Behavior of Beef Heifers on Ozark Ranges

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INTRODUCTION

The grazing habits of beef cattle are influenced by their environment. Control or partial improvement of the factors detrimental to good growth performance would lead to increased returns to cattlemen. Most nutrient factors can be adjusted by the proper placement of salt, mineral, and vitamin stations. Climatic factors, on the other hand, cannot be controlled, but any harmful effects can usually be reduced through grazing management.

Detailed observations of grazing habits of cattle in prairie regions adjacent to the Ozarks have contributed to the development of improved grazing management systems in those areas (Moorefield and Hopkins 1951; Weaver and Tomanek 1951; Dwyer 1961).[2] Little information, however, has been available about cattle movement and forage preference in forest ranges of the Ozark region. This publication reports some of the relations of range cattle activities to certain environmental factors and the extent to which these relations have contributed to overgrazing in some areas and undergrazing in others—a major range management problem in the Ozarks.

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[2] Names and dates in parentheses refer to Literature Cited, page 13.

Figure 1.— Typical southwest Missouri glade grazing land: *forefront and center,* **open glades;** *left,* **brushy glades,** *in the distance at right,* **old fields; and** *remainder,* **open and closed woods.**

METHODS AND PROCEDURES

The study area. — The study was made on a 1,240-acre grazing allotment in the Mark Twain National Forest, southwest Missouri, in 1962. The allotment enclosed approximately 232 acres of open glades, 260 acres of brushy glades, 140 acres of old fields, and 608 acres of open and closed woods (Fig. 1).

Observations of animals. — In April 1962, twelve 16-month-old heifers, relatively uniform in size and weight (slightly less than 500 pounds), were selected from the herd and marked with a cattle marking dye (Fig. 2). The animals were returned to the herd and allowed to disperse over the allotment before observations were begun. On each observation date—starting in mid-May and at approximately 14-day intervals —an animal was selected for study. No specific animal was observed more than one time throughout the grazing season. Observations were made during nine days over the study period; consequently, nine animals were actually observed. Notes were also recorded on movements of the herd.

Observation of an animal began about 5 p.m. and continued for 24 hours. The period from its rising in the morning to bedding down in the evening was called a "cow day;" the remainder of the 24 hours was called a "cow night." Time of change in activity and the time spent in each activity were recorded for each vegetation type. The route of animal travel during the 24-hour period was drawn on an overlay on an aerial photograph, and travel distance was measured from the drawn route.

Climatic factors. — Temperature and humidity at a 4-foot height (obtained with a sling psychrometer) were recorded hourly.

Vegetative factors. — A composite sample, weighing 100 grams air-dry, of the grasses, forbs, or browse eaten by the observed animal was collected on each date and analyzed for its nutrient content.

Figure 2.— At the start of the study, heifers were weighed, marked, and released to the main herd.

CATTLE ACTIVITIES

The cow-day was spent mostly in obtaining food or ruminating food ingested. Little time was left for resting—i.e., being completely inactive. These results suggest that the forage was either scanty or of low quality.

Grazing

HOURS SPENT

The heifers generally began to graze as soon as there was enough light to readily distinguish objects. They grazed intensively from approximately 5 until 9 in the morning, then ruminated and rested until 2 or later in the afternoon, and grazed again until 4 or 5 p.m. The morning grazing period was generally more continuous and more regular than the afternoon grazing period. Usually on hot summer and fall days the heifers waited until 6 p.m. to graze. There was little grazing after dark.

The heifers grazed an average of 10.6 hours in a 24-hour period, 9.4 of the hours during the cow-day. The total grazing time is somewhat less than the 11.6 hours spent by mature beef cows on short grass range in Montana, but only 6.7 of those hours were during the cow-day (Peterson and Woolfolk, 1958.) The results of both these studies are in strong contrast to those reported by Atkeson *et al.* (1942) in Kansas: Dry dairy cows and heifers spent only 7.0 hours grazing per 24-hour period on highly productive Balbo rye pasture; 4.3 of the hours were during the cow-day.

