Stocking Rate and Grazing Management

Kansas State University
Department of Agronomy MF-1118 Stocking Rate

Grazing management is the art of integrating animals, feed, and other inputs with land, labor, and capital resources. In this publication, land includes rangeland, tame pasture, annual forages, and crop residues. Labor includes the owner/operator, family, and hired help. Capital includes cash, other assets that can be easily converted into cash, and available credit.

The goal of grazing management is to market a valuable product at a profit, while maintaining or improving the productivity of grazing land resources. Grazing management relies on several principles and practices. Of these, stocking rate has the largest impact on both animal performance and forage resources. Understanding grazing management principles is one of the keys to the ultimate profitability of the operation.

Stocking Rate

Stocking rate is defined as the land area allocated to each grazing animal for a specific length of time. Stocking rate influences:

- How well the plant can recover from grazing during the growing season
- Future forage production
- The quality of the available forage
- Animal performance
- Long-term change in species composition

Many livestock operations base their stocking rate on tradition, the advice of their neighbors, financial pressure, research results, or simply a best guess. For grazed forages to remain productive, grazing use must be matched to the individual pasture's carrying capacity.

Determining stocking rates requires knowledge of forage production and grazing pressure. The amount of forage available for harvest is affected by climate; soil characteristics such as depth, slope, and texture; and the extent of unproductive areas where rocks, brush, and unpalatable species are prevalent. Of these factors, climate has the most significant and overriding influence on forage production. Forage production varies between pastures and locations within a pasture.

Grazing pressure is the ratio of forage demand to the amount of forage available. It is usually measured in terms of the number of animal unit months (AUM) per acre, although it may also be measured by AUMs per ton or pound of available forage. An animal unit (AU) is defined as the average annual amount of forage required for a 1,000-pound mature cow of above-average milking ability with a calf less than 3 to 4 months old, weaned at 400 pounds. After 4 months of age, a 400-pound calf requires an additional 0.3 AU equivalents (AUE). Other classes of livestock are defined in terms of AUEs. For example, a 1,000-pound dry cow has an AUE of 0.9. A 500-pound calf has an AUE of 0.5. One AUE consumes about 750 pounds of air dry forage per month.

Changes in the type of grazing animals, the animals' physiological stage, and forage availability can each cause a change in grazing pressure.

When matching grazing pressure and carrying capacity, the goal is to devise a management system that will optimize animal and forage production over the long-term, rather than attempting to maximize either factor by itself. The graphs in Figure 1 depict the relationships between animal production and stocking rate (Georgia — Hoveland, 1986; Virginia — Blaser, et al., 1986; Texas — Kothmann, 1975; Wyoming — Hart, et al., 1988). The results of these four research efforts, designed to maintain or improve long-term forage productivity, were essentially the same even though they were conducted at different locations with different forage types.

This relationship, along with long-term research in Kansas and other Great Plains states, indicates that a moderate grazing intensity will result in the best long-term economic gain. The goal of moderate stocking in this sense is to attain the best compromise between maximum gain per animal and maximum gain per acre, rather than to maximize either by itself.

Hart, et al. (1988) developed an economic relationship from their Wyoming stocking rate information (Figure 2). Maximum profits occur about midway between the maximum animal production per acre and the point at which individual animal performance begins to decline. These results are similar to those obtained by Bement (1969) on shortgrass plains in northern Colorado.

