Competency/Objective: Identify the different types of forages and select forages appropriate for intended use.

Study Questions

1. What are cool-season grasses grown in Missouri?
2. What are warm-season grasses grown in Missouri?
3. How do cool- and warm-season grasses complement each other?
4. What are forage legumes grown in Missouri?
5. How do forage legumes complement various grasses?
6. What types of small grains are used in a pasture management system?
7. What species can be used for silage or haylage?

References

1. Advanced Crop Science (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2000, Unit IX.
3. Extension publications on the various forages to use as possible handouts for students. Available at <http://muextension.missouri.edu/xplor/agguides/crops/#Forages>
   - GO4510 - Crownvetch
   - GO4511 - Orchardgrass
   - GO4515 - Annual Lespedeza
   - GO4550 - Alfalfa
   - GO4610 - The Bluegrasses
   - GO4620 - Bermudagrass
   - GO4638 - Red Clover
   - GO4639 - White, Ladino, and Sweet Clover
   - GO4640 - Birdsfoot Trefoil
   - GO4646 - Tall Fescue
   - GO4649 - Reed Canarygrass, Ryegrass, and Garrison Creeping Foxtail
   - GO4661 - Warm-Season Annual Forage Crops
   - GO4671 - Eastern Gama Grass
   - GO4673 - Big Bluestem, Indiangrass, and Switchgrass
   - GO4674 - Caucasian Bluestem
4. Activity Sheet
   a) AS 2.1: Identify Characteristics of Cool- and Warm-Season Grasses

Advanced Crop Science, IX-11
UNIT IX - FORAGE PRODUCTION

Lesson 2: Selecting a Variety

TEACHING PROCEDURES

A.  **Review**

In evaluating a site for forage use, one major consideration is matching a forage or combination of forages to the site characteristics. It is important to understand the different qualities of forages and conditions and compatibilities between the various species.

B.  **Motivation**

Bring in samples of grasses and legumes (live or preserved mounts) from the local area. Include examples of warm-season grasses, cool-season grasses, forage legumes, and small grains. Have the class separate the plants into the above categories. (An alternative to this motivation would be to have the class collect different forages from the local area by visiting nearby farms, parks, and/or public areas. Keep samples from each location separate for identification practice and to compare what natural forages are being grown and/or what forages have been planted to improve any of the locations.)

C.  **Assignment**

D.  **Supervised Study**

E.  **Discussion**

1. Begin discussion with the growth habits of cool-season grasses. Use examples from the motivation to point out cool-season grasses. Have students identify these using Table 2.1 and discuss which advantages and disadvantages apply to each grass in regard to the location where it was found.

   **What are cool-season grasses grown in Missouri?**

   a) Growth habit of cool-season grasses - grass plants exhibiting vigorous growth habits in the spring and fall months
      1) Plants turn green and initiate new growth.
         (a) Late February or early March
         (b) When soil temperatures reach 40°F
      2) Plants begin rapid growth period.
         (a) Soil and air temperatures rise.
         (b) Spring rains occur.
         (c) Optimum growth occurs when air temperature reaches 59E to 77EF in late spring and early to mid-fall.
      3) Plant growth slows down and plants become brown and dormant during summer.
         (a) Inefficient use of water and sunlight energy during hot, dry weather
         (b) Dormancy temperature variable by species
         (c) Irrigation prolonging growth but growth potential less than spring and fall
   b) Most common cool-season grasses grown in Missouri (Table 2.1)
      1) Perennials
         (a) Kentucky bluegrass (*Poa pratensis*)
         (b) Orchardgrass (*Dactylis glomerata*)
         (c) Reed canarygrass (*Phalaris arundinacea*)
2. Discuss the growth habit of warm-season grasses and display samples of these grasses from the motivation. Ask students to find the name of each in Table 2.2 and discuss the advantages and disadvantages in regard to the location where they were growing.

What are warm-season grasses grown in Missouri?

a) Growth habit of warm-season grasses - plants exhibiting vigorous growth in spring and summer
   1) Plants - green, new growth when soil temperature at 60°F
   2) Optimum growth with air temperature between 77°F and 104°F
   3) Annual warm-season grasses
      (a) Used as pasture, hay, or silage
      (b) Rapid production important for summer grazing systems
      (c) Work well in crop rotation systems but expensive source for animal gain

b) Most common warm-season grasses grown in Missouri (Table 2.2)
   1) Perennials
      (a) Bermudagrass (*Cynodon dactylon*)
      (b) Big bluestem (*Andropogon gerardi*)
      (c) Caucasian bluestem (*Bothriochloa caucasica*)
      (d) Easter gamagrass (*Tripsacum dactyloides*)
      (e) Indiangrass (*Sorghastrum nutans*)
      (f) Little bluestem (*Schizachyrium scoparium*)
      (g) Sideoats grama (*Bouteloua curtipendula*)
      (h) Switchgrass (*Panicum virgatum*)
   2) Annuals
      (a) Pearl millet (*Digitaria sanguinalis*)
      (b) Sorghum - sudangrass and hybrids

3. Have students analyze the grasses collected in the motivation and determine if species found at the same location were complementary. If not, have them suggest what would be good grasses to add to the location. Have students complete AS 2.1.

