Deferred-rotation Grazing with Steers in the Kansas Flint Hills

CLENTON E. OWENSBY, ED F. SMITH, AND KLING L. ANDERSON

Highlight: *Deferred-rotation grazing of Kansas Flint Hills' range grazed by steers May 1 to October 1 was compared to season-long stocking from 1950 through 1966. Deferred-rotation pastures had higher forage production and range condition than season-long stocked pastures. Steer gains were higher on season-long than deferred-rotation pastures. Increased stocking rates were more feasible on deferred-rotation pastures than on season-long pastures.*

Grazing systems have long been sought as a way to increase efficiency of range utilization. From Hickey's (undated) extensive report concerning grazing management systems, one can conclude that deferred-rotation grazing can improve many depleted range types and that cow-calf operations are more adapted than are steer operations to such grazing. Any grazing system should have as its goal range improvement, increased stocking-rate, and/or improved animal performance.

This study compared a three-pasture, deferred-rotation system grazed by steers during the summer growing-season with season-long, continuous stocking by steers.

Materials and Methods

The study area was in the Flint Hills region of the True Prairie, 5 miles northwest of Manhattan, Kans. (described by Herbel and Anderson [1959]). Vegetation was largely warm-season grasses; big bluestem (*Andropogon gerardi* Vitman) and little bluestem (*A. scoparius* Michx.) were the major dominants. Indiangrass (*Sorghastrum nutans* (L.) Nash) and sideoats grama (*Bouteloua curtipendula* (Michx.) Torr.) were secondary. Numerous forbs, woody plants, and other grasses constituted the remainder. Common species, grouped by behavior under grazing pressure, have been reported by Anderson et al. (1970), and range sites described by Anderson and Fly (1955). Loamy upland (ordinary upland of Anderson and Fly [1955]), clay upland, and limestone breaks were the primary range sites within each experimental pasture. The study involved 17 years, 1950 through 1966.

Three 60-acre pastures with similar amounts of the three principal range sites were used in the deferred-rotation plan. A single, similar 60-acre pasture, stocked season-long, served as a control. Stocking rate for all pastures was 3.3 acres per steer. During May and June, all animals in the deferred-rotation system grazed in two pastures, half in each of the two; the third pasture remained ungrazed (deferred). On July 1 all animals from the two pastures were moved to the previously ungrazed pasture and remained there until October 1. If grass in the deferred pasture was cropped too closely before October 1, the cattle were given access to all three pastures late in the season. This system was rotated annually so as to defer each pasture once each 3 years.

Each year from 1963 through 1966, the deferred pasture was burned to improve forage quality and to bolster late-season animal performance.

Forage production was estimated by the cage method (Klingman et al., 1943) at the close of each growing season, with contents from each cage separated into forage and weeds. Forbs utilized by livestock were included in the forage category. Ten cages were clipped each year in each pasture from loamy upland, breaks, and clay upland range sites. Yields are reported as pounds of air-dry herbage per acre.

To estimate botanical composition for each pasture, basal intercept was measured for each plant occurring along 20 to 30 randomly placed 5-meter line transects in each of the principal range sites. Species composition was calculated as percentage of total plant basal cover.

Hereford steers (average U.S. Dep. Agr. feeder grade of low choice) were used. Steers about 14 months old and initial average weight of 510 lb were used in 10 of the years, 26-month old steers averaging 733 lb (initial weight) were used in the other years. Steers were identified and weighed individually the first day of each month. Before being weighed, they were held, without feed or water, in pens—beginning in the afternoon of the day prior to day of weighing.

The authors are research range scientist, Department of Agronomy; research animal scientist, Department of Animal Science and Industry; research range scientist emeritus, Department of Agronomy, Kansas State University, Manhattan. (Contribution No. 1328, Department of Agronomy, No. 441, Department of Animal Science and Industry, KAES, Kansas State University, Manhattan, 66506.)

Manuscript received March 12, 1973.

