

# Response of Herbaceous Vegetation to Short Duration Grazing in Central West Texas

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## ABSTRACT

Short Duration Grazing (SDG) played a significant role in grazing management practices in Texas during the 1980s. The Soil Conservation Service estimates that about 320 ranches in Texas use SDG or cell grazing on over 1.3 million acres. The objective of this study was to evaluate basal cover of herbaceous vegetation in the SDG system as affected by plant community and by distance from cell center over a 10-year period. There was an increase ( $P < 0.05$ ) in percent basal cover of perennial herbaceous plants for the 2 vegetation mixes studied during the 10-year period. The increase in basal cover may be attributed to SDG but the primary cause of the positive response was probably the favorable precipitation received during the study period. Basal cover of herbaceous vegetation was also affected ( $P < 0.05$ ) by distance from cell center. Differences in basal cover with distance from cell center suggest that uniform utilization by livestock did not occur within our cell.

KEY WORDS: basal cover, livestock distribution, cell grazing, grazing systems

As with most specialized grazing systems, a goal of SDG is to maintain or improve range condition while optimizing animal production. Strategies associated with SDG, which allow for improvement in the forage resource, concentrate on the control of frequency and severity of defoliation of key plant species coupled with uniform utilization of forage plants (Savory and Parsons, 1980; Savory, 1983; Savory, 1988). Proponents of SDG report uniform utilization of herbaceous vegetation through control of spatial distribution of livestock (Savory and Parsons, 1980; Savory, 1983; Savory, 1988). Control of spatial distribution is purportedly achieved by high stock densities which force livestock to make balanced use of desirable and less desirable sites. The effect of SDG on livestock distribution is controversial because of a lack of supporting literature. Results of short-term studies conducted in Texas (Pitts and Bryant, 1987; Walker et al., 1989a; Walker et al., 1989b; McKown et al., 1991) indicate that SDG and conventional grazing systems are similar in livestock distribution and utilization patterns. Secondly, proponents of SDG generally suggest that cell grazing is applicable to most ecosystems and plant communities (Savory, 1983). Researchers working in Texas and the Southwest region, however, have suggested SDG has limited application in arid and semiarid regions (Pieper and Heitschmidt, 1988; Bryant et al., 1989). Therefore, the objective of our study was to examine the long-term effects of SDG on percent basal

Accepted 3 Feb 1992. \*Corresponding author.

cover of herbaceous vegetation of 2 different plant communities and at various distances from central watering facilities.

## MATERIAL AND METHODS

This study was conducted at the Angelo State University Management, Instruction, and Research (MIR) Center located 5 miles north of San Angelo, Texas. The MIR Center is situated in the transition zone between the Rolling Plains and the Edwards Plateau. Soils are predominantly clay loams in the Angelo series (deep, nearly level, calcareous soils). Average annual precipitation for the MIR Center area is 18 inches, but annual precipitation ranged from 14 to 32 inches over the ten years of the study.

Approximately 25% of the study area is covered by brush strips dominated by mesquite (*Prosopis glandulosa*). Intervening areas were rootplowed in the mid-1970s and reseeded to 2 different mixtures of introduced and improved, native midgrasses (Table 1). The only difference between the 2 mixtures was the variety of sideoats grama (*Bouteloua curtipendula*). Each mixture was seeded in 3 different pastures which were later incorporated in the SDG system at the MIR Center. The pastures seeded to the mixture including the 'El Reno' variety of sideoats grama are referred to as the El Reno pastures, whereas the pastures seeded to the mix including the 'Premier' variety are the Premier pastures.

Table 1. Percent composition of the two seeding mixtures used at the MIR Center.

