UNIT - FORAGES

Lesson 13: Haylage and Silage

TEACHING PROCEDURES

A. Review

Review the previous lesson.

B. Motivation

Using high quality forages in haylage and silage can be compared to putting some of your paycheck away in a savings account to be used for future purchases. At later dates the money can be taken from the savings account to buy items that are on sale. Silage and haylage may be used in the same way; they can be used as quality feed at an economical price when pasture is not available.

C. Assignments

D. Supervised Study

E. Discussion

1. Ask the students to list the advantages and disadvantages for the use of grass silage. Make sure the discussion covers the items listed in the outline below.

What are the advantages and disadvantages of grass silage?

1) Advantages
   a) Preservation of a high quality forage with minimum nutrient loss
   b) Feed maintained in succulent form
   c) Little or no loss from shattering, leaching, or bleaching
   d) Less dependence on having extended periods of favorable weather
   e) Can use crops which have high infestations of weeds because the fermentation process kills the weed seeds
   f) Permits early re-use of land
   g) Less fire hazard
   h) Can completely mechanize silage handling and feeding
   i) Fewer internal parasite problems
   j) Less need for supplemental feed
   k) Low cost per ton for medium to large operations with efficient, modern machinery and large storage capacities

2) Disadvantages
   a) Initially high investment costs for machinery, storage facilities, and feeding facilities
   b) Limited use for silage equipment
   c) High management skills required for obtaining and keeping quality silage
   d) Limited off-farm market value
   e) Necessary to continue feeding once feeding is started from a
storage facility that is not an oxygen-limiting structure. (Especially during warm weather, the top three to four inches will need to be fed to prevent spoilage.)

2. Ask the students to list the different types of crops which can be used for silage.

**What crops are used for grass haylage and silage?**

1) General conditions affecting crops used for silage
   a) Any crop that can be fed green or used for hay can be used for silage.
   b) Crops without an abundance of carbohydrates in the form of sugars do not ensile easily.
   c) Caution must be used with grass-legume silage because it usually lacks carbohydrate sugars.

2) Crop mixtures usually grown for ensiling
   a) Grasses: smooth bromegrass, Timothy, ryegrasses, millets, orchardgrass, forage sorghum, sudangrass, sorghum-sudangrass hybrids, and reed canarygrass
   b) Legumes: alfalfa, sweet clover, red clover, Ladino clover, Alsike clover, crimson clover, soybeans, field peas, vetch, kudzu, lespedeza, cowpeas and birdsfoot trefoil
   c) Grain crops: oats, barley, wheat, corn, grain, and sorghum

3. Discuss the fermentation process with the students. Point out the various factors that affect the preservation process.

**What factors affect preservation?**

1) Air must be excluded from ensiled forage by good packing.
2) Loosely packed silage delays lactic acid production, which encourages the development of putrefying and proteolytic bacteria and the formation of butyric acid.
3) Loosely-packed silage causes high temperatures of 120° to 155°F, which result in nutrient loss of over 50 percent and may also cause spontaneous combustion.
4) Steps in proper packing
   a) Ensile the forage at the proper moisture level.
   b) Chop the forage to 1/4-inch cut.
   c) Fill the silo rapidly.
5) Plants used as silage must contain sufficient carbohydrates for fermentation and low amounts of calcium and protein are preferable.
6) Legumes are low in carbohydrates and high in protein and calcium. (This inhibits acid formation, so care must be used in making silage from legumes.)

4. Point out to the students that making quality grass silage takes more management skills than does producing corn and sorghum silage. Oxygen limiting or conventional silos in good shape are required. (TM 11, TM 12)

**How is grass silage made?**
1) Harvest the forage at the right stage of maturity.
2) Wilt the crop to proper moisture levels for wilted silage and haylage.
3) Make correct chopper settings.
   a) 5/8 to 3/4 inch for direct-cut silage
   b) 3/8 to 1/2 inch for wilted silage
   c) 1/4 inch for haylage
4) Use a silo that excludes air and water.
5) Fill the silo as rapidly as possible using a mechanical distributor, or level and tamp the silage daily.
6) Add preservatives for high-moisture silage.
7) Use a suitable seal to exclude the air.
8) Don't store low moisture silage in trench or bunker silos. (They don't have enough height to obtain good packing and exclusion of air.)
9) Leave the silo undisturbed until you are ready to use the feed.

5. Write on the board the three headings of direct-cut silage, wilted silage and haylage. Have students list the advantages and disadvantages for each during discussion.

What are the advantages and disadvantages of different methods of making silage?

1) Wilted silage
   a) Moisture content of silage at time of ensiling should not exceed 60 to 65 percent for wilted silage.
   b) Moisture content at cutting is usually 75 percent. (This is why wilting is necessary.)
   c) Under good conditions with sunny weather, three or four hours of drying time is sufficient.
   d) Advantages of wilted silage
      (1) Good preservation usually maintained without additives
      (2) Less weight for handling than with direct cut method because of less moisture
      (3) Little or no loss from seepage
      (4) Pleasant odor of silage which leads to large intake by livestock
   e) Disadvantages of wilted silage
      (1) Requires more careful management
      (2) One or two more field operations than with direct cut method
      (3) Danger increased for loss from adverse weather
      (4) Damage to chopper increased in stony fields

2) Haylage
   a) Haylage is produced by storing forage at a moisture level of 40 to 50 percent in an airtight silo.
   b) The low moisture level limits bacterial action and, since air is eliminated, the high level of CO₂ from respiration creates good preservation conditions.
   c) Advantages of haylage
      (1) More palatable than high moisture silage
(2) More consumption of dry matter by livestock than with high moisture hay
(3) Less weight in material to be handled
(4) Usually no problem with silage freezing in silos
(5) No expense for preservatives
d) Disadvantages of haylage
(1) Requires greater management care
(2) Possibility of serious heat damage due to not excluding air

3) Direct-cut silage
   a) This involves harvesting a standing crop with a chopper and immediately putting it in storage.
   b) Advantages of direct-cut silage
      (1) Less possibility of loss due to adverse weather
      (2) Smaller risk of damage to the chopper from stones
      (3) Reduction in number of operations
      (4) Better packing into the silo
   c) Disadvantages of direct-cut silage
      (1) Additional weight from moisture to be handled
      (2) Larger loss from seepage
      (3) Additional cost of preservatives
      (4) Strong odor of silage
      (5) Lower dry matter intake by livestock
      (6) Need for stronger tower silos

6. Ask students to give examples of silage additives with which they are familiar. Have them describe the purposes of each different kind of additive.

