Introduction to Grassland Management

Student Reference

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In cooperation with
Agricultural Education Department of Practical Arts and Vocational-Technical Education
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MISSOURI AGRICULTURAL EDUCATION

Agricultural Education Section Division of Vocational and Adult Education
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Lesson 1: An Introduction to Grasslands

Grasslands cover much of the earth. On every continent, various types of grasslands spread over vast areas wherever environmental conditions favor these plant communities over forest and desert. Much of the best cropland, pasture, and range used for agricultural production was originally native grassland. As a natural resource, grasslands are priceless.

Grasslands play an important role in Missouri. Agriculture is Missouri's largest industry, and livestock accounts for more than half of Missouri's total agricultural production. Grasslands contribute more than half of the total amount of feed used by this industry. Besides forage for livestock, grasslands provide other benefits, including wildlife, recreation, and conservation of soil and water. The key to providing these benefits at the highest sustainable level is good management.

What is a Grassland?

Ecologically, a grassland is any plant community dominated by grasses, whether they exist naturally or because of management practices. In this sense, pastures, golf courses, and front lawns can all be considered grasslands.

Agriculturally, grasslands are areas managed to grow grass, legumes, or other pasture or range plants. Most agricultural grasslands are artificially established plant communities planted for forage production, though some are established for soil and water conservation and wildlife habitat. These uses usually can be combined successfully with proper planning.

What is a Forage?

Forages are plants, primarily grasses and legumes, grown as feed for livestock. In contrast to feed grains, the soft vegetative parts of forages—mainly the leaves and stems—become feed. Thousands of species of grasses and legumes exist worldwide, and most have value as forage. They are harvested by grazing and by mechanical mowing. While feed grain is not normally considered forage, the vegetative parts of grain plants are sometimes used as forages after harvest.

Natural Factors Affecting Grasslands

Climate, soil, plants, grazing animals, and fire all interact to determine what vegetation occupies a given area and how well it grows. Humans also have a huge impact on grasslands. By changing how these factors interact, grasslands can be improved or abused, created or destroyed. Understanding the natural system is necessary to manage grasslands for greater productivity.

Climate – Grasslands compete with other types of vegetation for growing space. They usually dominate in areas averaging 10 to 30 inches of rainfall annually. The local environment can have a great effect, however. For example, grasses may dominate in a forest region with rainfall exceeding 30 inches if other factors create a harsh environment for trees. Most of Missouri receives 35 inches or more, which is at the transition point between grassland and forest. Trees and shrubs will invade most Missouri grasslands if they are not managed properly.

Soil – Since Missouri is at a transition point between grassland and forest, soils play an important role in determining the type of vegetation found in a particular area. Some soils, such as those that do not hold moisture because they are shallow or coarsely textured or have hardpan (a dense layer of soil) close to the surface, may discourage tree growth even when enough rainfall exists. Soils with high water tables inhibiting the root systems of trees may also favor grasses.

Plants – Grasses may make up the bulk of the vegetation found in a grassland community, but a rich diversity of broadleaf plants may also be present. These plants can be nutritionally valuable for livestock. Relatively few are problem species that require control, and most of these species only become a problem in pastures that have been abused. A mixture of grasses and broadleaf plants is especially important to wildlife, which depend on them for a variety of foods and cover. Pure stands of legumes like alfalfa are sometimes planted on grasslands. They are usually used for hay or silage rationed to livestock along with other feed.

Many grassland plants have adapted to their environment by becoming dormant when conditions are harsh and producing new growth when conditions improve. Healthy plants can usually survive losing the current year's growth if allowed time to grow back. This process allows grassland species to survive damage from fire, grazing/browsing, drought, and high winds, all of which can kill or limit the growth of trees and shrubs.

Because most forage plants are perennials, the long-term health of the plants must always be a management priority. Excessive harvesting may yield more income one year, but overusing the plants year after year will cause the grassland to deteriorate and future productivity to decline.

Grazing – Grazing is natural to grassland communities. Before European settlement in Missouri, buffalo, deer, and elk grazed and then moved on as they depleted the forage, allowing plants to grow back. Unlike trees and shrubs, which can be severely damaged by grazing and browsing, grassland plants adapted to this cycle. The adaptation of grassland plants to grazing makes forages an important part of a productive farming operation. Grassland plants can produce an abundant crop for harvest while surviving to repeat the process. With good management, this harvest and renewal can go on indefinitely.

Fire – Grassland plants tolerate fire better than trees and shrubs and often depend on fire to maintain their dominance. With their most important parts insulated underground, they are better able to recover even if fire destroys living tissue. Grasslands are so well adapted to burning, they actually create dry conditions that favor fire at just the right time. Where fire occurs often enough to limit tree growth, grasslands usually dominate. If fire is excluded and not compensated for through practices like grazing, haying, disking, seeding, or prescribed burning, grasslands deteriorate in quality and productivity and begin to be replaced by forest.

Native Grasslands

Native grasslands are those that existed in America before the arrival of European settlers. For example the prairies of the Great Plains were originally one vast native grassland. These grasslands are sometimes called natural grasslands, but Native Americans are believed to have used fire extensively for thousands of years in ways that extended the natural range of grasslands. Therefore, human actions may have caused many of Missouri's original grasslands.

The trend toward conservation farming has led to new interest in native grasslands and their plants. Native plants and plant communities are well-adapted to Missouri's environments. When included in a farm plan and properly managed, native species can provide forage that is nutritious and palatable. The forage may be available for grazing when traditional pasture species are dormant. They can also provide better wildlife habitat and ground cover that is more effective in building soil and conserving water.

Missouri's native grasslands include several different plant communities. Most of them are prairies, glades, or savannas.

Prairies

Prairies are large, continuous native grasslands in which trees and shrubs are nearly absent. While grasses dominate, prairies support a rich diversity of grasses, legumes, and forbs. Before European settlement, more than 250 species of native grasses, legumes, forbs, and wild flowers thrived on prairies. Wildlife depended on these plants for survival. The prairies of the Great Plains reached well into Missouri and in some areas mingled extensively with forests, depending on local conditions. Prairies originally dominated nearly 27 percent of the state.

Different kinds of prairies develop on different sites. Drier sites support shorter grass species, such as little bluestem and sideoats grama. Most of these drier prairies have been converted to pasture, and much of it is improperly grazed. Wetter sites support taller species like big bluestem and indiangrass, which can reach 6 feet or more in height. Most moister prairies have been converted to cropland.

Overgrazing, invasion by woody plants, and conversion to cropland and other uses have made native prairies very rare. The result has been the loss and endangerment of many species of native plants and wildlife. However, native prairies are receiving new appreciation for their plant diversity and their production of summer forage when cool-season grasses are dormant.

Glades

Glades are relatively small, isolated native grasslands that form on hilltops and southwest-facing slopes where rocky outcrops, exposure to sunlight, and thin, dry soils create harsh, desert-like conditions during the summer. Dry conditions and fire keep them mostly clear of trees. Prairie grasses and forbs dominate, but plants and animals from western prairies and deserts like yuccas, cacti, tarantulas, and scorpions can be found.

Glades are rare environments found only in the central Midwest. They occur in prairie regions but are more obvious when found in forests. Different types of glades develop over different bedrock. Each of these communities is unique. The precise balance of environmental factors that create a glade also makes them fragile and easily disturbed by overgrazing, total exclusion of fire, and the introduction of nonnative plants.

Savanna

Savanna is a specialized community intermediate between grassland and forest with widely spaced trees, a noticeable absence of small trees and shrubs, and grasses as the main ground cover. Early settlers described parts of Missouri as park-like expanses of trees with grasses beneath them that were easily traveled on horseback. They were native savannas, once common along the edges of prairies and glades where grassland and forest met.

Savannas result from site conditions and a fire history that keeps many woody plants from reproducing while others manage to reach a size resistant to fire damage. They have become rare due to overgrazing, logging, replacement by true forest, and conversion to pasture, cropland, and other uses. If recognized and managed properly, savannas can provide wood and valuable wildlife habitat as well as forages for livestock.

Managed Grassland

Managed grassland is any area currently managed for forage, pasture, or grassland habitat. Most grassland in Missouri today can be considered managed, whether it consists of native grassland or an artificially established community. Even areas identified as "wild" grasslands must be intensively managed because human actions have altered the natural forces and cycles that created them.

More than 95 percent of grasslands in Missouri are privately owned. Most of them are used for forage; pasture is the most common type of grassland. Very little is managed as native grassland. However, because of improvements in management practices, native grasslands and pastures with native species can increase productivity.

Grassland Management and Conservation

Grassland management is the use and care of grasslands. As with any agricultural crop, grasslands must be cared for to keep them productive. Grassland management involves managing the plants, animals, equipment, and practices needed for the successful use of grasslands in an agricultural operation.

All grasslands are natural resources and require good conservation practices. Grassland conservation is the wise use of grasslands and other natural resources found on them to ensure long-term productivity and sustainability. Good management seeks to achieve the highest productivity while maintaining the system that provides it. Pushing that system beyond sustainable limits will cause the system to break down. Plants and soil will not suddenly disappear, but grasslands overgrazed or otherwise abused will decline in productivity over time. Properly managed grasslands maintain their productivity and even increase it by helping to build healthy plant communities. In addition, well-managed grasslands conserve soil, water, and wildlife.

Research and development into improved practices is a continuing effort, and grassland managers need to remain informed about new techniques that can improve their operations. Special grazing systems for livestock have been developed that protect grassland while improving production. Research is also showing how native species can increase production while protecting natural resources.

Introduction to Grassland Management

Summary

In agriculture, a grassland is an area managed to grow grass, legumes, or other pasture or range plants for forage production. Forages are primarily grasses and legumes used as feed for livestock. Several basic environmental factors—climate, soil, plants, grazing, and fire—influence the growth of grasslands. Native grasslands, including prairies, glades, and savannas, once covered much of the state, but most have been converted to other uses. Most of Missouri's grasslands now consist of pastures of nonnative plants, although native grasslands and native plants are showing new promise in livestock operations. The key to success in grassland farming is proper management, which focuses on sustaining the productivity of forage plants.

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Lesson 2: Plant Classification

Grasslands are useful due in part to the wide variety of plants that are found in them. The main feature of grassland agriculture is its dependence on grassland plants. By understanding the different plant types, increasing the benefits to livestock and wildlife from the grassland is possible. A thorough knowledge of the various types and life cycles of these plants is important to grassland management.

Grassland Plant Classification

A grassland may include a great variety of different plant species. All grassland plants can be classified according to two different criteria—life cycle and plant type.

Classification by life cycle divides plants based on their yearly growth and seeding characteristics. Each plant grows in stages which, from beginning to end, comprise its life cycle. A plant's life cycle is closely related to its productivity and is therefore extremely important. Plants can be divided by their life cycles into three categories: annuals, biennials, and perennials.

Annual plants complete their life cycle within one year or growing season. They die after producing seed and will not grow again the next year unless self-seeded or planted again. Corn, cheat, and crabgrass are examples of annual plants.

Biennial plants require two years to complete their life cycle. Generally, the plant produces mainly vegetative growth, including leaves, stems, and roots, in the first year after germination. The plant produces flowers, fruits, and seeds the second year. At the end of the second year, the plant dies. Red clover is an example of a biennial plant.

Perennial plants grow year after year. Perennials produce flowers, fruit, and seeds each year. After they produce seeds, they go into a resting period called dormancy. This process is more noticeable in regions that have cold winter seasons, where perennials may stop growing completely for the winter. During the period of dormancy, the perennial slows down all its natural processes to protect itself from colder temperatures. When spring comes, its pattern of growth begins again. Many forages and pasture crops are perennials. Trees and shrubs are also perennials.

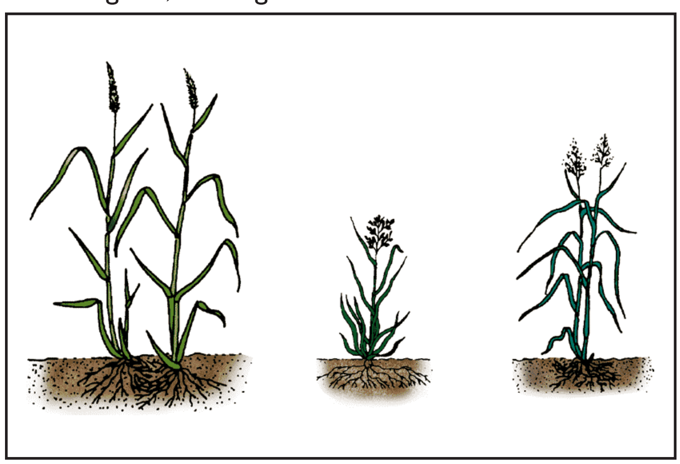
In classification by plant type, plants are categorized according to the physical characteristics of the plant. Each species within a plant type has characteristics that are similar to all other species of the same plant type. Four different plant types are found in grasslands—grasses, legumes, forbs, and woody plants.

Grasses of the Grassland

Grasses are one of the four dominant plant types found in a grassland. They serve many purposes, such as food for livestock and wildlife (orchardgrass, fescue, and alfalfa), food for humans (cereals and grain sorghum), and erosion prevention.

The grasses of the Great Plains are herbaceous, or without woody stems. The stems, or culms, of grasses are usually hollow and therefore resist compaction. Leaves or blades connect directly to the culm at a sheath, which surrounds the stem. All leaf blades have a distinctive parallel venation in which the veins run side by side along the length of the blade of grass. These visual characteristics make it possible to separate the grasses from all other plant species. Notice the characteristics of the grasses pictured in Figure 2.1.

Figure 2.1 – Characteristic Grasses: Indiangrass, Orchardgrass, Switchgrass



Introduction to Grassland Management

The two major groups of grasses are cool-season and warm-season grasses. Cool-season grasses tend to grow best during the spring and fall. These plants begin their growing season when the soil temperature reaches 40° F, but optimum growth occurs when air temperatures fall in the 59° to 77° F range. They may remain green all winter, but during the summer months they tend to become brown and dormant. They may be annuals or perennials. Examples of cool-season grasses include Kentucky bluegrass, orchardgrass, and smooth bromegrass.

Warm-season grasses are just the opposite, in that they grow best during periods of warm temperatures. These grasses are much more tolerant of heat and drought than cool-season grasses. Their growing season begins when soil temperature reaches 60° F, and they grow best during the summer when temperatures are in the 77° to 104° F range. They are dormant in the winter and do not begin to turn green until early summer. They also may be annuals or perennials, Some examples of warm-season grasses are indiangrass, big bluestem, and switchgrass.

Missouri has the right climate and amount of annual rainfall for both cool-season and warm-season grasses. Figure 2.2 shows how the growth periods of these two grass types complement each other and extend the length of green pasture production in Missouri.

Legumes

Legumes and grasses together make up the dominant plant types found in grasslands. Both are used as forage crops and therefore are beneficial to agricultural production. Figure 2.3 shows characteristic legumes. Examples of legumes include soybeans, alfalfa, clovers, and birdsfoot trefoil.

Legumes have several identifying characteristics. One characteristic of legumes is the fruit or pod that they produce. This pod has one chamber, with seeds lined in a single row. The seed number and size varies for different plants. All legumes have leaves that are alternate in arrangement on the stem and are connected to the stem

Figure 2.2 – Cool- and Warm-Season Grass Growth

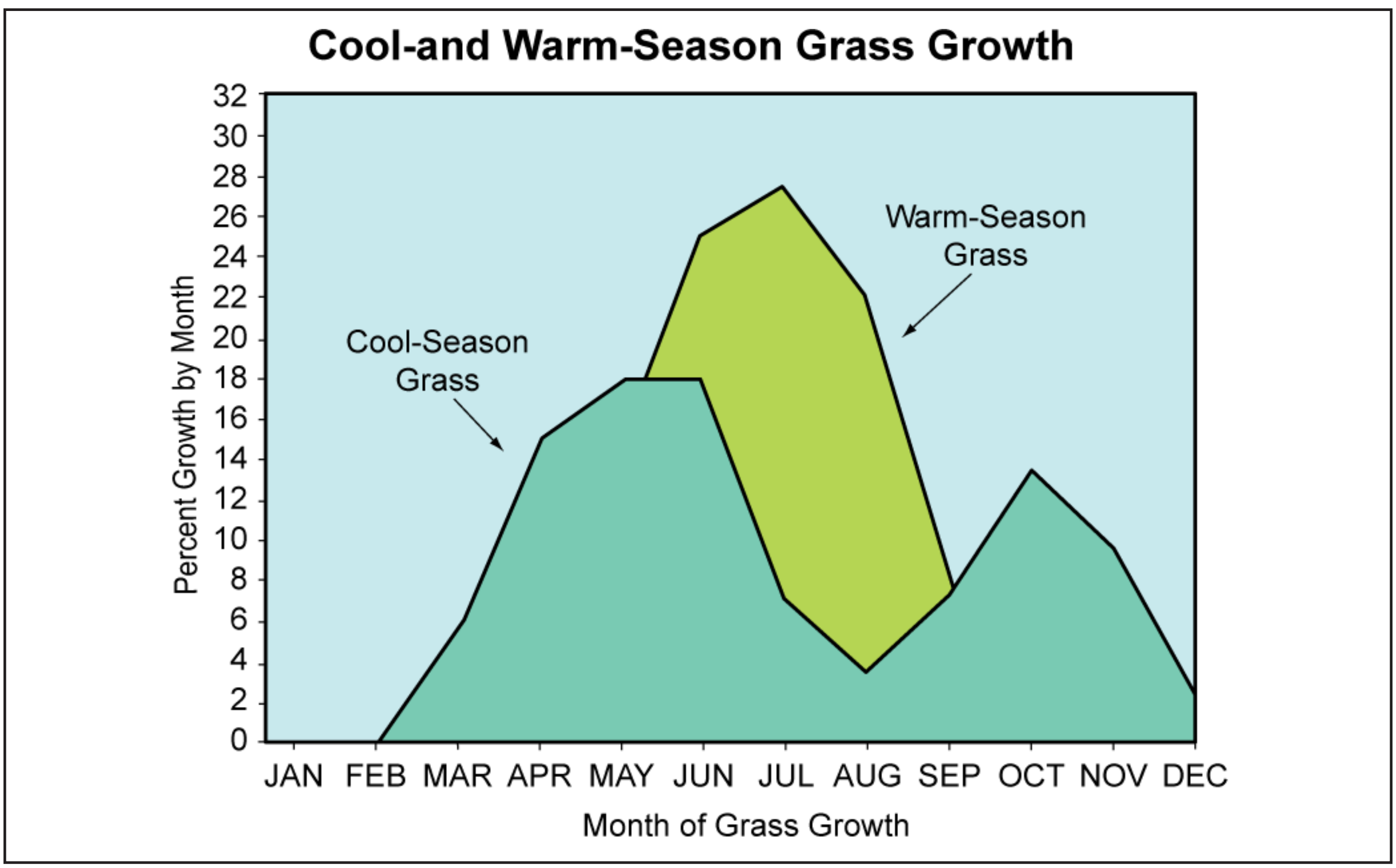
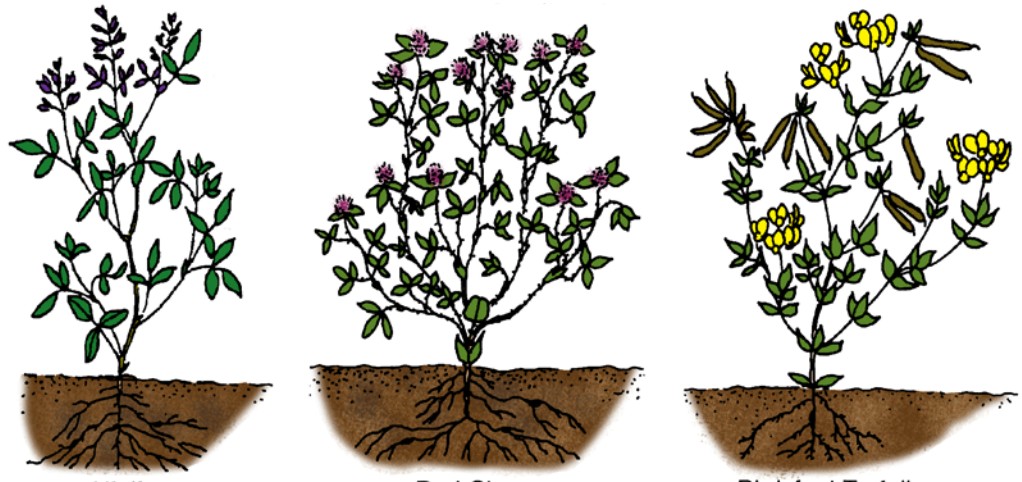


Figure 2.3 – Characteristic Legumes



by a stalk called a petiole. Unlike the grasses, venation in a legume consists of a network of veins rather than veins that run parallel to each other. Legumes may be annuals, perennials, or biennials.