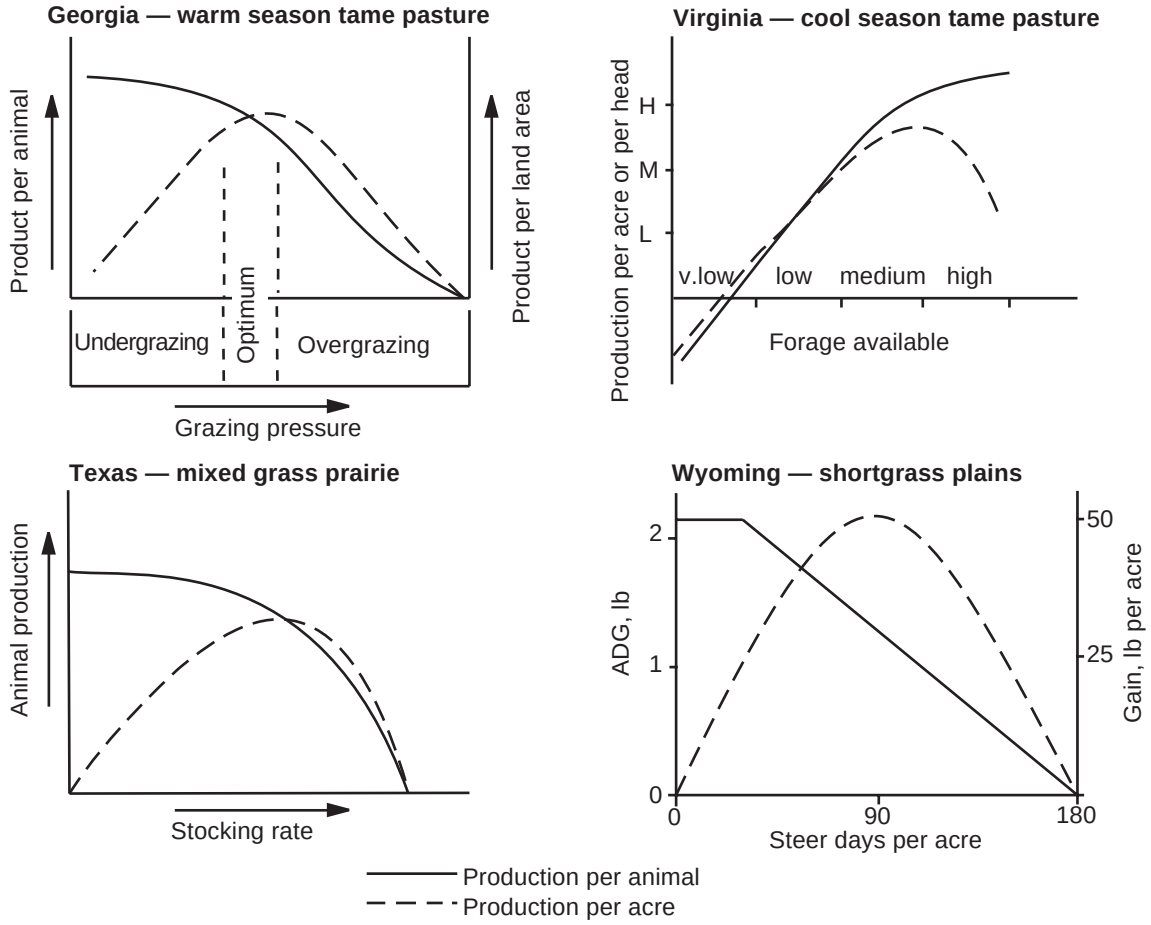


Figure 1. *The relationship of animal production to stocking rate based on research on different forage types.*

A manager's goal should be to use a moderate stocking rate, but be prepared to change stocking rate, remove livestock or supply additional feed during periods of drought or other stress situations.

Uniform Utilization

Grazing animals usually will not graze an area uniformly. When patchy grazing occurs, forage availability will suffer, resulting in reduced animal performance. Uneven grazing patterns can occur for several reasons:

Pasture shape, terrain, and water location. Rough terrain and poorly distributed water will often result in underused areas within a pasture. The shape of a pasture can also affect uniformity of grazing. For example, in a large "L" shaped pasture with the water in one end, the end farthest from water will usually be underused. Even utilization of these areas is often difficult and requires changing the grazing animals' habits and patterns. Animals will readily travel more than one mile to water on level terrain, but may not travel 1/2 mile in steep or heavily rolling terrain.

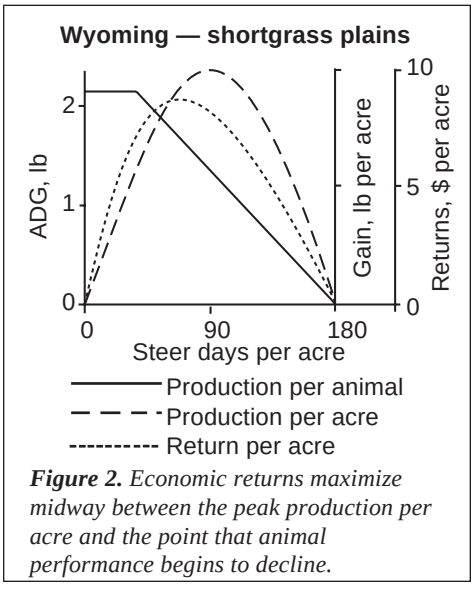


Figure 2. *Economic returns maximize midway between the peak production per acre and the point that animal performance begins to decline.*

Grazing preference. Grazing animals will often prefer certain forages over others, and those preferred forages are said to be more palatable. The relative palatability of a plant species depends on factors such as the other species present, stage of growth of each species, and soil fertility level.