Ozark range improvement, as pointed out by Ehrenreich and Buttery (1960), would provide additional forage, thereby reducing the hours spent traveling and grazing. The additional time available for resting would result in more efficient gains in animal weight.

EFFECTS OF TEMPERATURE AND HUMIDITY

The effects of temperature and humidity on the heifers in this study have been partially reported by Ehrenreich and Bjugstad (1966) and can be summarized briefly as follows: Temperature and humidity influenced daily activities, especially grazing. The two factors did not exert as great an influence during the late spring and early fall grazing season as during the hotter summer months. However, a temperature-humidity index shows grazing time is very closely related to the combined effects of temperature and humidity throughout the season (Table 1). This index is obtained by the equation:

$$THI = 0.4\ (T_d + T_w) + 15$$

where THI = Temperature-humidity index
T_d = dry-bulb temperature
T_w = wet-bulb temperature

A THI greater than 70 caused a reduction in grazing time. The reduction was substantially greater when the THI was above 75, meaning that the animals are reluctant to graze when humid conditions coincide with high temperatures (Fig. 3). This phenomenon—high temperature combined with high humidity—commonly occurs during the summer months and dictates the necessity of highly productive improved pastures or native pastures in top condition for consistent maximum gains in animal weight.

TABLE 1--RELATIONSHIP OF COW-DAY THI[1/] AND TIME SPENT GRAZING IN EACH COW-DAY AND 24-HOUR PERIOD

Observation date		THI	Grazing time (hrs.)	
			Cow-Day	24-hour period
Late Aug.	(22nd)	79	7	9
Mid-July	(11th)	77	9	9
Early Aug.	(8th)	77	10	11
Mid-May	(16th)	75	9	9
Late June	(27th)	75	9	9
Late May	(31st)	70	11	12
Early Oct.	(9th)	69	9	11
Mid-June	(13th)	68	11	12
Early Sept.	(5th)	64	11	12

1/ Temperature-humidity index.

Native grass pastures are commonly used during the hot summer months. A rotation burning system as advocated by Duvall and Whitaker (1965) or a rest-rotation grazing system as reported by Hormay and Talbot (1961) may increase the quality and quantity of native forage plants and reduce the grazing time needed to obtain adequate forage.

Figure 3.—Animals were reluctant to graze when humid conditions coincided with high temperatures.

Rumination

The animals ruminated while standing or lying, and occasionally while walking. Average ruminating time during a 24-hour period was seven hours and 33 minutes. Slightly more than half of this was at night. As the forage matured, rumination time and mastication per cud increased; both reached a maximum in July and August when most forage plants were near or had reached maturity.

Date	*Hours of ruminating*	*Mastications per cud*
Mid-May	6.6	45
Late May	5.2	44
Mid-June	6.3	44
Late June	7.9	58
Mid-July	9.0	53
Early August	6.0	52
Late August	9.3	74
Early September	8.8	No data
Early October	9.2	44
Average	7.6	52

Watering, Salting, and Walking

Water in developed ponds and springs and in intermittent pools in stream bottoms was plentiful throughout the 1962 grazing season. Salt, however, was supplied by only two salt licks in the 1,240-acre grazing allotment.

The time of day when animals took salt or water was without obvious pattern. However, all observed animals drank water at some time during the day of observation, but only three of them took salt—the animals observed in mid-May, late May, and early September.

Since drinking is a daily activity, the location of watering places should be selected carefully so as to distribute the animals for more uniform forage utilization.

The animals usually grazed in the general direction of water. They seldom lingered at the watering place, nor did they stand in the water to cool themselves or keep flies away as observed by Dwyer (1961) in Oklahoma and Weaver and Tomanek (1951) in Nebraska (Fig. 4). Instead, they would generally move into nearby woods or resume grazing. Possibly they used the bushes and trees to protect themselves from the sun as well as to dislodge insects. This suggests that a 100-percent kill of poor timber when converting an area to grass may not be desirable; perhaps 10 to 20 percent of the overstory should be retained.