Grass Species	El Reno mixture	Premier mixture
Sideoats grama variety El Reno	50	0
Sideoats grama variety Premier	0	50
Green sprangletop	20	20
Kleingrass	20	20
K-R bluestem	10	10

Several native mid- and shortgrass species, not included in the seeding mixture, became prevalent on the study site. The major midgrass species are silver bluestem (*Bothriochloa laguroides*), sand dropseed (*Sporobolus cryptandrus*), and windmill grass (*Chloris sp.*). Buffalograss (*Buchloe dactyloides*) and curly mesquite (*Hilaria belangeri*) are the primary shortgrasses, while threeawns (*Aristida sp.*) and numerous species of forbs are also common throughout the study area. Although annuals are present following favorable levels of precipitation, generally, they make up only a small portion of the total basal cover of herbaceous vegetation. Basal cover refers



to the cross sectional area of vegetation at ground level (SRM, 1989).

In 1979, SDG was installed on 1400 acres of this improved rangeland, including the intervening brush strips. The 13 pastures of the SDG unit, or cell, were each approximately 80 acres in size and arranged in a wagon-wheel design. The grazing cycle consisted of nongrazing periods of approximately 90 days and 2 to 10-day grazing periods. Length of these periods depended on such factors as forage characteristics of a particular pasture, plant growth rates, climatic factors, and time of the year. Initial descriptions of SDG implied a certain amount of rigidity in management as number and length of grazing and nongrazing periods as well as order of pasture rotation were to be predetermined and maintained over time. Savory (1983), however, stressed the need for flexibility in making grazing management decisions when using SDG. In particular, movement of livestock through the various paddocks of a SDG unit should follow plant and animal responses rather than a fixed schedule. Most practitioners of SDG now realize the importance of following a flexible schedule and base their movements on such factors as forage conditions of various pastures, weather patterns, and livestock performance. Consequently, grazing and nongrazing periods may vary to meet the aforementioned criteria.

Average stocking rate for the cell was 15 acres per animal unit year (AU), which is considered a heavy stocking rate for the region. The stocking rate, however, fluctuated widely (i.e., from a destocked condition to 9 acres per AU) in response to annual precipitation and available forage. The livestock mix was 3 AU of cattle to 2 AU of sheep. White-tailed deer were also common in the cell at approximately 15 acres per deer.

After establishment of the cell, 4 permanent line transects were systematically located in each pasture at approximately 1000-ft intervals radiating out from the cell center to the periphery. The transects were placed parallel to the cell center and 100 ft long. At each transect location, percent basal cover of herbaceous plant species was estimated using the line interception method (Canfield, 1941). Basal cover has often been used to evaluate dynamics in plant communities dominated by grasses (Cook and Stubbendieck, 1986). The initial sampling period was in the summer of 1981, followed by summer collections in 1984, 1986, 1988, and 1990.

Data from the 3 pastures seeded to the El Reno mixture and the 3 pastures seeded to the Premier mixture were used for analysis. All data were summarized by pasture (replication) within year and analyzed using analysis of variance procedures for a randomized complete block design with repeated measures. Seeding mixture and distance from cell center were whole plot factors with year as the repeated factor. Level of significance for mean separation was at  $P < 0.05$  and significantly differing means were separated by LSD test (Steel and Torrie, 1960).

## RESULTS AND DISCUSSION

Percent basal cover of herbaceous vegetation for pastures planted to the El Reno mixture was higher ( $P < 0.05$ ) than that of the Premier mixture for the 10 years of this study (Table 2). Although relative species composition of sideoats grama was similar for the two treatments, basal cover of sideoats grama on the El Reno pastures was considerably higher than on the Premier pastures. In forage production for livestock consumption, however, the Premier pastures appeared to be more

productive. For the past 4 years, the Premier pastures provided an average of 147 stock days per ac. (SDA) while the El Reno pastures provided only 96 SDAs. The El Reno sideoats grama is a rhizomatous plant while Premier is a bunchgrass. The spreading growth form of El Reno could largely explain its higher basal cover. The difference in basal cover between the two treatments was also due to the relatively high degree of cover by native midgrasses, shortgrasses, and forbs (Table 2). Differences in SDAs between plant communities may be the result of the bunchgrass growth form of Premier sideoats grama producing more total available forage.