How do cool- and warm-season grasses complement each other?

a) Provide a continuous supply of available forage for grazing due to different growth habits
   1) Warm-season grasses grow best in summer.
   2) Cool-season grasses grow best in spring and fall.
   3) One-third of grass pasture mixes should be warm-season grasses.

b) Complementary grasses in pasture situations
   1) Provide balanced nutritional quality throughout the grazing season
   2) Reduces risks of crop losses
      (a) Weather conditions
      (b) Plant specific diseases
      (c) Insect outbreaks
      (d) Other factors that affect pure crop stands

4. Display samples of forage legumes from collected species and discuss advantages and disadvantages of each found in Table 2.3 in the Student Reference regarding where they were
growing. Have students determine if legumes were naturally occurring or purposely planted at collected locations.

**What are forage legumes grown in Missouri?**

a) **Forage legumes - broad-leafed plants capable of “fixing” their own nitrogen**
   1) Tend to be higher in digestible proteins than grasses
   2) Higher producer of forage than grasses
   3) Alfalfa
      (a) Most productive legume
      (b) Productive into midsummer under nondrought conditions
      (c) Establishes deep taproot
      (d) Management practices
         (1) Timely harvesting at proper growth stage
         (2) Insect, disease, and weed control
         (3) Nutrient replacement
   4) Other legumes
      (a) Each with potential benefits
      (b) Diverse growing conditions

b) Most common forage legumes grown in Missouri
   1) Alfalfa - WS Perennial
   2) Birdsfoot trefoil - CS Perennial
   3) Alsike clover - CS Perennial
   4) Ladino clover - CS Perennial
   5) Red clover - CS Perennial
   6) Sweet clover - CS Biennial
   7) White clover - CS Perennial
   8) Korean lespedeza - WS Annual

5. Have students identify the differences in plant structures between grasses and legumes. Discuss how legumes can be used to complement and benefit grasses.

**How do forage legumes complement various grasses?**

a) Lengthening growing season of cool-season grasses because they grow longer into the summer
b) Enhancing soil quality by increasing nitrogen levels in the soil
c) Adding nutrients to soil for grass growth
d) Providing more available nutrition for livestock in both pastures and harvested forages
   1) Higher protein yields per acre
   2) Increased average animal gain
   3) Increased weaning weights
   4) Increased animal conception rates
   5) Decreased herd health problems
e) Continuous forage improvement; legumes not indefinite
f) Drought very damaging, especially to clovers
g) Legumes reduced or lost in pastures
   1) Overgrazing
   2) Lack of fertility or improper fertilization
   3) Diseases or insects
   4) Too much or too little rainfall

6. Discuss the types of small grains used in new and existing pasture systems. Display samples of each for ease of identification.

*Advanced Crop Science, IX-15*
What types of small grains are used in a pasture management system?

a) Wheat - most common
b) Winter rye - used in colder climates; most winter hardy of small grains
c) Winter barley and oats - along with rye, less desirable to use than wheat because their heavy, early growth competes with young forage seedlings
d) Pearl millet and winter vetch
e) Benefits of small grains in existing pastures
   1) Provide high-quality pasture forages in winter and spring months
   2) Increase pasture yields
   3) Extend grazing period
f) Benefits of small grains as cover crops for new pastures
   1) Reduce weeds
   2) Control erosion
   3) Furnish winter protection to young forage seedlings

7. Discuss the difference between silage and haylage and which species are best used in both. Display samples for identification and compare for firmness of leaves and stems, odor, and color.

What species can be used for silage or haylage?

a) Any crop that can be fed green as pasture or harvested for hay
   1) Silage - forage stored at 60 to 65% moisture
   2) Haylage - forage stored at 40 to 50% moisture
b) Typical crops
   1) Grasses - smooth bromegrass, timothy, ryegrass, millets, orchardgrass, sudangrass, reed canarygrass
   2) Legumes - alfalfa, sweet clover, red clover, ladino clover, alsike clover, soybeans, field peas, vetch, lespedeza, birdsfoot trefoil
   3) Grains - corn, grain sorghum, wheat, oats, barley, rye, triticale

F. Other Activities

1. Have a forage producer speak to the class about his or her methods of variety selection.

2. Research and report on a forage of economic importance in your area. Include in your report what species or combination of species should be used based on an intended use. Defend why the selected species would be the best choice and make suggestions as to other species that could be used if applicable.

G. Conclusion

By understanding the advantages and disadvantages of cool- and warm-season grasses and forage legumes, a producer can choose pure varieties or mixtures that best fit individual production needs. Combining legumes, grasses, and small grains will benefit pastures and harvested forages by providing added nutrition to existing pastures.