Grazing animals will concentrate in areas where the plants are most palatable. Highly palatable species include eastern gamagrass, big bluestem, Indiangrass, little bluestem, and sideoats grama.

Switchgrass, blue grama, and buffalograss will be grazed the least when the more palatable species are

present. Western wheatgrass is palatable in the early spring, but rarely grazed during late spring and summer. In the fall, new growth again makes it palatable.

Some plants are almost never preferred when other forage is available. These species are readily grazed only when planted and managed as a pure stand. Examples would be the Old World bluestems and tall fescue.

Forbs (broadleaf plants) and browse (woody plants) vary in palatability. Examples of highly palatable forbs are showy partridgepea and Illinois bundleflower, while leadplant and Russian olive are examples of browse that are palatable only at certain times of the season.

Seasonal nutritional needs. Forbs and shrubs often fill nutritional needs during certain periods of the year and may cause seasonal variations in grazing animal distribution. Western ragweed is consumed at higher rates in late spring and early summer because of its high dry matter content. Warm-season grasses are high in quality during this period, but are low in dry matter.

Many options are available to help encourage more uniform grazing patterns, such as salt/mineral movement, water developments, prescribed burning, and cross fencing. A more complete discussion of these management options is found in KSU Extension publication MF-515, *Grazing Distribution.*

Degree of Utilization

Degree of utilization refers to the proportion of the current year's forage production that is consumed and/or destroyed by grazing animals. Each pasture has an optimal degree of utilization, depending on the palatability of the plant species, the season that the pasture will be grazed, and the kind and class of livestock.

In determining stocking rates, only the palatable species on the areas normally grazed should be considered. If unpalatable species or ungrazed areas are included when determining the total forage production of the pasture, overuse of the most palatable species may occur.

Three questions should be answered in determining how much available forage the palatable plant species can produce:

How much of the herbage should remain when the animals are removed? As a general rule, no more than 50 percent of the current season's growth should be removed during the growing season. By leaving sufficient leaf area, the plants can produce enough foodstuffs for current growth and to rebuild stored food reserves. To maintain 50 percent of the leaf area, about $^2/_3$ of the current season's leaf length can be removed at any one time (Figure 3). Season of use, length of the grazing period, time available for regrowth after grazing, condition of the grazed plants, and current weather conditions influence this decision.

How much of the total plant biomass is expected to be lost during the season due to trampling, insects, leaf drop, disease, and wildlife? These are competing losses that must be considered in the determination of utilization. Normally, 25 percent of the current year's dry matter is considered lost through natural processes under season-long grazing.

How much of the herbage produced will be available for harvest by livestock? Season of use and forage nutrient content are major considerations in animal performance.

The estimated percentage of the forage actually harvested changes with the type of grazing method used. Indications are that harvest efficiency increases as the rotation interval is shortened. According to estimates, as much as 40 percent of the forage is harvested with intensive rotation systems. If these estimates prove to be real and animal performance can be maintained at or near season-long grazing values, increased harvest efficiency will result.

Specialized intensive-management grazing programs may increase the relative amount of forage harvested. The more intensive systems are normally used on irrigated, tamegrass, or annual pastures. Their use on rangeland is recommended only when the manager commits to the higher management level required.

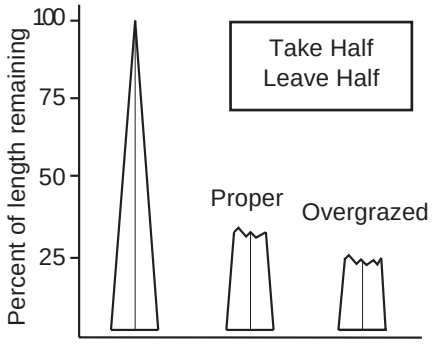


Figure 3. *Removing $^2/_3$ of the current season's leaf length (equivalent to 50% of total leaf area) will not reduce plant productivity.*

Season of Use

There is an optimum season of use for every combination of plant and grazing animal. Vegetative plant growth prior to seed stalk development is the period of highest nutritional quality and highest animal performance. After seed stalk development, forage quality declines. This is true for both warm- and cool-season forages, whether annual or perennial.

