

Unit D: Production of Field Crops

Lesson 4: Forage Crops

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Define and name examples of grass and legume forages.
2. Define grass and identify parts of the grass plant.
3. Explain how grasses grow.
4. Describe how grass forages are established and maintained.
5. Define legume and explain how legumes grow.
6. Describe how legume forages are established and maintained.
7. Explain how hay is made.
8. Explain the hay and fodder crops of Afghanistan

Recommended Teaching Time: 2 hour

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has been developed for use with this lesson plan.
- <http://www.fao.org/docrep/005/x7660e/x7660e0m.htm>

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Master
Variety of products made from wheat

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide 2):

- Annual
- Blade
- Boot stage
- Culm
- Forage
- Forb
- Grass
- Hay
- Haylage
- Hay making
- Heading
- Jointing
- Pasture
- Perennial
- Range
- Rhizomes
- Silage
- Silo
- Stolon
- Tillering

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Have the students get out a piece of paper. Write the word Hay on the board. Have them list or write out anything that comes to mind when they think of the word hay. Give them 3 minutes and then have them share. Lead into a discussion about forages.

Summary of Content and Teaching Strategies

Objective 1: Define and name examples of grass and legume forages.

(PowerPoint Slides 3 and 4)

I. **Forage** is vegetation fed to livestock. Forages are crops that are efficiently used by ruminant animals. Forages may be fresh, dried, or ensiled. Fresh forages include grasses and legumes grown in pastures.

(PowerPoint Slide 5)

A **pasture** is improved or unimproved plant material on land areas where animals graze. Livestock production in Afghanistan largely depends on grazing, but only about 40% of the area is suitable for grazing during winter. Dried forms of forage include hay and other plant materials.

(PowerPoint Slide 6)

Hay is green plant material that has been cut and dried for use as livestock feed. Ensiled plant materials refer to silage and haylage. **Silage** is chopped plant material that has been fermented.

(PowerPoint Slide 7)

Haylage is silage that contains less than 50 percent moisture. Both silage and haylage are more nutritional than hay because they are not dried.

(PowerPoint Slide 8)

A. Pastures are made up mostly of grasses and legumes. Pastures are often fenced in to reduce the intrusion of native plants. Areas of land covered with both forage plants and native plants are considered a range. A **range** is a large open area of land. Pastures may be permanent or temporary.

(PowerPoint Slide 9)

B. Permanent pastures are usually planted with perennial grasses and legumes. A **perennial** is a plant with a life cycle of more than two years.
C. Temporary pastures are usually planted with annual grasses and legumes. An **annual** is a plant that completes its life cycle in one growing season. Common annual pasture plants include millet and ryegrass.

(PowerPoint Slide 10)

- D. Hay can be made from a number of grasses and legumes. The cutting and drying of hay is important in maintaining the hay's nutrients.

(PowerPoint Slide 11)

Hay that has been rained on is of lower quality; excessive moisture can also cause the hay to rot. Handling hay can be made easier by baling the hay in square or round bales. This depends on the equipment available and the needs of the producer.

(PowerPoint Slide 12)

- E. Silage contains most of the aboveground plant parts including the leaves, stems, and heads. Most silage is made from green crops such as corn and grass.

(PowerPoint Slide 13)

Silage usually contains 60 to 70 percent moisture; the high moisture level leads to fermentation during storage. Fermentation produces acids that prevent spoilage of the silage. In some parts of the world silage is stored in silos.

(PowerPoint Slide 14)

- F. **Silos** are upright or horizontal facilities that maintain the quality of the silage.
- G. Haylage is silage that contains less than 50 percent moisture. Its production is similar to that of silage except that it is harvested later than silage and less moisture is added.

****PowerPoint Slide 15 and 16 lists to vocabulary students should know. Use these slides to review the terms.**

Objective 2: Define grass and identify parts of the grass plant.

(PowerPoint Slides 17 and 18)

- II. A **grass** is a plant that typically has leaves with parallel veins and stems that are hollow or solid. Grasses normally have herbaceous stems, except bamboo which has woody stems.

(PowerPoint Slide 19)

Height, color, life cycle, and seasonal preferences vary with the variety of the grass. Grasses are members of the *Gramineae* family.

(PowerPoint Slide 20)

- A. Grass plants are made up of roots, culms, blades, flowers, and fruit or seeds. **Culms** are the stems of the grass plant. **Blades** are the leaves of the grass plant. Grass plants have fibrous root systems that grow shallow into the soil.

(PowerPoint Slide 21)

Many grass plants reproduce using stolons or rhizomes. A **stolon** is an aboveground creeping stem. A **rhizome** is an underground structure that sends up shoots.