H. Answers to Activity Sheet

1. Orchardgrass
2. Kentucky bluegrass
3. Timothy
4. Smooth bromegrass
5. Tall fescue  
6. Small grains  
7. Pearl millet  
8. Sideoats gramagrass  
9. Indiangrass  
10. Caucasian bluestem  
11. Switchgrass  
12. Sorghum-sudangrass  
13. Bermudagrass  
14. Eastern gama grass  
15. Little bluestem  
16. Big bluestem  

I. *Answers to Evaluation*

1. b  
2. d  
3. b  
4. a  
5. b  
6. b  
7.

<table>
<thead>
<tr>
<th>Type of Forage</th>
<th>Perennial</th>
<th>Annual</th>
<th>Grass</th>
<th>Legume</th>
<th>Warm Season</th>
<th>Cool Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Bermudagrass</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Birdsfoot Trefoil</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Caucasian Bluestem</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Clover, Alsike</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Clover, Ladino</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Clover, Red</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Clover, Sweet</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Clover, White</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Eastern Gama Grass</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Indiangrass</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Lespedeza, Korean</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Little Bluestem</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Pearl Millet</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Reed Canarygrass</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sideoats Gramagrass</td>
<td>Small Grains</td>
<td>Smooth Bromegrass</td>
<td>Sorghum-Sudangrass and Hybrids</td>
<td>Switchgrass</td>
<td>Tall Fescue</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------</td>
<td>--------------</td>
<td>-------------------</td>
<td>--------------------------------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Small Grains</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth Bromegrass</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum-Sudangrass</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>and Hybrids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switchgrass</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tall Fescue</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timothy</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNIT IX - FORAGE PRODUCTION

Lesson 2: Selecting a Variety

EVALUATION

Circle the letter that corresponds to the best answer.

1. Cool season grasses initiate new growth when soil temperatures reach __________ EF.
   a. 35
   b. 40
   c. 45
   d. 50

2. Warm season grasses initiate new growth when soil temperatures reach __________ EF.
   a. 45
   b. 50
   c. 55
   d. 60

3. In a warm- /cool-season grass mixture, approximately _______________ of the stand should be warm season grasses.
   a. One-quarter
   b. One-third
   c. One-half
   d. Two-thirds

4. Forage legumes ____________________ digestible protein compared to grasses.
   a. Are higher in
   b. Are lower in
   c. Have the same amount of
   d. Do not require much

5. Forage legumes complement grasses by ________________________________.
   a. Lengthening the growing season of warm season grasses
   b. Enhancing soil quality by increasing nitrogen levels
   c. Providing insect protection during the warm season
   d. Conserving soil moisture during the cold season

6. Haylage is forages stored at __________ percent moisture.
   a. 30 to 40
   b. 40 to 50
   c. 50 to 60
   d. 60 to 70
7. Place an X in the correct box to indicate if a variety is a perennial or annual, grass or legume, and warm season or cool season.

<table>
<thead>
<tr>
<th>Type of Forage</th>
<th>Perennial</th>
<th>Annual</th>
<th>Grass</th>
<th>Legume</th>
<th>Warm Season</th>
<th>Cool Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bermudagrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Bluestem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birdsfoot Trefoil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian Bluestem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clover, Alsike</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clover, Ladino</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clover, Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clover, Sweet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clover, White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Gama Grass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiangrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lespedeza, Korean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little Bluestem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orchardgrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearl Millet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reed Canarygrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sideoats Gramagrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Grains</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth Bromegrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum-Sudangrass and Hybrids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switchgrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tall Fescue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timothy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Identify Characteristics of Cool- and Warm-Season Grasses

Objective: Students will become more familiar with the advantages and disadvantages of cool- and warm-season grasses.

Directions: Refer to the information given in Table 2.1 and 2.2 in Lesson 2 to answer the following questions.

Cool-Season Grasses
1. Which grass has rapid regrowth after cutting or grazing? __________________________________
2. Which grass has consistently low yields? ______________________________________________
3. Which grass is susceptible to heat and low moisture conditions? __________________________
4. Which grass is best adapted to deeper, better soils? _____________________________________
5. Which grass can be grazed closely? ____________________________________________________
6. Which grass has costly ground preparation? ___________________________________________

Warm-Season Grasses
7. Which grass is tolerant of acidic sites? __________________________________________________
8. Which grass grows in shallow soils? ___________________________________________________
9. Which grass should not be grazed until it reaches 8 to 10 inches in height? _________________
10. Which grass is not tolerant of wetland soils? ___________________________________________
11. Which grass has a high yield late spring/early summer? _________________________________
12. Which grass is difficult to cure as hay? _______________________________________________
13. Which grass prefers pH of 5.5 or above? ______________________________________________
14. Which grass prefers loamy soils with adequate moisture? ______________________________
15. Which grass is valuable in watershed protection? _______________________________________
16. Which grass is highly palatable to all classes of livestock? ______________________________