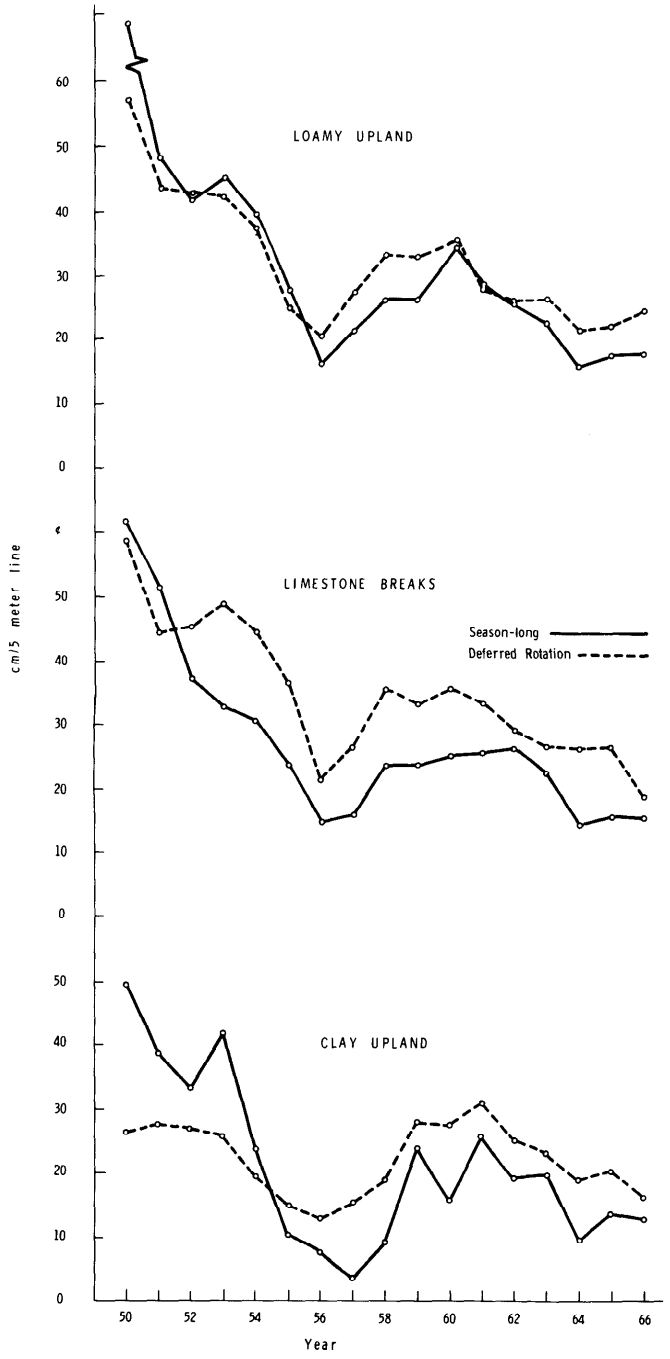

Fig. 1. *Basal cover (cm/5m line transect) of decreaser species (primarily big and little bluestem, and Indiangrass) on three different Kansas Flint Hills range sites under season-long and deferred-rotation stocking (1950–1966).*

For the starting and final weights each season all steers were mixed and weighed at random.

Results and Discussion

Herbage Yields

Forage yields were higher on the deferred-rotation pastures than on the season-long pasture (Table 1). Under both stocking systems, loamy upland consistently produced more forage than did breaks or clay upland. Since both systems were stocked at the same rate, failure to take advantage of the increased forage production under the deferred-rotation system by increasing stocking rate was a fault in experimental procedure.

Table 1. Forage and weed yields (lb/acre, air-dry) for season-long and deferred-rotation pastures stocked from May 1 to October 1 (9-year average, 1958-66).

Item and stocking system	Loamy upland	Breaks	Clay upland
Forage			
Season-long	3918 a[1]	2561 a	3165 a
Deferred-rotation	4251 b	3400 b	3968 b
Weeds			
Season-long	300 a	337 a	492 a
Deferred-rotation	270 a	164 b	343 b

[1] Yields followed by a common letter within a range site do not differ statistically ($P<0.05$).

Weed yields were higher on breaks and clay upland range under season-long stocking than under deferred-rotation (Table 1). On loamy upland range, weed yields for the two stocking systems did not differ. Concentrated use of forage probably forced use of some weeds, and increased vigor of the warm-season perennial grasses contributed to lower weed yields on the deferred-rotation than on the season-long pastures.