Most legumes have the unique ability to take nitrogen from the air between soil particles and change it into a form of nitrogen that plants can use. This process is known as nitrogen fixation and is carried out by symbiotic bacteria found in nodules on the roots. This nitrogen helps decrease fertilizer needs, reduce costs, increase yields, and enrich the soil.

Forbs

Herbaceous (or not woody) plants that are neither grasses or legumes are called forbs. Most forbs are broad-leafed, making it possible to distinguish them from grasses or grasslike plants. Forbs are not usually cultivated for agricultural production, but they commonly appear in both pastures and native plant habitats. Many forbs have value as wildlife food and cover or for prevention of soil erosion. Others are considered to be noxious weeds. Forbs may be annuals, perennials, or biennials. Some examples of forbs are sunflowers, thistle, and ragweed, which are pictured in Figure 2.4.

Figure 2.4 – Characteristic Forbs

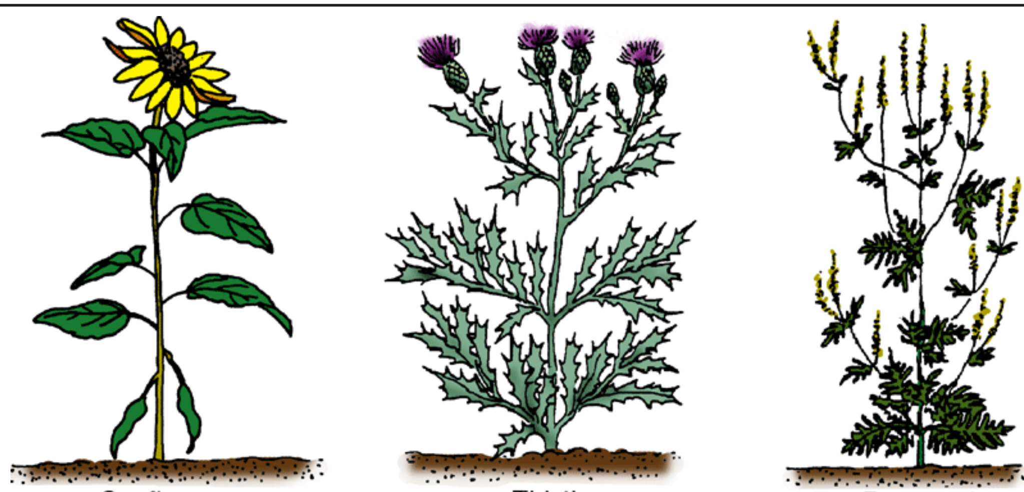


Figure 2.5 – Characteristic Woody Plants

Woody Plants

Woody plants are probably the easiest plants to identify in the grassland because of their tough, woody (nonherbaceous) stems. They are either shrubs, vines, or trees. Woody trees found in grasslands are almost always immature due to the nature and use of the grassland. They are kept small by animals that graze on terminal branches, by fires that stunt growth, by mechanical cutting, or by chemical treatments carried out to maintain the grassland. Woody plants are perennials. Examples of woody plants found in grasslands include wild rose, redcedar, and elm, shown in Figure 2.5.

Summary

Understanding plant types and life cycles will help in managing a grassland for many purposes. Grassland plants may be annuals, biennials, or perennials; they may also be grasses, legumes, forbs, or woody plants. They are important for the whole grassland habitat and its many uses.

Credits

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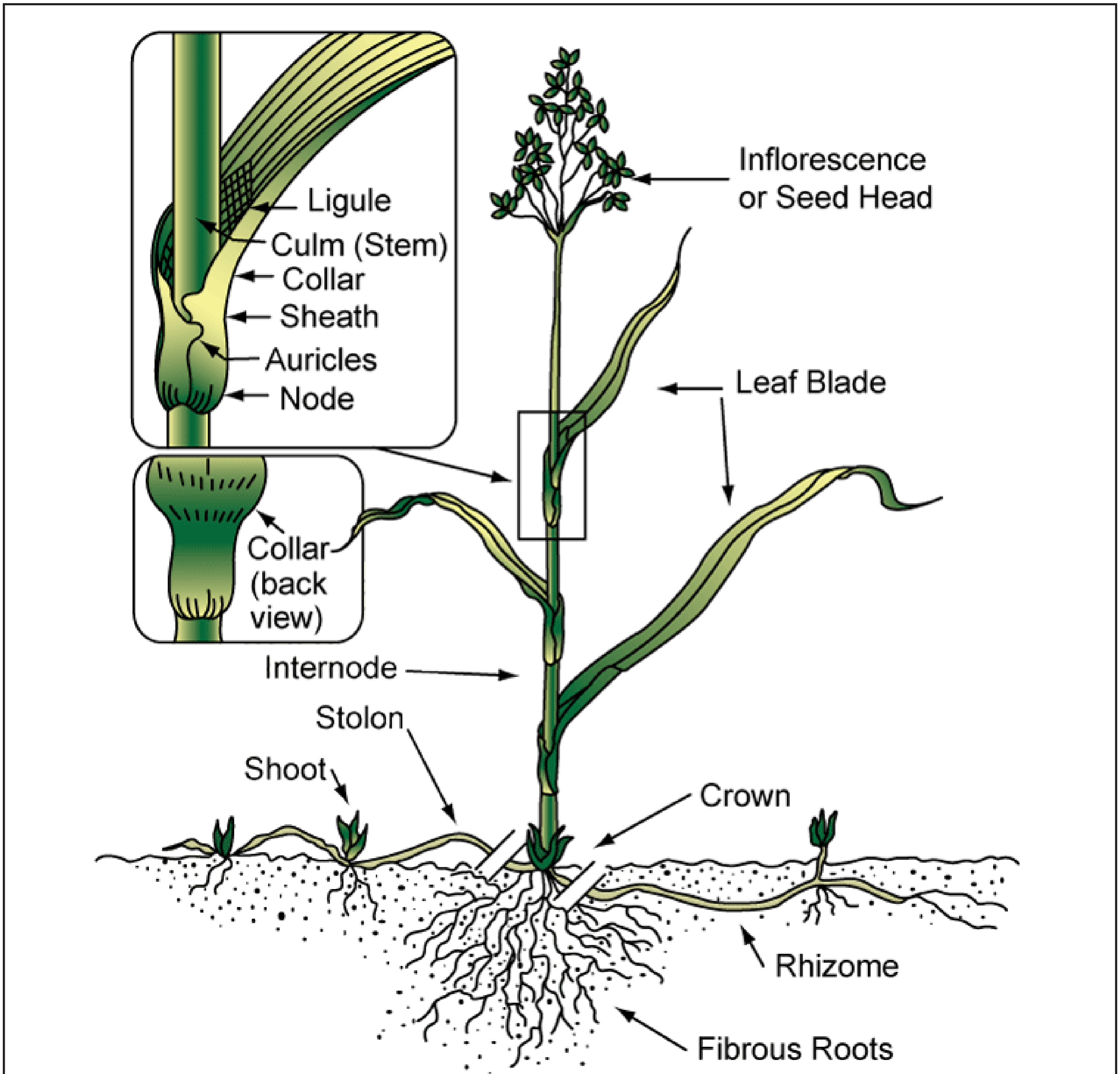
Lesson 3: Botanical Characteristics

The last lesson showed how plants can be similar, but the focus in this lesson is on the characteristics that can be used to distinguish between different plants. These characteristics will help in the identification of all grassland plants. Managing a grassland is easier if the plants growing in the area are identified.

Structural Parts of a Grass

The parts of a grass plant include the roots, culm, node (solid portion of the culm), internode, leaf sheath, leaf blade, collar, auricle, ligule, and inflorescence. See Figure 3.1.

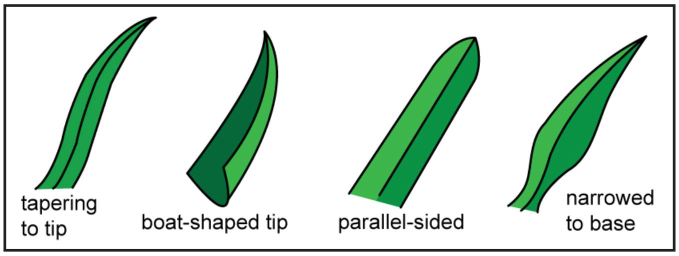
Figure 3.1 – Parts of a Grass Plant



Identifying Characteristics of Grasses

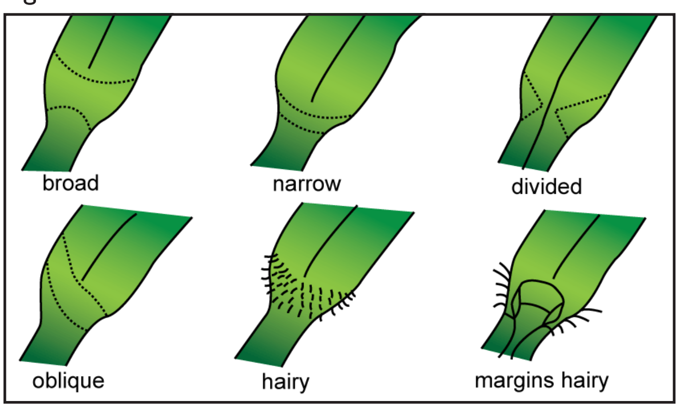
Leaf blade shape – The leaf offers several identifying characteristics. The width, length, and hairiness of the blade differ in each species; they also vary with the environment. The leaf blade and tip shape is a more distinctive identifying characteristic. The blade may be tapering to the tip, boat-shaped, parallel-sided, or narrowed to the base. See Figure 3.2 for examples of these shapes.

Figure 3.2 – Leaf Blade Shapes



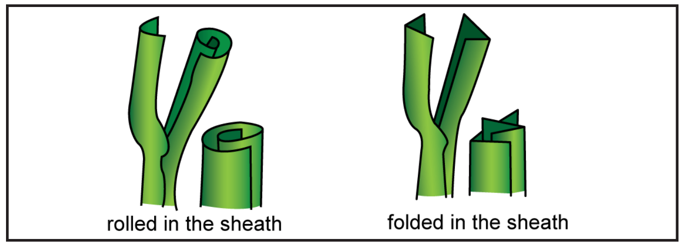
Collar – The collar on a grass blade is the external narrow band found where the blade and the sheath join. It can have different shapes (broad, narrow, divided, oblique) and different colors. The collar may also be found with hair or with a hairy margin. Figure 3.3 shows different collars.

Figure 3.3 – Collars



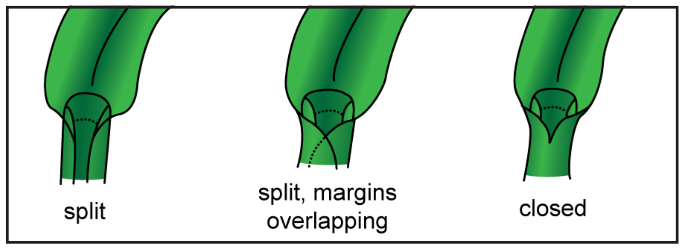
Leaf blade arrangement – Leaves may be arranged in the sheath in two ways—folded or rolled. To determine which arrangement exists, look at the way a new leaf naturally emerges from the sheath or find the last fully emerged leaf and cut the sheath just below the collar. See Figure 3.4 for leaf blade arrangements.

Figure 3.4 – Leaf Blade Arrangements



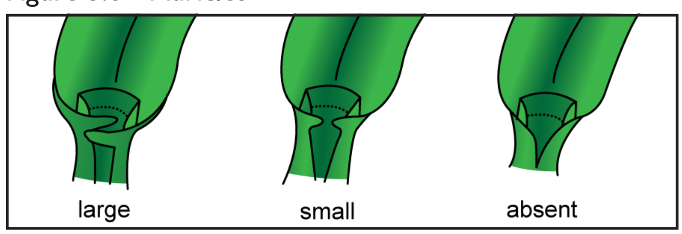
Sheath – The sheath is the part that encircles the stem and the bud shoot. In a cross section, the sheath will usually be round (or nearly round) if the bud shoot is rolled and flat if the bud shoot is folded. The sheath may be split, closed, or split with overlapping margins, as shown in Figure 3.5.

Figure 3.5 – Sheaths



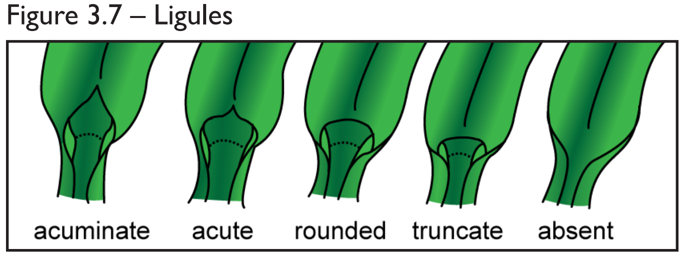
Auricles – The auricles are flaplike appendages that clasp the stem at the top of the sheath. They may be large, small, or absent entirely. See Figure 3.6 for examples.

Figure 3.6 – Auricles



Ligule – The ligule is the upright projection of tissue at the internal junction of the blade and the sheath. The shape, texture, and length are usually the same within each species. The shape of the ligule may be acuminate, acute, rounded, truncate, or absent, as illustrated in Figure 3.7.

Figure 3.7 – Ligules



Roots and Modified Stems

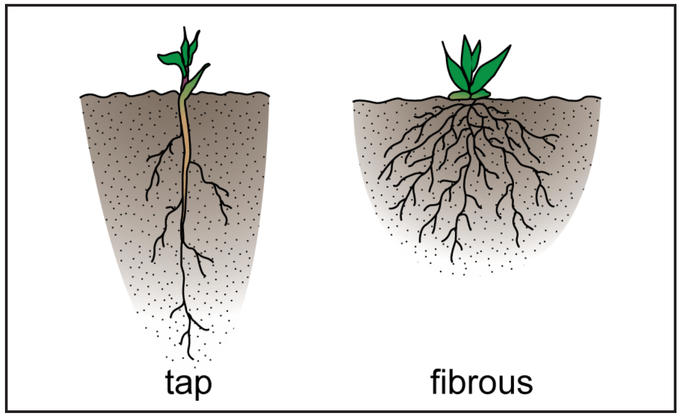
Root systems found in grassland plants differ. The two basic root structures that can be found in grassland plants are tap and fibrous roots. An annual usually has a weak fibrous root system that pulls out of the ground easily without tearing the top from the roots. Figure 3.8 shows the different root structures.

Rhizomes and stolons are modified stems. Rhizomes branch off from the main plant underground. Stolons are stems that grow horizontally along the ground's surface. They both root and send up shoots at nodes along the stem. The two types of modified stems are illustrated in Figure 3.9.

Inflorescence of Grassland Plants

The inflorescence, or arrangement of flowers, of a grassland plant can help in its identification. Grassland plants have six basic arrangements of flowers—spike, raceme, panicle, terminal, axillary, and umbel. On specific plants, slight variations of the inflorescence from the basic structure may appear. See Figure 3.10 for drawings of each type of inflorescence.

Figure 3.8 – Root Structures



Leaf Structure and Arrangement

<u>Leaf parts</u> – The basic parts of a leaf on legumes, forbs, and woody plants are the petiole, stipules, base, and blade. See Figure 3.11. The petiole is the stalk that connects the leaf to the stem. Stipules are small leaf-like structures sometimes found at the base of the petiole. They usually occur in pairs. The base is the bottom area of the leaf where the petiole connects to the blade. The blade is the flat, large part of the leaf, containing leaf tissue, a midrib (the large central vein from which all other veins branch), and veins. Photosynthesis and respiration occur in the leaves.

Figure 3.9 – Modified Stems

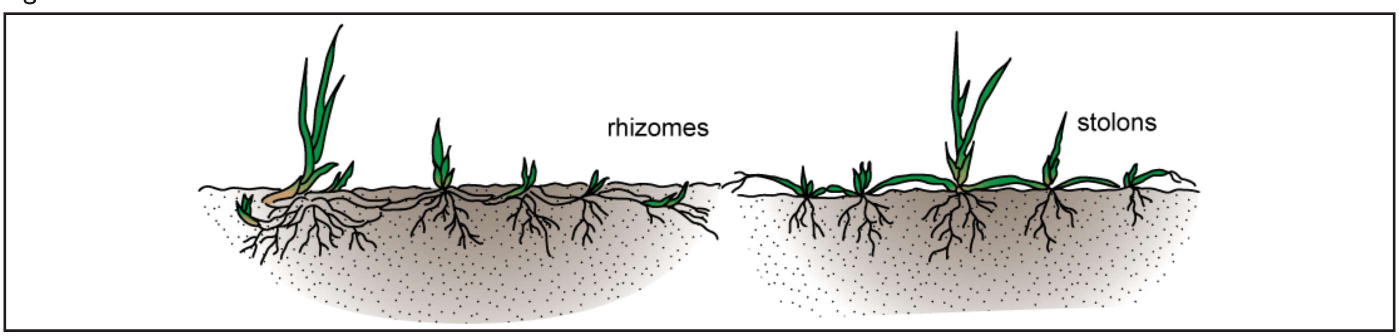


Figure 3.10 – Inflorescence

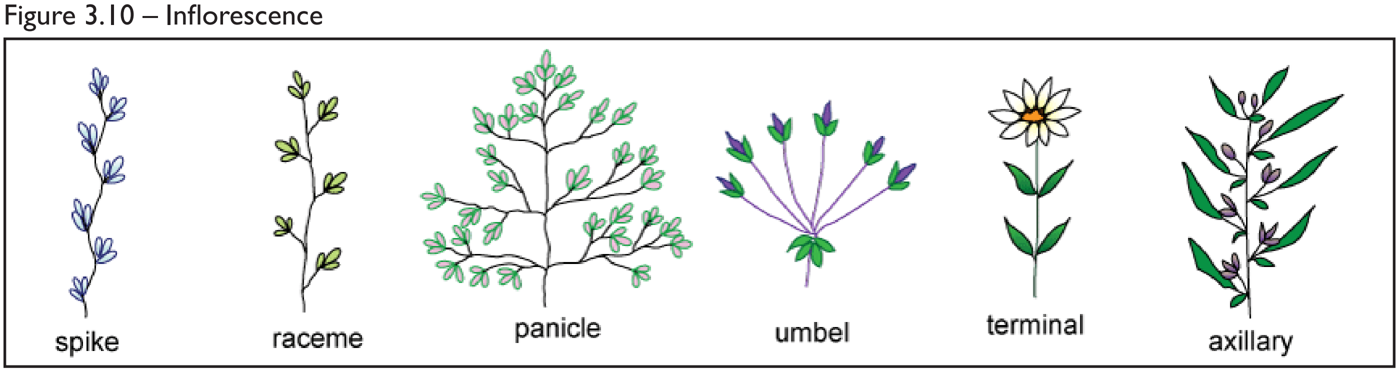
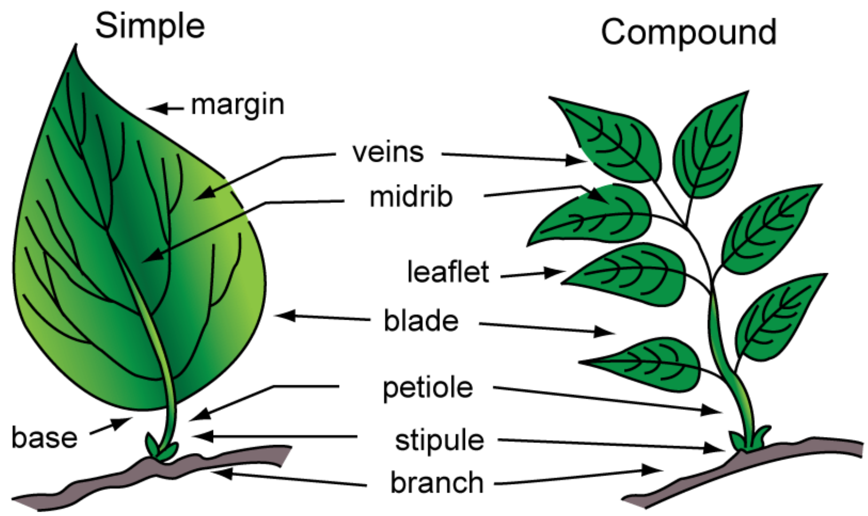


Figure 3.11 – Leaf Parts



The blade surface texture may be described in one of three ways:

◊ Glabrous – Smooth and shiny
◊ Pubescent – Covered with hair
◊ Glaucous – Covered with fine, waxy, whitish bloom

Leaf and bud arrangement – Leaves and buds can be attached to the stem in different arrangements. They may be alternate, opposite, whorled, or basal. In the alternate arrangement, the leaf or bud is located singly at different heights alternating from side to side along the length of the stem. In contrast, the leaves are located directly opposite each other in pairs along the stem in the opposite arrangement. The whorled arrangement consists of three or more leaves or buds arranged in a circle at one point on the stem. Finally, the leaves are located at the base of the stem in a plant with a basal arrangement. See Figure 3.12.

