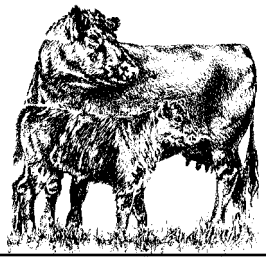

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Range and Pasture Section 590

Improved Pastures

Scott Jensen, University of Idaho
Amy Peters and Gene Pirelli, Oregon State University
Steve Fransen, Washington State University

Forages are a vital resource in the production of beef cattle. Feed costs typically exceed 50 percent of the total cost of production. Using cattle to harvest (graze) standing forage can significantly reduce feed costs and aid in decreasing the cost of production.

The basis of a successful livestock grazing system is proper management of the forage resource or pasture within the environmental limitations of the area and the knowledge and skill level of the resource manager. Climate, soil characteristics, available water, and plant species all affect pasture production and longevity, however, proper grazing management is the single most important factor affecting forage quality and quantity.

Forage quality and quantity will in turn affect stocking rate, daily gain, reproductive success, and general animal health and vigor. Much of this basic information has been known for more than a century; though it is receiving new attention as modern research and technology assist livestock producers to develop more sustainable grazing systems.

A sustainable and long-lived pasture is dependent upon proper grazing management as well as attention to details, such as appropriate soil fertility, irrigation, and weed management. A continual effort is required by grazing managers to meet the plants' needs in these areas.

Forage Growth and Management

One of the most basic needs of the pasture plant is the ability to capture solar energy through photosynthesis. This process mainly occurs in the chloroplasts of the leaves, although some chloroplasts occur in the stems. Plants that have had most or the entire stem and leaf material removed, whether through grazing or cutting, have diminished ability to photosynthesize and must rely on energy reserves from the crowns to generate new growth. Consequently, recovery from grazing/cutting is much slower.

Plant vigor and longevity can be reduced if the plants are regrazed before they have sufficiently recovered. If this process is continually repeated, a thinning or loss of the most desirable species occurs, which opens the ground cover for invasion of weeds or less desirable plant species.

The amount of residual (living plant material left after grazing or clipping) also affects the roots of the plant. Research by Johnston (1961) showed that up to 50 percent of the plant's above-ground biomass can be removed with minimal effect on the roots of that plant. Plant biomass removal of greater than 50 percent, however, has a detrimental effect on plant roots. (Table 1). This stoppage of root growth not only affects the plant's ability to recover from grazing, but it can also lead to an increase in bare soil and the invasion of weeds or less desirable plant species.

Growth of cool season pasture plants (both above and below ground) slows considerably during the heat of summer. Plants in non-irrigated areas often go through a period of dormancy during summer. In either case, proper grazing management requires that sufficient residual be left standing to provide the plant with the energy needed to rapidly initiate growth once growing conditions become favorable.

If plants are grazed below appropriate residual or stubble heights, growth that follows a dormancy period

Table 1. Effects of biomass removal.

% plant biomass removed	% root growth stopped
10%	0%
20%	0%
30%	0%
40%	0%
50%	2-4%
60%	50%
70%	78%
80%	100%
90%	100%

will be much slower and the amount of time required before the pasture is ready to graze will be lengthened. Total annual forage production of the pasture will also decrease.

Late summer and fall can be critical periods in the life of desirable pasture plants. Most pasture grasses and forbs store the bulk of their energy reserves in the lower portion of the stem and the crown. Growing points are developing in the fall to provide next spring's forage growth.

These young grass shoots or tillers are much like babies. Both need a steady supply of nutrients and protection from stress. In the fall, nutrients are supplied from the previous season's tillers, which have stored carbohydrates in the bottom 3 to 4 inches of their bases. Often these older tillers are dormant and brown at this time of year, but they aren't dead, and their storage function is critical. These older tillers also provide physical protection to the new tillers.

Common thought and practice is that dormant plants can be grazed to ground level without hurting the plant. However, plants that are grazed short during this time period are less likely to over-winter and will be slower to "green up" in the spring. The result is that these plants/pastures will require more time in the spring before they are ready to graze.

Soil Fertility

Fertility management is an important and often overlooked aspect of pasture management. Soil testing should be completed every third year at a minimum to ensure that plants' nutrient needs are met. Fertilizer should be applied to meet the needs of the growing plant but not to excess. Excessive fertilizer application will increase the potential for nutrient runoff and leaching into ground and surface waters. University fertilizer guides are available through local county Extension offices to assist with recommended application rates.

Manure is also a valuable source of nutrients for plants. Good grazing management can greatly influence manure consistency and distribution, which can in turn reduce the need for commercial fertilizer applications (see 594, Pasture Fertilization, for more details).

Nitrogen will generally mean more growth with each application. The added forage production, however, must be weighed against the cost of the increased nitrogen application to determine if it is economical.

Excessive nitrogen applications in the fall can be detrimental to plants. Excessive fall nitrogen application will inhibit the plant from starting into its over-wintering response and actually reduce plant sugar concentrations, thereby setting the plant up for possible death.

If plants are not allowed to rest and prepare for winter, they are susceptible to winter injury or death from the first major cold winter event. As temperatures change in the fall, plants protect themselves by producing a type of "antifreeze" called "Proline." This protection will accumulate in every living plant cell during the winter only if excessive nitrogen is not available.

Irrigation and Soil Moisture Management

Water availability is a major limiting factor in pasture production. Water is a vital ingredient in the photo-synthetic process. When moisture is limited, the stomata in plants close, and the photosynthetic process stops. This in effect stops plant growth.