Salt was not taken on every observation date, yet salt must be a necessity. The animal observed in mid-May spent over two hours licking a salt block. At one time on this day, a herd of 10 was trying to get to the block, and some animals left without suc-

Figure 4.— The cattle did not stand in the water to cool themselves or to get away from flies.

ceeding. Loose salt in place of block salt would reduce time needed to lick salt.

The salt licks were not always kept supplied. Both the north and the south lick were empty during the late June observation date. The animal under observation plus 10 others moved to the north salt lick for salt, found it empty, and then walked to the south lick, only to find it empty also. These animals walked 2 miles in search of salt. Obviously, a salt supply should be continuous, and the salt licks should be not more than ½ to 1 mile apart.

The animals walked (walking to salt or water plus moving during grazing or other activities) an average of 3.5 miles in 24 hours:

Observation date	*Miles per day*	*Observation date*	*Miles per day*
Mid-May	3.6	Early August	2.9
Late May	3.0	Late August	2.2
Mid-June	4.0	Early September	3.1
Late June	5.4	Early October	2.0
Mid-July	5.2	Average	3.5

Travel distances were greatest in mid-June, late June, and mid-July because the animals were searching for salt and mushrooms. As discussed later, the taste they had developed for mushrooms suggests a need for nutrients they were not getting from other plants. Providing a readily available salt source and a balanced ration by supplementation could reduce travel distances.

AREA PREFERENCE BY VEGETATION TYPE

"The eye of the master fattens his cattle" is an adage that every stockman should bear in mind. He must frequently observe his cattle to check for disease, parasites, injuries, or other maladies, and to see that the cattle are prospering. But to do this in the wooded grasslands of the Missouri Ozarks, he must have some idea where they will be; otherwise he will waste time searching for them. Even more important, if he knows where the cattle spend most of their time, he can place calf creep feeders, mineral and vitamin stations, and medicine for the animals in the most advantageous spots.

Grazing areas supporting the study animals, in descending order of preference, were open woods, open glades, old fields, brushy glades, and, least of all, the closed woods (Fig. 5).

In mid-May, most of the grazing was in old fields and open glades where there was ample young nutritious forage. At this crucial time when spring-born calves are very young and susceptible to disease and injury, the cattle were easily found and observed in these areas.

Between late May and mid-July, even though the open areas still had plenty of good forage, the cattle grazed mostly in open and closed woods. The protein and phosphorus content of grass and sedge forage reached deficiency levels during this period, and the cattle were alleviating a dietary deficiency by searching for and eating the mushrooms (high in protein and phosphorus) growing in the woods. The performance of these animals could have been improved by placing feeding stations with a high protein and phosphorus supplement in the open areas during June and July (Fig. 6). This might have induced the cattle to spend less time in the woods,

Figure 6.— Placing salt and supplementary feeding stations in fields and glades encourages grazing in these areas, where forage is most abundant and accessible.

