SEASONAL GRAZING OF SEMIDESERT TOBOSA RANGELAND IN SOUTHERN NEW MEXICO

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RESEARCH OBJECTIVES

1. Evaluate tobosa (Hilaria mutica) managed under seasonal-continuous stocking with a low stock density and seasonal-rotation stocking with a high stock density in arid southern New Mexico.
2. Characterize the average daily weight change in replacement Bos taurus and Bos taurus, Bos indicus crossbred replacement heifers managed under low stock density and high stock density grazing management.

RESEARCH APPROACH

Tobosa is an important grass resource of the arid Southwest that should be grazed when it is actively growing. The historical method has been to harvest tobosa using conservative seasonal-continuous stocking. Conservative stocking coupled with a prolific pattern of growth when adequate moisture is present has produced numerous tobosa paddocks that show nonuniform patterns of use and a standing crop characterized by an abundance of weathered, gray, and unpalatable herbage. Slow decomposition rates characteristic of arid areas allow the gray material to accumulate over a period of years, further promoting nonuniform use of the standing crop during grazing. High stock density grazing has been proposed as an alternative grazing method to promote uniform utilization (Savory 1978).

Two paddocks on the Jornada Experimental Range, 36.6 and 34.7 ha in size, were used to evaluate standing crop utilization and animal production. The study was initiated in 1979. The level ($\leq$0.4% slope) clayey bottomland site was dominated by a perennial standing crop of grass composed of tobosa with scattered patches of burrograss (Scleropogon brevifolius).

The 33.6-ha paddock was managed under low stock density seasonal-continuous stocking while the 34.7-ha paddock or cell was subdivided into several paddocks and stocked seasonally under a high stock density. In 1979 the cell was composed of six essentially equal size rectangular paddocks. However, in 1980 four of these paddocks were diagonally cross fenced to create eight triangular paddocks essentially half the area of the original rectangular paddocks. The resulting ten-paddock cell was then grazed seasonally in 1980 and 1981 by a single herd. Water, salt blocks, and trace mineral blocks were provided ad libitum to all the paddocks.

In 1979 the mean stocking rate was 0.22 A.U./ha in the 33.6-ha paddock and 0.23 A.U./ha in the 34.7-ha paddock. These values were based on the productivity of the paddocks as determined by Herbel and Nelson (1974) during the late 1960's and early 1970's. Liveweights were recorded for each animal following an overnight shrink prior to introducing heifers and cows into the grazing treatments. Hereford and Brangus purebred and Hereford, Santa Gertrudis crossbred cattle along with both classes were randomly assigned in similar proportion to both grazing

treatments. The yearling replacement heifers, 6-18 mo of age, representing different genetic backgrounds were used to evaluate liveweight changes during each of the three years. Liveweights were taken at the end of each cycle following an overnight drylot shrink from which average daily gains (ADG's) were calculated. A cycle is defined as an interval of time required for the high stock density herd to graze each paddock in the cell before being returned to the paddock originally grazed.

There were four grazing cycles during each growing season in each of the three years. The difference in the length and starting date of the grazing season in 1979, 1980, and 1981 reflects the erratic pattern of precipitation so characteristic of the arid Southwest.

Except for increasing the mean stocking rate from 0.32 A.U./ha in 1980 to 0.40 A.U./ha in 1981 in the low stock density paddock, management was essentially uniform. However, the basis for moving the single herd to sequential paddocks within the cell was not uniform throughout the three years. Rotation schedules were fixed by calendar dates in 1979 and 1980. Based on daily visual appraisals during 1981, livestock were moved when the tobosa standing crop at ten locations in the paddock being grazed showed a reduction in height of between 30-35%. The mean stocking rate was increased from 0.35 A.U./ha in 1980 to 0.43 A.U./ha in 1981 in the high stock density cell.

End-of-season tobosa standing crop was estimated by clipping forage at ground level after the first killing frost in November. In 1980 and 1981 tobosa standing crop was evaluated in the low stock density paddock, in each of the ten paddocks within the cell, and in an ungrazed control paddock located between the two. No end-of-season yields were obtained in 1979.