Venation – Leaf venation, or the arrangement of veins in a leaf, is another identifying feature of legumes, forbs, and woody plants. Plants may have two types of venation—parallel (as found on grasses) and netted. Netted venation can be either palmate or pinnate in structure. In palmate venation, all of the main veins fan out from the same point

Figure 3.12 – Leaf and Bud Arrangements

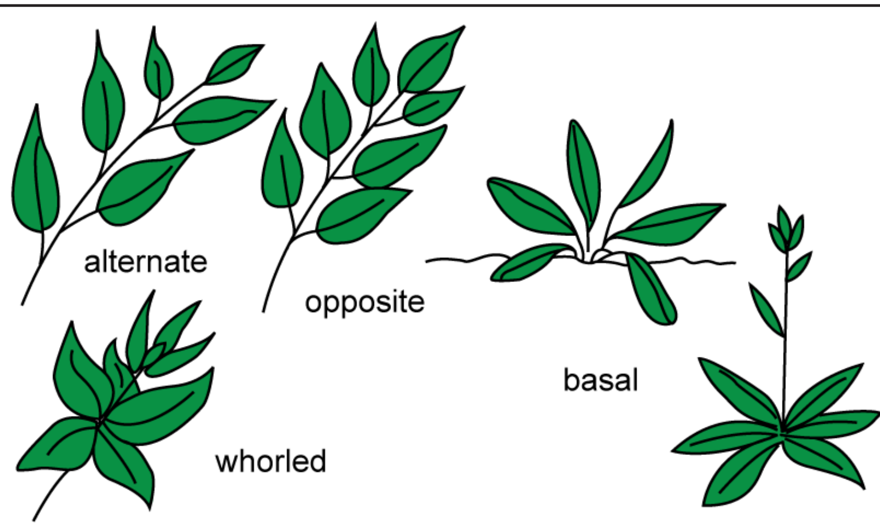
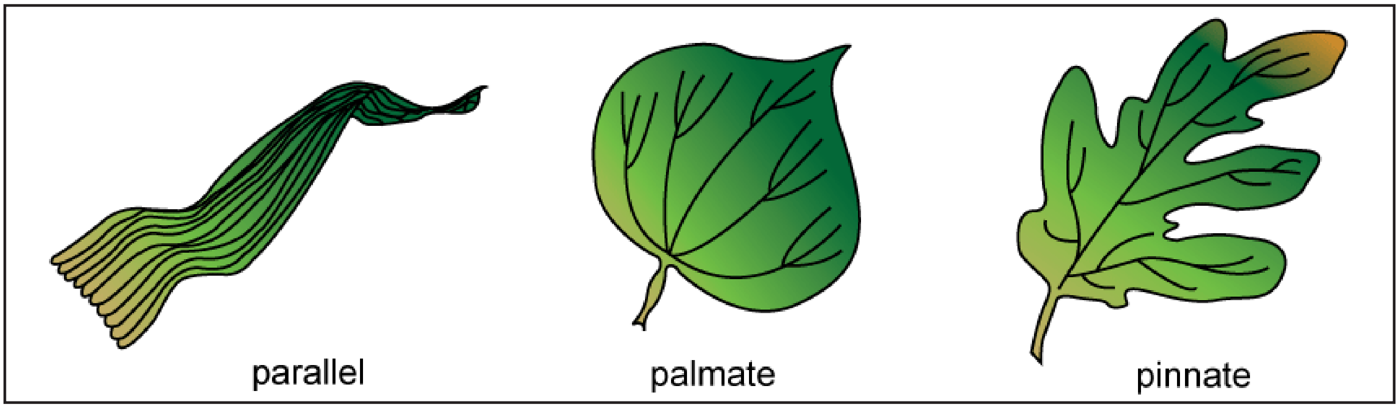


Figure 3.13 – Leaf Venation



at the base of the blade. Leaves with pinnate venation have a midrib running the length of the blade and smaller veins branching out from it. See Figure 3.13.

Leaf type – Figure 3.14 diagrams different types of leaves. Leaf structure may be characterized as one of the following:

◊ Simple – One blade rises from the petiole. It may have lobes.
◊ Compound – More than one small leaf, or leaflet, rises from the same petiole.
  - Palmate: All the leaflets attached to the same point at the tip of the petiole.
  - Pinnate: Pinnately compound leaves have a long stem, or rachis, to which the smaller leaflets are attached on both sides.
  - Bipinnate: Bipinnately compound leaves are divided twice, with the primary leaflet being divided into secondary leaflets.
  - Trifoliate: Trifoliate leaves have three leaflets. They can be palmate or pinnate.

Leaf anatomy – Leaf shapes, margins, bases, and tips can all be used in identifying plants. Leaf shape is the overall silhouette of the leaf. A leaf may be long and thin, fat at one end and thin on the other, or round or oval. Some of the more common shapes are shown in Figure 3.15.

Figure 3.14 – Leaf Types

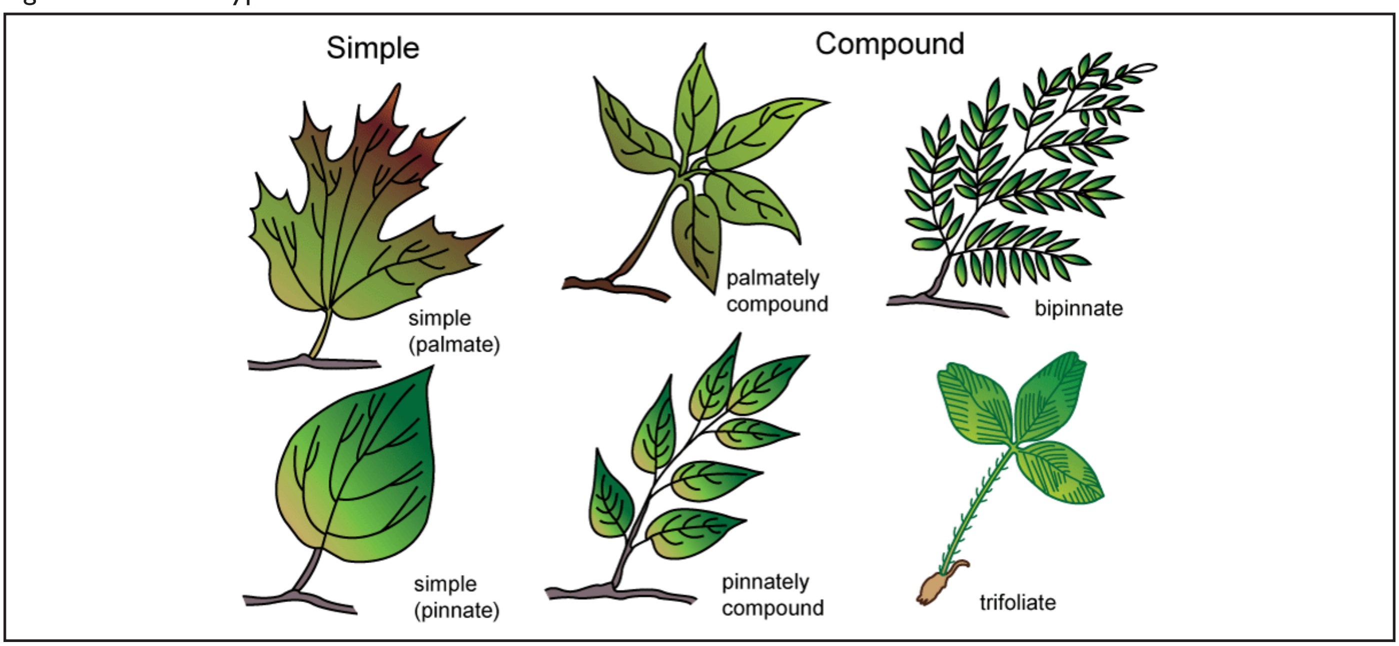
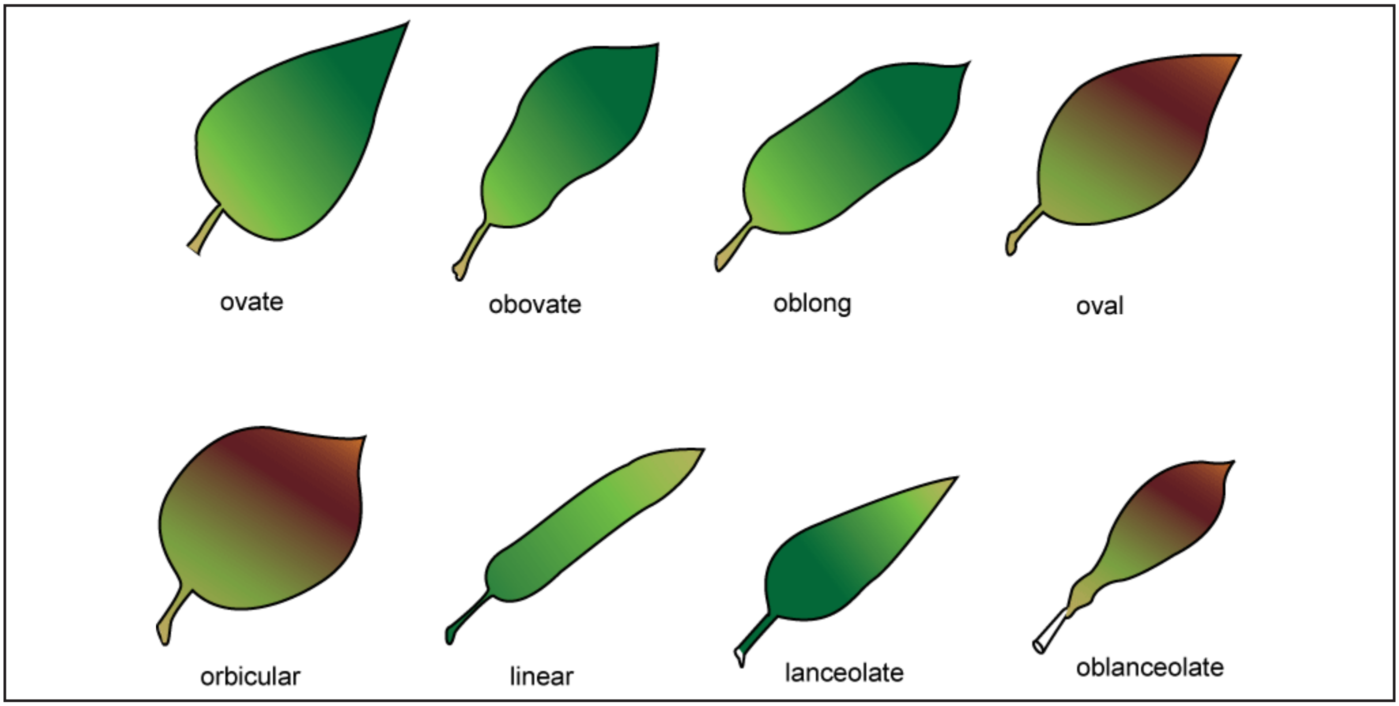


Figure 3.15 – Leaf Shapes



Leaves have differently shaped margins. The margin is the outside edge of the leaf blade. Some of the more common leaf margins are shown in Figure 3.16.

The base of a leaf has a distinctive shape where the blade intersects with the petiole. The tip, or apex, of a leaf also varies in shape. Some of the more common base shapes are shown in Figure 3.17. Figure 3.18 illustrates some of the more common leaf tip shapes.

Stem Shape

Stem shape may also be used in the identification process. When examined in cross section, stems may be square,

Figure 3.16 – Common Leaf Margins

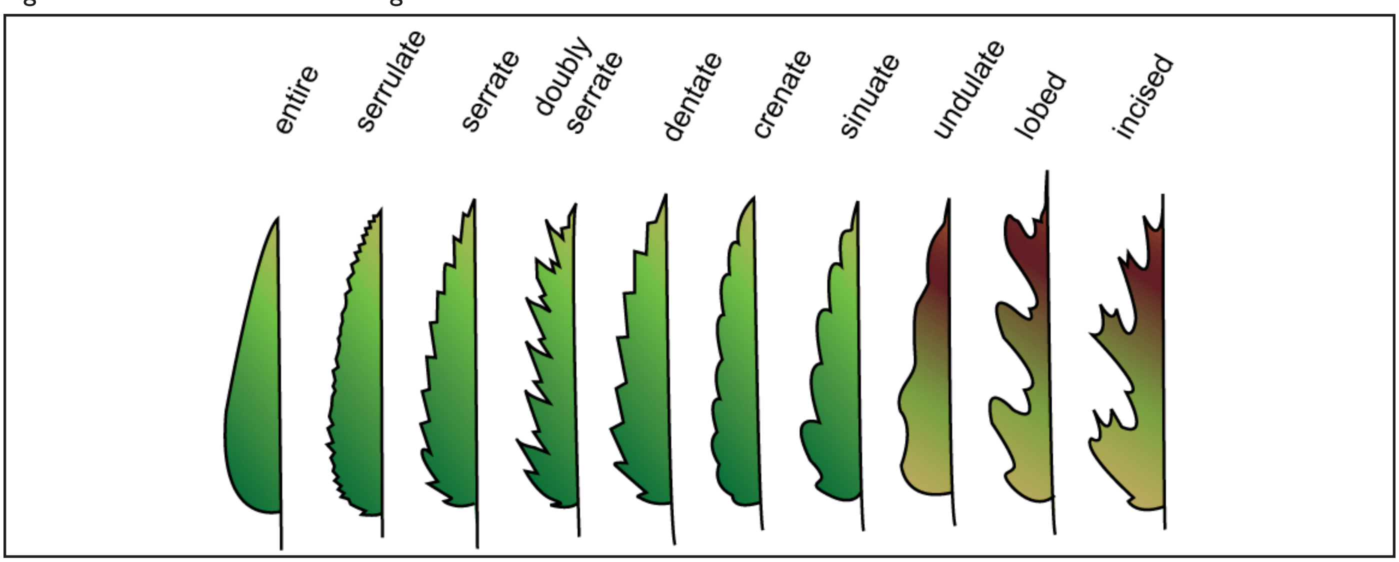


Figure 3.17 – Common Base Shapes

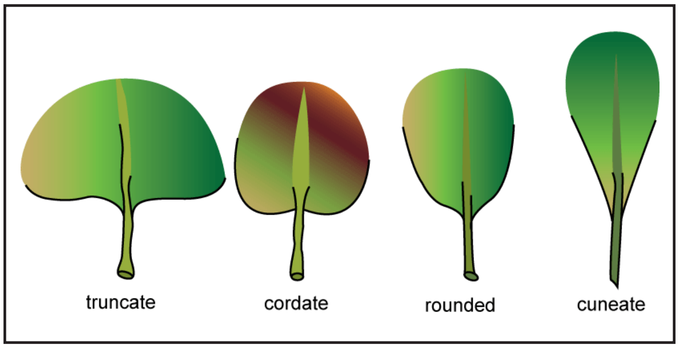
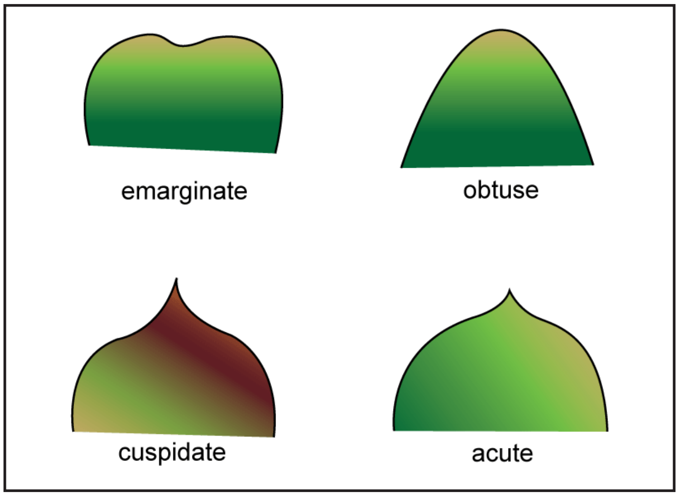


Figure 3.18 – Common Tip Shapes

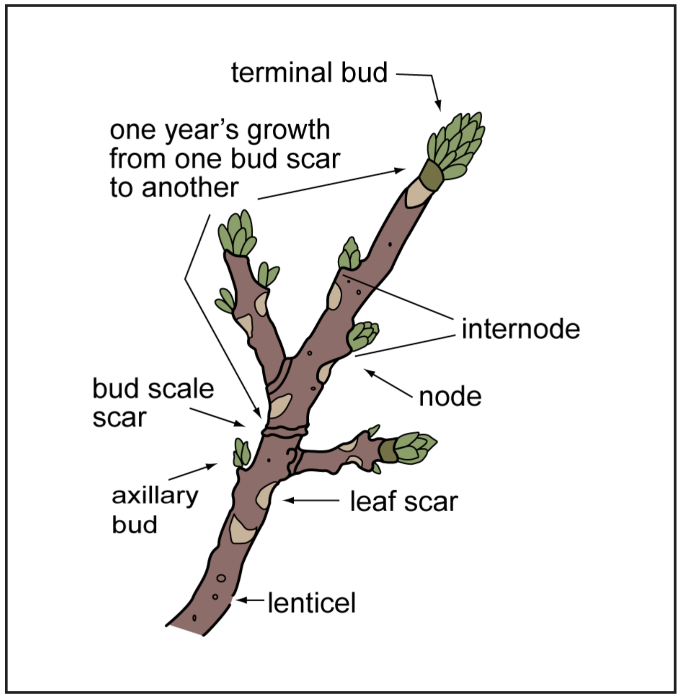


round, oval, or triangular in shape. For example, sedges have triangular stems, while mints have square stems. Stem shape can be used to differentiate between two species that are similar to each other, such as Canada bluegrass, which has a flat stem, and Kentucky bluegrass, which has a round stem.

Stem Structure of Woody Plants

Woody plants can be identified by the external structure of the stems. A typical stem has a terminal bud and axillary, or lateral, buds. The terminal bud is the point where the new season's growth starts; it is usually larger than a lateral bud and is found at the stem tip. Terminal buds may be flowering buds, which can be distinguished by their large, round appearance, or vegetative buds, which are thin and narrow and give rise to new leaves or stems. Axillary buds are found on the side of the stem and may

Figure 3.19 – Stem Structure of Woody Plants



be flowering or vegetative. All buds grow out of nodes, which are joints from which leaves or branches grow. The distance between adjacent nodes is the internode. A terminal bud scar is found where the previous year's terminal bud was located. The distance between two terminal bud scars shows one year's growth. Lenticels are breathing pores found scattered on the stem. A leaf scar is found where a leaf was attached to the stem. See Figure 3.19 for an illustration of the different parts of a woody plant stem.