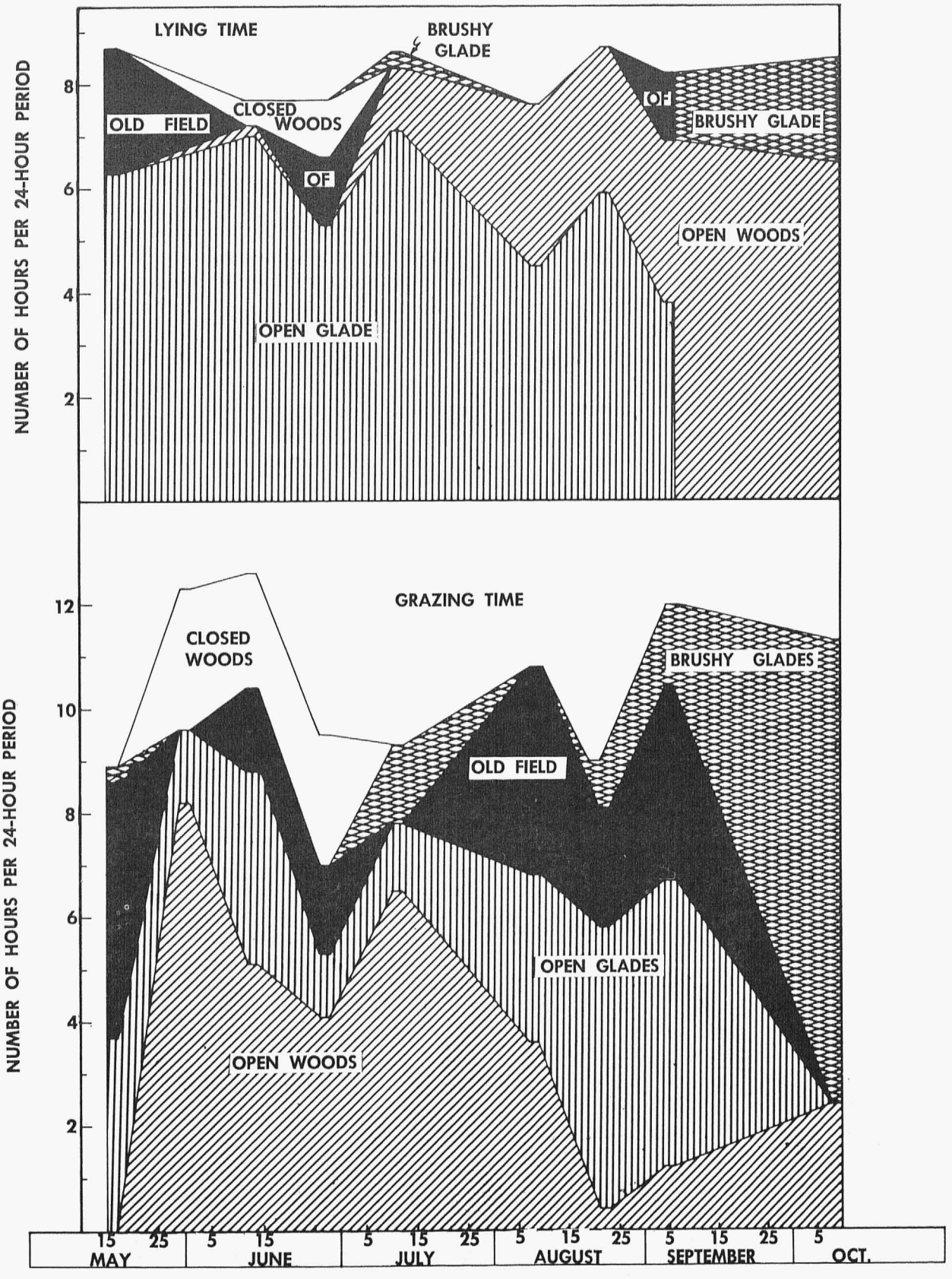

Figure 5.— Grazing *(lower)* and lying *(upper)* time spent in each vegetation type. One animal observed on each observation date.

where much walking is required to graze on the sparse forage and to obtain mushrooms. Creep feeders, to promote increased weaning weights of calves born in fall and early winter, then could be located in old fields and open glades. Creep feeders must be placed where the cows spend most of their time as the calves will not leave the cows to go to the feeders.

During August and early September grazing was again mainly in the old fields and open glades, but in late September and October, the animals started eating fallen fruit (including acorns), and grazed mostly in the brushy glades and, to a lesser extent, in open woods. The brushy glades supported a good stand of little and big bluestem, which remained green late in the fall of the year. These areas also had many wood species, such as persimmon, sassafras, and oaks, which shed fruits that are palatable but of questionable value for beef cattle. At this time, creep feeders and supplemental feeders should be shifted to the brushy glades to encourage utilization of grass and forb forage and less use of fruits such as acorns. In September and October calves require supplemental feeding of protein and phosphorus and make good use of creep feeders.

Most lying time was spent in the open glades throughout the grazing season except in early October when most of it was in the open woods (Fig. 5). Only a small part of the lying time was in brushy glades, open fields, or closed woods. Area preference for standing was very similar to that for lying. These preferences are additional indications that creep feeders and supplemental stations should be located in open glades for most of the season except late in September and October when they should be moved to the brushy glades.

FORAGE PREFERENCE

The study animals grazed on numerous species of plants at any one time, with further variation among seasons. Apparently the selection was based on the animals' desire as well as on the availability and palatability of the plants.

