PHOTO BY ELIZABETH VOIGHT, 2015 NJAA/*ANGUS JOURNAL* PHOTOGRAPHY CONTEST

Managing Grass Through Grazing

Understand how grass responds to defoliation.

by ***Austin Black***

Grass management is key for successful grazing. This requires knowledge of what grasses are present and how they grow. Producers should understand how grazing affects grass in both a positive and negative way.

"Grazing is the consumption of herbaceous plants by herbivores," said Casey Matney, University of Alaska range management specialist. Grass is the most common and identifiable herbaceous plant, but with more than 10,000 grass species globally, producers must know what species they are managing.

"Describing and understanding the diversity of grasses on the rangelands of North America is not simple. While different species of grass may look similar from a distance in shape and general parts, they can range in height from a few inches to over 5 feet tall at maturity," Matney said. He provided a detailed overview of forages and how grazing affects them to attendees of last fall's Range Beef Cow Symposium in Loveland, Colo.

Characterizing grasses

Despite the diversity, all grass species are classified as either warm- or cool-season. The distinction between the two is simple. Cool-season grasses begin spring growth when soil temperature is about 40° F. Warm-season grasses start growing when soil temperature is about 60°.

Each species of grass requires different management, so producers may have to adjust their approach throughout the year.

Warm- and cool-season grasses are further divided into annual and perennial species.

"Annual grasses are born from seed and only live one growing season, while perennial grasses have indeterminate growth that may allow them to live for a few years to well over 100 years," Matney said. Annual grasses include cereal rye, sorghum, Sudan grass and crabgrass.

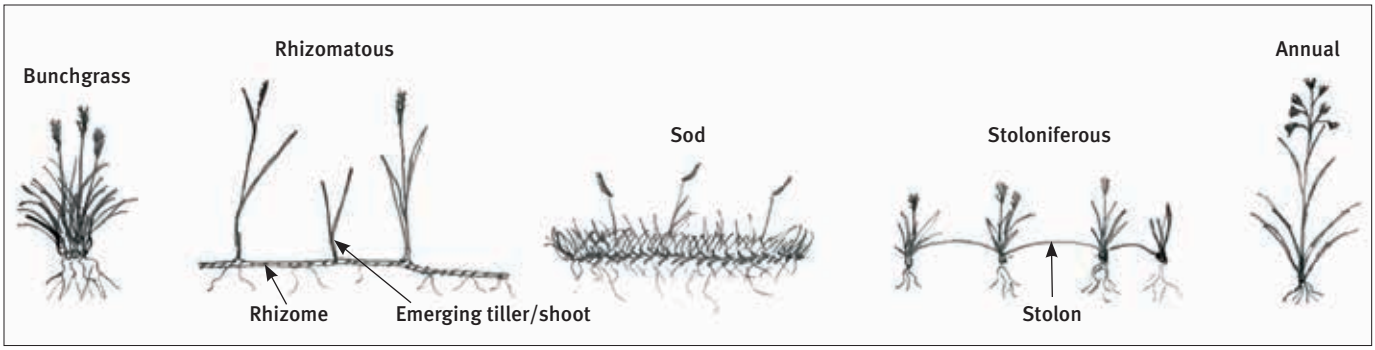
"They are fast-growing, they mine resources and they use them rapidly to produce seeds," Matney said. Annual grasses use a lot of nutrients in a short amount of time, solely for reproduction.

Perennial grasses include fescue, brome, bluestem, eastern gama grass and Bermuda grass. Unlike annuals, these grasses grow slower and conserve the soil nutrients.

"Their whole goal is to survive to the next year," Matney said. They focus on steady

CONTINUED ON PAGE 108

Fig. 1: Basic grass morphology



Source: Illustration by Casey Matney, 2012.

growth and population rather than getting big fast. By doing so, they don't use all the resources available in one season. Perennials develop larger root systems than annuals and reproduce through seeds or propagating roots.

How it works

Root structures vary among perennial grasses. They can dictate how much the grass grows under grazing and environmental stress. Perennial grass roots are stolons, rhizomes or bunchgrass (see Fig. 1).

Stolon shoots grow horizontally along the soil surface, just above the ground, Matney explained. Grasses with stolons have growing points close to the leafy area of the plant. This makes them more sensitive to grazing pressure.

Rhizomes go about 2-4 inches (in.) into the soil, Matney said. "That means those growing points down there are pretty safe from grazing." Grasses with rhizomes can tolerate intensive grazing and still reproduce.

Bunchgrass roots are found on plants that grow in a bunch, such as bluebunch wheatgrass. The roots form a massive extension within the soil, he said, but the growing points on the plant are elevated.