What are silage additives and how are they used?

1) Added feed stuffs help fermentation.
2) The nutritive value of silage is increased by providing energy, minerals or non-protein nitrogen.
3) Fermentable carbohydrates such as ground grain, molasses, and dried whey provide carbohydrates for fermentation into lactic acid. (Carbohydrates are often lacking in forages and this may limit fermentation.)
   a) They must be used at moisture levels above 65 percent.
   b) Cost and availability will govern their use.
4) Conditioners such as ground grains, dry beet pulp, ground corn-cobs, and chopped hay or straw are added to silage primarily to absorb moisture. (They are usually added when silage is being put into storage by hoppers or conveyors.)

7. Evaluating the quality of silage can be compared to evaluating hay. Emphasize to the students that a good quality forage crop must be used to obtain a quality silage product.

How is silage quality evaluated?

1) Chemical analysis should be made
2) Steps in sampling
   a) Randomly take two to three handfuls from each load
b) Mix these samples.
c) Take about one quart or liter, store in a plastic bag, and refrigerate until it can be sent to a testing lab.
d) To identify different field cuttings, place colored strips of plastic in the blower while storing.

8. Have students identify the different types of silos or storage facilities which are used for silage in their area. Also have them describe the different types of losses due to harvest and storage.

How are haylage and silage stored?

1. Tower silos (can completely automate removal and feeding)
   a) Conventional
      (1) Conventional tower silos are usually made of concrete and treated to reduce corrosion.
      (2) Unloader usually begins at the top and works its way down.
      (3) Storage losses can be limited to 12 percent of the wilted silage.
   b) Oxygen-limiting
      NOTE: Caution should be taken upon entering because of potentially harmful gases.
      (1) They are usually made of steel and treated to reduce corrosion.
      (2) The unloader usually begins at the bottom.
      (3) Spoilage from air is controlled.
      (4) They can be filled at various intervals without interrupting the feeding.
      (5) They are adaptable for feeding at different rates.
      (6) Because of high initial cost, year around use is suggested for making a profit.
      (7) Storage loss can be limited to 5 percent of the wilted silage.
   c) Advantages of tower silos
      (1) Relatively low storage losses
      (2) Easy adaptability for automated feeding
      (3) No need for extensive packing
      (4) Produces high quality forage
      (5) Can be located near livestock
   d) Disadvantages of tower silos
      (1) High initial cost
      (2) Need for special loading and unloading equipment
      (3) Difficulty in feeding if unloader breaks down
      (4) High cost of storage per ton of dry matter
      (5) Deterioration of some silo walls by acids

2) Horizontal silos
   a) Trench silos
      (1) Silos consist of a trench in the ground with one side located at ground level.
      (2) Walls may be made out of soil, wood, concrete blocks, or concrete.
b) Bunker silos
   (1) Silos are built on the ground level with two sloped walls and a floor.
   (2) Walls may be made of concrete and wood.

c) Temporary plastic silos
   (1) Plastic formed in a tube shape is filled with silage.
   (2) Structure is 8 feet in diameter and 100 feet long.
   (3) The plastic cannot be reused.
   (4) This works well if holes are not made in the plastic.

d) Silage in stacks
   (1) Stacks are used in an emergency as temporary storage.
   (2) Silage is packed into a pile several feet high and covered with plastic.

e) Advantages of horizontal silos
   (1) Lower construction costs per ton of forage
   (2) No need for special loading and unloading equipment
   (3) May be adapted to self-feeding
   (4) Lower cost per cubic foot of capacity than tower silos
   (5) Fill faster than tower silos
   (6) Reduced losses from seepage

f) Disadvantages of horizontal silos
   (1) Need for extensive packing
   (2) Not suitable to automatic feeding
   (3) More spoilage because of greater surface area
   (4) Greater care needed for good preservation
   (5) Feeding difficulties possible in winter because of ice and snow
   (6) Not adapted for storing low moisture silage
   (7) Well-drained locations not always available

F. Other Activities

1. Prepare a demonstration to study the effectiveness of recommended silage-making practices and their effects on the quality of the silage produced when using materials at different moisture levels. The procedure for this demonstration is as follows: Ensile finely-cut samples of forage in quart jars. In one series add water to dampen the forage if necessary. To another series, add about 2 percent of the weight of the forage in the form of ordinary white sugar. (If a jar holds about 400 grams of forage, mix 8 grams of sugar with the forage before packing it in the jars.) Store the jars containing forage under the conditions of complete exclusion of air, good exclusion of air, and poor exclusion of air. At the end of the ensiling process, have students compare the differences in taste and odor of the silages made under various conditions. A good silage should be almost odorless and sharply acid in taste. Explain the influence of acetic acid, lactic acid and butyric acid on the taste and odor of the silage. Relate the quality of silage to the storage conditions. (Michigan State University, Demonstrations in Farm Crops)

G. Competency

Compare production and storage methods for silage and haylage.