Table 2. Basal cover (%) of herbaceous vegetation as affected by seeding mixture and distance from cell center averaged over years.

Vegetation component	Seeding mixture		Distance from cell center (ft)			
	El Reno	Premier	1000	2000	3000	4000
Seeded species						
Sideoats grama	2.4	1.9	0.7b	1.9b	2.1b	4.0a
K-R bluestem	0.2	0.2	0.2	0.3	0.2	0.2
Kleingrass	0.5	0.5	0.3	0.4	0.8	0.4
Native species						
Midgrasses	1.7	1.4	1.3	1.1	1.9	1.8
Shortgrasses	1.5	0.8	0.6	1.5	2.1	0.3
Threeawns	0.5	0.8	0.2b	0.4b	0.5b	1.7a
Other grasses	0.4	0.6	0.4	0.4	0.9	0.4
Forbs	1.0	0.7	1.1	1.0	0.6	0.6
Total	8.2a	6.9b	4.8c	7.0b	9.1a	9.4a

Values within rows and by category (i.e., mixture and distance) followed by different letters are significantly different ( $P < 0.05$ ).

Over the 10 years of this study, there was an increase ( $P < 0.05$ ) in percent basal cover of herbaceous vegetation across the two treatments (Figure 1). Basal cover remained at similar ( $P > 0.05$ ) levels from 1981 through 1986 but increased to higher ( $P < 0.05$ ) levels in 1988. Although basal cover of herbaceous vegetation declined ( $P < 0.05$ ) between 1988 and 1990, basal cover in 1990 was higher ( $P < 0.05$ ) than the pre-1988 levels.

Much of the increase in percent basal cover can be attributed to significant ( $P < 0.05$ ) increases in native midgrasses, shortgrasses, and threeawns (Figure 2). Over the 10 year period, the seeded species either maintained relatively constant levels, i.e., sideoats grama and K-R bluestem (*Bothriochloa ischaemum*), decreased sharply ( $P < 0.05$ ), i.e., kleingrass (*Panicum coloratum*), or appeared infrequently, i.e., green sprangletop (*Leptochloa dubia*) (Figure 3). Increases ( $P < 0.05$ ) in native grasses occurred in 1986 and 1988 while kleingrass and green sprangletop declined in basal area during the early part of the study. Basal cover of forbs varied over the