In mid- to late spring the animals grazed on forbs and to a lesser extent on browse, grasses, and sedges (Table 2). The new growth of sunflower, blackeyed Susan, and several lespedezas and other legumes were the main forbs consumed (Table 3). The young shoots of little bluestem and some sedges were also eaten, along with some buckbrush.

In early summer the cattle started to eat a large amount of browse, especially shrubs and vines such as Virginia creeper and greenbrier; they also consumed more grass and less forbs. They spent much time searching for and eating mushroms. Little bluestem and switchgrass were the main grasses eaten. Most of the forbs consumed were of low palatability, such as lace-leaf ragweed and pennyroyal, but some of the better legumes such as sensitive brier were also eaten.

Browse consumption decreased to 5 percent in mid-July and sharply increased to 40 percent in August (Table 2 and Fig. 7). The grasses, mostly little bluestem, made up the major portion of the diet. The forbs eaten were mostly sunflower and some legumes. Mushrooms were still being eaten in midsummer.

TABLE 2--DIET COMPOSITION OF GRAZING ANIMALS UNDER OBSERVATION BASED ON FRACTIONATED TIME SPENT GRAZING EACH GROUP OF PLANTS
(The data represent the diet of one animal for each date)

Date	Ration composition (percent)			
	Grass and sedge	Forbs	Browse	Mushrooms
Mid-May	30	60	10	0
Late May	20	40	40	0
Mid-June	35	5	20	40
Late June	40	20	10	30
Mid-July	50	25	5	20
Early August	50	10	40	0
Late August	50	20	30	0
Early September	80	15	5	0
Early October	50	10	20	20

TABLE 3--GRASS, FORB, AND BROWSE SPECIES[1/] MOST COMMONLY GRAZED IN RELATION TO SEASON OF USE

Type of plants	Late spring (May)[2/]	Early summer (June)[2/]	Mid-summer (July)[3/]	Late summer (Aug.-Sept. 15)[4/]	Early fall (Sept. 15-Oct. 15)[3/]
Grass and Sedge	Little bluestem Switchgrass Rushes Sedges	Little bluestem Switchgrass Paspalum	Little bluestem Big bluestem Sedges	Little bluestem Baldgrass Poverty oatgrass Broomsedge	Little bluestem Baldgrass Poverty oatgrass Switchgrass Indiangrass Big bluestem
Forbs	Sunflower Blackeyed Susan Lespedeza False indigo Tick clover Compass plant	Lace-leaf ragweed Pennyroyal Sensitive brier Cinquefoil	Sunflower Goats rue Lespedeza Tick clover		Sunflower Blackeyed Susan rosettes Lespedeza Tick clover Goldenrod rosettes American feverfew Goats rue Compass plant
Browse	Elm Buckbrush Aromatic sumac	Smoketree Virginia creeper Greenbrier	Smoketree Buckbrush Aromatic sumac Virginia creeper Elm Hackberry Oak Dogwood	Buckbrush	Oak Sumac Poison ivy
Other		Mushrooms		Acorns Persimmon fruit	Mushrooms Acorns

1/ For common and scientific names of plants, see page 14.
2/ Diet observed for two animals.
3/ Diet observed for one animal.
4/ Diet observed for three animals.

Figure 7.— Buckbrush is a common browse plant in July and August.

In late summer the animals' diet was mainly grasses, such as little bluestem, baldgrass, broomsedge, and poverty oatgrass, with little use of forbs and light use of browse. Some of the grass species, such as baldgrass, consumed in late summer were those that "green up" about this time (Table 3). Grasses continued to be eaten quite intensively into early fall. Forbs, especially rosettes of blackeyed Susan and goldenrod, which were heavily used, were included in the diet in the later part of summer and early fall with some "picking" at browse such as oak and sumac. The cattle also spent some time muzzling the leaf litter for acorns and mushrooms, which were available at that time.

FORAGE NUTRIENT ANALYSIS

Although bluestem ranges are thought to be deficient in nutrients during most of the season (Buttery and Ehrenreich 1961), this study indicates that plant selectivity by grazing cattle, resulting in use of forbs and browse, alleviates some of this deficiency.