Above ground, all grasses have the same characteristics and parts, although appearance may vary, Matney said. The main parts are the infloresence, culm, phytomer and crown (see Fig. 2; for pictures of additional plant parts, see Matney's PowerPoint presentation available in the Newsroom at *www.rangebeefcow.com*).

The infloresence is the flower or seedhead at the top of the plant. The stem, leaves and leaf parts all comprise the culm.

As a plant grows, it develops phytomers. Each phytomer is an individual unit of grass. It contains a leaf blade, leaf sheath, internode, an intercalary meristem, an auxiliary bud and a node. Matney said the node works like a telescoping fishing pole. It's the piece that connects each new section of grass. Nodes allow the stem to extend, providing a point from which the phytomer can grow. Just above each node is the intercalary meristem, which is the base of the internode.

"These growing points are where the plant cells divide and elongate," Matney said. These three pieces form the stem section of each phytomer.

"Inside grass we have phytomers within phytomers when the plant is very short," he explained. When the plant is young, the phytomers are all stacked inside each other close to the ground. As it grows, phytomers start to appear, pushing each out as new leaves and blades develop. The plant expands and grows taller until it reaches maturity and produces seeds. Elevation occurs early in the growing season for cool-season grass and later for warm-season.

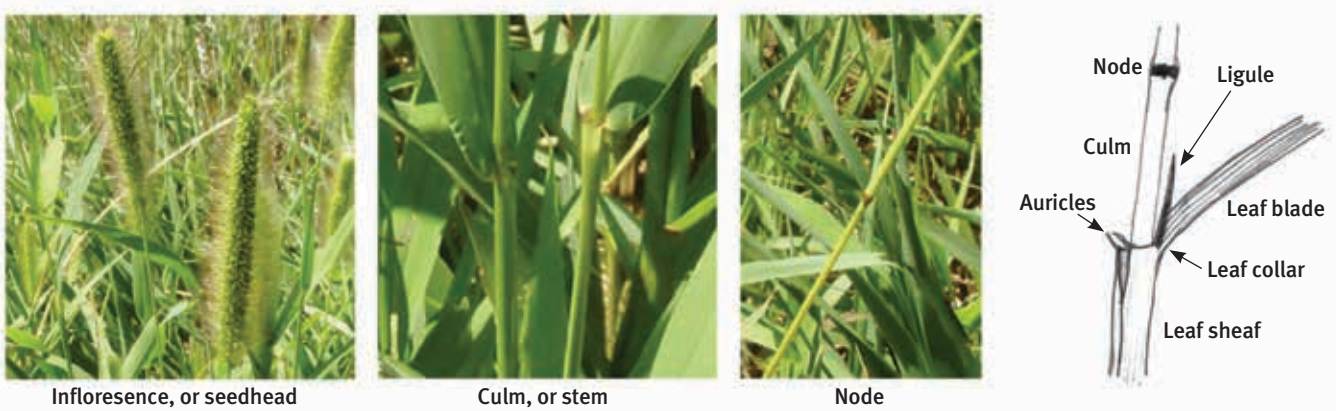
When a plant is young, these parts are found in the crown, located at the base of the plant. The crown also contains the buds and roots of the plant, located within the soil or just below the surface.

How it grows

"Tillers are individual shoots that come up from the bottom of the plant," Matney said. Each tiller contains several phytomers. For these tillers to grow, they need certain elements.

"Plants aren't going to produce [tillers] unless you have moisture and the right temperature," he said. Adequate nutrients are also important, and the plant must be the right age to produce tillers.

Fig. 2: Grass characteristics



Source: Colorado State University.

Source: Illustration by Casey Matney, 2012.

"A seedling plant is going to produce one or maybe two stems," Matney said. As a result, there isn't enough forage on the plant for an animal to eat it without pulling the plant out of the soil.

"That's why we usually don't try to graze newly seeded pasture right away," he said.

Plants require light to produce tillers, Matney added. "If the canopy is getting closed in and we're not doing a lot of grazing, we don't have a lot of light accessing the plant." Plants under shade get more far-red radiation, reducing the red-to-far-red-radiation ratio. In normal daylight, this ratio is about 1.15.

"Red light is absorbed well by plants and the far-red is not," Matney said. When leaves grow in the shade beneath a canopy, the ratio reduces to a range of 0.7 to 0.9. Removing shade from plants allows more red light to access the leaves and increases the ratio.

"More red light reaching the plant favors more tillers and less red light reduces tillering," he said. Grazing partially removes the canopy and allows more red light to reach the bottom of the plant. This helps boost growth.