Botanical Census

Decreasers

Deferred-rotation stocking benefited basal cover of decreaser species (primarily big bluestem, little bluestem, and Indiangrass), which initially were higher on the season-long pasture (Fig. 1). After 6 years on loamy and clay upland range—and before that on breaks range—basal cover of decreasers was higher (and remained higher until the end of the study) on the deferred-rotation than on the season-long pastures.

The primary increase in decreaser basal cover on the deferred-rotation pastures came from little bluestem, though Indiangrass also was noticeably higher; big bluestem was similar for both systems.

Increasers

As a group, increasers (primarily sideoats grama and Kentucky bluegrass [*Poa pratensis* L.]) did not differ between season-long and deferred-rotation grazing. Sideoats grama,

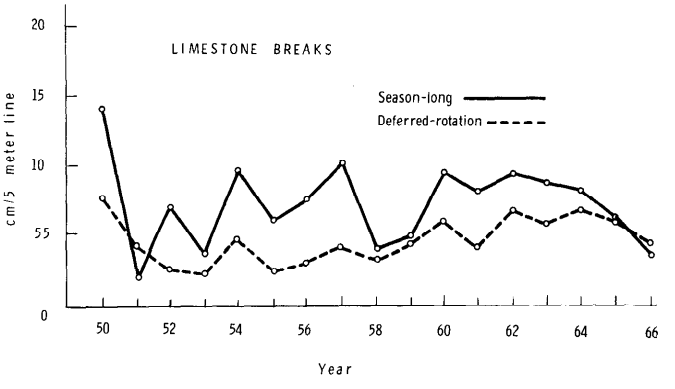

Fig. 2. *Basal cover (cm/5m line transect) of sideoats grama on Kansas Flint Hills breaks range under season-long and deferred-rotation stocking (1950–1966).*

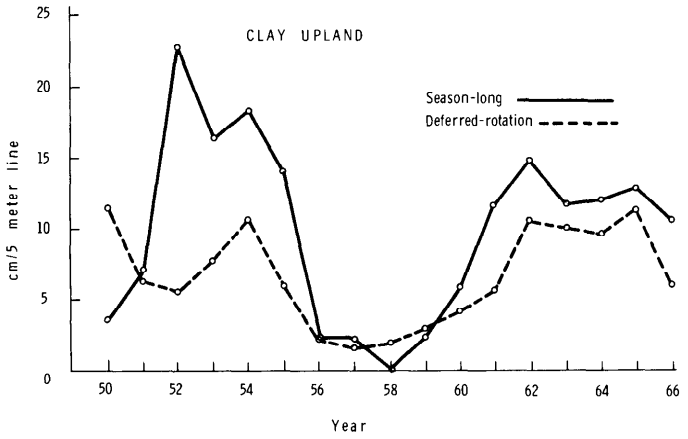

Fig. 3. *Basal cover (cm/5m line transect) of Kentucky bluegrass on Kansas Flint Hills clay upland range under season-long and deferred-rotation stocking (1950–1966).*

however, was higher in the season-long pasture, apparently being replaced in the deferred-rotation unit, particularly in the breaks range site, by the increase in little bluestem (Fig. 2). Kentucky bluegrass, which fluctuated widely in response to rainfall on the clay-upland range site, was nearly eliminated regardless of treatment during the severe drouth of the mid-1950's (Fig. 3). There was significantly more Kentucky bluegrass on the clay-upland site in the season-long stocked unit than in the deferred-rotation units.

Other Species

No differences in sedges, forbs, or annual-grass basal cover were detected between season-long and deferred-rotation systems. Shrubs, though low in basal cover, were higher on the season-long pasture than on the deferred-rotation pastures.

Livestock Gains

Steers on the season-long pasture gained more than did animals on the deferred-rotation pastures. During May and June gains did not differ under the two systems; during July, August, and September steers gained less on deferred-rotation than on season-long pastures (Fig. 4). At the end of the growing season, steers on season-long pastures weighed 23 lb more than did those on deferred-rotation pastures (Fig. 5). Apparently, moving the steers to a new environment and to mature forage reduced their performance. Whereas in the deferred pasture animals had to eat older, maturer forage, in the season-long pasture they could graze on higher quality regrowth from previously grazed plants.