Likewise, there is a period during the plants' growth cycle when grazing pressure should be reduced. For warm-season plants, this period is during early vegetative growth (late April to early May) and again during reproductive development (July to frost). For cool-season plants it is in early spring and again in the July-August and early fall periods. During these periods, heavy grazing should be avoided.

Reducing the leaf area of a perennial plant during the late summer and early fall restricts its ability to produce foodstuffs for current growth needs, stored food reserves and root growth. Each growing season, approximately one-third of the root system must be replaced by new growth due to losses caused by root pruning, shrink-swell of the soil, and diseases. Under heavy grazing pressure, this new root growth may stop and existing roots may die back even further.

Developing a grazing management strategy that meets both plant and animal needs is a challenge. Consideration should be given to using forages that have different growing seasons. Combining a cool-season pasture (such as smooth brome, tall fescue, wheat, rye, and triticale) with a warm-season pasture (such as rangeland, bermudagrass, sudangrass, and millet) can be a way to increase carrying capacity and animal production. This type of system provides a longer green forage period. A complete economic analysis of the alternatives should always be made **before** beginning the system. For more information on economic budgets, see the most recent set of KSU Extension Farm Management Guides available at your county Extension office

Table 1. *The relative proportions of grass, forbs, and browse in the diets of cattle, sheep, and goats.*

Kind of Forage	Cattle	Sheep	Goats
Grass	60%	40%	20%
Forbs	20%	40%	30%
Browse	20%	20%	50%

Kind and Class of Livestock

The kind and class of livestock influences stocking rate. Different animals prefer different forages, as shown in Table 1 (Taylor, 1981):

- Cattle diets consist primarily of grass.
- Sheep tend to prefer forbs over grass and browse.
- Goat and deer diets contain large amounts of browse compared to cattle and sheep diets.

Because of the differences in dietary preference, mixing kinds of livestock under certain conditions to increase carrying capacity and production is possible. However, the forage source must have the necessary

