# Plains Pricklypear: Relation to Grazing Intensity and Blue Grama Yield on Central Great Plains[1]

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## Highlight

**Twenty-five years of light, moderate, and heavy grazing by cattle have had little effect on abundance of pricklypear at Central Plains Experimental Range. Pricklypear was removed from heavily infested sandy-loam and clay-loam soils; blue grama yields were measured in each of the five following years. Pricklypear removal did not increase blue-grama yield, but did make more forage available to the cattle.**

Extensive acreages of rangeland in the Central Great Plains are infested with pricklypear (*Opuntia polyacantha* Haw.). An abundance of pricklypear has been attributed to heavy livestock grazing (Stoddart and Smith, 1943). However, Turner and Costello (1942) indicated that outstanding changes in cactus population should not be expected from modification in intensity of grazing in northeastern Colorado. Klipple and Costello (1960), in a study at Central Plains Experimental Range, reported that frequency of pricklypear, the most frequent "shrub" in the study, increased under all treatments during the period 1940 through 1953. The increase was largest under no grazing, intermediate under moderate use, and least under heavy use. Hyder et al. (1966), at the same location, showed that pricklypear frequency increased as soil permeability decreased, and that species composition, including cactus, on upland soils, was not significantly affected by different intensities of grazing.

Houston (1963) and other observers reported the influence of insects on mortality of pricklypear. In his study at Central Plains Experimental Range, Vaughan (1967) found that plains pricklypear was by far the most important food of the pocket gopher (*Thomomys talpoides*).

Pricklypear data reported by Klipple and Costello (1960) on intensity of grazing studies for the period 1940 through 1953 were supplemented with data taken at the same location from 1954 through 1964. This was done to study the effects of 25 years of heavy, moderate, or light grazing on pricklypear abundance. In 1960 a cactus removal study was initiated to determine the effect of pricklypear on forage yields of blue gramagrass (*Bouteloua gracilis* (HBK.) Lag. ex Steud.).

## Methods

Annual precipitation at Central Plains Experimental Range, 38 mi northeast of Fort Collins, Colorado, averaged 11.77 inches from 1939 through 1964. Precipitation received May 1 through September 30 averaged 8.53 inches. The average frost-free period was 133 days. Average annual wind velocity varied from a low of 5.9 to a high of 8.0 mi/hr.

Three half-section pastures on upland-grama range, block III in the study reported by Klipple and Costello (1960), were grazed at light, moderate, and heavy intensities from 1940 through 1964.

[1]A contribution from the Central Plains Experimental Range, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture in cooperation with Colorado Agricultural Experiment Station. Published with the approval of the Director of the Colorado Agricultural Experiment Station as Scientific Paper No. 1197.

Average stocking rates for the 25-year period were 1.79, 3.13, and 4.11 acres/yearling heifer per month respectively for the heavy-, moderate-, and light-use pastures. The primary soils in these three pastures are the deep Ascalon sandy loam and the shallow Shingle clay loam. Forty permanent plots each containing 25 ft² were established in each pasture. In 12 of the 25 years of the study, the percentage of ground surface covered by herbage of each species was estimated on 120 plots. Pricklypear cover was taken from these data.

During the winter of 1959–60 three sets of adjacent paired plots, 70 × 40 ft, were selected on Ascalon soils and three on Shingle soils. The moderately grazed upland pastures in which the plots were located are grazed from November 1 through April 30. Before the growing season in 1960, cactus was removed from one plot of each pair. Pricklypear was removed by hand clipping below the root crown to minimize soil disturbance and damage to the grass. The randomly selected plot from which cactus was removed was outlined by a ripper tooth mounted on a tractor tool bar. This was done to prevent roots of cactus plants outside the plot from extending into the treated area. Twenty 1 × 2 ft subplots were clipped annually in October before cattle were turned into the pastures, to estimate blue-grama yield from 1960 through 1964. Herbage clipped on untreated plots included that growing within the cactus clumps. Clipping was carefully done in order to avoid damage to the pricklypear.

In 1962, while clipping for herbage yield in the plots containing pricklypear, herbage available to grazing cattle was kept separate from that produced within the pricklypear clump to determine how much was unavailable to the cattle.

Frequency data on pricklypear and blue grama were taken in 1965, using the method developed by Hyder et al. (1965). A 16-inch square quadrat was used for the pricklypear and a 2-inch square quadrat for the blue grama. Five transects with 25 quadrats spaced 3 ft apart on each transect were measured at each of the six locations. These data were taken to show the degree of pricklypear infestation and the frequency of blue grama at the study sites.