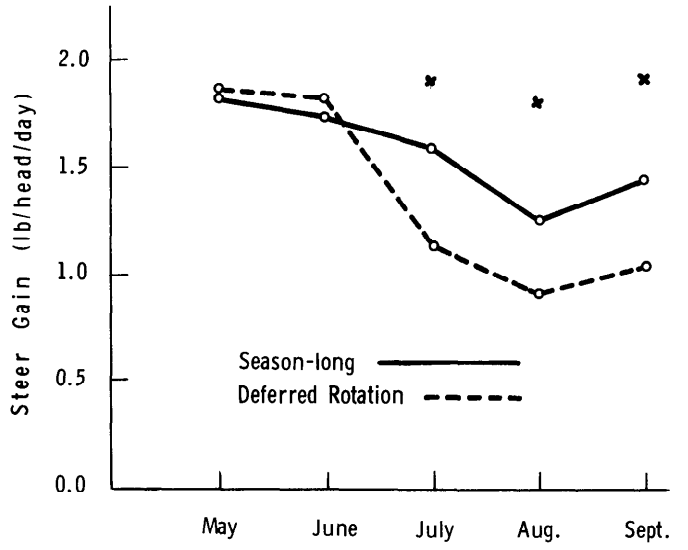

Fig. 4. *Average per head daily gain (lb/head/day) of steers on Kansas Flint Hills range under season-long and deferred-rotation stocking (17 year average). Asterisk above a given date indicates a significant difference (P<0.05).*

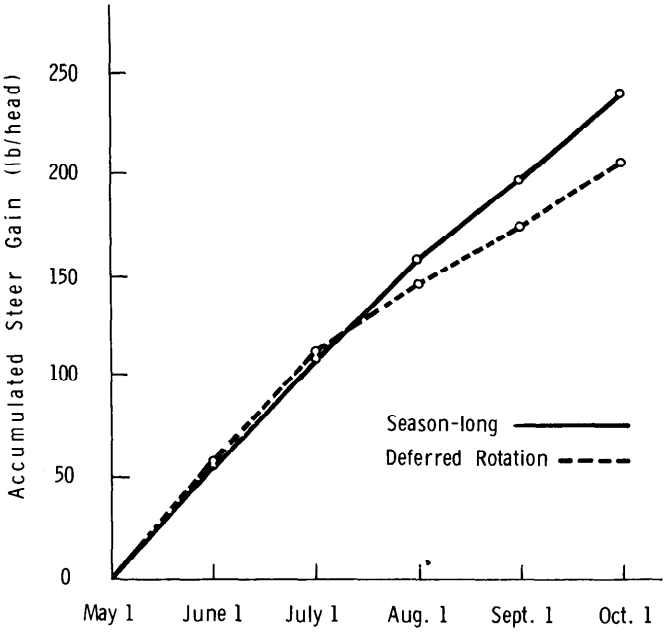

Fig. 5. *Total steer gain (lb/steer) per growing season on Kansas Flint Hills range under season-long and deferred-rotation stocking (17 year average).*

Conclusions

1) Deferred-rotation stocked pastures had higher forage production than did season-long stocked pastures.

2) Desirable warm-season, perennial grass basal cover was greater on deferred-rotation than on season-long pastures.

3) Steer gains were higher on season-long than on deferred-rotation pastures.

4) Increased stocking of the deferred-rotation pastures was feasible.

5) Poor-condition range probably would benefit more from deferred-rotation stocking than would good-to-excellent range.

Literature Cited

Anderson, Kling L., and C. L. Fly. 1955. Vegetation-soil relationships in Flint Hills bluestem pastures. J. Range Manage. 8:163-169.

Anderson, Kling L., Ed F. Smith, and Clenton E. Owensby. 1970. Burning bluestem range. J. Range Manage. 23:81-92.

Herbel, C. H., and Kling L. Anderson. 1959. Response of True Prairie vegetation on major Flint Hills range sites to grazing treatment. Ecol. Monogr. 29:171-186.

Hickey, Wayne C. Undated. A discussion of grazing management systems and some pertinent literature (abstracts and excerpts) 1895-1966. U.S. Forest Service. Denver, Colorado.

Klingman, D. L., S. R. Miles, and G. O. Mott. 1943. The cage method for determining consumption and yield of pasture herbage. Agron. J. 35:739-746.