legumes) stages, depending on the vegetative growth.</p>

Instructor Directions	Content Outline
<i>possible. Ask students to identify the best time to harvest to optimize quality and quantity.</i>	
<b>Application</b>	<p>Other activities</p> <p>Have students develop their own silo models that will prevent spoilage and quality loss due to leaching of nutrients. Place silage samples in the models and check them at a later date to determine the quality of storage.</p>
<b>Closure/Summary</b>	<p>Forage harvesting and storage is a crucial component of livestock management. The two methods of harvesting forages produce hay and silage, which may be stored in many different ways. Forage quality and costs should be considered when selecting the best method of storage for a specific operation. Harvesting time, moisture content, species composition, and storage method all affect the quality of the harvested forage. All forages should be harvested while in the vegetative growth phase during the boot stage in grasses and the early bloom stage in legumes.</p>
<b>Evaluation: Quiz</b>	<p>Answers:</p> <ol style="list-style-type: none"> <li>1. c</li> <li>2. c</li> <li>3. d</li> <li>4. b</li> <li>5. d</li> <li>6. Hay has low moisture levels, while silage is fermented to form a moist, succulent livestock feed. Hay is cured by drying it before it is stored, while silage is cured through fermentation that takes place during storage.</li> <li>7. Forages should be mechanically harvested and stored to preserve the quality and quantity of the forage by maintaining the vegetative state; to optimize forage utilization during times when forage production is more than the herd can consume; to meet the nutritional needs of the herd when pastures are dormant; and to sell if not needed by the herd.</li> </ol>