Summary

The basic characteristics by which grassland plants can be identified are presented in this lesson. Grasses generally need to be identified in their vegetative state because they do not flower until late in the season. The structural parts of grasses are used to identify the vegetative plant. Each forb, legume, and woody plant has its own stem structure, bud shape and size, leaf structure, and leaf arrangement that makes it unique. All of the variations in plant parts between different species do not necessarily need to be memorized, however. In working with grassland plants, an individual gradually learns which plant has which characteristics.

Credits

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Lesson 4: Grassland Composition

Grassland composition and forage quality are two ways in which an area can be evaluated for production. In combination with soil and land evaluation (covered in Unit II), they form the evaluation process used in grassland management.

Importance of Grassland Composition

Grassland composition refers to the quality and variety of plants that grow in the grassland. Determining grassland composition is important because understanding the current condition of the grassland helps a producer estimate its potential for livestock production and wildlife management. The quality of the plants that make up a pasture affects the quality of the livestock produced and the wildlife found in the area. Many economic benefits may be gained from maintaining high quality pastures, while nonmonetary benefits may result from providing a good habitat for wildlife.

Knowing the plant composition of the grassland also has other benefits. Examining grassland composition allows the grassland manager to determine the length of the grazing season based on the seasonal growth of the plants. The grassland manager can also use his or her knowledge of grassland composition to adjust the plant composition of pastures to reach the optimum economic yield from production and achieve the most successful wildlife management. This adjustment involves modifying the current composition to match the ideal composition. Improving the composition to improve the quality of the plants and lengthen the grazing season can improve the use of the land.

Components of Grassland Composition

Determining grassland composition can be done by making a visual appraisal of a given area of land. Overall, the more leafy the stand, the higher the quality.

A more specific method of making an appraisal of grassland composition is to use a stick to find the percentages of different plants in the grassland. The person doing the evaluation takes 10 steps in a random direction at a representative spot in the grassland. The stick is then placed on the ground on end. Whatever plant the tip lands on should be recorded, and the total number of each of the plants the stick touches should be tallied in a systematic way. At least 10 to 20 determinations should be made. The percentage of each plant in the grassland can then be calculated.

The dominant plants in grasslands are usually grasses and legumes. These plants are the main forage crops. They may be grown in single stands or in mixtures in which two or more forage crops dominate the grassland. Stands composed of only one plant species are of less value to livestock and wildlife. Cool-season and warm-season grasses are not often mixed in the same stand because this combination is difficult to maintain.

Grassland plants not beneficial to livestock production goals are considered to be weeds. Weeds may be any type of plant that is not desired for production. It is important to remember, however, that wildlife may have uses for the plants many people think of as weeds; some of these plants may also have nutritive value for livestock.

Grassland Viability

The needs of livestock and wildlife in the grassland are very similar. They share the same basic needs for food, shelter, and water, although the specific kinds of food and shelter required by livestock may differ from that required by wildlife.

<u>Quality food</u> – A grassland must provide quality food to sustain a population of animals. Nearly all the different parts of plants are eaten by one animal species or another. Livestock need a quality stand of forages, including warm-season grasses, cool-season grasses, and legumes, to sustain the herd. Wildlife usually require a greater mixture of plants, since different animals may feed on leaves, stems, twigs, bark, roots, fruits, seeds, insects, or small mammals supported by these plants

<u>Shelter</u> – In grasslands, shelter provides protection from harm. Livestock use shelter to reduce the effects of sun, heat, wind, and cold. In addition, wildlife need shelter for nesting and protection from predators. The terrain of the

land and large plants like trees provide shelter. Wildlife also find safety in brush piles and nearby woods and among tall grasses.

Water – Clean, uncontaminated water is necessary for sustaining all animals in the grassland. Water quality in ponds, streams, and groundwater is influenced by the surrounding vegetation. Proper grassland management helps maintain quality water in these sources by preventing erosion, limiting runoff, and filtering nutrients and wastes.

Livestock require a source of surface water. The best source is from a freeze-proof water tank located below a pond or at a water hydrant. Some species of wildlife, such as deer, can drink from streams or ponds, while others, like quail and rabbits, obtain most of their moisture from berries, plants, or even dew.

Forage Quality

Forage quality refers to the nutritive value of the forage needed to produce a desired level of animal performance. The type of performance will depend on the use of the animal. It could be milk production (lactation) for dairy cattle, gain for beef cattle, or work for horses.

A detailed chemical analysis can be run on a forage to measure its quality. This test measures several items.

- ◊ Moisture – Testing can reveal the amount of water present in the forage.
- ◊ Crude protein (CP) – Crude protein includes both true protein and non-protein nitrogen. The percentage of crude protein indicates the ability of the forage to meet an animal's requirements for protein.
- ◊ Acid detergent fiber (ADF) – Acid detergent fiber indicates the percentage of plant material that is indigestible. A low ADF is preferred, because as it increases, the forage becomes less digestible and contains less energy.
- ◊ Neutral detergent fiber (NDF) – Neutral detergent fiber refers to the percentage of structural or cell wall material in the forage. A low NDF is preferable, since it correlates to increased food intake.
- ◊ Total digestible nutrients (TDN) – Total digestible nutrients represent the percentage of digestible material in the forage. The higher the ADF is, the lower the TDN will be.
- ◊ Net energy for lactation (NE_l) – This measurement indicates the energy available in a forage to meet the requirements of lactating cows.
- ◊ Net energy for maintenance (NE_m) – Net energy for maintenance indicates the energy available in a forage to meet the requirements for maintenance in meat-producing livestock.
- ◊ Net energy for gain (NE_g) – This measurement indicates the amount of energy available in a forage to produce growth or gain.

These levels will vary according to a number of factors that affect forage quality. The plant's stage of growth is the most important factor. Plants that are young are of higher quality than older, more mature plants. As plants mature, they produce more stem than leaves. The nutritive value of the forage crop decreases with increased maturity because the plants have more indigestible material due to their higher fiber content.

Another important factor is the type of forage. Plant species differ in their digestibility and energy content. For example, legumes tend to be higher in digestibility than grasses.

A third factor affecting quality is the growing conditions for the forage. The surrounding environment plays a role in determining the value of the plants for forage. The temperature, amount of sunlight, and amount of rainfall all have an effect.

The presence of noxious weeds also has an effect on forage quality. Weeds affect intake by livestock because they are less palatable. They are also less nutritious than desired forages.

Summary

The evaluation of grassland composition allows a producer to estimate the potential for livestock production and wildlife management, determine the length of the grazing season, and modify the plant composition. Determining grassland composition can be done by making a visual appraisal of the land. Grassland viability is also important; livestock and wildlife require food, shelter, and water from the grassland. The quality of the forage on the grassland is vital, since it affects the level of performance of livestock. Factors that influence forage quality include stage of growth, plant type, growing conditions, and the presence of noxious weeds.

Credits

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Lesson 1: Soil Tests

Grassland soils are important in meeting production goals on any given plot of land. To best manage the area, analyses to evaluate the fertility status of the soil must be performed. A soil test report, which provides information from such tests, is a valuable tool in grassland management.

The procedures used to collect a soil sample may influence the results of the test. A representative sample must be taken from within the grassland; for example, wet spots as well as dry spots should be represented. Ideally, about 15 to 20 subsamples should be taken to a depth of 6 to 7 inches and then combined in a composite sample. Once the sample is taken, it may be analyzed by the University Extension service or private soil testing labs.

Soil Test Information

Soil test reports should include the following information (see Figure 1.1).

Field information (A) – This section contains information provided by the producer to identify the field and summarize previous management. This information includes, for example, the field name or number, field size, and previous crop.

Soil test information (B) – This section provides the results of the soil tests performed on the sample. The regular soil tests include the soil salt pH; available phosphorus, potassium, calcium, and magnesium; organic matter; neutralizable acidity; and cation exchange capacity. Tests for other nutrients can be obtained at additional charge. The basic set of tests provides the necessary data to develop nitrogen, phosphate, potash, and agricultural lime recommendations for the intended cropping plan.

Rating (C) – This section provides a rating for the salt pH and nutrients tested. The rating system helps interpret the soil test information in Section B.

Nutrient requirements (D) – This section contains three parts: cropping options, yield goal, and fertilizer recommendations.

Cropping options (E) – This section lists cropping plans or crops for which fertilizer recommendations were requested. Recommendations can be given for up to four different cropping scenarios. Additional scenarios can be done at the local University Extension center if plans change after the lab report comes back.

Yield goal (F) – The yield goal section shows the level of production selected for the crops listed in Section E, "Cropping Options." The yield goal chosen should be based on soil type, yield history, fertility level, presence of irrigation, and economic considerations.

Pounds per acre (G) – This section lists the fertilizer recommendations for the crops and yield goals listed. The recommendations are reported as pounds of N (nitrogen), P_2O_5, (phosphate), and K_2O (potash) per acre. The fertilizer recommendation is designed to provide an agronomic recommendation of the nutrients needed to meet the yield goal in Section F and improve soil fertility over time. Following these soil test recommendations will increase or maintain the levels of phosphorus and potassium needed for the high rating category if the recommended fertilizer rate is applied annually for 8 years Micronutrient recommendations, such as zinc, should be applied once and the soil resampled in 3 to 5 years to determine the need for additional applications.

Limestone suggestions (H) – This section gives the suggested amount of limestone to raise soil salt pH to an optimal level for the cropping options listed. Desired soil salt pH ranges for Missouri crops are given in Figure 1.2.

The limestone recommendation is given for the cropping option requiring the highest salt pH range. For example, if a cool-season grass and alfalfa were both listed in Section E, the limestone recommendation would be for alfalfa since it requires a higher soil salt pH level. The recommendation is reported as pounds of effective neutralizing material (ENM) per acre.

Special Notes (I) – Many times notes appear at the bottom of the soil test report to help the producer interpret and use the results and recommendations.

Figure 1.1 – Soil Test Report

University Extension UNIVERSITY OF MISSOURI COLUMBIA

Soil Test Report

Soil Testing Laboratory
23 Mumford Hall, MU
Columbia, MO 65211
Phone: (573) 882-0623

or

Soil Testing Laboratory
P.O. Box 160
Portageville, MO 63873
Phone: (573) 379-5431

Serial no. M9999		Lab no. 9969999
Area 015	County 010	Region 3
Submitted 06/10/96		Processed 06/12/96

A

FIELD INFORMATION		
Field ID Hill top field	Sample no. 1	
Acres 40	Last Limed Not known	Irrigated No
Last crop 019 Cool-Season Grass Pasture		

Soil sample submitted by:

This report is for:

Example Report
University of Missouri
Columbia, MO 65211

B SOIL TEST INFORMATION — **C** RATING

SOIL TEST INFORMATION			Very low	Low	Medium	High	Very High	Excess
pH_s	(salt pH)	4.9	*******					
Phosphorus	(P)	22	********************					
Potassium	(K)	lbs/acre	********************************					
Calcium	(Ca)	303	************************					
Magnesium	(Mg)	lbs/acre	**************					
Sulfur	(SO_4-S)	ppm						
Zinc	(Zn)	ppm						
Manganese	(Mn)	ppm						
Iron	(Fe)	ppm						
Copper	(Cu)	ppm						

Organic matter	2.2 %	Neutralizable acidity	6.0 meq/100g	Cation Exch. Capacity	12.8 meq/100g
pH in water		Electrical Conductivity	mmho/cm	Sodium (Na)	lbs/a
Nitrate (NO_3-N) Topsoil ppm	Subsoil ppm	Sampling Depth	Top inches	Subsoil inches	

D NUTRIENT REQUIREMENTS — **G** Pounds per acre — **H** LIMESTONE SUGGESTIONS

E Cropping options	**F** Yield goal	N	P_2O_5	K_2O	Zn	S
Alfalfa/Grass	0	20	55	0		
Establishment	0	20	45	0		
Clover/Grass Establishment	6	0	80	235		
Alfalfa/Grass Hay	150 CD/A	90	30	20		

LIMESTONE SUGGESTIONS	
Effective neutralizing material (ENM)	1,395
Effective magnesium (EMg)	

I

To determine limestone need in tons/acre, divide ENM requirements by the guarantee of your limestone dealer.

When N requirement for cool-season grass exceeds 90 lbs/acre, apply 2/3 of it during the period from December through February, and the remainder in August.

Do not use nitrogen on spring seedlings of legumes after May 1st because of potential weed competition.

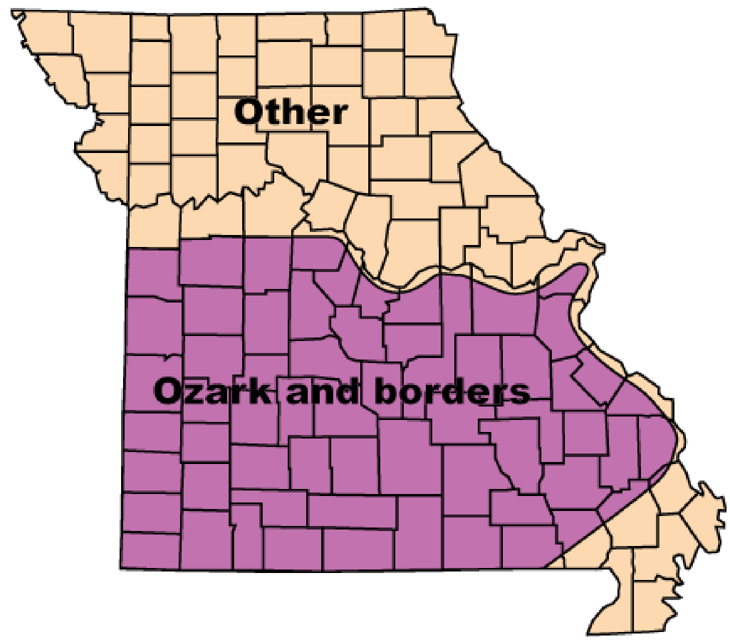
Area Agronomy Specialist Agronomy Specialist Phone (573) 882-1000 ____________ Signature

White - Farmer, Yellow - ASCS, Blue - Firm, Pink - Extension MP 189 Revised 1/96

University of Missouri, Lincoln University, U.S. Department of Agriculture & Local University Extension Councils Cooperating
equal opportunity institutions

Figure 1.2 – Desired Soil Salt pH Ranges for Missouri Crops

	Soil region	
Crop	Ozark and border	Other
Alfalfa and alfalfa-grass establishment	6.6-7.0	6.1-6.5
Birdsfoot trefoil and birdsfoot trefoil-grass establishment	6.1-6.5	5.6-6.0
Clover and clover-grass establishment	6.1-6.5	5.6-6.0
Cool-season grass establishment and production	5.6-6.0	5.6-6.0
Lespedeza and lesbedeza-grass establishment	6.1-6.5	5.6-6.0
Overseeding legumes	6.1-6.5	5.6-6.0
Warm-season grass establishment and production	5.6-6.0	5.6-6.0
Sudan grass and sudan/sorghum crosses	5.6-6.0	5.6-6.0
All row crops	6.1-6.5	6.1-6.5



Interpreting the Soil Analysis

The basic soil test in Missouri provides results for the salt pH, phosphorus, potassium, calcium, magnesium, organic matter, neutralizable acidity, and cation exchange capacity of the soil sample.

Salt pH (pHs) is a numerical measure of the relative level of soil acidity. Salt pH refers to the salt solution used in the laboratory to measure the pH of the soil sample. Some laboratories used water instead of a salt solution for pH measurements and these results are simply reported as pH. Crops require different pH levels for optimum growth and yield. Proper pH levels help to improve root development and provide a good environment for soil microorganisms. Soil pHs for some crops differs among regions of the state.

Phosphorus (P) is the second line of the table. The test for phosphorus measures the relative availability of phosphorus to the plant for growth, not the total amount in the soil. The ratings range from very low to very high.

Potassium (K) is measured by the amount available for plant growth (also referred to as exchangeable potassium) and not by total potassium in the soil. The cation exchange capacity (CEC) of the soil and the current level of exchangeable potassium are used to determine the need for additional potassium. Generally, as the CEC increases, so does the desired level of exchangeable potassium.

Calcium (Ca) is measured to help calculate the CEC of the soil. The rating for calcium levels is based on the soil pH. Soils with very low to low soil pH will rate medium for calcium, and soils with pH of medium to high will rank high for calcium. Missouri soils are rarely in need of calcium.

Magnesium (Mg) is only added when levels are very low to medium. For soils that are rated very low to low, crop yields will be improved with applications of magnesium. When lime and magnesium are both needed, dolomitic limestone may be applied because it contains calcium and magnesium.

Organic Matter (O.M.) is the decayed plant material, or humus, in the soil. The level of organic matter is used to determine the potential nitrogen available to a crop during the growing season.

Neutralizable acidity (N.A.) measures the exchangeable hydrogen. It is a measure of the reserve acidity in soil, or its ability to remain acid. Higher N.A. indicates more reserve acidity. This figure aids in the calculation of liming requirements for the soil.

Cation exchange capacity (CEC) measures the soil's ability to hold positively charged nutrients called cations—calcium, magnesium, potassium, and hydrogen.

Routine fertilizer recommendations are made for the major nutrients used by plants. Nitrogen, phosphorus, and potassium are the major nutrients applied in fertilizer for forage production. In some cases, sulfur or micronutrients like zinc (Zn), manganese (Mn), iron (Fe), and copper (Cu) may be added when they become deficient in the soil.

The amount of nitrogen (N) that needs to be added to the soil is determined by the cropping option, soil texture, and organic matter. The figure is expressed in pounds of nitrogen needed per acre.

Phosphorus and potassium are added in the fertilizer mix based upon the soil test and the desired yield of a particular crop. Phosphorus is added in fertilizer to build up or maintain the current level of phosphorus in the soil. Potassium levels needed for alfalfa hay, row crops, and small grains are calculated by the following formula:
220 + 5(CEC) = lbs. K/acre.

Fertilizer Application and Yield Response

The soil test rating in Section C indicates the relative level of each nutrient tested and provides information on the probability that the application of a particular fertilizer will increase crop yield. Table 1.1. can be used to determine the probability of a yield increase from fertilizer applications for each soil test rating. The probability of an increase in yields from fertilizer drops as the soil test rating rises. For example, soil with a rating of very low for a particular nutrient is much more likely to respond to fertilizer than soil with a rating of medium for that nutrient.

Liming to Increase pH

Agricultural limestone is tested based on purity and fineness of grind. These results determine the limestone's effective neutralizing material, or ability to reduce soil acidity. A producer can call an agricultural lime dealer at a quarry to find out the local ENM. This figure and the ENM required by the soil (provided on the soil test report) are all that is necessary to calculate the tons of limestone needed per acre, as shown in the formula below.

$$\frac{\text{ENM required by the soil test}}{\text{ENM of agricultural limestone}} = \text{tons of limestone/acre}$$

To determine the amount of lime needed in tons per acre, divide the ENM value from the soil test by the ENM of the limestone. For example, if the soil test ENM requirement is 1,395 pounds per acre and the quarry guarantees 400 pounds of ENM per ton of limestone, then 3.48 tons of limestone per acre (1,395 ÷ 400 = 3.48) are needed.

Limestone is applied to neutralize soil acidity and increase salt pH. It does contain calcium, but its main use is to neutralize acidity. Dolomitic limestone contains appreciable amounts of magnesium and is often used on magnesium-deficient soils. Some liming materials have a higher ENM rating than calcitric limestone.

Table 1.1 – Probability of Yield Increase from Fertilizer Application

RATING						Probability of response to fertilizer
Very low	Low	Medium	High	Very High	Excess	
* * * *						very high
* * * * * *	* * * *					high
* * * * * *	* * * * * *	* * * * *				medium
* * * * * *	* * * * * *	* * * * * *	* * * *			low
* * * * * *	* * * * * *	* * * * * *	* * * * * * *	* * *		none

Summary

Soil tests provide important information that can affect a grassland's production. To use the data correctly, an understanding of the soil test results and the suggested treatments is required.

