FERTILIZER EFFECTS ON THE QUALITY AND PRODUCTION OF PRICKLY PEAR CACTUS AND ITS WILDLIFE VALUE

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INTRODUCTION

Prickly pear cactus (Opuntia lindheimeri E.) is an abundant plant in South Texas and northeastern Mexico. The Rio Grande Plain, also known as the Texas brush country, probably has the highest populations of prickly pear. Heavy infestations of prickly pear also extend to west-central Texas. Prickly pear is a drought-resistant, hardy plant.

Although prickly pear cactus has relatively low levels of crude protein (CP) and phosphorus (P), it is often used as emergency livestock feed (Griffiths, 1905, 1906; Shoop, et al. 1977; Everitt, et al. 1981; Gonzalez & Everitt, 1982). In addition to feed for domestic stock, prickly pear is an important wildlife food (Ramsey, 1965; Teer, 1975; Arnold & Drawe, 1979; Everitt & Gonzalez, 1981; Everitt, et al. 1981). However it has also been considered a "nuisance plant", controlled by both chemical and mechanical methods (Dameron & Smith, 1939; Thatcher, et al. 1964; Hoffman, 1967; Powell & Box, 1967; Dodd, 1968; Wicks, et al. 1969; Gonzalez & Dodd, 1979; Lundgren, et al. 1981; Aldridge, et al. 1983).

The economic potential of prickly pear has long been recognized (Griffiths & Hare, 1907) and there has been recent renewed interest in this aspect (Russell & Felker, 1985). The young pads of the plant are eaten as "nopalitos", an important vegetable in Mexico and the southwestern United States where there are large populations with a Mexican heritage.

This paper is a review of the various attributes of prickly pear cactus, with special emphasis to the Rio Grande Plain of South Texas. The application of fertilizer was evaluated to increase the nutritive content both for livestock and wildlife feed. The value of prickly pear as food and cover for wildlife is also addressed.

METHODS AND MATERIALS

The prickly pear cactus study was conducted on the southern edge of the Rio Grande Plain, about 38 km north of Rio Grande City, Starr County, Texas. In May 1978, mature prickly pear cactus cuttings that had two to three joints were planted on 102 cm beds, 46 cm apart in a row. Fertilizer treatments were applied 30 days prior to

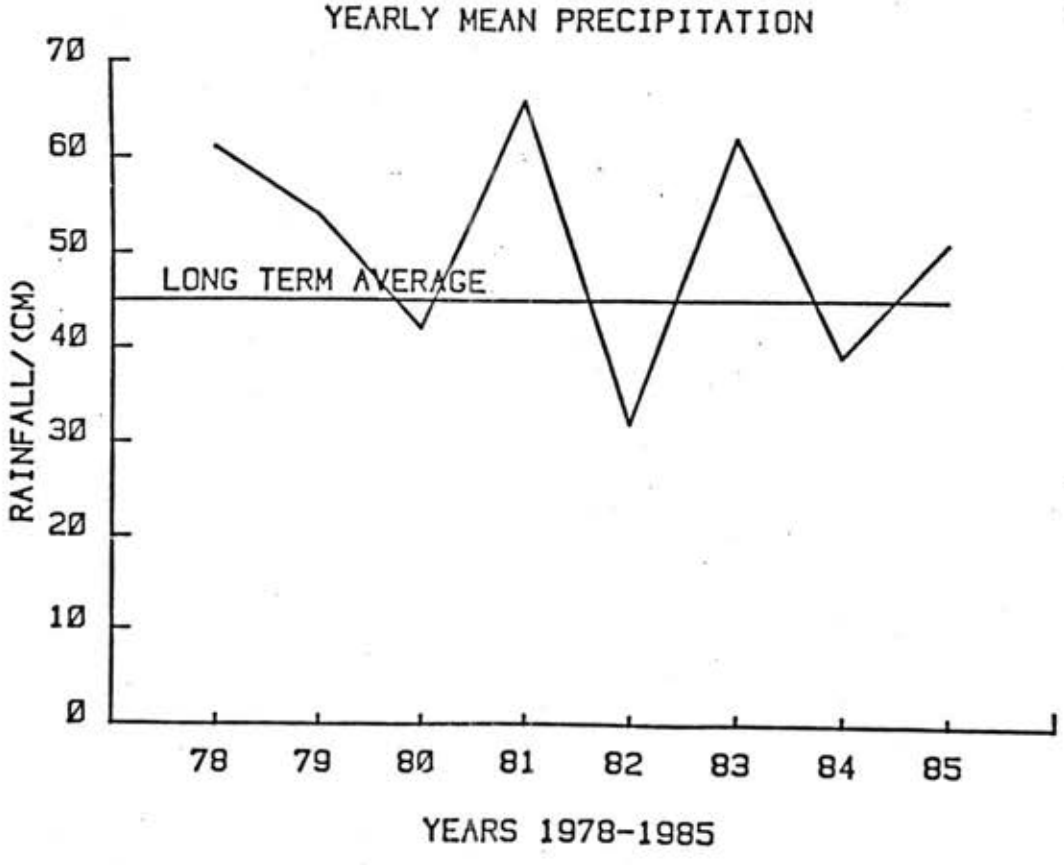
planting and again in the spring of 1979, 1980, and 1981. Plot size was 12 x 12 m, 11 rows/plot and replicated 4 times. Plant material was sampled for chemical analyses every spring and fall from 1979 to 1985. Plants for total biomass were harvested in spring from 1981 to 1985.