The protein content of grass after May was below the minimum requirement of 9.5 percent for growing 500- to 600-pound heifers (Fig. 8). This conclusion agrees with that of Ehrenreich *et al.* (1960) and Buttery and Ehrenreich (1961). However, the protein content of the forbs and browse grazed

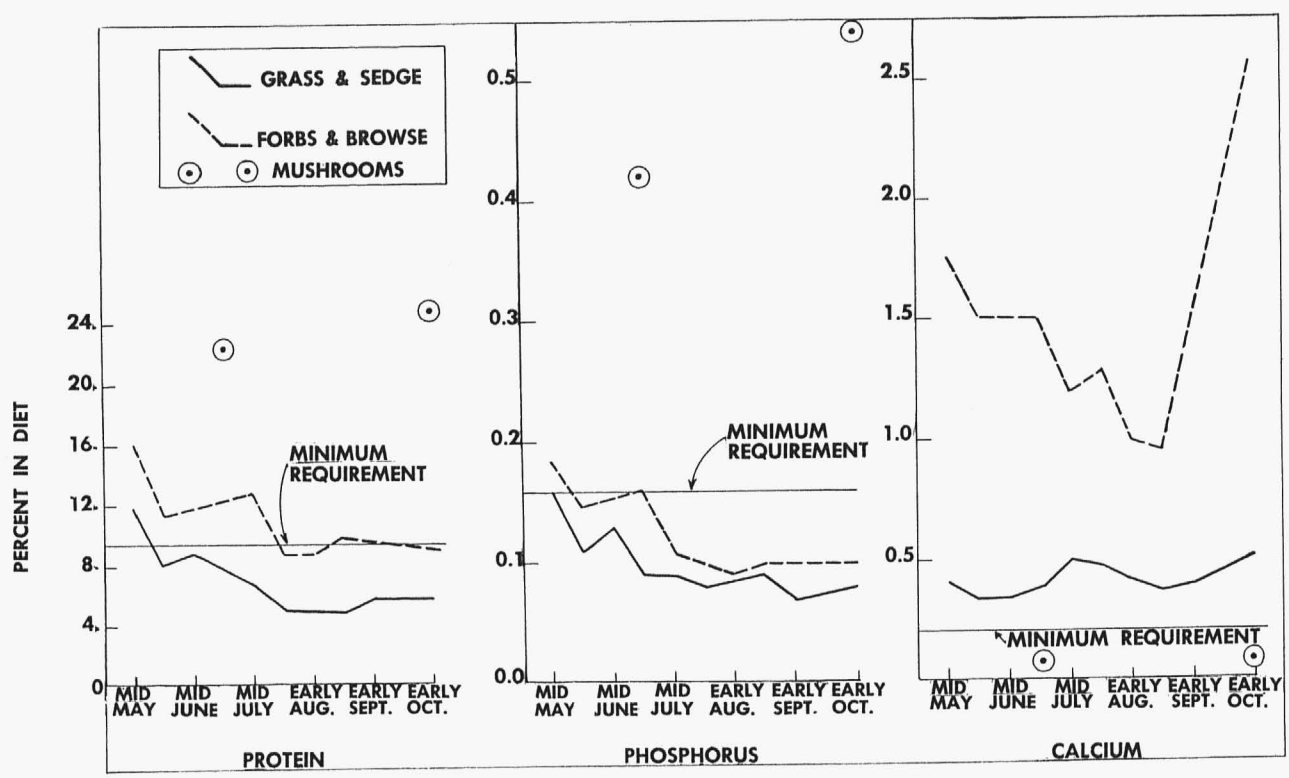

Figure 8.— Protein, phosphorus, and calcium content of forage eaten by grazing heifers.

throughout the season was almost equal to or greater than the minimum requirement. In addition, mushrooms, although they were available only a short time, had a protein content of about three times the minimum needs. Therefore, high selectivity of plants by the animals probably furnished them with a diet adequate in protein throughout the grazing season.