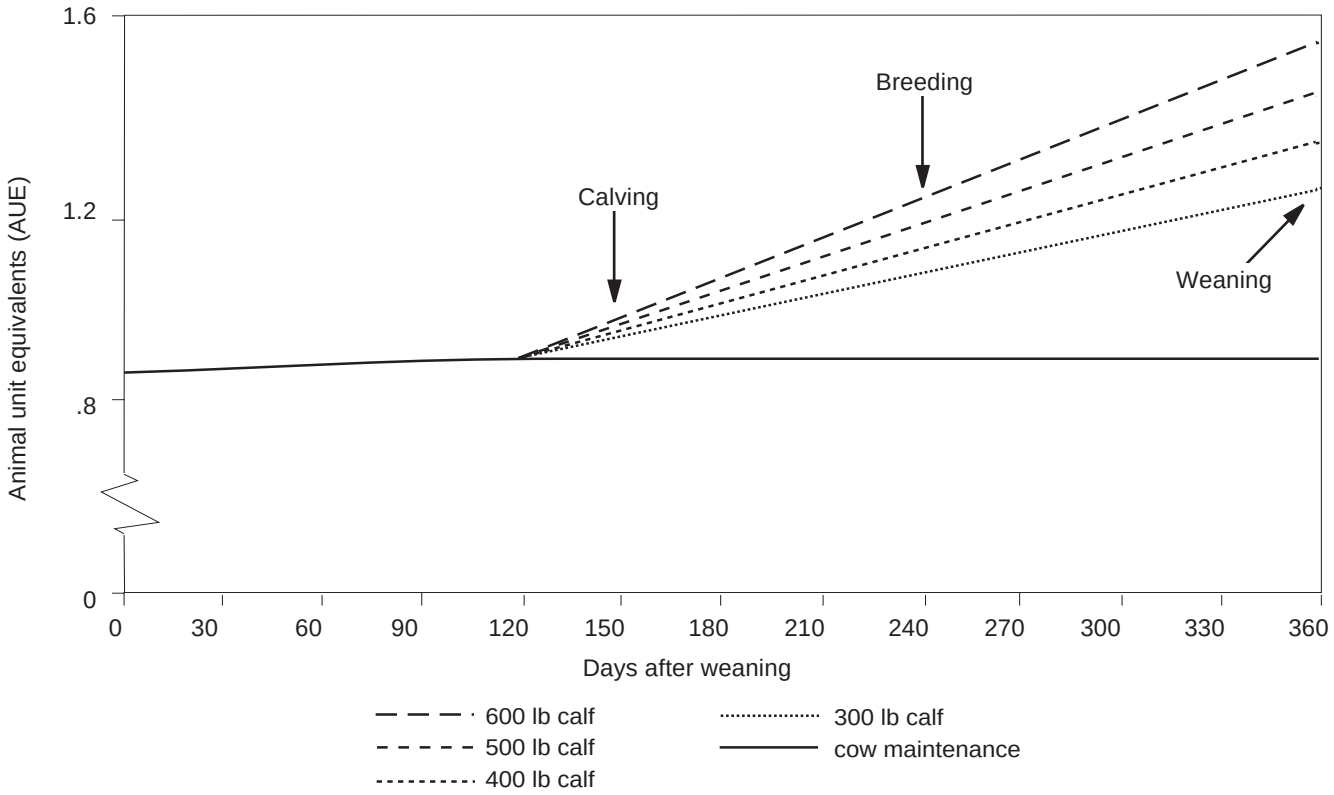


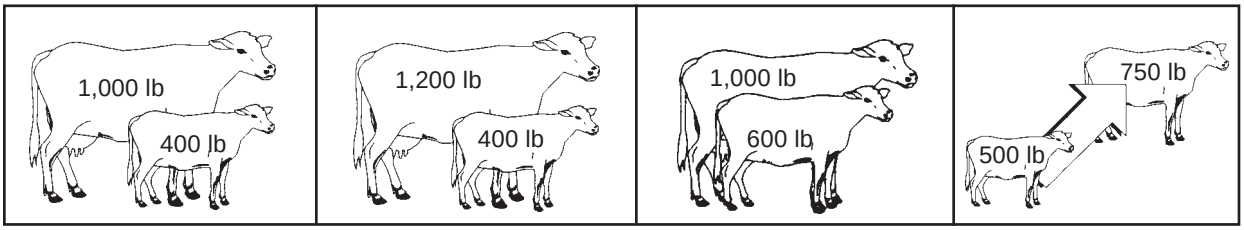
Figure 4. *The relationship of weaning weight to animal unit equivalents for a 1,000-pound cow with various weaning weights, based on NRC requirements.*

diversity and production for the animals to meet their dietary preferences. For example, cattle and sheep will compete if grazed together in a predominately grass pasture. However, they will complement each other if grazed together in a pasture with a high proportion of forbs and browse. Whatever the forage source, grazing cattle and sheep together will place increased management requirements on the operator.

The size, age, and reproductive stage of an animal determines forage needs. As an animal's size increases, its forage requirements also increases. Forage requirements also increase for rapidly growing animals. Pregnant and lactating females have added demand for forage from the last trimester of pregnancy through weaning.

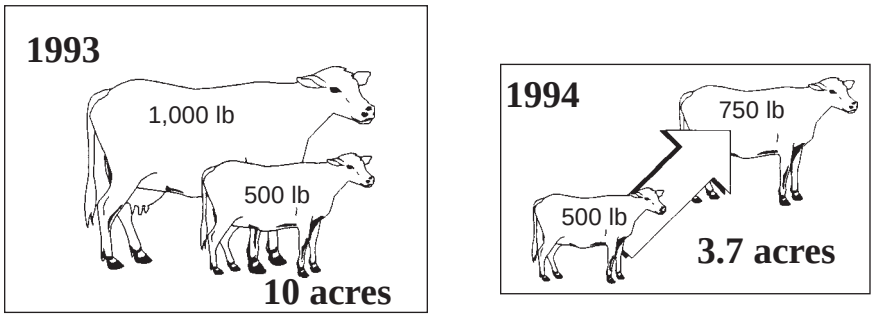
The AU method, defined in a previous section, is a convenient way of adjusting stocking rate for size, age, and reproductive status. An AUM is the amount of forage intake for one AU for 30 days — about 750 pounds of air dry forage. Figure 4 depicts the AU changes for a 1,000-pound cow weaning different size calves for one year. A dry cow requires approximately 0.9 AUE of forage. By weaning time, 1.2, 1.3, 1.4, and 1.5 AUEs are required for weaning weights of 300, 400, 500, and 600 pounds respectively. A cow weighing 1,200 pounds has an AUE of 1.2 plus the requirement for the calf.