The wildlife studies (white-tailed deer and peccary) were conducted in 7 counties of South Texas. Counties included Zapata, Jim Hogg, Starr, Hidalgo, Kenedy and Willacy. Rumen and stomach analyses were used to determine food preferences.

FERTILIZATION AND PRODUCTION STUDY

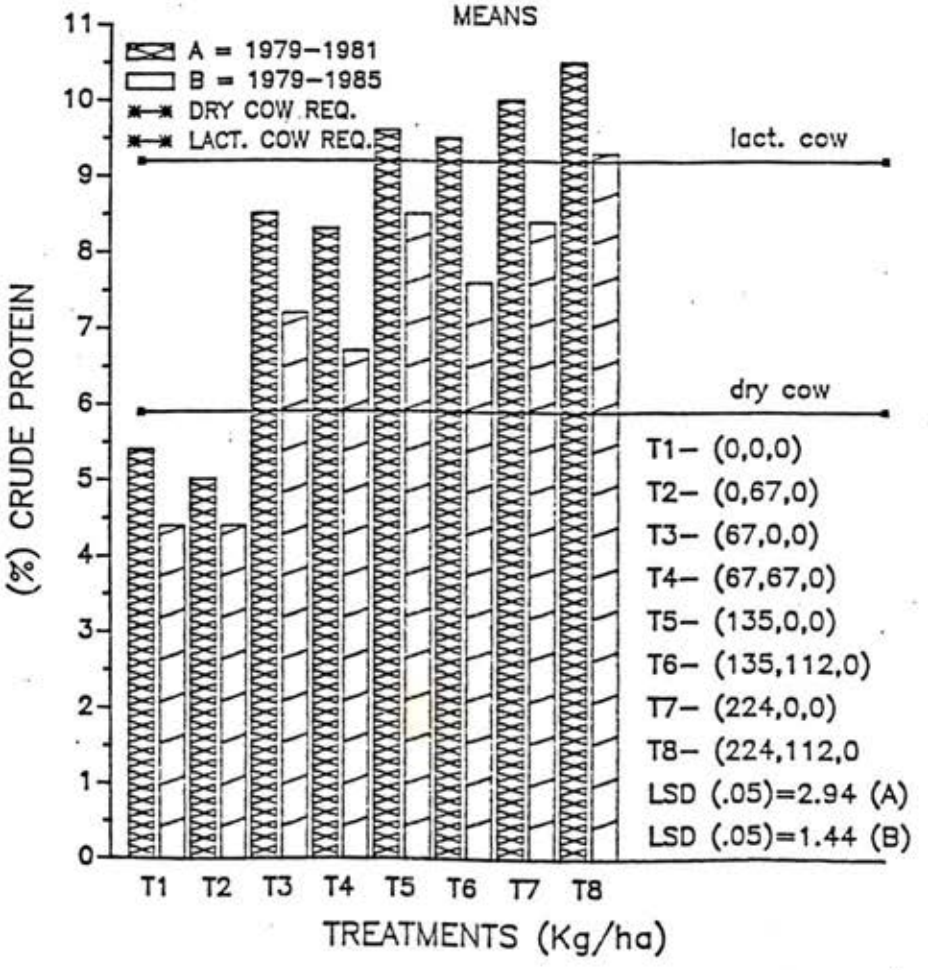
Precipitation. Annual precipitation was recorded throughout the study period (Fig. 1). Precipitation during this period was above normal (43 cm) in all years except 1980, 1982, and 1984. It was above the mean during winter except in 1979 and 1982. Spring periods of 1978 and 1984 were extremely dry, while spring 1981 was extremely wet. Annual precipitation for summer was normal or above normal for all years except 1982. No significant rainfall was recorded for 102 days in mid-1982.