Credits

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University Extension agricultural publications, University of Missouri-Columbia.

G9102: *Liming Missouri Soils*
G9111: *Using Your Soil Test Results*
G9112: *Interpreting Missouri Soil Test Reports*

Lesson 2: Using Soil Survey Manuals

Soil survey manuals provide useful information for grassland management. Soil scientists evaluate the soil for chemical and physical properties, make maps, and interpret the information for agricultural, engineering, recreational, and urban uses.

The characteristics of soils are very important when selecting plants for a grassland. Because soils provide so many vital components required by plants, it is imperative that the soil and plants of a grassland are suitable for each other and can meet the production goals and wildlife needs of the area.

Soil Surveys and Grasslands

The soil survey manual begins with a section on how to use the soil survey that provides an introduction to or review of the manual. A large map called the general soils map, which is used for land use planning, is also included. The general soils map shows the phases, or borders, of the different soil series (groups of similar soils) by means of lines that outline irregularly shaped areas and often follow contour lines.

When more detailed planning is necessary to manage a particular grassland, aerial photographs on which the phases of the soil series are drawn can be used to aid in making land use decisions. Information on the use and management of the soils is provided next, describing the land use potential and management for all areas of interest. The series are also covered in descriptions of the soils, which discusses the soil characteristics, limitations on use, land capability (uses), and suggested management practices. Finally, a section on the formation and classification of the soil is also included. It provides information on uniform systems of soil classification.

Locating Property

When trying to locate a plot of land in the manual, first find the property in the "Index to Map Sheets." Then turn to the page number of the map sheet indicated by the index and use landmarks and features and/or the U.S. standard land survey system to locate the plot. The U.S. standard land survey system is the method used for locating specific areas of land. The basis of this system is the base line (x-axis) and the principal meridians (y-axis). These two lines act as the reference points from which townships are established. Each township is a six-mile square divided into 36 sections, making each section one square mile. Most sections contain 640 acres, but the sections on the north and west sides may be larger or smaller if correlations need to be made. Sections are broken down into further subdivisions called quarters, which are identified by direction (NW, NE, SW, SE) and contain 160 acres. Each quarter can be divided into smaller components. Townships are numbered from the base line both north (N) and south (S), and the ranges from the principal meridian are numbered east (E) and west (W). See Figure 2.1 for a diagram of the system. Figure 2.2 shows divisions of a section.

Figure 2.1 – U.S. Standard Land Survey System

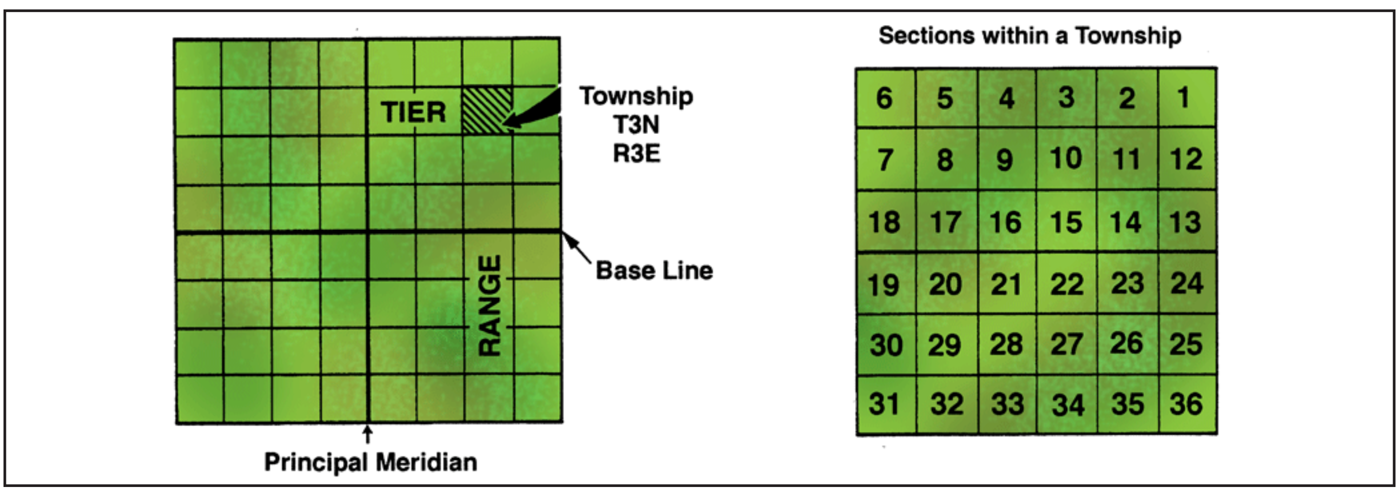
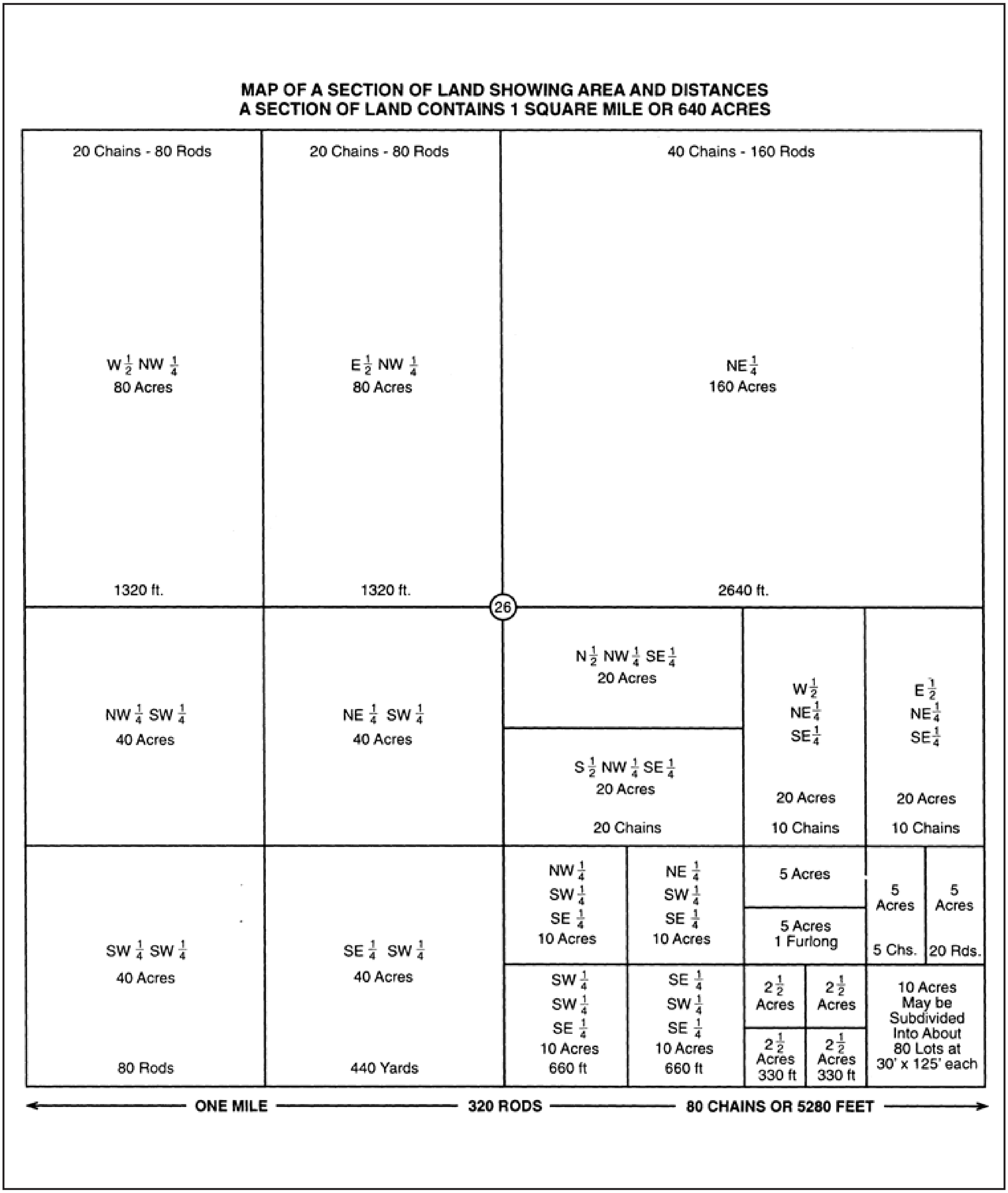


Figure 2.2 – Divisions of a Section



Soil Limitations

A soil's capability class, which indicates its uses, is determined by the limitations of an area. Limitations can be permanent or temporary. Knowledge of these limitations is of great value to the grassland manager, since it allows the management practices to be customized to the individual needs of the area.

Permanent limitations are not easy to change with conservation practices or management. Examples of permanent limitations include severe slope, soil depth, flooding, and large rocks. Some of these may be changed, although to do so would take great effort and expense, while others cannot be controlled.

Temporary limitations are problems that decrease land use potential but can be improved or removed with the implementation of conservation practices and better management. Examples of temporary limitations would include soil nutrient content, moderate slope, and minor drainage problems.

Soil Classifications

All soils are classified according to their uses and limitations. These soils are either cultivatable (able to produce crops) or noncultivatable (not able to produce crops). Each of these divisions is broken down into four different levels of cultivation, making eight soil classifications. A piece of property may have land that falls into several different soil classifications.

The cultivatable soils are Class I through Class IV.

Class I (1) – These soils have very few limitations to restrict use. No special treatment is needed for prevention of surface runoff even if the land is cultivated year after year. The land is nearly level with little risk of wind or water erosion. It has deep, well-drained soils that are easy to maintain.

Class II (2) – These soils have a few limitations that reduce the plant choices or that require moderate conservation practices to increase yields.

Class III (3) – Special conservation practices are needed for these soils because of the severe limitations that reduce the choice of plants. These conservation practices are less practical than Class II and require extra effort and costs.

Class IV (4) – Very sever limitations require careful management and/or special conservation practices on these soils to decrease the limitations that restrict the choice of plants.

Class V through Class VIII are the noncultivatable soils.

Class V (5) – This land is suitable for pasture and wildlife food and cover. It has few erosion hazards and is nearly level or gently sloping. The limitations are difficult to remove and prevent the use of standard farm equipment. The land may be wet, stony, and/or flooded by streams that may decrease the growing season.

Class VI (6) – These soils have severe limitations that reduce the uses of the area to grassland, range (if not overgrazed), and wildlife food and cover.

Class VII (7) – These soils have very severe limitations. An example would be a steep, rocky, eroded hillside.

Class VIII (8) – These areas are mountainous and suitable for wildlife, recreation, and/or water supply.

Classes II through VIII may have an additional label of E for erosion, W for wet, or S for stoniness, shallowness, or droughtiness. These labels indicate special conditions affecting the soil.

Factors Influencing Plant Selection

For plants to perform well, their needs for certain basic requirements must be met. Areas of interest when evaluating a grassland for plant selection are soil texture, soil depth, slope, erosion, surface runoff, permeability, and drainage.

Soil texture – The relative proportions of sand, silt, and clay particles in a soil determine its texture. It can vary from coarsely textured to finely textured with moderately coarse, medium, and moderately fine soils in between. Soil texture affects the amount of contact plant roots have with available water, air, and nutrients.

Soil depth – Soil depth refers to the area that plant roots have available to extend downward. Soil is divided into deep soils, which are more than 36 inches deep; moderately deep soils, which are 20-36 inches deep; shallow soils, which are 10-20 inches deep; and very shallow soils, which are less than 10 inches deep. Soil depth can limit the type of plants that can root in the soil. For example, if the soil depth is very shallow, the plant species that would prosper in that area are limited to short-rooting plans.

Slope – Slope refers to the steepness of the land's surface. It is measured as a percentage calculated by the difference in vertical elevation over a 100-foot horizontal distance. The severity of slope affects erosion and the ability to use farm machinery.

Erosion – The loss of soil by wind or water is erosion. Erosion can decrease the soil depth by removing the top-soil layer, which will decrease the quality of plant growth and limit the number of plants suitable to the area.

Surface runoff – Surface runoff refers to the rate at which water disappears from the soil surface by absorption or flowing over the soil. It can lead to erosion, the leaching of soil nutrients, and/or the washing away of seeds or nutrients.

Permeability –The movement of air and water through the soil is permeability. Root penetration, water movement in and on the soil, and nutrient leaching are all affected by the soil's permeability.

Drainage – Drainage refers to the speed at which water moves from the soil surface. Excessive or poor drainage limits plant growth. Drainage classes are discussed in greater detail in the next section.

Other factors also influence plant selection. Temperature range, rainfall, and length of season are climatic factors that affect plant growth and selection. Economic concerns also affect the selection of plants; one type of seed may cost less than another, making the first more economical, even though both may grow well in that soil.

Drainage Classes

Drainage classes are based on the frequency and duration of the periods during which the soil was saturated (voids between soil particles filled with liquid) or partially saturated when a particular soil was formed. The characteristics of the seven classes are based on the color and thickness of the subsurface soil layers.

Excessively drained soils – These soils are very porous and freely permeable for great depths.

Somewhat excessively drained soils –Water and air move freely but more slowly than excessively drained soils.

Well-drained soils – They are most often sandy or intermediately textured soils. The color is uniform except near the deep water table, where it becomes mottled or spotty.

Moderately well-drained soils – The soils have slower internal water movement. More mottling appears further up the profile (vertical section of the soil). Artificial drainage is suggested for an alfalfa crop.

Somewhat poorly drained soils – The surface is wet for many weeks throughout the year. Mottling is prominent just below the surface. Artificial drainage is almost always needed.

Poorly drained soils – These soils are wet for many months in the year. Mottling is prominent throughout the profile. Artificial drainage is required for crop growth.

Very poorly drained soils –The soils are wet almost every month of the year. They are usually gray in color with mottling on the surface. Artificial drainage may be difficult to install but is required for crop growth.

Obtaining Soil Manuals

Soil survey manuals for many Missouri counties can be obtained at no cost by Missouri residents and by all non-residents for a fee. Some counties do not have manuals. Contact a local Soil and Water Conservation district office or Natural Resources Conservation Service office to obtain copies if they are available.

Summary

Soil survey manuals are very useful for grassland managers. The maps and other information included in the manual help an individual to understand the potential uses of the soil and the conservation practices that could improve grassland production. Plant selection and growth depends a great deal on the characteristics of the soil. To select the best plants for a given area, these characteristics must be taken into account. Knowing the soil's limitations will improve management decisions made for the grassland.

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Lesson 1: Grasslands and the Nutritional Needs of Livestock

This unit examines grassland management. Managing grasslands effectively is very important for livestock production. It is important to know the nutritional needs of livestock to be better able to meet those needs. Nutritional needs vary according to the type of production required, and the producer needs to be able to adjust daily forage dry matter intake to meet them. The focus of this unit will be on beef cattle, since beef production takes place in nearly every county in Missouri.

Nutritional Needs of Livestock

The nutritional needs of livestock are determined by the type of production (function) that the animals perform. All animals have nutritional needs for maintenance, in which nutrients (carbohydrates, fats, protein, and minerals) are used to maintain vital bodily processes and normal body temperature, with no weight gain or loss and no additional production. Increased amounts of certain nutrients are needed for the other production functions—growth, fattening, reproduction, rebreeding, lactation (milk production), and work.

The specific nutrients needed by the animals depend on the production function. The nutrient needs for each production function are as follows.

◊ Maintenance – carbohydrates, fats, protein, and minerals
◊ Growth – protein, carbohydrates, fats, minerals, and vitamin D
◊ Fattening – carbohydrates and fats
◊ Reproduction – protein, carbohydrates, fats, and minerals
◊ Rebreeding – carbohydrates, fats, protein, and vitamins
◊ Lactation – carbohydrates, fats, protein, and minerals
◊ Work – carbohydrates and fats

The total amount of nutrients needed varies from animal to animal. The level of output required for production affects the amount of nutrients required by a particular animal. For example, a horse that performs in a rodeo will have higher nutritional needs than a horse that provides rides for children at a fair, although both are working. The quantity of nutrients required varies with body size as well. Large animals need more nutrients than do smaller animals.

The nutritional needs of animals can be met by quality forages. The amount of forage required by an animal is given in terms of dry matter (DM), which is the total amount of matter in a forage minus any moisture it contains. Table 1.1 gives guidelines for estimating the forage daily dry matter intake (DMI) requirements for cattle. These figures are given as a percentage of body weight (BW) to account for the differences in requirements due to body size.

Changing Nutrient Requirements

Nutritional requirements of livestock change as the animals go through different stages of production. For example, forage quality must be higher for growing animals than for mature animals. Growing animals, such as steers or heifers, need high quality feed to maintain

Table 1.1 – Forage Dry Matter Intake Requirements by Production Class

Class	Forage Dry Matter Intake Requirements Per Day (% of BW)
Dry beef cow	2%
Lactating beef cow (average milk production)	2.5%
Lactating beef cow (superior milk production)	3%
Bull (during breeding season)	2.5%
Bull (out of breeding season)	2%
Growing steers and heifers	3%

growth. Shortages in quality will sharply reduce gain and decrease profits. As they mature, the animals' nutritional needs will change since they no longer require nutrients for growth. The forage quality needed by mature animals changes as production varies throughout the year. Mature bulls, for example, need good quality forages during the breeding season but can use lower quality forages at other times of the year.

The forage quality needed by mature animals changes as production varies throughout the year. A mature beef cow goes through four stages of production each year, and its nutritional needs will be different in each of these stages. Figure 1.1 illustrates the changing energy needs of the cow.

Stage 1 follows calving and lasts 90 days. Since the cow has just had a calf, her nutrient needs are now the highest of the entire year. She is lactating at her highest level, and her uterus is returning to its normal size after being enlarged during pregnancy. The cow must also cycle and rebreed within 90 days of calving to stay on schedule for production, since cows must rebreed in time to have a calf every 365 days. Failure to do so results in an unprofitable operation due to the added costs of maintaining open, unbred cows. With all the physical demands on the cow, a lack of nutrients during this period results in lower milk production and failure to rebreed. The cow must therefore be fed high quality forages at this time.

In Stage 2, the cow is in the early stages of pregnancy and is lactating to nurse her calf. This stage usually lasts 115 days. Nutritional needs drop slightly during this period because the calf is getting some food from creep feeding, but the cow should be gaining some weight due to pregnancy.

Stage 3 is mid-gestation and lasts about 100 days. The cow has just weaned her calf and is dry. Her nutritional needs are at the lowest point of the entire year, since she only has to maintain herself and the developing fetus. She can get by on much lower quality pasture.

Stage 4 precedes calving. This stage lasts about 60 days and is nutritionally the second most important period during the year. During this stage, 70 to 80 percent of fetal development occurs. The cow is gaining weight and preparing for lactation. Inadequate nutrition during this stage will often cause weak calves and inhibit rebreeding. The cow needs good quality pasture or hay to make sure that both she and the calf will be strong and healthy.

The herd has the highest forage quality requirement after the majority of the cows have given birth, when they are in Stage 1 and require energy for lactation and rebreeding. The growth of cool-season grasses such as tall fescue and orchardgrass meets the nutritional needs of both spring- and fall-calving cows. See Figures 1.2 and 1.3. In spring calving, cows calve just before the peak of grass growth in May and June, when forage quality is very high. The cow's nutritional needs peak when the grass growth peaks. Fall calving also works well in Missouri, since it matches the period of the cow's highest nutritional needs with another peak in forage growth in October. The calves will be weaned in the spring in time to take advantage of the lush spring pasture growth, ensuring high weight gain.

Summer calving is not recommended. The cow's nutritional needs and cool-season pasture production are mismatched. See Figure 1.4. The pasture is at its poorest quality and lowest production right when the cow needs the highest quality feed, after calving. Summertime heat and humidity also reduces rebreeding success; conception rates are low. Warm-season forage could help improve pasture quality but will not offset problems due to heat and humidity.