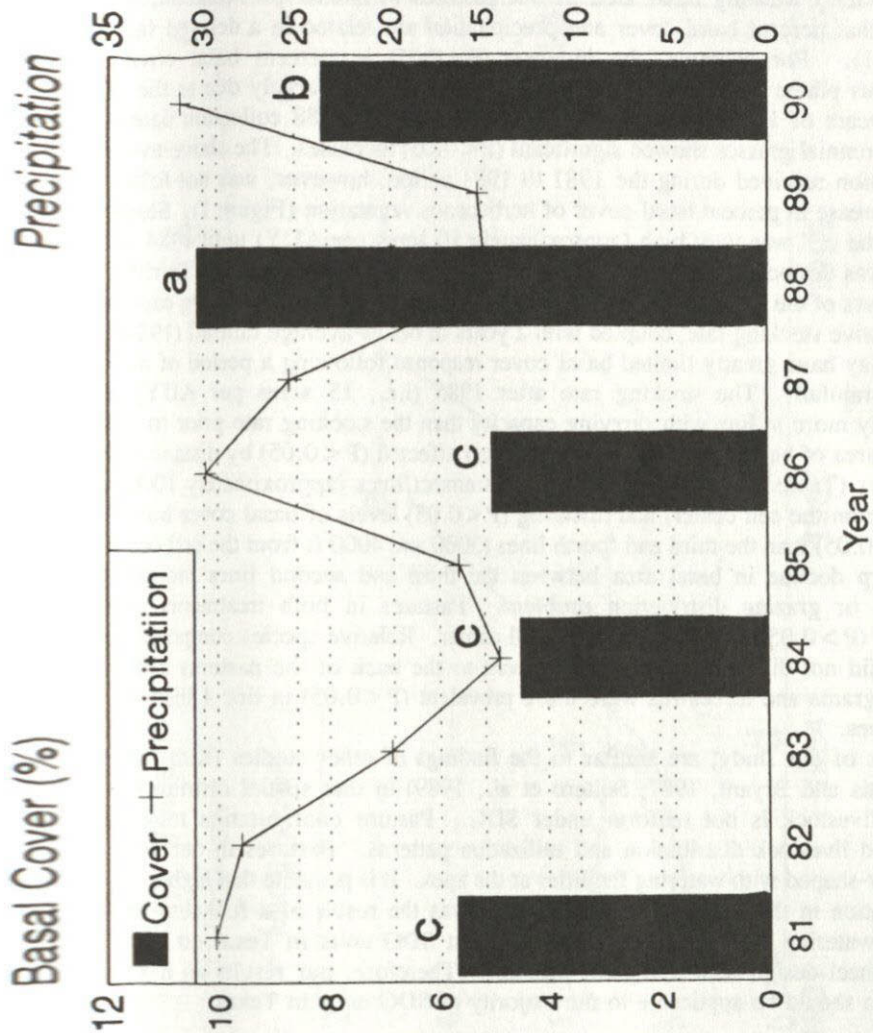


Figure 1. Percent basal cover of herbaceous vegetation as related to annual precipitation from 1981 to 1990 at the MIR center. Different letters indicate year differences ( $P < 0.05$ ) in percent basal cover.

years in response to precipitation; however, forbs generally accounted for only about 10% of total herbaceous plant basal cover.

Dynamics in basal area of the herbaceous plant species may have been related to grazing management practices and grazing resistance of the various plant species; however, annual precipitation appeared to play an equally important role. We assumed that basal area of grasses was not substantially influenced by seasonal precipitation and temperature. Instead, changes in basal area were a result of longer-term (2 or more growing seasons) shifts in climatic conditions (Paulsen and Ares, 1962). Relating basal area in our pastures to annual precipitation, could indicate that percent basal cover and precipitation are related in a delayed fashion (Figure 1). For example, the increase ( $P < 0.05$ ) in percent basal cover of herbaceous plants between 1986 and 1988 may have been largely due to the high rainfall years of 1986 and 1987. Between the 1986 and 1988 collection dates the native perennial grasses showed significant ( $P < 0.05$ ) increases. The above-average precipitation received during the 1981 to 1983 period, however, was not followed by an increase in percent basal cover of herbaceous vegetation (Figure 1). Stocking rate for the cell was very high (approximately 10 acres per AU) until 1984 when the cell was destocked for 1 year because of drought and lack of forage. During the first 4 years of the study, stocking rate was apparently higher than carrying capacity. An excessive stocking rate, coupled with 2 years of below average rainfall (1984 and 1985), may have greatly limited basal cover response following a period of above-average rainfall. The stocking rate after 1985 (i.e., 15 acres per AU) was apparently more in line with carrying capacity than the stocking rate prior to 1984.

Basal area of herbaceous vegetation was also affected ( $P < 0.05$ ) by distance from cell center (Table 2). The first and second transect lines (approximately 1000 and 2000 ft from the cell center) had differing ( $P < 0.05$ ) levels of basal cover but were less ( $P < 0.05$ ) than the third and fourth lines (3000 and 4000 ft from the cell center). The sharp decline in basal area between the third and second lines indicated a livestock or grazing distribution problem. Pastures in both treatments varied similarly ( $P > 0.05$ ) with distance from cell center. Relative species composition of grasses did not differ greatly from the front to the back of the pastures although sideoats grama and threeawns were more prevalent ( $P < 0.05$ ) in line 4 than in the first 3 lines.