Figure 1. Annual precipitation record in study area. The horizontal line is long term average.



Crude Protein (CP). From 1979-1981, the mean CP of N-fertilized prickly pear cactus was significantly higher than that of those not fertilized (Fig. 2). Mean CP content of prickly pear cactus for 7 years (1979-1985) was significantly higher only on the two high N treatment with or without P. The application of N fertilizer maintained CP levels higher for years after fertilizer was applied; however, the CP means for 1984 and 1985 were lower than 1982 and 1983.

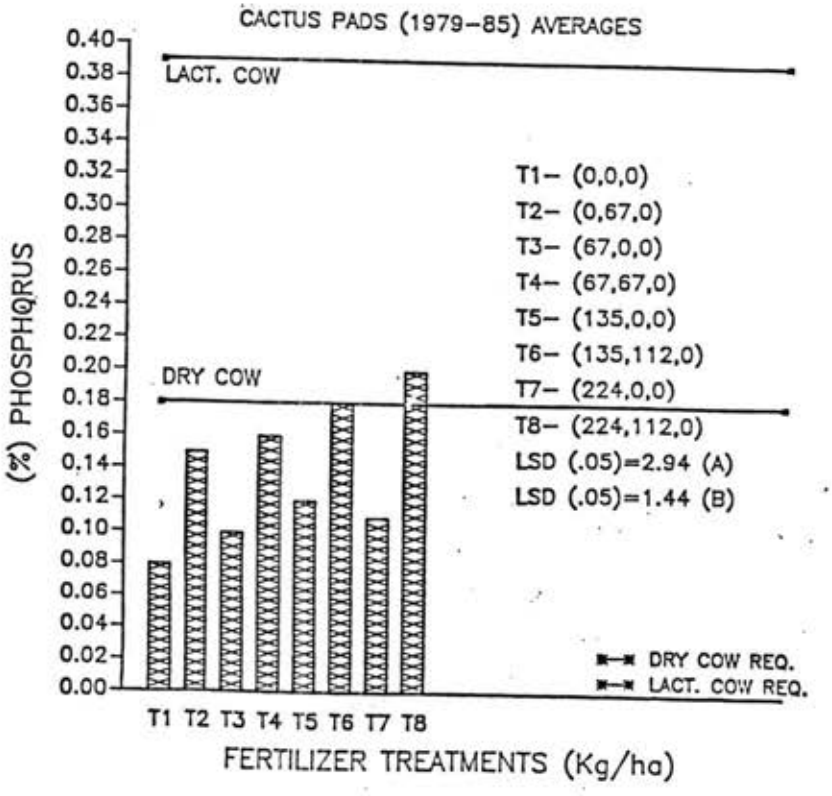
Figure 2. Prickly pear cactus crude protein percent from 1979-1985.



The CP requirements for lactating and dry cows are 9.2 and 5.9%, respectively (N.R.C., 1976). The application of 67 kg N/ha increased prickly pear CP levels above the dry cow requirement up to four years after application. The application of 224 kg N/ha raised CP levels above both dry and lactating cow requirements every year when N was applied, while a single application of this rate maintained CP levels near that required for lactating cows four years after application. Managers should apply 224 kg N/ha every two years to maintaining prickly pear CP levels above the requirements of both dry and lactating cows.