Calculating Daily Forage Dry Matter Intake

Although cattle need quality forages at specific stages of production, they also need an adequate quantity. Estimating the total amount of forage needed by a herd is not difficult but requires a calculation. The formula for determining daily forage dry matter intake for cattle is as follows.

Daily dry matter intake =
# of animals in a class x avg. weight per animal x forage dry matter intake requirement

The pounds of forage dry matter needed per day for a herd is equal to the total of the daily dry matter intake

Figure 1.1 – Energy Needs of a Mature Beef Cow for Spring Calving

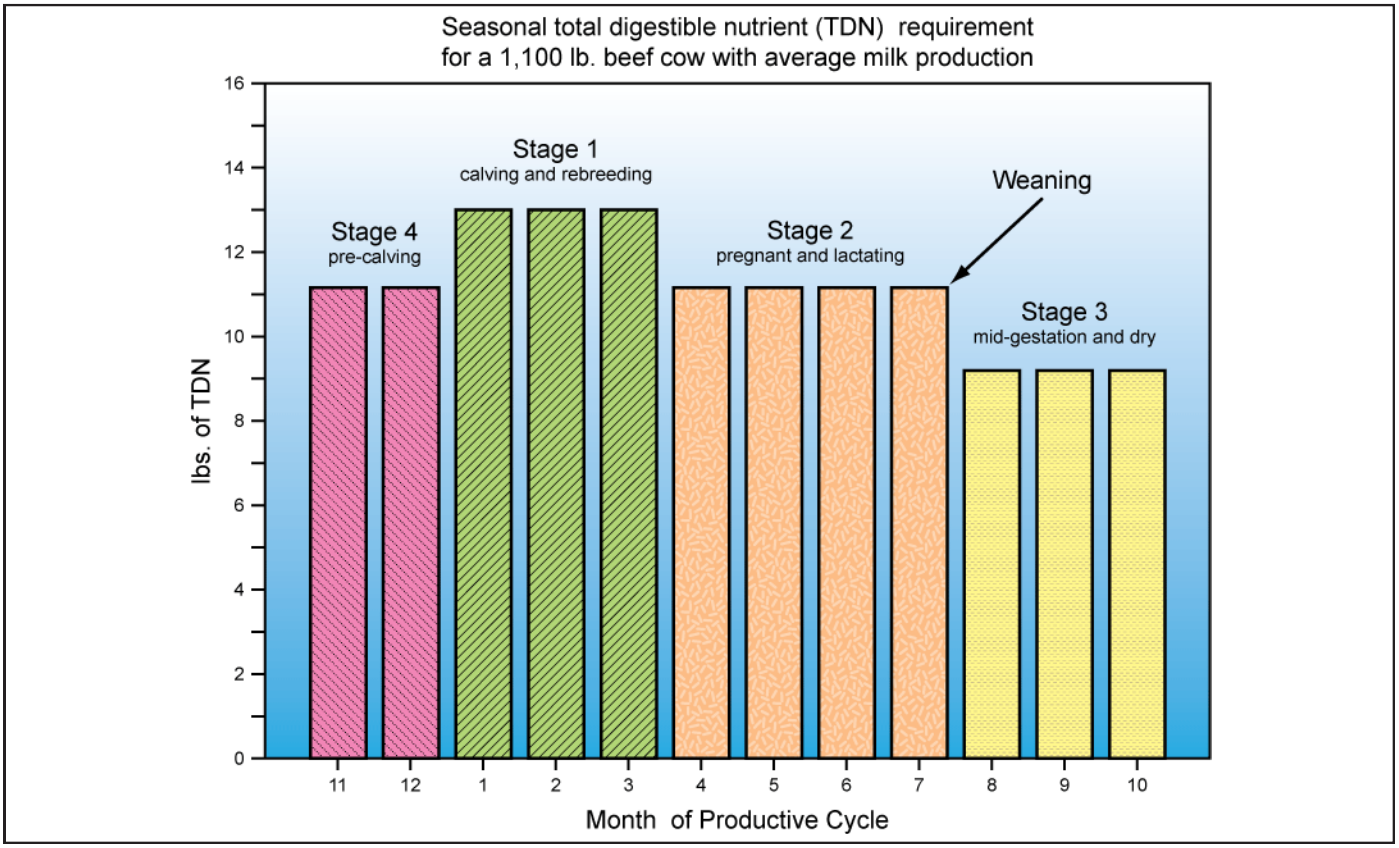


Figure 1.2 – Spring Calving on Cool-Season Grass

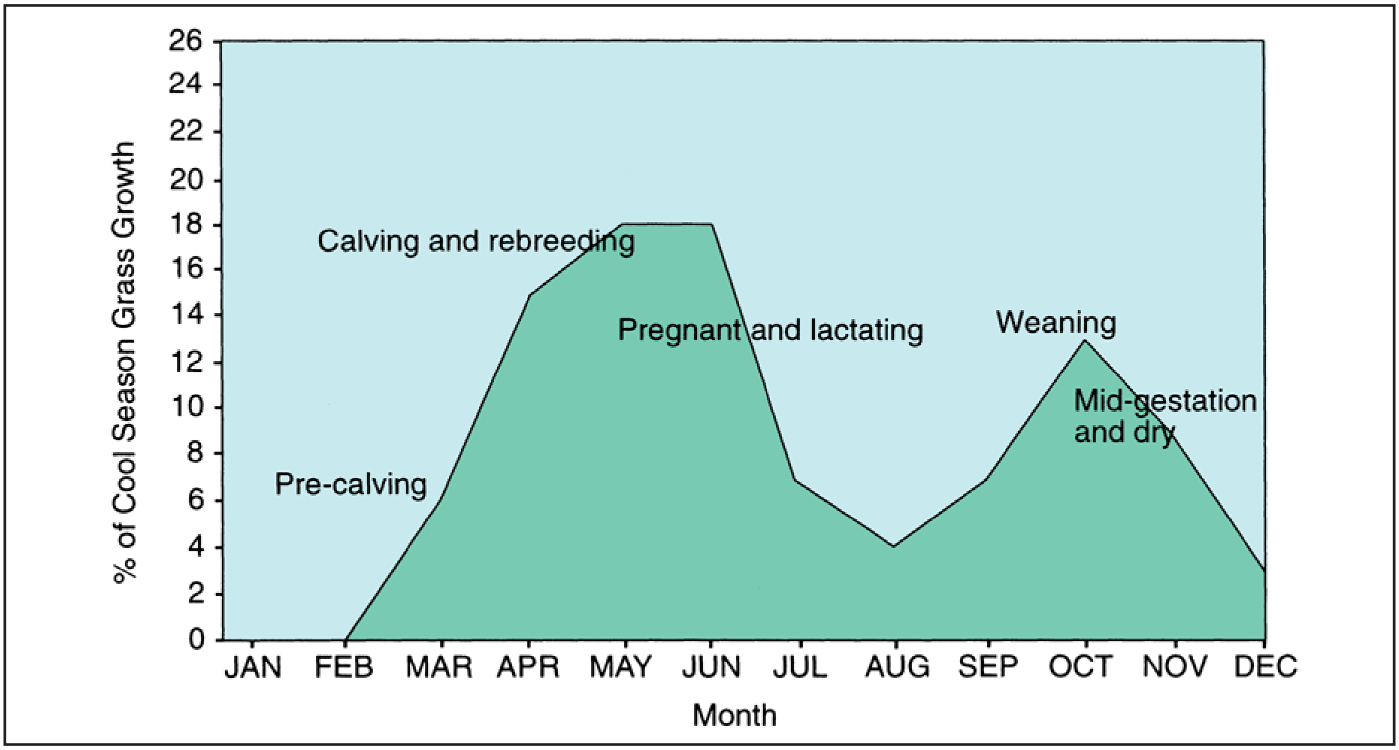


Figure 1.3 – Fall Calving on Cool-Season Grass

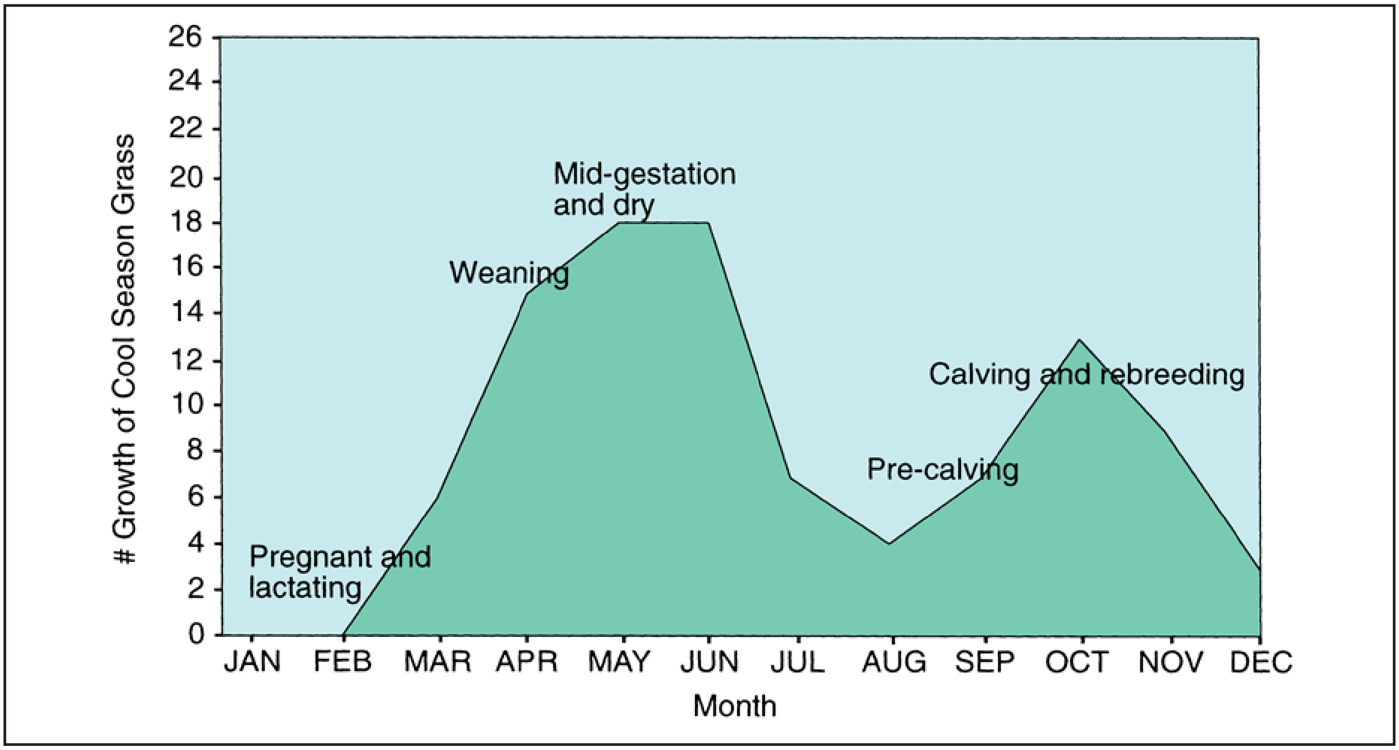
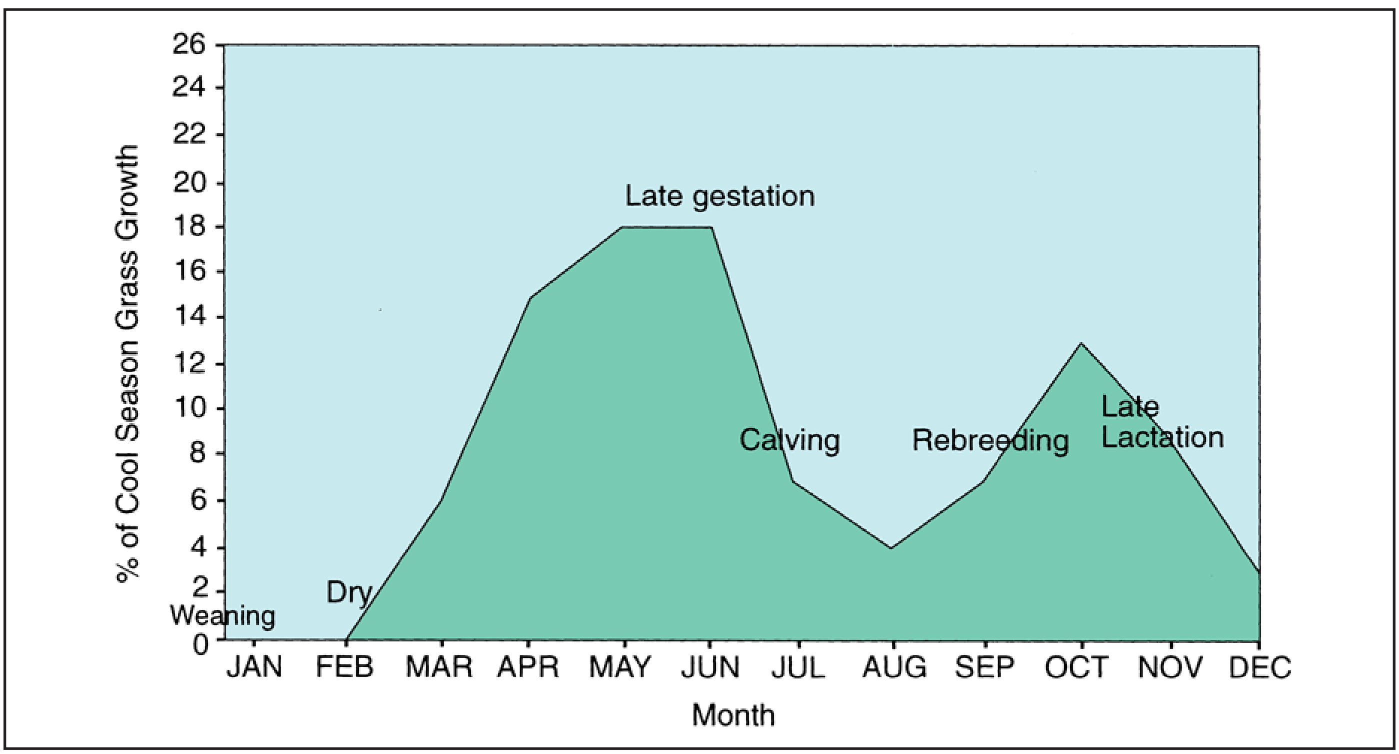


Figure 1.4 – Summer Calving on Cool-Season Grass



for all the classes of cattle in the herd. The following example illustrates how to calculate forage dry matter intake requirements for a herd.

Example: 1 bull – 2,000 lbs., during breeding season
10 heifers – average weight of 750 lbs.
30 lactating cows – average weight of 1,100 lbs., average milk production

Solution: 1 breeding bull x 2,000 lbs. x 2.5% = 50 lbs.
10 heifers x 750 lbs. x 3% = 225 lbs.
30 lactating cows x 1,100 lbs. x 2.5% = 825 lbs.

The total for the herd is 1,100 lbs. (50 + 225 + 825 = 1,100 lbs.) of forage dry matter per day.

To calculate the forage dry matter intake requirements for a specific season, the pounds of dry matter needed per day are multiplied by the number of days in the season. For the above example, the seasonal dry matter intake requirements for spring (100 days) would be 110,000 lbs.

Summary

Understanding the nutritional needs of a livestock herd and how to meet those needs is the key to optimal production. Knowing the quality and quantity of forage needed for optimum livestock production allows the manager to make informed decisions concerning feeding practices. The manager can then use the grasslands more efficiently to meet the nutrient requirements of animals.

Credits

Blakely, James, and David H. Bade. *The Science of Animal Husbandry*. 5th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1990.

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Lesson 2: Grazing Management Systems

The key to efficient livestock production is feeding and management. Grazing management combines these two elements. The way in which the forage is utilized will affect the profitability of a livestock operation. Knowing the needs of the herd and the potential of the pastureland will help the producer to determine which grazing system is best.

Methods of Harvesting

Forages are harvested by animals and by humans. Animals, both livestock and wildlife, eat forages by grazing. Two basic types of grazing systems—continuous and rotational grazing—are used for livestock. In continuous grazing, livestock graze on only one pasture unit. The animals are allowed to graze unrestricted throughout the grazing season. In contrast to continuous grazing, rotational grazing requires at least two grazing units. The animals alternate between the different pastures in a preplanned cycle. Strip grazing and management-intensive grazing are two types of rotational grazing. Each of these methods has its advantages and disadvantages. The best method to use depends on the grassland, animal needs, and management priorities.

One of the major differences between continuous and rotational grazing is selective grazing. In continuous grazing, livestock have unrestricted access to the pastureland throughout the grazing period. The animals can pick and choose the plants that they consume. In rotational grazing systems, however, the animals are only provided with the amount of forage they require for the grazing period. The animals feed on the pants in the area more evenly, because they are limited by the quantity of forage available.

Humans also harvest forages directly through mechanical harvesting for hay, silage, or green chop. The forage is cut and then stored to be fed later. This form of harvesting will be discussed in depth in the next lesson.

Continuous Grazing

The single pasture unit grazing system used in continuous grazing has the advantages of high initial performance and low maintenance. The high performance of animals at the outset is due to their being able to selectively graze on the most palatable grasses and legumes and leave the less palatable and less nutritious weeds. The production weight of these animals will therefore be higher than that of animals that do not selectively graze. In addition, because only one pasture unit is utilized, continuous grazing requires less maintenance than rotational grazing systems, in which the herd is moved frequently.

The disadvantages of continuous grazing are the risk of changing the grassland composition and poor forage utilization by the herd. Whenever pastures are selectively grazed, the risk exists that the forage composition will be altered due to the overgrazing of quality forages. When these plants are grazed, other, less desirable plants are allowed to grow that may eventually shade the desired forages, either hindering their regrowth or killing them. Since the quality of a pasture that is being continuously grazed will quickly decline if it is overgrazed, this system is best used for areas that are only grazed for part of the year. In addition to changing grassland composition, the selective grazing that occurs in continuous grazing means that less desirable plants are not consumed by the animals, therefore decreasing the overall utilization of the forages available. The quality of forage that the herd eats will boost their production and increase gains, but production per acre will suffer because they are not using all of the plants available. Lower forage utilization results in lower carrying capacity.

Rotational Grazing

Rotational grazing requires more intensive management of pastureland and animals than continuous grazing due to the sequenced movement of the animals between two or more pastures or paddocks (smaller divisions of pastures). In rotational systems, the herd may be moved every 1 to 30 days. Movement of the animals is based on the rate of vegetative growth of the forage and the grazing intensity. Any grazing system based on management of forage availability, quantity, quality, and utilization is considered to be controlled grazing.

Rotational grazing has four main advantages for the producer. First, it helps to maintain the desired composition of the grassland. This form of grazing helps to reduce selective grazing of plants that are more palatable to the animals. A second advantage of rotational grazing is that this system allows for the regrowth of vegetation after grazing by providing rest periods for the grassland. These periods may last from 10 to 60 days, depending on the rate of vegetative growth and the number of paddocks. Third, the rest periods decrease the amount of damage caused by compaction of the ground and animal wastes, because the time the herd is on the land is substantially decreased. Finally, rotational grazing allows more animals to be produced on a given area of pastureland, because more of the available forage will be utilized by the livestock. With a higher rate of forage utilization, production per acre is increased.

The grazing system has disadvantages as well. While production per acre is increased, the production weight of the livestock, or production per animal, may not be as high as that of animals that can selectively graze, although the livestock will still be of good quality. In rotational grazing, managing the herd requires much more time and labor than continuous grazing, since the animals are moved frequently. A rotational grazing system also requires extra fencing to separate the land into paddocks, increasing the costs to the producer.

Strip grazing is a type of rotational grazing system. In strip grazing, a large pasture is divided into strips with movable fences to control grazing. Paddocks are usually defined by a portable electric fence that allows the animals access to 1 to 3 days worth of forage. They have access to the areas that have been previously grazed as well as the fresh vegetation. The animals are grazed at a high stocking intensity (relative number of livestock per unit for a fixed period). Strip grazing is used mainly for stockpiled forages during the dormant season.