****Use TM: D4-1 or PowerPoint Slide 22 to show students the major parts of a grass plant. A live forage grass plant or one that been recently dug up would also serve as a beneficial teaching tool for this objective.**

Objective 3: Explain how grasses grow.

(PowerPoint Slides 23 and 24)

III. Grasses grow both horizontally and vertically in a variety of ways. Horizontal growth includes bunching and sodding. Vertical growth includes short and tall grasses.

(PowerPoint Slide 25)

Grasses have fibrous root systems and are either annuals or perennials. Perennial grasses go through three phases of growth.

(PowerPoint Slide 26)

- A. During horizontal growth, some grasses bunch while others sod. Bunching plants often grow in circular patterns. Sod grasses are more aggressive than bunching grasses. Sod grasses use both stolons and rhizomes to reproduce and form a thick mat of stems, leaves, and roots.

(PowerPoint Slide 27)

- B. Short growing grasses are more tolerant of grazing than taller grasses. Height varies with the variety of the grass.
- C. Grasses have shallow, fibrous root systems. These roots store little or no food and do not grow into the moistest layers of the soil.

(PowerPoint Slide 28)

Annual grass plants are planted each year and are commonly used in temporary pastures. However, most grass is established for long-term use, therefore, perennial grasses are used because they grow back each year. Perennial grasses go through three phases including tillering, jointing, and heading.

(PowerPoint Slide 29)

- D. **Tillering** is the growth of buds from dormant shoots. These buds are known as tiller buds. This is the first growth of the year.
- E. **Jointing** is the growth phase in which the internodes begin to elongate. Vertical growth is rapid during this stage. This is not a good time to cut forages. The **boot stage** is the end of stem elongation.

(PowerPoint Slide 30)

- F. **Heading** is the phase in which seed heads form on the plant. During this phase, shoots begin to grow from the base of the plant. This is a good time to cut forage grasses because they have basal buds ready to repeat the growth process.

****Review of this objective would benefit from live or recently dug up samples of a variety of forage grass plants.**

Objective 4: Describe how grass forages are established and maintained.

(PowerPoint Slides 31 and 32)

IV. The forage grass established should be chosen based on its use and the climate in which it is to be grown. Forage grasses can be established using a number of methods. Seeding, sprigging, and specialized methods can be used in establishing forage grasses. Forage grasses can be used to reduce erosion.

(PowerPoint Slide 33)

A. Forage grasses can be planted into existing vegetation. This method of establishment causes minimal soil disturbance. Preparing a seedbed, which would include disking or plowing, is often done for crops to be used as hay or silage.

(PowerPoint Slide 34)

B. Permanent pastures require yearly maintenance. Nitrogen fertilizers are often needed for forage grasses. Pesticide use, mowing, and irrigation may also be required.

Objective 5: Define legume and explain how legumes grow.

(PowerPoint Slides 35 and 36)

V. Legumes are plants that fix nitrogen from the air in the soil. Legumes used as forage plants are known as **forbs**. A **forb** is a flowering, broad-leaf plant that has a soft stem. Forage legumes grow much like other legume crops.

****A live forage legume plant or one that been recently dug up would serve as a helpful teaching tool for this objective.**

Objective 6: Describe how legume forages are established and maintained.

(PowerPoint Slides 37 and 38)

VI. The first step in establishing forage legumes is the choice of legume. The legume chosen should be well adapted to the climate and should meet the needs of the consumer. Like forage grasses, forage legumes can be grown in both prepared and existing seedbeds. However, it is important that the soil contain rhizobia bacteria so that nitrogen fixation can occur.

(PowerPoint Slide 39)

A. Maintaining forage legumes is also similar to maintaining forage grasses. Maintenance is determined by the needs of the specific field. Pesticide application, grazing, and mowing may all be used as maintenance activities.

Objective 7: Explain how hay is made.

(PowerPoint Slides 40 and 41)

VII. Hay is an economical source of nutrients in livestock feed. **Hay making** involves the cutting, curing, and storing of high-quality, nutritious feed. Hay that is green, fine stemmed, free of weeds, and cut before it reaches full maturity makes the best quality hay.

(PowerPoint Slide 42)

A. Most forage grasses and forage legumes can be used to make hay. Cereal grains are also used to make hay. Hay can be a mixture of legumes and grasses or may be pure.

(PowerPoint Slide 43)

B. Hay should be cut at the growth or bloom stage of the plant. Cutting at this time will ensure the highest quality hay. Some plants may produce many hay cuttings per growing season.