Results of our study, are similar to the findings of other studies (Kirby et al., 1986; Pitts and Bryant, 1987; Soltero et al., 1989) in that spatial distribution of grazing livestock is not uniform under SDG. Pasture configuration may have influenced livestock distribution and utilization patterns. Pastures in our cell are triangular-shaped with watering facilities at the apex. It is possible that higher levels of utilization in the front portion of pastures was the result of a funneling action towards watering facilities. Nevertheless, most SDG units in Texas do utilize a wagon-wheel design with triangular pastures. Therefore, our results on livestock utilization should be applicable to the majority of SDG units in Texas.

## CONCLUSION

Basal cover of herbaceous vegetation increased over the 10 years of the study in both seeding treatments within our SDG unit. Much of this increase may be attributed to increases in basal area of the native perennial grasses in response to the



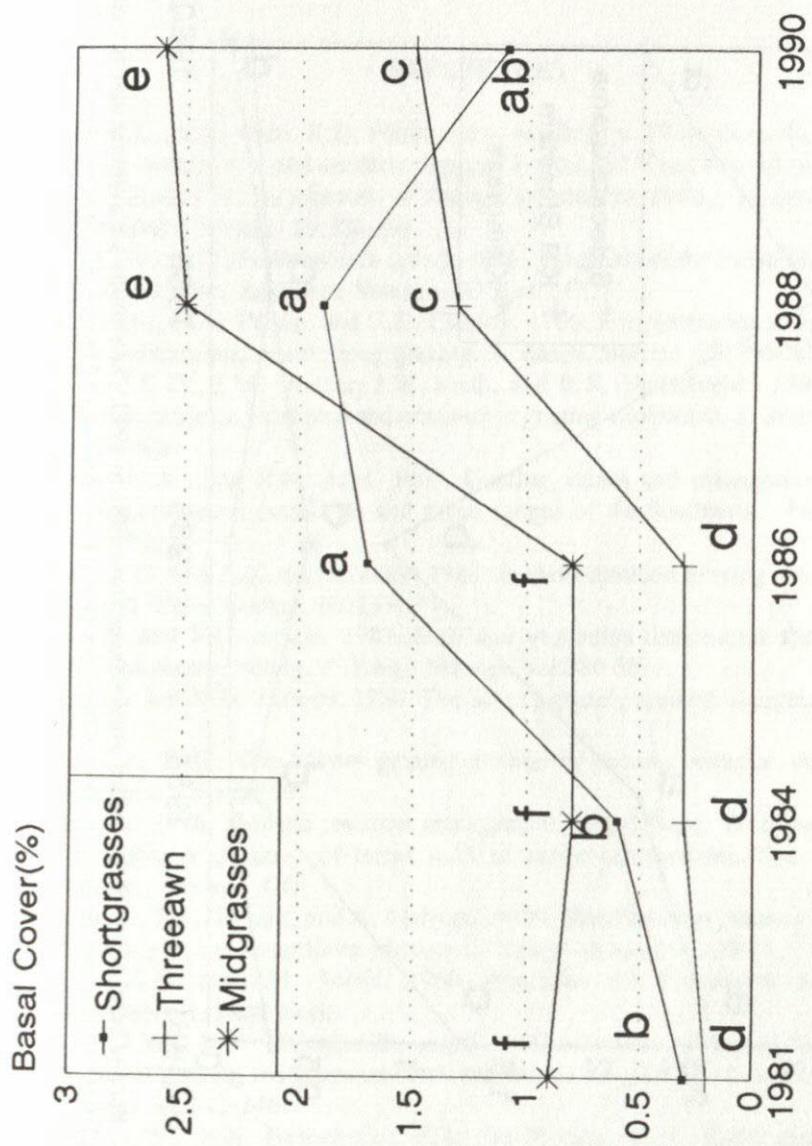


Figure 2. Percent basal cover of the major classes of native grass species from 1981 to 1990. Data points are averages across treatments. Different letters within species indicate year differences ( $P < 0.05$ ). Absence of letters indicates no significant ( $P > 0.05$ ) differences among years.