Management-Intensive Grazing

Management-intensive grazing is another form of rotational grazing. The length of the grazing period is usually less than 5 days. The stocking rate in intensive grazing systems is increased, with the number of animals per unit area being greater than the other systems.

Advantages of intensive grazing include the maintenance of grassland composition and decreased damage from compaction and animal wastes. Because more animals are stocked and forage utilization is high, the production per unit area is even greater than in other grazing systems. Since the herd is moved frequently, the increase does not additionally harm the forage population. With its short grazing periods, intensive grazing also provides for long periods of rest and regrowth. Another advantage is that the operator is in contact with the herd on a regular basis to identify and correct potential problems.

Disadvantages to using this system also exist. More time is needed to plan and set up the system. The pasture is divided into numerous paddocks, and the additional fencing increases costs. Production per animal may be decreased compared to animals allowed to selectively graze, although the large number of animals stocked in an intensive grazing system may make up for the loss per animal.

Grazing Efficiency

No grazing system is 100 percent efficient. In a pasture system, animal utilization of the forage is between 30 and 65 percent of what is actually grown. In continuous grazing systems, only 30 to 35 percent of the total forage produced is eaten by the livestock. When management intensive grazing is used, forage utilization can be as high as 65 percent of the forage produced.

To determine if forage availability is adequate for the herd, the efficiency of gazing must be considered. To calculate the actual amount of forage dry matter needed in a pasture to feed a herd during a particular season, the seasonal dry matter intake requirements should be divided by the forage utilization rate. For example, in a continuous grazing system with a herd that has a daily dry matter intake of 1,500 pounds and a season dry matter intake of 150,000 pounds, the amount of dry matter actually needed to feed the herd is 428,571 pounds (150,000 ÷ .35).

Grazing Intensity

Grazing intensity refers to the extent to which a plant or grassland is grazed. It is evaluated by looking at the height of the forage after grazing. The three levels of grazing intensity are heavy, moderate, and light grazing.

Heavy grazing, or overgrazing, exhausts the energy reserves of forages by removing growth too frequently, before it has a chance to replenish itself. Production declines, preferred plants are damaged, ground cover is reduced, and erosion begins. In cool-season grasses, heavy grazing is marked by the presence of less than 4 inches of growth in the fall. In warm-season grasses, anything less than 8 inches left at the end of the growing season would be overgrazing. Overgrazed fields typically have thin stands of vegetation, low forage vigor, and invading weeds or brush. The plants may appear short and weak.

Spot grazing is a form of overgrazing in which patches of pasture are grazed too frequently. Spot-grazing occurs during periods of active forage growth when livestock graze spots in a pasture while allowing other areas of the field to become mature and unpalatable. The livestock frequently regraze new growth in these spots because it is more palatable. Spot-grazed pastures have uneven forage heights and the forage in the grazed spots may become weak and thin.

Moderate grazing leaves enough vegetation to maintain the vigor of forage plants and protect the soil. Grass production remains high due to healthy root systems with substantial energy reserves. Cool-season grasses that are moderately grazed are 4 to 8 inches high at the end of the season. Warm-season grasses have 8 to 10 inches of growth left. Moderate grazing generally results in pastures that are evenly grazed, with a uniform grazing height, thick stands, and good forage vigor.

Light grazing, or undergrazing, may not be beneficial if it results in too much tall, dense forage left in the fall. Excessive ground litter (accumulated plant parts on the soil surface) can interfere with the next year's crop. Cool-season grasses left taller than 10 to 12 inches at the end of the growing season are considered lightly grazed. Lightly grazed warm-season grasses are more than 12 to 14 inches high.

Carrying Capacity

Carrying capacity is the number of animals that a grazing unit can sustain throughout the grazing season. Factors that affect carrying capacity are annual forage production, seasonal utilization rate, average daily intake, and length of the grazing season. These factors are applied in the following formula.

$$\text{Carrying Capacity} = \frac{\text{Annual Forage Production} \times \text{Seasonal Utilization Rate}}{\text{Average Daily Intake} \times \text{Length of Grazing Season}}$$

Annual forage production is the amount of forage dry matter produced per acre (lbs./acre) during the year.

Seasonal utilization rate is the percentage of the forage produced that will be consumed by the herd in one year. This figure will vary according to the length of the grazing period.

Average daily intake is the percentage of the animal's body weight that will be consumed in forages on a daily basis (lbs. forage/lbs. live weight). Because it is an average, this figure may vary from animal to animal. It is determined by the performance class of the animal, as described in Lesson 1 of this unit.

Length of grazing season is the number of days per year that the herd's nutritional needs are met through grazing.

Suppose the annual forage production for a particular grazing unit is 7,000 lbs. of forage per acre. With a 15-day rotation period, the seasonal utilization rate is 60 percent. The average daily intake for the heifers that will use that paddock is 3 percent. It is grazed from April 1 to September 30, or 183 days. The carrying capacity is 765 lbs. live weight/acre.

$$\frac{\text{7,000 lbs./acre} \times .60}{\text{.03 lbs./lbs. live weight} \times \text{183 days}} = \text{765 lbs. live weight/acre}$$

Time of Grazing

Grazing time is determined by the stage of growth, not the calendar. The time of harvest will therefore vary slightly by plant species and may also vary within a plant species due to environmental conditions and management practices.

The goal of grazing is to keep the forage in the vegetative (leafy) stage, when forage growth is continuous and nutritional quality is high. The vegetative stage ends when plant reproduction begins. Plant growth occurs in four stages. They are referred to as the vegetative, boot, heading, and mature seed stages in grasses. In legumes, they are the vegetative, bud, bloom, and mature seed stages.

Grazing's Effect on Wildlife

Because grazing changes the quality and quantity of plants in the grassland, wildlife is affected by grazing livestock. Continuous grazing does not benefit wildlife because it depletes the amount of food and protection available. However, special provisions such as brush piles and fence lines with tall vegetation may aid wildlife. In contrast, rotational systems provide food and habitat for wildlife while forages are growing. They favor more diversity in grassland composition, which improves the food and cover available to wildlife. Rotational grazing systems also tend to protect wildlife habitat found in woody draws and along bodies of water by restricting livestock from these areas.

Cool-Season Grasses, Warm-Season Grasses, and Legumes in Grazing Systems

Using cool-season grasses, warm-season grasses, and legumes in a grazing system can be very beneficial. Doing so can improve overall quality of forages and increase livestock carrying capacity. Ideally, one-third of a producer's grazing system should consist of warm-season grasses. These grasses, such as big bluestem, eastern gramagrass, and indiangrass, begin the bulk of their growth around June and July, just when cool-season grasses like tall fescue and orchardgrass are finishing their spring growth. Legumes like red and white clover can lengthen the grazing season of cool-season grasses because they will often grow longer into the summer than the grasses do. They will also provide higher quality forage, fertilize the ground (through nitrogen fixation), and increase yields. As warm-season grass production declines after growth peaks in August, cool-season grasses reach another peak in forage growth during early fall.

Benefits for Wildlife

A grazing system of cool- and warm-season grasses and legumes can also provide wildlife with a more diverse habitat. By the time warm-season grasses are ready to be harvested (hayed or grazed), most grassland species of wildlife are finished using them for reproduction. At this time, the cool-season grasses are being rested, and wildlife can then use them for cover or nesting if necessary.

Summary

Grasslands may be harvested through grazing or mechanical harvesting. Rotational and continuous grazing are two types of grazing systems. Continuous grazing is a grazing system in which the herd remains in one pasture for the majority of the grazing season. Rotational systems, such as strip grazing and intensive grazing, involve movement of the herd between two or more pasture units. Movement is based on the rate of growth and grazing intensity. The carrying capacity of a particular pasture is determined by annual forage production, seasonal utilization rate, average daily intake, and length of grazing season. The quality and quantity of forages is optimized if harvest occurs during the second stage of plant growth. Rotational grazing is the best system for maintaining wildlife habitat. A grazing system that combines cool-season and warm-season grasses and legumes benefits both livestock and wildlife.

Credits

Coambes, Howard, John Jennings, and David E. Pitts. *Grassland Evaluation Contest Study Guide*. University of Missouri-Columbia: Instructional Materials Laboratory, 1997.

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Lesson 3: Harvesting and Storing Forage Crops

The goal of livestock management on a grassland is to provide the best quality forage at the most reasonable cost. When the grassland is unable to provide for the nutritional needs of the herd, supplemental feeding is needed to sustain the animals. The most cost-effective method of supplemental feeding is to harvest and store the forage from the grassland when it exceeds the amount required by the herd and then feed it when needed later. High quality stored forages allow livestock operations to cut costs on supplemental feeds. This lesson will discuss the different methods of harvesting and storing forages.

Why Mechanically Harvest Forages?

As discussed in the previous lesson, grazing best meets the nutritional needs of the herd while the forage is in the vegetative state. If the grassland is providing more forage dry matter than the herd can use at the time, harvesting and storing the forage will keep the forage in the vegetative state and preserve the quality of the forage for later usage. Forage utilization will also be optimized by harvesting when the grassland is producing more than is needed by the herd, which maximizes the yield of the forage. The stored forage can be used to meet the nutritional needs of the herd when pastures are dormant. Finally, some producers sell the harvested forage for profit if it is not needed by the herd.

Methods of Mechanical Harvesting

Two main methods of mechanical harvesting provide feed for livestock—harvesting for hay or harvesting for silage. The forage is cut or chopped and then cured to produce hay or silage

Hay is harvested at low moisture levels. Although many forages may be cut for hay, alfalfa is most commonly used. Hay can be grown on rough and rolling land that is unsuitable for many crops. The forage is cut and cured by allowing it to dry before being stored. The cutting and curing of hay is important. Too much or too little moisture can affect its quality. Wet weather, for example, can cause a considerable decrease in quality between cutting and drying the hay. When dry, hay can be stored inside or outside, but protection from the wind and rain will help to preserve its quality.

Silage is forage converted into moist, succulent livestock feed through fermentation. Corn is most commonly used for silage. The forage is cut when moisture is high, wilted to a 60 to 70 percent moisture content, and then cut or chopped into smaller particles. The silage is cured by fermenting it in its storage structure. Additives can be included to increase its feed value or maintain its quality. Silage can be kept for 2 or more years if properly stored.

Storage Methods

Hay may be formed into square bales, round bales, or stacks and then stored in a barn, under temporary cover, or in the field, depending upon the resources available and the size of the bales. The better the quality of the hay, the more important it is to place it under cover. The higher the quality, the faster the hay will rot without protection.

Barns provide the best protection from the wind and rain. Temporary covers of black polyethylene, canvas, or nylon, which prevent water penetration, are sometimes placed on hay stored in the field in large round bales or loose stacks. Covers are an inexpensive form of protection from the wind and rain. The cheapest form of storage is leaving the hay in the field. However, the hay can undergo excessive loss of quality from wind, rain, and sun.

Silage is stored in silos to prevent spoilage and quality loss through the leaching of nutrients. These silos may be either vertical or horizontal. Vertical silos have several benefits. Storage losses are relatively low for all vertical silos. They can be located near the livestock and easily adapted for automatic feeding. The two types of vertical silos are the conventional silo and the oxygen-limiting silo. Conventional silos are made of metal, concrete, or tile. Oxygen-limited units are sealed or lined with fused glass. This difference increases the cost per cubic foot but decreases storage losses.

Horizontal silos are much easier to construct and cost less than vertical silos. However, more leaching of nutrients occurs than in vertical silos, and horizontal silos should therefore be located on well-drained land to reduce spoilage. Due to their construction, the silage in horizontal silos also requires extensive packing, or tamping down with heavy equipment. Three different types of horizontal silos are used—bunker, trench, and stack silos. Bunkers are constructed above ground and have concrete floors and concrete or plank walls. Trench silos are dug into well-drained ground or hillsides. The walls and floor may be either soil or concrete. Stack silos are used only for temporary storage or emergency situations. They have no walls and may or may not have a concrete floor. The silage is formed into a pile and compacted. The lack of walls and floor increases spoilage losses greatly, so the silage should be used as soon as possible.

Factors Affecting Forage Quality

Several factors may affect the quality of stored forages. The moisture content of hay and silage can affect its quality. If hay is too moist, it will become moldy. If hay is too dry, leaf loss will occur due to dry and shattered leaves. Silage will become moldy if it is too dry. A reduction in quality may also occur in storage due to improper storage or lack of protection from the environment. A third factor affecting quality is the species composition of the forage. Different species of plants have different storage qualities as well as different palatability and nutritional benefits to livestock. Finally, as discussed in the previous lesson, the quality of the forage depends greatly on its stage of growth when harvested. As a forage reaches maturity, its quality is decreased as reproductive growth starts.

Stage of Growth at Harvest

As discussed in the previous lesson, plants pass through four stages of growth. Plants should be in the boot (grasses) or early bloom (legumes) stage at harvest. The time of harvest depends on the vegetative growth. Quality (digestibility) and quantity are in an inverse relationship. As maturity and quantity increase, quality decreases. Sometimes a producer may sacrifice quality to increase the quantity of the forage harvested.

Summary

The harvesting and storage of forages is a crucial component of livestock management. Forages may be harvested as hay or silage, which may be stored in a number of different ways. Moisture content, storage method, and time of harvest all affect the quality of stored forage crops. The time of harvest depends on the vegetative growth during the boot or early bloom stage of growth.

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Lesson 4: Wildlife Management

Managed grasslands have room for both wildlife and livestock. Both depend on grasslands to be in good condition to supply their needs. Modern management practices can improve most Missouri grasslands enough that both livestock production and wildlife habitat will increase.

Wildlife in Missouri's Grasslands

Many kinds of wildlife use grasslands, and each has different needs at different times. Some animals depend entirely on grasslands for all their needs. Greater prairie chickens, upland sandpipers, and meadowlarks are so adapted to grasslands, they can live virtually nowhere else. They require large open grasslands to survive. Rabbits, quail, and pheasants depend on grasslands extensively for food and cover but also need other habitat, like brushy cover. Deer and turkeys use grasslands when available but can survive in other habitats if grasslands are not within their range. Some amphibians require seasonal wetlands within a grassland, while some reptiles need rocky outcrops. A well-managed grassland will result in healthy streams and ponds for fish habitat. All these different types of wildlife depend on the people managing the land to maintain habitats for their survival.

Wildlife Needs

While the specific needs of each type of wildlife vary, the three basic components that determine wildlife habitats are water, food, and cover, as discussed in Lesson 4 of Unit I.

Water – Missouri has plentiful rainfall, many rivers and streams, and plants that produce succulent foliage and fruits, all of which are natural sources of water for wildlife. Additional water sources can benefit wildlife, especially during drought. For example, farm ponds are common throughout the state. Water supplies developed for livestock are generally adequate for wildlife, with a few precautions. Water tanks accessible to wildlife should have a way for small animals to escape. It also helps to provide access points and perches so animals can get to water safely.

A bigger concern is controlling livestock so they do not damage water supplies. Unlimited access to streams and ponds allows animals to congregate and destroy bank vegetation, cause erosion, degrade water quality, and spread disease. Producers should restrict livestock to certain points of access where damage will be reduced and rotate between locations so no part of the shoreline is overused. A better option is to provide separate watering facilities supplied by a pond or stream but away from these sensitive areas. Stock watering tanks below dams and mechanical and solar watering devices improve the availability and quality of water for livestock and allow the pond or stream to be fenced off. Assistance and cost sharing may be available through the Natural Resources Conservation Service (NRCS) and the Missouri Department of Conservation (MDC).

Food – The grassland food chain begins with forage plants that produce green browse and seeds and provide a home for insects. Quail, prairie chickens, and pheasants require seeds in their diet. Insects are a major part of the diet of many birds and mammals, especially young game birds. Rabbits eat vegetative parts of grasses, legumes, and forbs.

A single pasture or grassland over-utilized by livestock may not have enough forage and seed for wildlife, but wildlife are not restricted to that area. This makes land next to a pasture critical to the carrying capacity for wildlife. Leaving a few rows of grain sorghum, corn, or sunflowers along the edges of nearby crop fields can provide standing grain. One-acre grain food plots can be planted in odd areas and left standing for wildlife. Grassy areas along the edges of fields, fencerows, waterways, roads, terraces, and dams, along with pastures being rested, can be allowed to go to seed. All these areas should be protected from livestock grazing.

Producers should arrange to supply food for wildlife during winter. Fall plowing buries seeds and crop residues and should be avoided whenever possible. Snow and ice can also bury foods, so leaving standing seed heads of grasses and grains can be beneficial to wildlife. Fruits of trees and shrubs are also very important to wildlife survival during winter.

Cover – The need for cover varies with the wildlife species and season. Cover is important for protection, nesting, and roosting. Food must be near suitable cover, and wildlife should be able to walk through good cover to their feeding grounds. Wildlife use four types of cover: soft cover, shrubby cover, hard cover, and escape cover.

Soft cover is the nonwoody growth of grasses, legumes, and forbs. This cover needs to be at least 8 inches tall to be of value to most wildlife. Grassland birds depend greatly on soft cover. They need a canopy of grasses and forbs overhead to hide from predators and shield them from harsh weather; they also need open spaces between plants at ground level where they can scurry around finding seeds and insects. Native warm-season grasses provide the best soft cover. As bunchgrasses, they have the perfect combination of an overhead canopy with openings below for travel lanes. Most cool-season grasses are sod-forming grasses that lack these lanes.

Shrubby cover consists of woody brush and shrubs with multiple stems growing from a common base that are generally less than 20 feet tall. It provides shelter and concealment for many animals. When growing close together in a thicket, it also supplies escape and nesting cover. Shrubby cover produces browse for deer along with seeds and fruits for other wildlife.

Hard cover consists of trees and shrubs 20 or more feet tall. This type of cover is beneficial for deer, turkey, and many songbirds. Seeds, fruits, nuts, and acorns are important foods provided by hard cover.

Escape cover is especially dense shrubby or hard cover where wildlife can escape predators. For example, a rabbit or quail would use it to get away from foxes, coyotes, and hawks. This dense "brush" is often found in areas next to grasslands and should always be protected from grazing. If escape cover is scarce, producers can construct brush piles from limbs left from firewood cuttings or from the thinning of trees along the grassland edge to reduce competition from shading.

Producers should manage the shrubby, hard, and escape cover on their land. The cover in woody draws, brushy fencerows, and adjacent woodlands should be protected and fenced to prevent grazing. Where woody or shrubby cover is lacking, planting may be needed. Seedlings are available through the MDC's state nursery for a nominal charge. Occasionally, good wildlife management will require the removal of woody vegetation when woody plants are invading grasslands. Their removal improves the overall balance of the grassland habitat for specific wildlife needs.

Factors Affecting the Value of Grasslands for Wildlife

The characteristics of a grassland affect what kind of food and cover it provides. To manage a grassland for any particular wildlife species means creating the habitat that most closely meets that animal's needs. Another approach to managing grasslands is to create a diverse habitat that will meet the needs of a variety of wildlife. Four factors usually determine how valuable a grassland is for wildlife—the type of grassland, composition of the grassland, use of the grassland, and size of the grassland or pasture unit.

Type of grassland – Each species of grass has its own growth characteristics. Depending on their abundance in the grass stand, the plant species that are present will influence the habitat provided for wildlife.

Cool-season pastures are dominated by nonnative, sod-forming grasses such as tall fescue, Kentucky bluegrass, and bromegrass. These grasses are often harvested for hay at the height of the nesting season, which creates problems for ground-nesting birds like bobwhite quail.

Native warm-season pastures are dominated by native bunchgrasses such as big bluestem, indiangrass, sideoats gramma, little bluestem, and switchgrass. Although warm-season grasses have a shorter growing season, they use water and soil nutrients more efficiently than other grasses. They generally provide better food and cover when properly managed. They are not ready for haying until midsummer, when most ground-nesting wildlife have produced their broods.

Native grasslands (remnant prairies) are dominated by a mixture of native warm-season grasses with a good complement of native legumes and forbs. The plant species may number into the hundreds, attracting many species of wildlife. In west, central, and north-central Missouri, remnant prairies are vital to the survival of the prairie chicken.