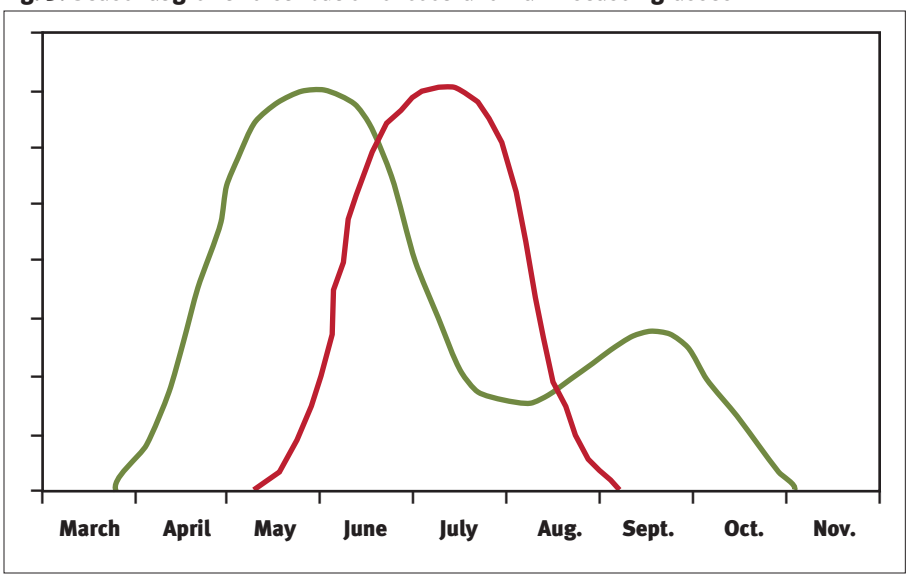
Tiller production also depends on how much defoliation the plant experiences. Factors include the kind of plant, plant size and age, time, and method of defoliation and plant height. Grazing and mowing are the main causes of defoliation.

As a plant grows, it has an apical bud at the center of the stem, Matney explained. At the beginning, this bud is at the bottom of the plant. It continues to move up as the stem grows until mid-summer when it reaches the top of the stem. At that point, the phytomers and seedhead are attached to the apical bud.

"When the leaves of a grass are removed, but the apical bud is left unharmed, then grass growth will continue seemingly unharmed," Matney said. This often occurs early in the growing season. The leaves are near the ground, and the stems haven't fully developed. If defoliation occurs below the apical bud, the bud is removed and there is no more room for phytomers to grow.

"Vertical growth for that tiller will cease and new growth will have to be initiated from dormant auxiliary buds or remaining leaves that occur below the height of the grazing event," Matney said.

Fig. 3: Seasonal growth distribution of cool- and warm-season grasses



Source: Casey Matney, 2015 Range Beef Cow Symposium, Loveland, Colo.

> **"What you want to try to do is give your grass all the benefits you can while still grazing it, and grazing it in a pattern or grazing it overall so not all the plants take all the impact all the time."**
> ***— Casey Matney***

The grazing timeline

Once producers understand how plants grow, it's important to know when that growth occurs. Cool-season plants start growing when temperatures are between 40° and 45°. Some years this happens as early as February, while other times it's later in the spring.

"Warm-season grasses start to grow in 60° to 65° weather," Matney said. Temperatures often reach this point in May.

Cool-season grasses grow the most in the spring, with peak production around May. In July, production drops, but if enough moisture is present, regrowth can occur around September, he said.

"Warm-season grasses put all their resources into the warm-season window and basically have one season of growth," Matney said. Production quickly rises in the summer to peak in July. Then it drops in the fall around the time cool-season grasses start regrowth. When growing reaches the peak, grasses shift their efforts to seed production.

"That tapering off is the initiation of what we would call the dormant period," he said. Limited day length and moisture and declining temperatures cause production to stop. Matney said producers should consider the growing cycle between warm- and cool-season grasses since both are present in many areas across the nation.

Throughout the growth period, several physiological processes take place. Plants must be able to form buds, replace roots and regenerate leaves and stems.

"When the plants grow during the season, they are using up roots. Along each root are tiny root hairs that actually don't have a very long life. They have a certain shelf life and then they'll start to die," Matney said.

Plants must also regrow after defoliation and convert oxygen to carbon dioxide during dormancy. The result is new leaf growth.

Leaf growth is crucial to grazing, so producers need to understand how plants grow leaves and how grazing affects defoliation.

During the first half of leaf growth, plants use all their energy to grow and expand the leaves. Matney said they put up their "solar panels" to absorb sunlight and stimulate growth. When the leaves are one-half to three-fourths developed, plants use their energy for self-maintenance. Afterward, plants shift energy focus to seed and root production, plant expansion and tillering.

