UNIT - FORAGES

Lesson 12: Harvesting and Storing Hay

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Hay production is important in most districts of Missouri except the Bootheel. Even with the drought conditions of 1983, the total production of hay which was harvested from 3,300,000 acres was 5.71 million tons. This was valued at 359 million dollars. Hay is used to provide feed for the important livestock industry in Missouri.

C. Assignment

D. Supervised Study

E. Discussion

1. Create a discussion with the students by asking "What is the importance of hay?" Make sure that major points (such as "Hay is an inexpensive source of feed for livestock during seasons when pasture isn't available," and "Hay is third in dollar value for crops produced in the United States") are emphasized.

What is the importance of hay in the U.S. and in Missouri?

1) The importance of hay in the U.S.
   a) From 1978 to 1980 hay acreage averaged 61 million acres and was valued between six and seven billion dollars.
   b) Hay ranks third in dollar value for crops behind corn and soybeans.
   c) Hay is the cheapest source of nutrients for cattle during times when pasture isn't available.
   d) Hay provides energy and protein for livestock.
   e) Increased technology has lessened costs and improved hay quality.

2) The importance of hay in Missouri
   a) From 1979 to 1983 hay acreage averaged 3.4 million acres and had an average value of 360 million dollars.
   b) This hay is used as feed for cattle and calves which bring in the highest cash receipts in Missouri.

2. Have some samples of different types of hay that vary in quality. Have the students examine these and during a discussion session, list the characteristics on the board.
What characteristics are associated with high quality hay?

1) Bright green color
2) Leafy
3) Fine stemmed
4) Pleasant aroma
5) Free from foreign material
6) High nutritive value
7) Good palatability

3. Discuss the factors that affect hay quality. Point out that except for bad weather, all of these factors are dependent on the producer's management decisions. (TM 10, TM 11)

What factors affect hay quality?

1) Fertility of soil
   a) Soil fertility has a greater affect on the protein, mineral, and vitamin content of forages than on grain crops.
   b) Adding fertilizer to already fertile soils will cause little change in hay quality.

2) Climate conditions
   a) High temperatures and drought accelerate maturity, slow growth and yield, and alter chemical compositions.
   b) Extreme rainfall causes coarse stem growth and lodging, which shades and kills lower leaves.

3) Species
   a) Composition and feeding value depends on the species grown.
   b) Legumes provide the most nutritious hay because of their high protein, carotene, and calcium levels.
   c) Grasses cut at the right stage of maturity are comparable in energy to legumes.
   d) Grasses are harder to digest than legumes because their higher cell wall content reduces their nutrient intake.

4) Disease and insects
   a) Loss of leaves from insects and disease lowers nutrient value.
   b) An average loss of 20 to 30 percent may be expected from disease and insects.

5) Moisture content
   a) Bale hay when it has no higher moisture content than 20 to 22 percent (whether it is stored inside or outside).
   b) Keep moisture from entering hay after it is baled.
   c) Careful moisture control avoids dry matter loss.
   d) Use crimpers.
   e) High moisture levels in baled hay cause problems.
      (1) Wet baled hay begins to mold, forming heat.
      (2) Molds develop at temperatures of 113 to 149°F.
      (3) Temperatures of above 150°F are in danger of spontaneous combustion.
      (4) Losses from heating and molding are proportionate to moisture levels of hay that are above 20 percent.
      (5) Large bales retain heat longer, resulting in more damage.
6) Stage of maturity
   a) Harvesting ten days after the most desirable stage results in
      a 20 percent loss of TDN (total digestable nutrients) and a 40
      percent loss of protein.
   b) Legume-grass mixtures should be harvested when the legume
      is at the proper stage, regardless of the species of grass.
   c) Determine when to cut hay.
      (1) Alfalfa - bud to 1/10 bloom
      (2) Red clover - 1/4 to 1/2 bloom
      (3) Lespedeza - before bloom
      (4) Birdsfoot trefoil - early bloom
      (5) Sweet clover - first blooms
      (6) Ladino clover - full bloom
      (7) Orchardgrass - early heading to bloom
      (8) Tall fescue - late boot stage
      (9) Bromegrass - heads emerged
      (10) Timothy - late boot
      (11) Reed canarygrass - heads emerged
      (12) Sudangrass - early heading
      (13) Small grains - late milk stage
   d) Shattering of leaves and wilting losses are greater when hay
      is harvested past its maturity stage.

4. Discuss the basis for grading hay. Let students try to grade samples of
   hay.

How is hay divided into groups and grades?