Plant composition – Grasses are the main plants in a grassland, but a variety of plants generally makes the grassland more productive and improves wildlife habitat. A mixture of vegetation improves the quality of cover and the available food supply. Two or more grasses generally provide a more rounded diet for livestock and wildlife. Legumes and forbs that produce seeds are also a very important part of the diet of many wildlife species. Flowering plants are important to insects, which in turn are needed for pollination and seed production. A diversity of plants attracts insects important in the food chain supporting wildlife. The more types of broadleaf and seed-producing plants there are, the more value a field has for wildlife. If too many of these plants are removed, the number of animals the area can support will also be reduced.

Size of the grassland – To provide suitable habitat, food, cover, and water must all be found in an area that a particular species can use. Depending on its size, a grassland may or may not support certain kinds of wildlife, since different species require grasslands of different sizes. A 100-acre grassland can support many butterflies on just a partial acre if it has an abundance of their preferred flowers and food plants. A collared lizard occupies a small area in a glade, but an entire population of lizards needs 10 acres or more. A covey (small flock) of quail will range over 20 to 40 acres to meet their needs; a grassland 100 acres in size will be more valuable to them if it is broken up by woody draws, fencerows, edges, and crop fields. Deer may range over an area twice that size or larger and can do quite well if bordering areas have plenty of woody and brushy areas. Prairie chickens require a nearly pure grassland with few trees and shrubs interrupting the landscape and would fare better if neighboring fields were also primarily grassland.

Use of the grassland – When and how grass is harvested is probably the most critical factor affecting the value of a grassland for both wildlife and livestock. Haying removes food and cover in one sudden operation. Grazing removes vegetation more slowly; the rate at which it is removed depends on the grazing period and stocking rate, or number of livestock on the grassland.

Grassland Management Practices

Management is necessary to keep grasslands productive. When left idle for too long, grasslands lose productivity as ground litter builds up and woody species invade. Management practices include grazing, haying, fertilizing, overseeding with legumes, irrigation, reestablishing native warm-season grasses and forbs, and prescribed burning.

Grazing – Overall, cool-season grasses can be grazed shorter than warm-season grasses, which gave early grassland managers the misconception that cool-season grasses are more productive and better for forage operations. In reality, they were simply managing warm-season grasses improperly. The most productive grassland operations today feature warm-season grasses in many of their pastures.

Of the two types of grazing, continuous grazing is less beneficial for wildlife than rotational grazing. Grazing intensity is hard to control under continuous grazing. Even when stocking is correct, animals may seriously overgraze certain areas before moving to others and thus eliminate the palatable plants that are the most valuable for wildlife. It also leads to soil erosion, decreases wildlife food and cover, and disturbs birds during nesting. Rotational grazing allows managers to move livestock when necessary to maintain the grassland. It gives the valuable palatable plants a resting period in which to grow and multiply. This type of grazing gradually results in increased livestock production, reduced soil erosion, conservation of water and soil nutrients, and improved wildlife food and cover.

The timing of grazing is critical to wildlife, and rotational grazing allows it to be timed to benefit both livestock and wildlife. Livestock can disturb birds during courtship and trample their nests. Grazing can also remove the top growth before most plants have gone to seed. Producers can schedule prime nesting areas for rest periods when wildlife need them. They can arrange to have livestock graze next to nesting areas so chicks will have access to open ground with a different mix of foods next to good soft cover. Paddocks next to woody cover or other wintering grounds can be scheduled for grazing early in the season so they can regrow cover and seed to help wildlife through the winter.

A moderate grazing intensity is the most beneficial level of grazing for wildlife. In heavy grazing, little vegetation is left for wildlife cover or food, while light grazing can leave dense forage that hinders the movement of small wildlife like game birds. Moderate grazing provides adequate food and cover. Grazing at this level opens travel lanes between plants and creates some bare ground for seed gathering and dusting areas (areas where birds can stir up dust to get rid of mites).

Mechanical harvesting – Many of the same considerations for grazing apply to mechanical harvesting. The main difference is vegetation is removed in one operation. Such sudden changes in habitat are hard on wildlife. On the positive side, the equipment is more precisely controlled than livestock.

Grassland managers can adjust location, timing, and mowing height to leave enough food and cover as needed. To reduce the impact of haying, the recommended practice is that the outer 30 feet of hay fields be left standing or be cut later. Another beneficial practice is to have a balance of warm- and cool-season pastures with different harvest dates so areas of food and cover are always available for wildlife. Staggering haying schedules so harvest takes place over a longer period can also benefit wildlife.

Fertilizing – Only well-managed pastures benefit from fertilizer and liming. If grasslands are overgrazed or otherwise in poor condition, weeds will be the first to benefit from using fertilizer. Fertilizing can help wildlife if it increases grassland production and improves the nutritional quality of their food, but only if other management practices leave enough food and cover. Native grasslands do not usually benefit from fertilizing. In a healthy native plant community, fertilizer acts as a foreign disturbance that can change plant composition and allow weeds to take over.

Overseeding with Legumes – In pastures, seeding with legumes helps wildlife by adding diversity to the types of food and cover available. Legumes should not be added to native grasslands because these areas already contain legumes and forbs more suitable to the site. Overseeding may disrupt the composition of the natural community and could introduce weeds. Overseeding is described in more detail in the next lesson.

Irrigation – Irrigated pasture is not widely used in Missouri, though it may become more common as the economics of intensive forage production continue to develop. Irrigation should benefit wildlife as an additional source of water, especially in times of drought. It could harm wildlife if production required irrigating during critical times such as the nesting season, while small chicks are in the field, or when it might make wildlife more susceptible to weather extremes. This seems unlikely in Missouri, but all factors should be considered in planning any management practice to make sure it is truly beneficial to the overall grassland operation.

Reestablishing native warm-season grasses – Most of Missouri's grasslands have been converted to fescue or a mixture of cool-season grasses with fescue dominating. Landowners can improve seasonal forage production and help wildlife by converting a portion of this cool-season pasture to native warm-season grasses. These grasses are the plants to which the wildlife have adapted, and they are best at fulfilling most needs for food and cover.

Prescribed burning – Prescribed burning is being recognize as a prime tool in maintaining native warm-season grasslands. It helps in maintaining a vigorous grassland community; for example, it can maintain or increase the native legumes used by wildlife. Training, advance planning, and extreme care are needed to use fire safely. A more detailed discussion of the use of prescribed burning is given in Lesson 5.

Evaluating Existing Wildlife Habitat

The first step in incorporating wildlife management into a grassland management plan is to assess the grassland to figure out its usefulness for rabbits and quail. Several factors must be examined when looking at wildlife habitat to decide how it can be improved for these species. The criteria used to evaluate grasslands may be different for other species.

Extent of the border – The border refers to herbaceous, grassy, or woody (brush, windbreaks, hedgerows, etc.) strips of vegetation between habitat types. The strip must be a minimum of 5 feet in width to be of value to wildlife. To evaluate a border, the vegetation change must exist within the fenced area of the grassland being evaluated. Habitat components in adjacent fields will be evaluated separately within that field.

Percent of field covered by winter or escape cover – Winter and escape cover is very important to the survival of rabbits and quail. It includes dense brushy cover, brush piles, fallen logs, etc. To be of value, the cover must be dense enough that a human would have great difficulty walking through it, and a coyote or fox would be unable to catch a rabbit that ran into it.

Percent canopy coverage of shrubs and herbaceous vegetation 6 to 18 inches tall – Canopy cover provides protection from birds of prey (or aerial cover) while allowing easy movement through the vegetation. It consists of shrubs and weedy plants that are from 6 to 18 inches tall, or around knee high. The ideal range of canopy cover for quail and rabbits would be between 26 and 75 percent. When canopy coverage is less than 25 percent or more than 75 percent, the area is considered less attractive to upland wildlife, especially rabbits and quail. For example, an area with more than 75 percent coverage may be difficult for them to walk through.

Grazing pressure – The height of the grass or forage is a critical factor for wildlife such as rabbits and quail. During the growing season, quail may use the field edges for nesting but will be forced to move to other sites if the livestock graze plants to less than 8 inches. Quail nests can also be trampled and destroyed by livestock in pasture units with heavy grazing.

Light grazing may result in tall forage being present on the unit during most of the year. Too much forage could be present for rabbit and quail. Very dense grassy vegetation, especially fescue, can restrict the ability of young quail to range away from the nest.

Moderate grazing refers mainly to a cool-season pasture and is defined as leaving 3 to 6 inches of growth during the winter. For native warm-season grasses, only 50 percent of the year's growth should be removed through grazing. These grasses should not be grazed to a height of less than 8 inches. Livestock should never be allowed to "winter" on any native warm-season grassland.

If a cool-season grass pasture has a history of heavy grazing, all grazing should be deferred during the growing season to improve the vigor of the grass stand. Deferment will also improve plant composition. After a period of rest, the stand can be grazed, but it should be monitored closely to avoid the removal of too much of the forage.

Percent of ground covered or shaded by legumes – Legumes are an important plant group for both wildlife and livestock. They include alfalfa, clovers, tick trefoil, Korean lespedeza, partridge pea, lead plant, hop clover, and many others. Wildlife use both the seeds and the vegetative parts of legumes. These plants are also important in removing nitrogen from the air and fixing it in the soil for use by other plants, including grasses and forbs. Insects that make up a high percentage of the diet of quail and songbirds can also be found on these plants. Rabbits and quail find grazing units with less than 5 percent or more than 50 percent of the ground covered by legumes to be less attractive than when the ground cover ranges between 6 and 50 percent.

Plant composition – A field that is more than 90 percent tall fescue is not beneficial to wildlife. The stem density at ground level would be too thick to be attractive to wildlife. Most species would avoid an area for nesting and other purposes when fescue approaches 40 percent of the plant composition.

Pastures with mixed cool-season grasses are common in Missouri, but legumes do not make up enough of the plant population in these pastures to be attractive to wildlife. The grasses could include a mixture of orchardgrass, fescue, and bluegrass.

In some pastures, cool-season grasses are dominant, with legumes making up only a small percentage of the composition. The dominant grass could be tall fescue, orchardgrass, timothy, etc.

Areas with cool-season grass and 26 to 60 percent legumes are usually considered to be cool-season/legume pasture. These grasses could be a mixture of fescue, orchardgrass, and bluegrass, with legumes such as clovers and lespedezas. This forage system is probably the most widely used system in Missouri. The grass and legume mixture is attractive to insects that make up nearly the entire diet of young quail chicks that have just left the nest in search of food.

Pastures where legumes are dominant are excellent for turkey poults, quail chicks, and many songbirds, which can easily move through the vegetation in search of insects and succulent plants for food. Deer, rabbits, groundhogs, and small rodents also find these areas attractive as a source of food and cover.

A grassland in which native warm-season grasses are dominant provides an excellent habitat for most wildlife species when managed for other necessary habitat components as well. These grasses provide a cool, moist summer environment and a warm, dry winter environment. They are compatible with the legumes, sedges, and seed-producing forbs, which are used as browse by wildlife species. Insects, which are important in the diet of many wildlife species, thrive in the native bunchgrasses and feed mainly on the legumes and forbs. A mixture of broadleaf plants and grasses provide the diversity required by ground-nesting birds such as quail and many songbirds. It should be noted that not all introduced (nonnative) warm-season grasses provide an attractive habitat after they have become established. They most often form a dense sod that eliminates or restricts wildlife movement.

<u>Distance from center of field to edge of nearest crop field</u> – Studies show that crop fields are an important part of the habitat of bobwhite quail. If a minimum amount of pesticides is used, soil disturbance produces ragweed and other seed-producing plants that are important quail foods. Crop residues (waste grain) left on the soil surface after harvest can be an important source of food during the winter.

Studies also show that a large number of bobwhite quail nests are found within 50 to 150 feet of bare ground. If bare ground, such as crop field, is next to a properly managed grassland, the chance of a pair of quail successfully hatching and rearing their brood of young chicks is greatly increased.

When evaluating a grassland, the distance from the center of the grazing unit or paddock to the edge of the nearest crop field should be estimated. A crop field that is more than 500 feet from the center of the grassland unit is considered to be of no value to upland wildlife like rabbit and quail. A crop field with no fall tillage that is found less than 250 feet from the center of the pasture is considered to be of the highest value.

<u>Percent of grazing unit that is within 250 feet of dense woody cover or ungrazed woodland</u> – Generally, the larger the field, the less value it has for wildlife. Quail use the field edge where other habitat types, especially escape cover, are available. Studies show that quail rarely move farther than one-eighth of a mile (660 ft.) between habitat components. Cottontail rabbits require habitat components that are even closer together—250 feet. The interior of a very large grassland grazing unit would therefore be used very little by these wildlife species.

In evaluating the grassland, the percent of the field that is located within 250 feet of concealment cover, ungrazed woodland, or dense woody cover should be estimated. Generally, this area represents that portion of a pasture or hay field that quail and rabbits will use during average seasonal conditions.

Management Plans for Rabbits and Quail

Just as producers can make plans for managing livestock on a grassland, they can also make plans for the wildlife that live there. Management plans for wildlife can be designed to benefit any species. Usually, they are written for rabbits and quail. One reason is that both rabbits and quail are popular game animals. They also require a relatively small acreage, so good wildlife management plans can be written for both large and small farms. A more important reason is that the habitat needs of these species are similar to those of a variety of other species. Rabbits and quail are referred to as indicator species because if a habitat benefits them, many other species will prosper. They can therefore indicate the usefulness of a grassland for wildlife.

Summary

Producers can manage grasslands to accommodate the needs of livestock and many different kinds of wildlife. The basic requirements for wildlife habitat are water, food, and cover. Four characteristics of grasslands affect how they meet these requirements: type of grassland, plant composition, use, and size. Producers need to take these characteristics and the needs of wildlife into account when carrying out grassland management practices like grazing and haying. As they develop a grassland management plan, they need to look at the quality of the grassland for wildlife to decide where improvements can be made. Producers may also adopt wildlife management plans to manage their grassland for a particular species.

Credits

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Lesson 5: Grassland Management Plan

This lesson will show how a grassland management plan is developed to build a profitable livestock operation. The information covered in previous units will be incorporated in the plan through the management decisions made for the livestock operation.

Components of a Grassland Management Plan

Certain management tools are needed to run a profitable livestock operation. They include soil test results, soil identification information, maps, a knowledge of plant composition, information on livestock needs, and a herd inventory. Each of them provides information needed for a grassland management plan.

Soil test results provide information on the current condition of soil fertility. Soil tests are used to determine what amendments should be made to the soil in order to increase the quality and yield of the forage.

Information on soil identification can be found in soil survey manuals. The type of soil will affect the drainage and use classification of a particular grassland.

Maps in the soil survey manual will make it possible to determine where a type of soil is located in the pasture. Maps provide a visual representation of the land that shows its physical layout, including water, slope, and drainage.

Plant composition is the current quality, quantity, and variety of forage plants found on a given plot of land. A knowledge of plant composition will help to determine the best grazing system and carrying capacity for a grassland.

Livestock needs are determined by their species, age, sex, production level, and environment. This information represents the nutritional needs of the animals at any given time.

A herd inventory reveals the quantity of animals in the different production classes discussed in Lesson 1 of this unit. Production is optimized if the total nutritional needs of the herd are met by the grassland without any waste or shortage of feed.

Developing a Grassland Management Plan

Developing a grassland management plan (GMP) involves several steps. One of the first steps in developing a grassland management plan is to acquire an aerial photograph of the grassland. On the map, outline the field included in the GMP. Soil tests should then be completed for each field. A complete grassland inventory looking at plant composition must also be conducted to help the grassland manager determine the quality and quantity of pasture available and assist in calculating stocking rates.

Wildlife needs are another factor to be considered in a grassland management plan. A successful GMP can provide for both wildlife and livestock. Assistance for creating a wildlife management plan is available from the Missouri Department of Conservation.

After these steps have been completed, a grassland management plan must be selected. Possibilities for grazing are endless, and the grazing system chosen depends on the individual's situation. For example a dairy farm that requires high quality forage may have 20 paddocks and may rotate the herd twice a day. On the other hand, a small cow-calf producer could do quite well with only a three- to five-paddock system with longer rotation periods. The grassland manager needs to decide what areas should be grazed and which fields should be mechanically harvested for hay or silage.

Selection of Grazing Systems

The selection of a grazing method is based on the interaction between soil, environment, resources (such as time and labor), herd needs, wildlife, and plants. The goal when choosing a grazing system is to match the forages with livestock needs, but other factors may influence the choice of a grazing system. For example, the amount of labor available could determine how many rotations may be made or if a rotational system would be feasible. If there has been a drought, forages will decrease in yield, and supplemental feeding may be needed. Plant composition could lengthen the grazing season if the forages chosen have different growing seasons. Flexibility, intensive management, and a knowledge of plant and animal growth are the keys to profitable livestock management.

Basis of Forage Selection

The two factors that determine forage selection are forage management and livestock management. The goal of forage management is to find a forage that will create a persistent stand and produce acceptable yields. It involves determining what will grow in the given climate and site conditions. Livestock management influences forage selection by looking at the nutrient needs of the livestock and the intensity of harvest or grazing needed to sustain the herd and reach the goal of profitable gains.

Of the two factors, forage management should be considered first. The fact that a particular forage can meet the needs of the herd is not important if the forage cannot grow in the grassland. A producer should determine what plant species will grow and then decide which of these plants will best meet the needs of the herd.

Maintaining and Renovating a Grassland

Several practices are commonly used to maintain or renovate a grassland. Renovating involves making improvements to promote renewed growth. Some methods for maintaining and renovating a grassland are outlined below.

Testing the soil and then amending it is a good practice. Learning the current conditions of the soil from the test results will indicate what changes need to be made to improve the soil. Spreading fertilizer or liming are two ways to amend the soil. Disking may also be used to amend the soil when maintaining the grassland.

In renovation, suppressing or destroying existing unwanted plants may be necessary to decrease competition. The grassland manager can use chemicals or machinery to get rid of unwanted plants. If chemicals are used, he or she should be aware of the safety precautions for humans and animals and always follow the instructions on the label. Machinery can also be used to disk or plow the surface to eliminate existing plants.

Most often, renovation of a grassland includes the introduction of legumes, which may be done by overseeding or no-till planting. In Missouri, the legumes most often used are white clover, annual lespedeza, red clover, and birdsfoot trefoil. They may also be used in combination with each other. Overseeding is accomplished by broadcasting legumes into an existing pasture in which the stand is thinned or grazed close to the ground. This practice is usually carried out during late winter, which is sometimes called frost-seeding, or early in the fall. Overseeding can be one of the most effective methods of renovation if conducted properly and at the right time.

No-till renovation is accomplished with a no-till drill. The no-till drill is a piece of specialized machinery that can place the seed into the ground at an optimal depth without the ground being worked up (i.e., by disking or plowing). This practice is also sometimes used to establish additional grass. Some advantages of no-till planting are lower seeding rates, precise placement of seed, and reduction in the loss of valuable organic matter due to tillage. One of the greatest benefits of the no-till method is that soil erosion can be greatly reduced.

Prescribed burning is another way to renovate and improve the quality of grasslands. This practice is most commonly used for native warm-season grasses such as switchgrass, big bluestem, and indiangrass. Fire is used deliberately to remove the unwanted previous year's growth, keep invading woody plants in check, and reduce competition from invading cool-season grasses, such as tall fescue, bluegrass, and smooth bromegrass. Burning is usually conducted in the spring. This practice encourages fast and vigorous growth right after the burn, since it releases nutrients that are locked up in the previous year's growth. Benefits from fire usually peak 2 or 3 years after the burn, and most native warm-season Missouri grasslands need prescribed burning every 3 to 5 years. Landowners interested in using prescribed burning to maintain grasslands must learn to use it safely. Training is available from the NRCS and MDC. When planning a burn, the grassland manager should contact the local NRCS office and local rural fire departments.

Summary

For a grassland management plan to be profitable, many aspects of production must be considered. An inventory of current conditions helps the producer to make educated choices about grazing systems, forage selection, and renovation plans.

Credits

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