(PowerPoint Slide 44)

C. Haymaking is almost entirely manual; mowing is generally by sickle, although the scythe is known. The common traditional sickle is smooth-bladed with a relatively straight blade set on a long metal neck attached to a wooden handle; the handle may have a slight hook at its extremity; the sickle is wielded with a scythe-like motion but using only one hand.

(PowerPoint Slide 45)

D. Hay from cultivated forage is nearly all lucerne and shaftal. They are both excellent hay crops, but the greatest problem in making hay in the hot and dry summers is avoiding leaf-loss through shattering. Traditional systems take this into account. The crop is mown and left to wilt in the swath until limp, and it is removed from the field and dried elsewhere before there is danger of leaf-loss.

(PowerPoint Slide 46)

E. The wilted herbage may be tied into small trusses which are set on the bunds to dry; this also frees the field and allows re-growth with a minimum of shading from cut herbage and traffic during other haymaking operations. The trusses are turned periodically and, when they are judged sufficiently dry, are stacked loosely for further field drying, before final transport and storage.

(PowerPoint Slide 47)

F. Excellent hay is produced in this way and the leaves are kept within the trusses. After wilting, the forage may be carried to the homestead and dried out of reach of livestock, often on the roof. Any fallen leaves will be swept up and saved. Shaftal is sometimes made into long, rope-like trusses, which are hung over the sunny sides of houses for initial drying and then finished on the roof. Hay storage is often under cover.

****PowerPoint Slide 48 shows a picture of Shaftal drying on a roof. Students in the class with hay baling experience may also be able to add to the discussion. A review of this objective using a question and answer session would benefit the students.**

Objective 8: Hay and Fodder Crops of Afghanistan

(PowerPoint Slides 49 and 50)

VIII. The most important fodder crops are lucerne (*Medicago sativa*), shaftal (*Trifolium resupinatum*) and, in the hotter areas of eastern Afghanistan, berseem (*Trifolium alexandrinum*).

(PowerPoint Slide 51)

All three fodder crops are mainly fed to large ruminants. Berseem is given fresh, and lucerne and shaftal both fresh and as hay. Lucerne is also sold to other farmers, both fresh and as hay. It is grown as a perennial, but length of utilization varies between areas, from 2 to 7-8 years.

(PowerPoint Slide 52)

Shaftal is planted as a second crop and mainly harvested in late spring. For Ghazni province, hay yields from four cuts of lucerne were reported as 7-9 t/ha and from shaftal as 2.5-3.5 t/ha. More details of each types explained below.

(PowerPoint Slide 53)

A. Lucerne (*Medicago sativa*) (*rishka*) is the most widespread and popular fodder and is cultivated from the lowest and hottest to the highest and coolest zones in all provinces of the country. Local ecotypes are used.

(PowerPoint Slide 54)

1. Nearly all the crop is irrigated, so one of the criteria when choosing between lucerne and clover as a fodder is always the availability of water throughout the entire growing season - much of the irrigation is seasonal.
2. The crop is often sown under wheat, and very high seed rates of up to 60 kg/ha are used. Seed quality is often mediocre; farm-grown seed or seed exchanged with neighbors is usual.

(PowerPoint Slide 55)

In areas of specialized cultivation, close to big towns where lucerne is sold as a cash crop, it may be direct sown or sown with a temporary nurse crop for shade, especially in the hot season; millet (*Panicum miliaceum*) is sometimes used as a summer nurse crop near Kandahar. Spring sowing is as successful as autumn, but, since most is sown with wheat, broadcast autumn sowing is general.

(PowerPoint Slide 56)

3. The crop is established with the intention of its lasting for many years - ten is often claimed - and local ecotypes certainly persist well, although their best performance is in the first five years. The number of cuts depends on the local climate; in low-altitude areas, six to eight cuts are possible where water is adequate; in the high areas, over 2 000 m, three cuts are usual.

(PowerPoint Slide 57)

B. Shaftal or Persian clover (*Trifolium resupinatum*) is the second of Afghanistan's major fodders. It is used in rotations and also in situations where perennial irrigation is not available for lucerne.

(PowerPoint Slide 58)

1. In warm zones with two-season cropping, e.g., Khost, it is preferred to lucerne since the shaftal is harvested in time for summer crops to be sown; it is sown September-October and harvest is over in May. In high altitude areas, where the clover is dormant under snow for months, harvest does not begin until May, and three cuts are taken up to August - the last cut may be harvested for seed.

(PowerPoint Slide 59)

In all areas, it is autumn-sown for spring and summer use. In the higher, cooler areas it may also be grown as a summer catch crop after winter cereals; in some places, shaftal is sown in standing wheat at the time of the last irrigation.