1) Basis for hay grading
   a) Stage of maturity
   b) Percentage of natural green color
   c) Percentage of leaves
   d) Size and softness of stems
   e) Aroma
   f) Percentage of foreign material

5. Discuss with the students how the rate of milk production and the rate
   of grain can be predicted for hay by testing.

How is hay forage tested for quality?

1) Sample test to determine the nutrient value of the hay.
2) Sampling steps
   a) Take a core sample with coring tool.
      (1) Sample rectangular bales from the end.
      (2) Sample large round bales from the rounded sides.
      (3) Take stack samples from the end and side.
   b) Obtain a number of samples.
      (1) Randomly sample ten to twelve bales.
      (2) Take samples from several haystacks from each lot of
          hay.
   c) Mix core samples and send in a 1/2 pound sample to the
      testing center.
6. Ask the students to list the various methods of curing and preserving hay. List these on the board and underneath each write its advantages and disadvantages. (HO 9)

What are the different methods of curing and preserving hay?

1) Field curing
   a) An average of thirty hours of sunshine are needed to dry hay.
   b) Hay permitted to dry in a swath as it is cut is called swath cured hay. (This hay dries partially and is raked into a windrow to finish curing.)
   c) Conditioning (crimping) is used to shorten the drying time of hay that is placed in windrows.
   d) Legume hay or mixtures dry slower than grass hay.
   e) Advantages of field curing
      (1) It is the least expensive and simplest method.
      (2) Vitamin D content is increased.
   f) Disadvantages of field curing
      (1) It is dependent on weather.
      (2) The quality of hay is reduced by bad weather.
      (3) There is an increased chance for fire.

2) Hay preservatives
   a) Products used are propionic acid, cetic acid, formaldehyde and occasionally anhydrous ammonia.
   b) These products are added to hay which has a moisture content between 25 and 35 percent.
   c) The preservative is applied when hay is baled or processed in the field.
   d) Preservatives inhibit microorganism activity, thereby controlling mold and heating.

3) Dehydration: direct cut or wilted hay is cured by a dehydrator.

7. Ask the students to list the different methods of harvesting hay. Write these on the board, leaving room to list the advantages and disadvantages of each. Discuss with the students the type of equipment used in each system and show pictures of each. (Missouri Cooperative Extension Service Agricultural Guide GO1260 has good illustrations.)

What are the different systems of harvesting hay and how do they compare?

NOTE: The following systems call for hay to be mowed, possibly conditioned or crimped, and windrowed at a 20 percent moisture level or less.

1) Conventional bales (small square bales)
   a) Advantages of square bales
      (1) Use storage space efficiently
      (2) Easy to handle for feeding
      (3) Convenient for handling hay which is being transported a distance
   b) Disadvantages
      (1) Initial cost of machinery
(2) Fire hazard with high moisture hay
(3) Usually a high labor requirement without special handling equipment

2) Large bales
   a) There are two types, round and rectangular.
   b) Bale weight varies from 800 to 2,000 pounds, depending on baler.
   c) Advantages of large bales
      (1) Baling proceeds rapidly.
      (2) Less labor is needed than with conventional bales.
      (3) Feeding can be done with power equipment and needs to be done less often.
   d) Disadvantages
      (1) Special equipment is needed for handling more than one bale at a time.
      (2) Spoilage occurs with bales stored which are outside.
      (3) Large bales cannot be conveniently stored in conventional buildings.
      (4) Specially designed feeding facilities are usually required.
      (5) Large round bales cannot be easily transported for long distances.

3) Small round bales
4) Compressed stacks
   a) Stacker picks up hay from windrow, coarse-chops it, and blows it into the enclosed stack wagon.
   b) The contents of the wagon are periodically compressed hydraulically.
   c) Stacks come in one-, three- or six-ton sizes.

5) Loose hay (not often used in Missouri)
6) Chopped hay - Hay is chopped at less than 20 percent moisture, blown into wagons, and taken to storage.
7) Wafers or cubes (This method is not commonly used in Missouri because field moisture levels need to be 6 to 18 percent.)
8) Economic considerations
   a) Initial cost comparisons for machine harvesting systems (from highest to lowest)
      (1) Small square bale with automatic handling (self-propelled)
      (2) Small square bale with automatic handling (PTO)
      (3) Large round bale
      (4) Stacker

   NOTE: The capacities of each system are not equal.

   b) Cost per ton for each system decreases as expected with increase in production.

   c) The break-even point for owning a system and having a custom harvester do the harvesting is the annual production level at which the cost per ton for owning machines equals the cost per ton for custom work.

F Other Activities

Have students determine the break-even point of owning equipment vs. custom harvesting hay.