## Results and Discussion

*Grazing intensity.*—In 1940, pricklypear cover averaged 0.61, 0.32, and 0.61% in the heavy-, moderate-, and light-use pastures, respectively. To measure the relative cover changes under three rates of stocking, the average pricklypear cover on each of the three pastures in 1940 was considered as 100 and each of the subsequent 11 measurements was calculated as a percentage of the 1940 measurement (Table 1).

**Table 1. Changes in pricklypear cover expressed in percent of the cover initially measured in 1940 on heavily, moderately, and lightly grazed pastures.***

| Year | Annual Precipitation (inches) | Heavy | Moderate | Light | Mean |
|---|---|---|---|---|---|
| 1940 | 14.81 | 100 | 100 | 100 | 100$^{de}$ |
| 1944 | 8.17 | 54 | 80 | 57 | 64$^{e}$ |
| 1952 | 14.01 | 51 | 34 | 104 | 63$^{e}$ |
| 1955 | 13.08 | 116 | 112 | 182 | 137$^{cde}$ |
| 1957 | 16.57 | 122 | 145 | 172 | 146$^{cd}$ |
| 1958 | 13.27 | 342 | 270 | 388 | 333$^{a}$ |
| 1959 | 12.24 | 128 | 163 | 208 | 166$^{bcd}$ |
| 1960 | 7.10 | 195 | 184 | 228 | 202$^{bc}$ |
| 1961 | 16.09 | 193 | 208 | 228 | 210$^{bc}$ |
| 1962 | 15.88 | 197 | 225 | 210 | 211$^{bc}$ |
| 1963 | 13.44 | 188 | 220 | 191 | 200$^{bc}$ |
| 1964 | 4.31 | 201 | 289 | 210 | 233$^{b}$ |
| Mean | | 157$^{a}$ | 169$^{ab}$ | 191$^{b}$ | 172 |

* Pasture border means followed by the same letter are not significantly different at the 5% level. Year border means followed by the same letter are not significantly different at the 1% level.

Relative changes in pricklypear cover were abrupt, with comparable decreasing and increasing trends on all pastures. The cover in 1964 was more than double that which existed in 1940. The greatest increase occurred on the light-use pasture and the least increase occurred on the heavy-use pasture. The difference between heavy and light use is significant. Of greater importance, however, is that cover percentages never exceeded 2.4% (Fig. 1) and that 85% of the variation in pricklypear cover was associated with years.

The small deviations between pastures cannot be attributed to grazing intensity because the rates of increase or decrease also vary within pastures. Heavy grazing appears to be detrimental to pricklypear in some series of years, and favorable to it in other periods. Changes in grazing intensity cannot be depended upon as a management practice to either increase or decrease pricklypear.

Variations in abundance of pricklypear are due primarily to soil conditions (Hyder et al., 1966), and to year to year fluctuations in weather and associated factors. An example is the increase of pricklypear cover in 1958 and the decrease in 1959 (Fig. 1). Six inches of precipitation were received after vegetation measurements were made in 1957, and another 6 inches fell in 1958 prior to measurement of vegetation. At the time of measurement in 1958 individual pricklypear pads were much larger than usual. Individual pads were small in 1959, when it was observed that many pads showed insect damage. Houston (1963) found that pricklypear infestation by cactus-joint bug (*Chelinidea vittiger*) increased with an increase in precipitation during the previous year.

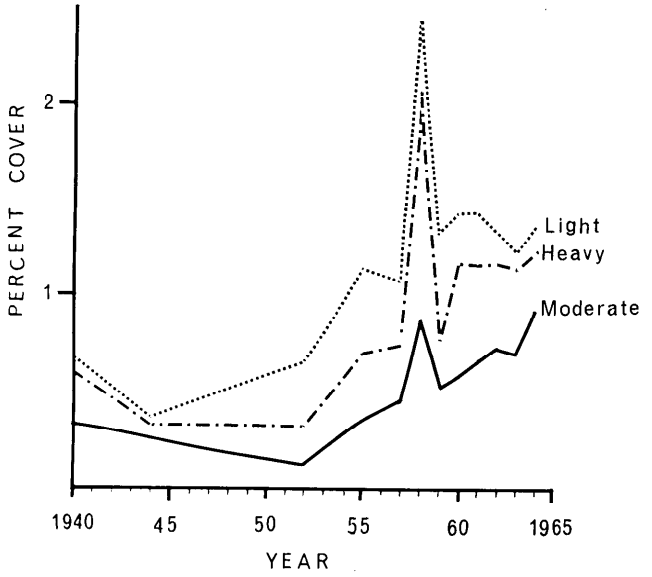


FIG. 1. Percentage of ground cover occupied by pricklypear on heavy-, moderate-, and light-use pastures in 12 of 25 years.