SIGNIFICANT FINDINGS

During 1979, 1980, and 1981 low stock density seasonal-continuous grazing and high stock density seasonal-rotation grazing did not differ significantly ($P>0.05$) for heifer ADG, regardless of the heifers' genetic background. End-of-season tobosa standing crop production was not found to be significantly ($P>0.05$) influenced by either grazing treatment during 1980 or 1981. Regardless of the method used, grazing significantly reduced ($P<0.0001$) the standing crop at the end of the season in the grazing treatments compared to the ungrazed control. For the ungrazed control the least square mean, plus and minus the standard error, was 2,039 $\pm$ 345 and 2,096 $\pm$ 345 kg/ha for 1980 and 1981, respectively.

The least square mean and standard error of the standing crop within the cell was 832 $\pm$ 147 and 711 $\pm$ 46 kg/ha for 1980 and 1981, respectively. For the low stock density paddock the least square mean and standard error of the standing crop was 838 $\pm$ 167 and 1,119 $\pm$ 154 kg/ha for 1980 and 1981, respectively. Even though the least square means in the cell were not significantly different ($P>0.05$) between 1980 and 1981, the variances were significantly different ($P<0.0001$). Furthermore the variances in the low stock density paddock differed only marginally ($P<0.10$) between 1980 and 1981. However, the variance associated with the mean standing crop within the cell in 1981 was significantly less ($P<0.001$) than the variance associated with the mean standing crop in the low stock density paddock (990 $\pm$ 79 kg/ha) when 1980 and 1981 clippings were combined.

Except in 1979, the high stock density cell received less precipitation than did the low stock density paddock located 0.8 km to the south. Precipitation during the seasonal grazing in 1979, 1980, and 1981 was 174, 107, and 144 mm in the low stock density paddock compared to 189, 80, and 123 mm in the cell, respectively. Grazing began in 1979, 1980, and 1981 on May 9, May 21, and July 14, respectively. The 168-day grazing season in 1979 and 1980 was shortened by 61 days in 1981 because active growth of the tobosa was not observed before July.

The heifers' ADG was significantly different between years ($P<0.0001$) and for the year x cycle interaction ($P<0.001$); while cycles only approached significance ($P<0.10$) when all three years were analyzed together. It is impossible to fully interpret in an accurate manner the difference in years because adjustments were being made in 1979, 1980, and 1981 in stocking, length of the grazing season, beginning date of grazing, paddock size, number of paddocks within the cell, and the basis on which the livestock were to be rotated.

The ADG was highest in 1979 as shown by the least square mean and standard error, (0.63 ± 0.07 kg/da) when compared to 1980 (0.13 ± 0.05 kg/da) and 1981 (0.34 ± 0.02 kg/da). In 1979 cycles were significantly different ($P<0.0001$) with the lowest ADG recorded in cycle two (Table 1). The treatment x cycle interaction was also significant ($P<0.05$) in 1979; this resulted from a decrease in the ADG from 0.75 to 0.64 kg/da between cycle three and four in the low stock density paddock compared to the cell in which ADG increased from 0.37 to 0.64 kg/da during this same time interval. Average daily gain was significantly different between cycles ($P<0.0001$) in 1980, the year in which the least precipitation was recorded (Table 1). The ADG for cycle and the treatment x cycle interaction was again significantly different ($P<0.0001$) in 1981. The ADG decreased from 1.15 to 0.57 kg/da in the low stock density paddock while ADG increased from 0.31 to 0.75 kg/da in the cell between cycle two and three during 1981. The ADG was significantly less ($P<0.01$) during the initial and final cycle of 1981 compared to the middle two grazing cycles, which were higher and similar (Table 1).

Between 1979 and 1981, 183 kg more heifer liveweight was obtained from the low stock density paddock compared to the high stock density cell even though there was an average of 271 more animal-unit days of grazing in the cell (Table 2). Tobosa was utilized more uniformly under flexible seasonal-rotation stocking with a high stock density in contrast to a rigid sesonal-rotation stocking with a high stock density or seasonal-continuous stocking with a low stock density. These conclusions are based on the magnitude of the variance associated with the least square mean tobosa standing crop and are substantiated by field observations.

RESEARCH DIRECTION

The seasonal-rotation high stock density grazing method used in 1981 will be continued concurrently with the seasonal-continuous low stock density grazing. The stocking rate in both grazing treatments will be maintained at similar levels which will range between 0.32 and 0.43 A.U./ha depending on the growth of the standing crop.