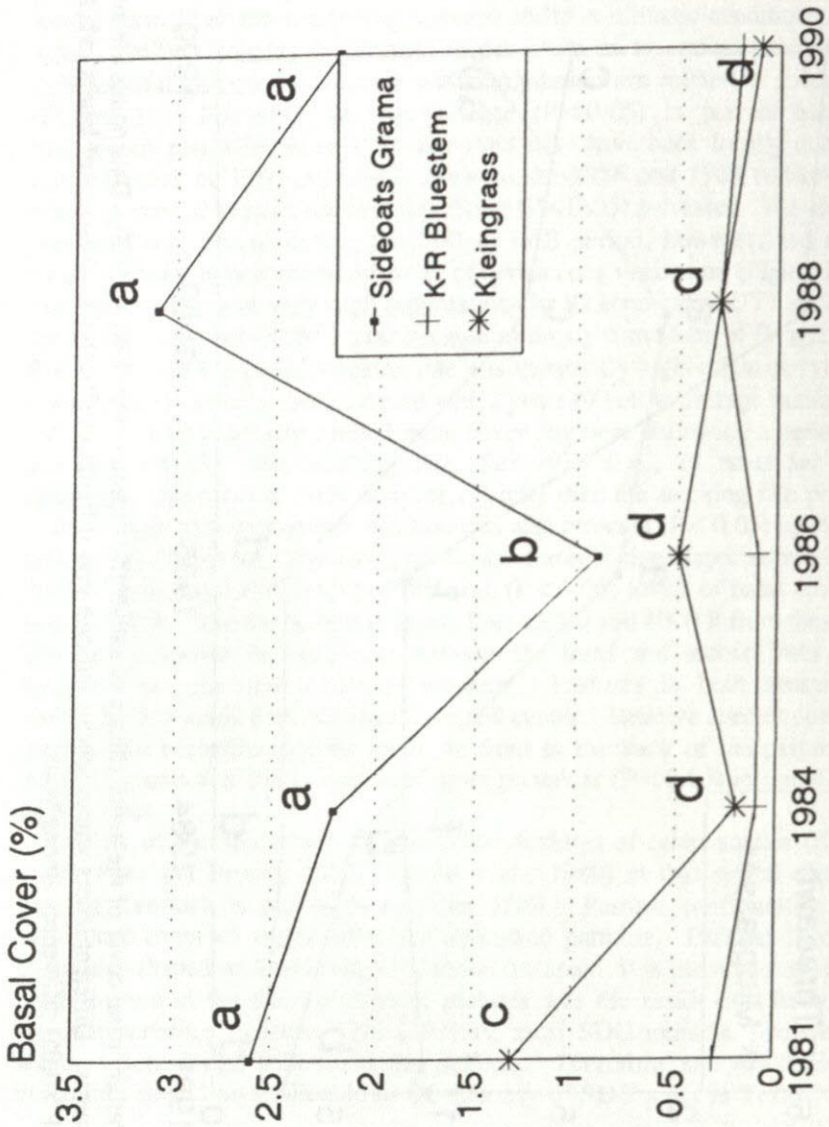


Figure 3. Percent basal cover of the seeded grass species from 1981 to 1990. Data points are averages across treatments. Different letters within species indicate year differences ( $P < 0.05$ ). Absence of letters indicates no significant ( $P > 0.05$ ) differences among years. Green sprangletop is not shown because only a trace was recorded.



above-average precipitation years of 1986 and 1987. Furthermore, it appears that achieving and maintaining the proper stocking rate may have aided in the increase in percent basal area in our study. Finally, the relatively low percent basal cover of herbaceous vegetation in the front portion of the pastures indicates that the experimental pastures were not evenly utilized. Therefore, the hypothesis that SDG leads towards uniform utilization of the forage resource is not supported by the results of our study.

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