*Pricklypear removal.*—Table 2 shows the mean air-dry yields of blue-grama herbage clipped annually. Each figure is the mean of 60 clipped subplots, 20 of which were taken at each of the three locations on a given soil. The mean yield of 442 lb/acre from the control plots is not significantly different from the 402 lb/acre taken on the plots from which the cactus had been removed. The extremely low yields in 1964 resulted from annual precipitation of only 4.31 inches. The removal of pricklypear did not result in an increase in yield of blue-grama herbage. Moisture used by the pricklypear was probably compensated for by other factors. The pricklypear pads may serve as small windbreaks and produce a more favorable microclimate. After summer showers the surface soil within the clumps remains moist several hours longer than that outside the clumps, and during the winter, snow accumulates within clumps. It is possible, too, that the pricklypear can utilize moisture from the many small showers of only a few hundredths of an inch that would otherwise be lost through evaporation and thus would not be available to the grass. At Central Plains Experimental Range lateral roots of pricklypear are so near the surface that they are often exposed.

**Table 2. Mean air-dry yields of blue-grama herbage (lb/acre) clipped annually from check plots and plots with pricklypear removed on Shingle and Ascalon soils.**

| Year | Treatment | Shingle soil | Ascalon soil | Mean |
|---|---|---|---|---|
| 1960 | check | 702 | 588 | 645 |
| | cactus removed | 575 | 425 | 500 |
| 1961 | check | 434 | 328 | 381 |
| | cactus removed | 414 | 315 | 365 |
| 1962 | check | 469 | 577 | 523 |
| | cactus removed | 386 | 575 | 481 |
| 1963 | check | 480 | 596 | 538 |
| | cactus removed | 429 | 646 | 538 |
| 1964 | check | 113 | 133 | 123 |
| | cactus removed | 120 | 129 | 125 |
| Mean | | | | |
| | check | 440 | 444 | 442 |
| | cactus removed | 385 | 418 | 402 |

**Table 3. Mean air-dry yields of blue-grama herbage (lb/acre) clipped inside and outside pricklypear clumps in 1962 on Shingle and Ascalon soils.**

| | Shingle soil | Ascalon soil | Mean |
|---|---|---|---|
| Available outside clumps | 397 | 449 | 423 |
| Unavailable inside clumps | 72 | 128 | 100 |
| Total | 469 | 577 | 523 |
| Available to grazing cattle | 85% | 78% | 81% |

*Available herbage.*—Table 3 shows the mean air-dry yields of blue-grama herbage produced within pricklypear clumps and considered unavailable to grazing cattle. The mean herbage yield of 523 lb/acre in 1962 is very near the long time average yield at Central Plains Experimental Range. Removal of pricklypear increased the amount of available forage by an average of 100 lb/acre in 1962.

*Frequency.*—Blue grama was present in 79% of the quadrats on both soils. Pricklypear occurred in 55 and 63% of the quadrats on the Ascalon and Shingle soils, respectively. Hyder et al. (1966) reported mean frequency percentages of 35% on Interpretive Soil Group 3 and 43% on Interpretive Soil Group 4. The Ascalon and Shingle soils are in Interpretive Soil Groups 3 and 4, respectively. These frequency data show the high degree of pricklypear infestation at the study sites.

## Conclusions

Under conditions similar to those at Central Plains Experimental Range, differences in summer stocking rates of 1.79 acres/yearling month to 4.11 acres/yearling month cannot be expected to increase or decrease abundance of plains pricklypear. Changes in stocking rates between these levels cannot be recommended as a management practice to change pricklypear abundance.

The illusion that pricklypear abundance in this area is associated with heavier grazing is because the pricklypear in the more lightly-used pastures is camouflaged by the ungrazed grass. In the more heavily-used pastures the grass is shorter and grazed closer to the pricklypear clumps which in turn makes the pricklypear appear to be much more abundant than it is where more ungrazed grass is present.

Pricklypear removal did not result in an increase in blue-grama production, but did make more forage available for grazing.

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