Irrigated pastures should be managed to maintain a soil-moisture level of 50 percent or more available moisture in the root zone of the plants. In a pasture situation, the plant root zone is approximately the top 18 inches of the soil, although this may vary according to plant type and soil conditions.

A good tool for estimating soil moisture is "Estimating Soil Moisture by Feel and Appearance" (USDA 1998).This publication has pictures and descriptions to assist in estimating soil moisture content. University of Idaho CIS 1039, "Irrigation Scheduling Using Water-use Tables" (http://info.ag.uidaho.edu) also is a good resource. Many other tools are available for monitoring soil moisture, including resistance blocks, tensiometers, Hansen meters, and others.

Actual water needs (both frequency and quantity of application) on irrigated pasture will vary with such factors as soil type, ambient temperature, plant density, plant residual, etc. Clay soils have a higher water-holding capacity than sandy soils. Soils with high levels of organic matter will also hold more water. Sandy or shallow soils have limited water-holding capacity and need more frequent irrigations to keep plants growing.

Pasture plants will typically require 0.2 to 0.3 inch of moisture per day during the growing season, depending on conditions. In dryland (non-irrigated) areas as well as in irrigated areas, leaving adequate ground cover can help to conserve soil moisture and increase forage production.

Wet soils are easily compacted. Soil compaction due to hoof traffic on wet soils increases soil bulk density to the point you can hardly drive a shovel into the dry soil. Rooting intensity is reduced in these conditions and soil oxygen is also reduced, which may negatively influence rooting intensity on these pastures when root regeneration occurs again. Care should be taken to avoid grazing during or immediately after irrigation.

Forage Species Selection

One of the most frequently asked questions in regard to pasture is what plant species are best for any given area. The reality is that it "depends." While certain plant species will perform better in specific circumstances, over time pasture plant species composition and performance will mainly be determined by the management of the grazing animals.

Oftentimes productive species, such as orchard grass, tall fescue, and meadow brome, are planted in irrigated pasture ground and then repeatedly and severely grazed. Over time, these species give way to other less productive plant species, such as Kentucky bluegrass and white clover, which can better tolerate that type of management. In a real sense, plant whatever you want but over time you will get exactly what you manage for.

One choice that must be made when establishing a pasture is whether to plant one single plant species (monoculture) or a mixture of plant species (diverse). A monoculture will most likely be simpler to manage as all of the plants in the pasture will grow and mature at approximately the same rate. This might be an advantage if the pasture will be cut for hay.

A diverse pasture increases the likelihood that there will be something green and growing more days of the year. Diverse pastures are generally more productive on a total pounds of forage produced basis as diverse plants tend to "fill in" in and around each other. Diverse pastures also generally provide a more nutritionally balanced diet for livestock.

The inclusion of legumes in a diverse pasture mix should also be considered. A legume, such as alfalfa, clovers, birdsfoot trefoil, and others, can have a beneficial effect on pasture growth because legumes fix nitrogen from the atmosphere. This nitrogen can help to improve overall pasture plant vigor and growth. Be aware that legumes can potentially cause an increase in bloat problems and should generally be limited to 25 to 30 percent of the overall plant species composition.

Common grass and legume species for irrigated pastures are orchardgrass, tall fescue, meadow brome, perennial ryegrass, annual ryegrass, alfalfa, red clover, and ladino clover. Species recommendations for non-irrigated land vary greatly according to the annual precipitation the area receives.

For detailed plant specie descriptions, seeding rate recommendations, and recommendations for special soil or precipitation conditions, see USDA-Natural Resources Conservation Service (NRCS) TN Plant Materials No. 24 publication available at the local NRCS office. Forage handbooks available in many Extension offices and Web sites such as http://forages.oregonstate.edu/index.cfm can also provide valuable information on plant species selection.

Livestock Grazing Management

Grazing management is the single most important factor affecting forage quality and production. Pastures should not be grazed until the plants have recovered from the previous grazing or cutting event or dormancy period. For most cool-season grasses, this equates to approximately 8 inches of total growth. Generally, plants should not be allowed to grow beyond 12 inches unless they are going to be cut for hay. If plants are allowed to grow beyond 12 inches, they begin to enter a reproductive phase and growth rate drops, nutritional quality decreases, and the plants require a longer rest period to recover for the next grazing event.

Pasture managers should rotate livestock to leave the necessary residual required for prompt pasture recovery from grazing. The necessary residual will vary according to the plant species that are being managed for. For example, Kentucky bluegrass, white clover, and ryegrass require a minimum of 2 inches of residual for prompt recovery. Orchardgrass, tall fescue, and meadow brome as well as most other pasture species including legumes require a 3- to 4-inch residual.

While a 4-inch residual might give the appearance of leaving considerable feed ungrazed, it is important to recognize the benefits to both pasture and livestock. Pastures will recover more quickly and require shorter rest periods since they have more photosynthetic area. This will result in increased forage production over the length of the growing season. Livestock will benefit through increased bite size and, thus, increased intake. This translates into better performance of the cattle.

The speed of recovery is also influenced by additional factors. Available moisture, nutrient availability, forage species, and ambient temperature will affect growth and recovery rates. Timing of the plant's growing cycle in which grazing occurs also plays a significant role in plant growth and recovery rates. Grazing rotations should be adjusted to reflect growth rate of the pasture.

Productivity of a pasture can often be increase by increasing the intensity of the management of that pasture. Additional information on management intensive grazing can be found in fact sheet 592.

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