Additional studies will involve refined monitoring of tobosa standing crop quantity and quality by clipping plots in a paddock in which grazing is not permitted and where previous grazing patterns have been eliminated by either fire or mowing. The clipping will simulate the frequency and severity of defoliation observed in the paddocks

managed under the low stock density and the high stock density seasonal methods of grazing management.

LITERATURE CITED

Herbel, C. H., and A. B. Nelson. 1974. Utilizing tobosa (Hilaria mutica Buckl. Benth.) during the winter and summer. Proc. 12th Inter. Grassl. Cong. III: 184-190. Moscow.

Savory, A. 1978. A holistic approach to ranch management using short duration grazing. In: Proc. First Inter. Range Cong., Soc. Range Manage. Denver, Colo. pp. 555-557.

Table 1. Mean average daily gain (ADG) for two treatments, expressed as least square means, and precipitation (mm) for six periods and annual totals for two locations[1] on the Jornada Experimental Range for 1979, 1980, and 1981.

Cycle, Mean ADG, and Period and amount of precipitation by year	Periods: Prior to grazing	Grazing cycle[2] 1	2	3	4	Following grazing	Total
1979							
Cycle dates		5/9-6/19	6/20-7/31	8/1-9/11	9/12-10/05		
Mean ADG		1.01[a]	0.30[b]	0.56[c]	0.64[c]		
Low density							
Date	1/1-4/30	5/1-6/30	7/1-7/31	8/1-8/31	9/1-9/30	10/1-12/31	
Precipitation	31	14[3]	36	121	3	7	212
High density							
Date	1/1-5/8	5/9-6/19	6/20-7/31	8/1-9/11	9/12-10/5	10/6-12/31	
Precipitation	42	32	26	120	11	28	259
1980							
Cycle dates		5/21-7/1	7/2-8/14	8/15-9/23	9/24-11/5		
Mean ADG		0.52[a]	0.04[b]	-0.01[b]	0.04[b]		
Low density							
Date	1/1-5/31	6/1-6/30	7/1-8/31	9/1-9/30	10/1-10/31	11/1-12/31	
Precipitation	91	0	42	53	12	6	204
High Density							
Date	1/1-5/20	5/21-7/1	7/2-8/14	8/15-9/23	9/24-11/5	11/6-12/31	
Precipitation	70	1	14	42	23	3	153
1981							
Cycles dates		7/14-8/10	8/11-9/11	9/12-10/12	10/13-10/29		
Mean ADG		-0.16[a]	0.73[b]	0.66[b]	0.12[c]		
Low density							
Date	1/1-6/30	7/1-7/31	8/1-8/31	9/1-9/30	10/1-10/31	11/1-12/31	
Precipitation	71	31	85	17	11	22	237
High density							
Date	1/1-7/13	7/14-8/10	8/11-9/11	9/12-10/12	10/13-10/29	10/30-12/31	
Precipitation	70	69	52	1	1	18	211

[1]A standard rain gauge was located in the southeast corner of the low stock density paddock while a recording rain gauge was located near the high stock density cell approximately 1.2 km northeast of the standard gauge.

[2]An interval of time required for livestock to graze each paddock in the cell before being returned to the paddock originally grazed.

[3]Value may be low due to malfunction of rain gauge.

[a,b,c]Means in the same line with different superscripts differ (P<0.01).

Table 2. Mean stock density, total animal-unit days (AUD) of grazing, and mean average daily gain (ADG), expressed as least square means, of heifers grazing tobosa managed under seasonal-continuous stocking with a low stock density and seasonal-rotation stocking with a high stock density 1979, 1980, and 1981 on the Jornada Experimental Range.

Seasonal grazing treatment	1979			1980			1981		
	Mean stock density	Total grazing	Mean ADG	Mean stock density	Total grazing	Mean ADG	Mean stock density	Total grazing	Mean ADG
	(A.U./ha)	(AUD)	(kg/da)	(A.U./ha)	(AUD)	(kg/da)	(A.U./ha)	(AUD)	(kg/da)
Continuous									
Low density	0.22	1,231	0.63	0.32	1,739	0.17	0.40	1,361	0.39
Rotation									
High density	1.37	1,324	0.62	3.85	1,999	0.08	3.08	1,510	0.29