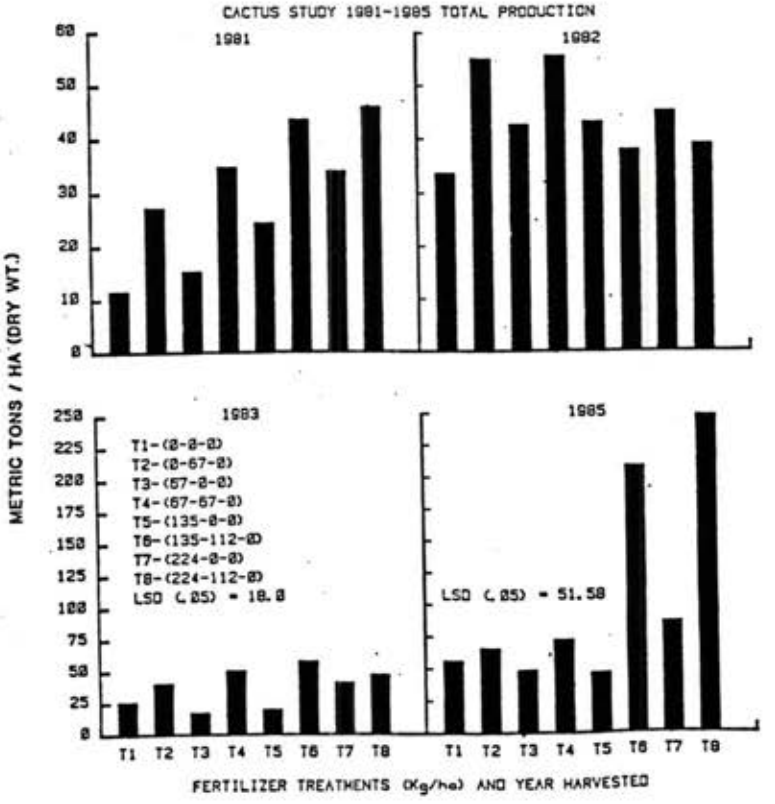
Phosphorous (P). Phosphorous content of prickly pear was generally low (Fig. 3), except when fertilized with P. When prickly pear was fertilized with 112 kg P/ha, P levels met the dry cow requirement (0.18%), but were far below the requirement for a lactating cow (0.39%) (N.R.C., 1976). High P content in plant material three years after fertilizer application indicated that P remains in the soil for at least this time period. Since P deficiencies are extremely critical especially when Ca concentrations are high (Hill and Guss, 1976), P probably should be supplemented free choice throughout the year.

Figure 3. Phosphorous per cent of prickly pear cactus form 1979-1985.



Biomass (total dry weight production). Prickly pear grew relatively slow the first four years after planting. Yields from the first two harvest (1981 and 1982) did not show significant difference among treatment means (fig. 4). In 1983 production was low, reflecting the 1982 drought, (32 cm of rainfall). Two years later (1985) production yields were much higher. The N and P fertility treatments (T-6 and T-8) yielded 208.3 and 247.5 metric tons/ha, respectively, and were significantly higher than other treatments. The increase in production was attributed to a significant interaction of N and P. Probably at the lower rates of P, it was depleted faster in the soil and no interaction took place. When compared with the control treatment, the increase in production was 270 and 340% higher for T-6 and T-8, respectively. These yields are similar to those reported in Mexico (Hernandez, 1970), but much higher than those reported earlier in south Texas (Griffiths, 1908; Griffiths, 1915). However, yields reported in earlier Texas studies were not from fertilized plots.

Figure 4. Total biomass production for 4 years following several fertilization treatments.



Calcium (Ca), Magnesium (Mg), Sodium (Na), and Potassium (K). Chemical composition of prickly pear and cattle requirements are shown in Table 1. The application of N and P did not change the mineral composition of prickly pear. Prickly pear had a mean K level of 2.3%, which was well above the K requirement (0.6-0.8%) of beef cattle (N.R.C., 1976) and higher than that in most grasses (Gonzalez & Everitt, 1982). Mean Na levels were below the 0.06% level considered adequate for beef cattle (N.R.C., 1976). Mean Na levels in most south Texas grass species are also deficient (Gonzalez & Everitt, 1982), but Na deficiencies rarely occur because it is a common practice to supply salt blocks.

Table 1. Average mineral composition of prickly pear cactus from 1979-1985.

Elements	Percent		
		Cattle Requirements[1]	
		Dry	Lactating
Calcium	4.2	.18	.44
Potassium	2.3	.6	.8
Magnesium	1.4	.04	.18
Crude Protein	5.8	5.9	9.2
Phosphorus	.09	.18	.39
Sodium	TR	.06	

[1] Gonzalez and Everitt (1982)

Calcium levels exceeded beef cattle requirements (0.18 to 0.44%) (N.R.C., 1976). The Mg requirement of beef cattle depends on many factors. Although beef cattle Mg requirements are low (0.04 to 0.18%) (N.R.C., 1976), Mg should not be deficient if K is present in excess because hypomagnesium tetany could occur. According to Hill and Guss (1976), a forage diet with less than 20% Cp and 3.0% K should contain 0.20% Mg. Prickly pear cactus meets these requirements, thus no tetany problem should occur.