Phosphorus content of grasses sampled was adequate only in mid-May, but that of forbs was almost equal to the animals' minimum requirement until late June (Fig. 8). The high phosphorus content of mushrooms may be the reason animals spent so much time seeking these plants at certain times. This strongly emphasizes the need for a phosphorus supplement early in the grazing season.

Calcium supplied by the forage exceeded the minimum requirement throughout the season.

CONCLUSIONS

In the days when open range was common in the Ozarks, cattle were allowed to roam and harvest whatever forage they found, and little thought was given to their welfare. Experience and research have shown sound management of cattle on cultivated pastures to be highly rewarding. However, even with the elimination of open range, little is known about the behavior and welfare of young beef cattle on native hill-range in the Ozarks. The results of this study lead to the following conclusions:

1. The young beef heifers spent most of the day grazing or ruminating and very little in resting. This fact indicates that the forage was either scanty or of low quality. An abundance of high-quality forage would allow more resting and higher weight gains.
2. When temperature and humidity were high, the cattle were reluctant to graze and forage intake was reduced. Here again, an abundance of high-quality forage would allow the animals to feed adequately in the morning and late evening hours when the temperature is down.
3. Drinking water was a daily activity. Consequently, watering places should be readily available and located in places that would encourage uniform forage utilization.
4. Although salt was not taken every day, it was eagerly sought on occasions. Consequently, a salt supply should be continuous.
5. Cattle seek shade when the temperature is high. This suggests that part of the overstory should be retained when converting poor timber to grass.
6. Supplemental feeders should be placed in open areas—old fields and open glades—where forage is most abundant to encourage more season-long use of these areas and discourage woods grazing where forage is sparse.
7. Composition of diet varied throughout the season with heavy use of browse and forbs at times, and considerable traveling was done to locate mushrooms, which are rich in protein and phosphorus. A phosphorus supplement should be supplied early in the grazing season—mid-June—but protein deficiencies in grasses and sedges at this time are partially reduced by grazing browse and forbs.

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COMMON AND SCIENTIFIC NAMES OF PLANT SPECIES MENTIONED

Grasses and Grasslike Plants

Baldgrass ..... *Sporobolus neglectus* Nash.
Big bluestem ..... *Andropogon gerardi* Vitnam
Broomsedge ..... *Andropogon virginicus* L.
Indiangrass ..... *Sorghastrum nutans* (L.) Nash.
Little bluestem ..... *Andropogon scoparius* Michx.
Paspalum ..... *Paspalum* spp.
Poverty oatgrass ..... *Danthonia spicata* (L.) Beauv.
Rushes ..... *Juncus* spp.
Sedges ..... *Carex* spp.
Switchgrass ..... *Panicum virgatum* L.

Forbs

American feverfew ..... *Parthenium integrifolium* L.
Blackeyed Susan ..... *Rudbeckia* spp.
Cinquefoil ..... *Potentilla* spp.
Compass plant ..... *Silphium laciniatum* L.
False indigo ..... *Amorpha fruticosa* L.
Goats rue ..... *Tephrosia virginiana* (L.) Pers.
Goldenrods ..... *Solidago* spp.
Lace-leaf ragweed ..... *Ambrosia artemisifolia* L.
Lespedeza ..... *Lespedeza* spp.
Pennyroyal ..... *Hedeoma hispida* Pursh
Sensitive brier ..... *Schrankia uncinata* Willd.
Sunflower ..... *Helianthus* spp.
Tick clover ..... *Desmodium* spp.

Shrubs, Trees, and Vines

Aromatic sumac ..... *Rhus aromatic* Ait.
Buckbrush ..... *Symphoricarpus orbiculatus* Moench.
Dogwood ..... *Cornus* spp.
Elm ..... *Ulmus* spp.
Greenbrier ..... *Smilax hispida* Muhl.
Hackberry ..... *Celtis* spp.
Poison ivy ..... *Rhus radicans* L.
Post oak ..... *Quercus stellata* Wang.
Smoketree ..... *Cotinus obovatus* Raf.
Virginia creeper ..... *Parthenocissus quinquefolia* (L.) Planch.