Figure 5. *Calculating the AUE of different classes of livestock.*



	Standard Animal			
Animal	1,000-lb cow Above-average milking Graze 6 months Wean calf at 400 lb	1,200-lb cow Above average milking Graze 6 months Wean calf at 400 lb	1,000-lb cow Above average milking Graze 6 months Wean calf at 600 lb	500-lb stocker Graze 5 months to 750 lb
Change	—	Cow is larger	Calf is larger	Stockers
AUE				
Cow	This 1,000-lb cow is defined as 1.0 AUE	$\frac{1{,}200\text{ lb}}{1{,}000\text{ lb}} = 1.2$ AUE	$\frac{1{,}000\text{ lb}}{1{,}000\text{ lb}} = 1.0$ AUE	NA
Calf	A 400-lb calf averages 0.3 AUE over a 6-month period	0.3 AUE	$0.3 + \frac{(600 - 400)}{1{,}000} = 0.5$ AUE	NA
Stocker	NA	NA	NA	$\frac{(500\text{ lb} + 750\text{ lb}) \div 2}{1{,}000} = 0.625$ AUE
AUM				
Cow	1.0 AUE × 6 months = 6.0 AUM	1.2 AUE × 6 months = 7.2 AUM	1.0 AUE × 6 months = 6.0 AUM	NA
Calf	0.3 AUE × 6 months = 1.8 AUM	0.3 AUE × 6 months = 1.8 AUM	0.5 AUE × 6 months = 3.0 AUM	NA
Stocker	NA	NA	NA	0.625 AUE × 5 months = 3.125 AUM
Total AUM	7.8	9.0	9.0	3.125
***Forage equivalent**	7.8 AUM × 750 lb = 5,850 lb	9.0 AUM × 750 lb = 6,750 lb	9.0 AUM × 750 lb = 6,750 lb	3.125 AUM × 750 lb = 2,345 lb

*750 lbs of air dry forage per AUM



Assumptions:

- 1993 stocking rate was correct.
- Length of time on pasture was 6 months for 1993 and will be 5 months for 1994

AUE	Cow/calf = 1.4 AUE	Stocker = 0.625 AUE
AUM	1.4 x 6 = 8.4 AUM	0.625 x 5 = 3.125 AUM
Stocking rate	10 acres per pair	(3.125 AUM/8.4 AUM) x 10 = 3.7 acres per stocker

Figure 6. *Adjusting Stocking rate for different classes of livestock*

To estimate the AUE of growing cattle (stockers, replacement heifers), the following equation can be used:

$$\frac{(\text{weight on grass} + \text{weight off grass}) \div 2}{1{,}000}$$

As an example, a 500-pound stocker going on grass is expected to weigh 750 pounds coming off the pasture. The AUE is 0.625. Figure 5 illustrates the AUE calculation for four examples: a standard animal, a cow-calf pair with a heavier cow, a cow-calf pair with a heavier calf, and a stocker.

AUE's can be used to adjust stocking rates for the class of livestock being grazed. The method to use is illustrated in Figure 6. In the example given, a 1,000-pound cow weaning a 500-pound calf (1.4 AUE) were grazed on a 10-acre pasture during the previous year. Assume that this stocking rate was satisfactory. During the current year, stocker cattle with an AUE of 0.625 (as described in Figure 5) will be grazed on that same pasture. To adjust the stocking rate for the new class of animal, calculate the AUM's of grazing each will require. The ratio between the new stocker animal (3.125 AUM) and the previous cow-calf pair (8.4 AUM) should be determined. This ratio is 3.125/8.4, or 0.37. Now, instead of one cow-calf pair per 10 acres, the 500-pound stocker animal would require less than half as much acreage, or 3.7 acres. If the grazing season length is different between the two animals, adjust the stocking rate by the proper ratio. Suppose the stocker will be grazed for 5 months compared to 6 months for the cow-calf pair. The stocking rate for the stocker would be $^{5}/_{6}$ of 3.7 acres, or 3.1 acres per animal.

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For additional information:

Tame Pasture:

Smooth Brome Production and Utilization, (C-402)
Tall Fescue Production and Utilization, (C-792)

Rangeland:

Range Grasses of Kansas, (C-567)
Management Following Wildfire, (L-514)
Grazing Distribution, (MF-515)
Rangeland Weed Management, (MF-1020)
Rangeland Brush Management, (MF-1021)
Native Hay Meadow Management, (MF-1042)

Prescribed Burning:

Prescribed Burning: Safety, (L-565)
Prescribed Burns: Planning and Conducting, (L-664)
Prescribed Burning: A Management Tool, (L-815)
Prescribed Burning: Equipment, (L-876)

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