PRICKLY PEAR CACTUS AND WILDLIFE

During spring 1970 and 1971, rumen analyses were used to determine the food preferences of white-tailed deer on the Zachry Ranch in Jim Hogg and Zapata Counties of south Texas (Everitt and Drawe, 1974). A total of 83 plant taxa were found to be eaten by the deer. Prickly pear comprised a high percent volume (15.4%) of the diet. Both fruits and pads of prickly pear were utilized. Several individual rumens contained as much as 50-75% volume of prickly pear.

A year-round study on the Zachry Ranch showed that prickly pear comprised 21.1% of white-tailed deer diets on an annual basis (Arnold & Drawe, 1979). Prickly pear was heavily consumed from June-September, making up 32.9% volume of the diet. Consumption of prickly pear could not be linked directly to the availability of other plants, because many species for which deer showed high preference were available when cactus consumption increased.

During late fall-early winter, food preferences and nutrient content of white-tailed deer diets were determined for two areas of rangeland in extreme southern Texas (Everitt and Gonzalez, 1979). In Hidalgo County, prickly pear comprised about 55% of the total diet. In Kenedy and Willacy Counties, prickly pear comprised only 4.3% of the diet. The lower utilization of prickly pear in this area was attributed to its low availability. Although prickly pear had low level of CP and P on both study sites, it had a high percentage of digestible dry matter when tested in vitro. Nutritional data revealed no other important deficiencies on either study area; however, P and Na were slightly deficient in some forb species at the Hidalgo County sites.

Food habits of the collared peccary (Pecari tajacu) were determined from three locations in South Texas (Everitt, et al., 1981). From September 1976 through August 1978 peccary food preferences on the Zachry Ranch were 74.7% cacti, 15.3% woody plants, 5.1% forbs, 2.3% grasses, 2.3% unknown plants, and 0.3% animal matter. Prickly pear pads comprised the bulk of the diet from October to March, whereas prickly pear fruit and mesquite pods were the most important foods from April to September.

During the fall and early winter period, peccary food preferences were determined on the Gonzalez Ranch in Starr County and Yturria Ranch in Kenedy and Willacy Counties. Food preferences on the Gonzalez Ranch were 81.5% cacti, 13.6% forbs, 2.0% woody plants, 0.6% grasses, 2.3% unknown plants, and 0.1% animal matter. On the Yturria Ranch food preferences were 48.1% forbs, 32.5% cacti, 8.3% woody plants, 5.7% grasses, 5.3% unknown plants, and 0.1% animal matter. Prickly pear cactus had a relatively low density on the Yturria Ranch in comparison with higher densities on the Zachry and Gonzalez Ranches. We can conclude that prickly pear was the preferred food of peccaries in south Texas, but in areas of low prickly pear density, forbs are highly utilized.

Many other wildlife species in south Texas depend upon prickly pear cactus for food, habitat and water. Bobwhite quail use prickly pear cactus for food and cover (Lehmann, 1984). Judd and Rose (1983) reported that the distribution of tortoise activity was closely associated with the distribution of prickly pear and they hypothesized that if prickly pear is an important food source, tortoise should be larger and their densities higher where prickly pear is more abundant.

SUMMARY AND RECOMMENDATION

The nutritive value of prickly pear growing on native rangeland grazed by cattle in south Texas is generally low in CP, P, and Na. The application of low rates of N increased CP in adequate amounts, but only the high N treatment (224 kg/ha) met requirements for lactating cows. The application of at least 224 kg/ha every 2 years would probably meet CP requirements for both dry and lactating cows.

The application of 112 Kg P/ha doubled P content in prickly pear, but only met cattle requirements for dry cows. Phosphorus would have to be supplemented to lactating cows. Since most Texas grass species are low in P, it should probably be supplemented throughout the year. Most of the other nutrients were present in adequate amounts to meet beef cattle requirements. Sodium levels were low, but Na intake is likely to be adequate because salt blocks are used year-round by most ranchers.

Prickly pear cactus can be considered a permanent feedstuff in any cattle operation, to be utilized throughout the year. Planting it in rows increases production and harvesting efficiency, as well as making fertilization and cultivation easier. The application of N and P increases its nutritive value and biomass production four-to-five fold.

Prickly pear cactus comprises the major portion of peccary and white-tailed deer diets in south Texas and provides food and habitat to many other species of wildlife in this area. If a major objective of a ranch is production of cattle, white-tailed deer, and peccary, it would be good management practice to plant prickly pear in rows. Leaving adequate space between the rows would allow for periodic disking or chiseling which would enhance the availability of forbs and grasses.

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