Intensive grazing in early stages of leaf growth can reduce root expansion for that year, Matney explained. Grazing during the second stage sometimes depletes energy reserves built during the last stage. The plant

CONTINUED ON PAGE 110

Managing Grass Through Grazing CONTINUED FROM PAGE 109

must use its energy to maintain growth instead of saving it for the following year. This can lead to reduced plant vigor and inability to handle stressors, one of which is lack of moisture. This stress causes plants to focus on root development rather than leaf production.

Effect of grazing

When cattle graze, they defoliate the grass by removing material from the plant. If grass is tall, cattle often grab the plant for their first bite about 3 in. above the soil surface on average. When cattle regraze that plant, they will often bite it off about ¾ in. off the ground. The same will happen if grass is short to start with.

Grasses all respond differently to grazing pressure, Matney said. Some grasses create grazing resistance by producing thorns or chemicals. Many are designed to tolerate grazing. Those that tolerate grazing approach growth either through morphology or physiology.

Morphology entails the structure of the grass as it grows. Buffalo grass uses morphology to grow horizontally before extending upward, he shared. As a result, it can tolerate grazing to a shorter height because the growing points are near the ground.

Physiological tolerance involves the process in which the grass grows. Some grasses grow fast to ensure they are big enough before anything has a chance to graze them.

Grazing can have a positive or negative effect on grass. Negative effects include removal of photosynthetic tissue and reduced root growth and seed production.

"These are all the bad things that can happen, and whether or not bad things happen depends on genetic potential," Matney said. The kind and variety of grass and environmental stressors all dictate plant performance.

"What you want to try to do is give your grass all the benefits you can while still grazing it, and grazing it in a pattern or grazing it overall, so not all the plants take all the impact all the time," he said.

Research shows removing half the plant can disrupt root growth for one to three weeks. Removing 80%-90% of the aboveground volume can affect root growth for two to three weeks, Matney said. "However, multiple defoliations occurring at approximately 70% of shoot volume at three times per week can completely stop root growth for over a month."

That's why producers should avoid grazing a pasture the same time every year. This can tap into the energy reserves and affect root growth, he explained. "If you're trying to do root storage in July and you graze it in July every year, you're going to start pruning those roots back."

To generate growth, plants need increased photosynthesis and tillering, reduced shade and water loss, and adequate fertilizer.

When a plant is grazed, it has three options for how to use energy. It either reproduces leaves, stores energy in reserve or expands the whole plant. "The plant is constantly trying to decide what to do," Matney said, "and the response is unique for each plant."

As producers plan their grazing, it's important to remember three things, Matney said. Grazing a pasture several times creates more stress on the grass than grazing it once.

Pastures should receive adequate rest during the growing season to support plant regrowth, he added. "If I finish my grazing on a pasture at the end of September, how much time is left to regrow? Almost none. So if you do that, you realize you're giving up regrowth."

Also, grazing in winter or during seed production often provides lower-quality feed, but doesn't affect future growth.

Grazing affects photosynthesis. Thus, management will result in either reduced, equal or increased growth in grass. Decreased growth may result from environmental factors or the response of individual grasses to grazing. Lack of rest in the growing season and removal of all growing points can also affect growth.

Matney said plants need two things for increased growth to occur during grazing. They must have optimum growing conditions and multiple growing points present.

"Since field conditions are not always optimal for growth and due to a high likelihood of plant competition, increased growth is the least likely to occur of the three different scenarios," he said.

Equal or increased growth depends on the amount of leaf material removed, when the pasture is grazed, how many times grazing occurs and which plants are grazed. Plants need enough leaf material for photosynthesis and enough rest to not deplete root reserves.

"How much do you leave? Everyone knows the rule of thumb is 50%. But 50% when?" Matney said. It all depends on how much time you leave for regrowth and how many growing points are present.

"If you graze early, there's more chance for regrowth. If you graze late, potentially none," he said.

"Best production of grasses will occur when soil, water and fertility are not limiting; plant competition with undesirables is at a minimum; grazing occurs at a frequency and amount that does not overlimit root growth or remove plant growing points; there is time left in the growing season for plants to have regrowth; and expectations of managers match the ecological site, environment and year-to-year variability in which the grasses are growing," Matney said.

PHOTO BY SAMANTHA SCHERMER, 2012 NJAA/*ANGUS JOURNAL* PHOTOGRAPHY CONTEST

Editor's Note: *Austin Black is a freelance writer from Nevada, Mo.*