(PowerPoint Slide 60)

2. Two hay cuts and a seed cut are frequently taken from autumn-sown crops. A precocious cut of very young leaves may also be made for drying as a table vegetable. Shaftal is successfully made into hay.
3. Most of the shaftal sown in its traditional areas is from locally-grown seed that has had little or no quality control, and in some places farmers use very high seed rates.

(PowerPoint Slide 61)

- C. Egyptian clover or berseem (*Trifolium alexandrinum*) is a crop of recent introduction, via Pakistan.
1. It is grown in some of the lower areas, such as Khost and Ningarhar, where the winters are sufficiently mild; it only withstands light frost.

(PowerPoint Slide 62)

2. Cultivation methods are similar to those for shaftal, but it is usually sown directly in early September, possibly mixed with some mustard. If sown early, berseem, unlike shaftal, has rapid early growth and one or more cuts can be taken before growth stops temporarily due to cold weather. A further four or five cuts can be taken in spring.

(PowerPoint Slide 63)

3. It is, in suitable climates, more productive than shaftal and produces in autumn and early winter as well as during the spring peak.
4. It is not as popular as shaftal and is mainly used as green feed, and is not nearly as easy to make into hay as lucerne or shaftal. It is not suitable for use as a table vegetable.

(PowerPoint Slide 64)

- D. Other fodders, such as vetches (*Vicia* spp.), are widely grown, often as a summer catch crop, but their volume is nowhere near as important as that of lucerne and clover. Chickling vetch (*Lathyrus sativus*) is cultivated in the very high altitude areas as both a fodder and a pulse. No fodder grasses are cultivated, although maize thinnings are used in all areas where the crop is grown, and green wheat may be cut as fodder in times of scarcity.

****It may be beneficial to show students the seeds of as many of the forage grasses and legumes listed. You can also bring in the actual plant if it is available. Ask the student if they cut hay, and have them explain the variety their family uses. Ask them why they chose that particular variety.**

Review/Summary: Summarize the lesson by asking students to explain the content of each objective. Reinforce the key terms and concepts. Key points on PowerPoint Slide 65 and 66 can also be used to review.

Application: Students can apply the information learned in this lesson when dealing with hay in Afghanistan.

Evaluation: Student comprehension of these objectives can be measured with the attached test.

Answers to Sample Test:

Part One: Matching

1 = e, 2 = a, 3 = f, 4 = k, 5 = j, 6 = n, 7 = r, 8 = g, 9 = b, 10 = q, 11 = l, 12 = m, 13=p, 14 = c, 15 = h, 16 = o, 17 = d, 18 = i

Part Two: Completion

1. Graminae
2. fibrous
3. Hay making

Part Three: Short Answer

1. Use Objective 8 to evaluate these test questions, answers will vary.

Sample Test

Name _____

Test

Unit D Lesson 4: Growing Forage Crops

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|-------------|--------------|---------------|
| a. Range | g. Blade | m. Stolon |
| b. Hay | h. Heading | n. Forb |
| c. Forage | i. Tillering | o. Pasture |
| d. Silage | j. Annual | p. Haylage |
| e. Culm | k. Silo | q. Grass |
| f. Jointing | l. Rhizomes | r. Boot stage |

- _____ 1. The stem of a grass plant.
- _____ 2. Large open areas of land.
- _____ 3. The growth phase in grass plants in which the internodes begin to elongate.
- _____ 4. An upright facility that maintains the quality of silage.
- _____ 5. Grass plants that complete their life cycle in one growing season.
- _____ 6. Legumes used as forage plants; a flowering, broad-leaved plant that has a soft stem.
- _____ 7. The growth phase in grass plants following jointing at the end of stem elongation.
- _____ 8. The leaf of a grass plant.
- _____ 9. Green plant material that has been cut and dried for use as livestock feed.
- _____ 10. A plant that typically has leaves with parallel veins and stems that are hollow or solid.
- _____ 11. A below ground structure that sends up shoots to reproduce plants.
- _____ 12. An above ground creeping stem used to reproduce some grass plants.
- _____ 13. Silage that contains less than 50 percent moisture.
- _____ 14. Vegetation fed to livestock.
- _____ 15. The phase in which seed heads form on the grass plant.
- _____ 16. Improved or unimproved plant materials on land areas where animals graze.
- _____ 17. Chopped plant material that has fermented.
- _____ 18. In grass plants, the growth of shoots from buds that have been dormant.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. Grasses are members of the _____ family.
2. Grasses have _____ root systems.
3. _____ is cutting, curing, and storing hay crops for high quality, nutritious feed.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. List one of the three popular fodder crops in Afghanistan. Explain three reasons why it is used.

TM: D4-1

MAJOR PARTS OF A BERMUDAGRASS PLANT

