Standing crop patterns under short duration grazing in northern Mexico

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Abstract

Patterns of end-of-season standing crop were evaluated during a 4-year period on an oak-bunchgrass range site under short-duration grazing in northern Mexico. Patterns were determined as a function of reduction of standing crop biomass of grasses within strata (300 m each) from a central watering point. Significant differences in end-of-season standing crop ($P<0.05$) were found among the strata. Four-year average standing crop biomass was 383 kg/ha within 300 m from the central watering point; whereas, standing crop biomass was 538, 691, 855, and 805 kg/ha within strata 300–600, 600–900, 900–1,200, and 1,200–1,500 m from the central watering point, respectively.

Key Words: standing crop biomass, Mexico, short duration grazing

Recently, intensive grazing schemes were introduced to the United States and Mexico as a means to increase secondary productivity. One of these intensive schemes, short-duration grazing (SDG), recommends a wagon-wheel design with pastures radiating from a central watering point (Savory 1979a). One concept of SDG is to increase animal numbers, up to 2 times the normal stocking rate, to produce the desired effect on the range. Reportedly, this management practice prevents overgrazing on any range type near stock concentration points (Savory and Parsons 1980). Evidence exists that cell pasture arrangements on west Texas ranges with high density stocking provide excellent animal distribution (Dahl 1986). However, other studies have found no improvement in grazing distribution (Kirby et al. 1986). Evidence is still needed on the effect of wagon wheel designs on standing crop distribution under various range types. Therefore, the objective of this study was to evaluate short-duration grazing effects on standing crop distribution on an oak-bunchgrass range type. The hypothesis being tested was: short-duration grazing, by promoting an even distribution of grazing and utilization of forage, will improve standing crop distribution over time.

Study Area and Methods

The study was conducted at the La Campana Experimental Station of the National Institute for Forestry, Agriculture, and Livestock Research (INIFAP-SARH). La Campana is located in the central region of the State of Chihuahua, Mexico, 82 km north of the capital city of Chihuahua. The geographical coordinates are 20° 20′ N latitude and 106° 20′ W longitude.

The study area has a semiarid, temperate climate. Average annual temperature is 16.3° C with extreme temperatures reaching 40° C during summer and -9° C during winter, with an average frost-free period of 199 days. Average annual precipitation is 355 mm, occurring mostly during July, August, and September.

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The study site was on foothill range with slopes greater than 3% at 1,540 m elevation and was representative of the oak-bunchgrass range type of northern Mexico. Soils were sedimentary with strong regional metamorphism, gravel-rich and rocky. Soils were sandy loams and had a pH between 5.2 and 6.5

The dominant grass genera were: *Bouteloua, Lycurus, Leptoloma, Digitaria, Aristida, Schyzachyrium, Muhlenbergia,* and *Elyonurus* associated with oak trees (*Quercus* spp.) and juniper *(Juniperus monosperma)*. Numerous forb species were present in the area. Sacahuiste *(Nolina texana)* also was abundant in this plant community (Rancho Experimental La Campana 1982). Also, shrubs such as *Acacia* spp., *Eysenhardtia spinosa, Mimosa* spp., *Condalia ericoides,* and *Prosopis glandulosa* were present.

The oak-bunchgrass site on which the SDG system was established had been deferred from grazing during the spring, summer, and fall and grazed at a light to moderate rate during the winter for 18 years before this study was initiated.

The study area consisted of 259 ha subdivided into 8 triangular shaped pastures of equal size. On this area, a SDG cell was established in August 1982 and standing crop distribution was studied over a 4-year period through September 1986. The SDG cell was designed according to the guidelines of Savory (1979a,b,c) with a central watering point and management area. Supplements (protein and minerals) were provided in the center of the cell-type system.

The SDG cell was stocked with mature Brangus cows from 1982 to 1983 and with mature Hereford cows from 1984 to 1986. Animals were rotated on the basis of 4-day grazing periods in the eastern 4 pastures and 3-day grazing periods in the western 4 pastures. This modification was based on previous observations of cattle behavior and grazing distribution in these pastures.

Stocking rates on the SDG system were adjusted each year depending upon vegetation and/or livestock response. Recommended stocking rate for this range type was 14 ha/AU (COTECOCA 1978). In August 1982, at study initiation, stocking rate was 9 ha/AU because of recommendations that stocking rates should be higher than recommended levels (Savory and Parsons 1980). In August 1983, stocking rate was lowered to 14 ha/AU because of drought conditions and depressed cattle weights. Stocking rates were returned to the original rate of 9 ha/AU in August 1984. Stocking rates were adjusted to 8 ha/AU in August 1985, and to 7 ha/AU in August 1986 because of greater precipitation and subsequent forage production.

Standing crop biomass of grasses (kg/ha) was determined at 5 strata (300 m each) from the central watering point in 4 of the 8 pastures. Standing crop biomass of grasses was determined by hand-clipping 1-m square quadrats randomly located within each strata. Quadrats were clipped at the end of each growing season from 1983 through 1986. Sample size of 20 randomly placed quadrats per strata was determined by the *n* formula derived from the *t* distribution, with a 95% confidence level within 10% of the mean (Pieper 1978). All samples were oven dried at 55° C for dry matter weight determination.

Standing crop biomass of grasses was analyzed using the

General Linear Model of SAS in a split-plot design to detect differences in standing crop biomass among distances from the watering point and between years sampled. LSD tests were performed to detect differences among means (Steel and Torrie 1980).

The size and nature of this study precluded replication of the SDG system. Thus, pastures within the SDG cell were used as replicates. This approach is considered valid under such circumstances (Guthery 1987).

Results and Discussion

Differences ($P<0.05$) were found in biomass of grasses among strata at progressive distances from the central watering facility in the 4 SDG paddocks (Table 1). The lowest standing crop occurred between 0 and 300 m from the central point of the cell, whereas the greatest biomass production occurred in the 2 strata farthest from the watering point (900 to 1,500 m). Mean standing crop biomass increased from 40 to 123% when comparing the biomass data within 300 m of the cell center with the other 4 strata. When averaged over 4 years, strata 0–300 and 300–600 m were 45 and 30% lower, respectively, in standing crop biomass than the other strata sampled (Table 1).

Table 1. Standing crop biomass of grasses (kg/ha) at different distances from the watering point under SDG in northern Mexico.

Distance (m)	1983	1984	1985	1986	Mean[1]
0–300	257	484	373	419	383[a]
300–600	414	675	451	613	538[b]
600–900	526	752	609	876	691[c]
900–1200	580	849	965	1027	855[d]
1200–1500	546	778	870	1026	805[cd]
Mean[1]	465[x]	707[xy]	654[xy]	792[y]	

[1]Means within the same row or column with the same superscript are not significantly different ($P<0.05$).

The uneven use of the first 2 strata was greater when stocking rate was increased in 1985 and 1986. Standing crop biomass of grasses within 0–300 and 300–600 m from the watering point during these 2 years averaged 55 and 45% lower, respectively, than the 600–900, 900–1,200, and 1,200–1,500 m strata. Thus, increasing the stocking rate did not promote more even distribution of standing crop biomass. We suggest that these results were due to cattle over-utilizing strata near the center of the cell. Further studies addressing grazing distribution under SDG on this range type are recommended.

Although some reduction in standing crop biomass near the watering point may have existed when this study was initiated, the purpose of this study was to determine if a cell-type SDG system promoted more even utilization of the forage over time, regardless of the previous production within the various strata of the pastures. Thus, on an oak-bunchgrass range site in northern Mexico, short duration grazing did not improve standing crop distribution over a 4-year period.

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