

Pricklypear Management in South Texas

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Pricklypear (*Opuntia* sp.) occurs on over 25 million acres of rangeland in Texas. Weather and soil type are two major factors controlling cactus populations but grazing, insects, fire and physical disturbance also influence abundance. South Texas stands have increased from 100%–300% after mechanical brush control such as rootplowing, chaining, and discing. These treatments scatter the cladophylls (pads) on disturbed soils and a high percentage take root and develop into new plants.

Negative attitudes toward pricklypear exist among ranchmen because dense stands interfere with livestock handling and movement and forage utilization. The cactus plants also compete with desirable grasses and shrubs. Livestock may become habitual consumers of pricklypear ('pear-eaters'). The pricklypear spines can cause bacterial infections in mouths and the gastrointestinal tract and seeds may cause rumen impaction in sheep.

Conversely, wildlife and emergency livestock feed value of pricklypear are the reasons why over 60% of South Texas ranchers believe the plant enhances ranch productivity. Pricklypear is important to white-tailed deer, javalina, and other wildlife species and provides bobwhite quail screening cover.

Vegetation management decisions must be based upon livestock and wildlife needs. A rational management plan, based upon goals and objectives, must consider pricklypear's net value, including costs of pear-related livestock health problems, impacts of pricklypear on herbaceous forage production and utilization, costs/benefits of preparation and feeding of pricklypear to livestock, and costs and effectiveness of available options for control.

Pricklypear Management

The primary reasons for including pricklypear in a forage program have been to diversify the forage base and to provide a drought reserve and supplemental forage system for beef cattle and wildlife enterprises. This serves to level forage supply fluctuations caused by weather events and lowers grazing risks.

Beef cattle carrying capacities are usually estimated on the grass forage component (26 lb of dried forage/A.U./day) whereas pricklypear as a supplement or emergency feed is calculated at 112 lb/A.U./day (22 lb dry matter and 90 lb water). White-tailed deer require 1,200 lb of browse annually (Nelle 1984). If 21% of the diet is cactus (Arnold and Drawe 1979) an additional 270 lb of pricklypear/deer/year will be necessary.

Since a cow can consume 10% or more of her body weight in cactus per day, she needs 20–25 lb of dry matter in her daily diet. Consuming 112 lb (fresh weight of pricklypear) daily will provide for these needs. Rangeland supporting 25 tons of pricklypear per acre will provide for the needs of one cow for one year. This includes the factor that only 66% of a pricklypear plant should be browsed during the year and that a three-year recovery period for the plants is necessary. Similar calculations are necessary for wildlife considerations.

Controlling Pricklypear

Range evaluations indicate that pricklypear canopies increase from 25% to 33% per year and densities may double within three years. If dense pricklypear stands are a problem the manager has several effective control methods to limit populations. Treatment selection depends on stand size and density, availability of hand labor, associated vegetation, and financial resources.

Pricklypear on rangeland can be effectively controlled with prescribed fire, hand grubbing, mechanical methods, or herbicides (Hanselka, Paschal, and Landers 1993). Prescribed burning under very hot conditions and/or with heavy fine-fuel loads may provide sufficient control to meet management objectives. It is often difficult to accumulate adequate fuel under dense pricklypear stands. Burning alone usually kills most of the pads but many clumps will resprout and regrow to the original size in three to five years. Mechanical treatments such as chaining, riling, or rootplowing can aggravate a pricklypear problem by spreading pads and increasing stand densities. Under hot, dry conditions, dragging (riling) may cause the pads to dry before rains wet the soil surface. This will reduce pricklypear stands. Aerial and ground broadcast spraying of herbicides, particularly picloram, or prescribed fire followed by picloram treatments is effective. Picloram may also be mixed with clopyralid, triclopyr, and other herbicides for increased control of

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Fig. 1. Spines are singed off pricklypear with "Pearburners" to allow livestock to consume the "burned" cactus.

associated brush species. Costs of control will vary with the kind and extent of treatment.

Preparation and Use As An Emergency Feed

The main considerations in using pricklypear as a feed pertain to when to feed, ensuring a balanced diet, and preparation of the cactus for consumption by livestock. As an emergency feed ration pricklypear is an abundant natural resource. However, as an alternative forage, it must be considered in a total forage management context. Beef cattle stocking rates must be adjusted to changing forage supplies and care taken not to overuse grasses. Managers should evaluate their pastures and begin burning pear as a supplement before grasses are depleted. Under extremely dry conditions, pricklypear may become the primary nutrition source instead of a supplement.

Pricklypear's nutrient content is often less than that required for livestock maintenance (Hanselka and Paschal 1991) so a salt and protein supplement, such as cottonseed meal, needs to be fed with pricklypear to meet the

nutritional requirements of beef cows. Cottonseed meal's high protein and phosphorous content complements pricklypear's highly digestible carbohydrates (energy), vitamins, and water.

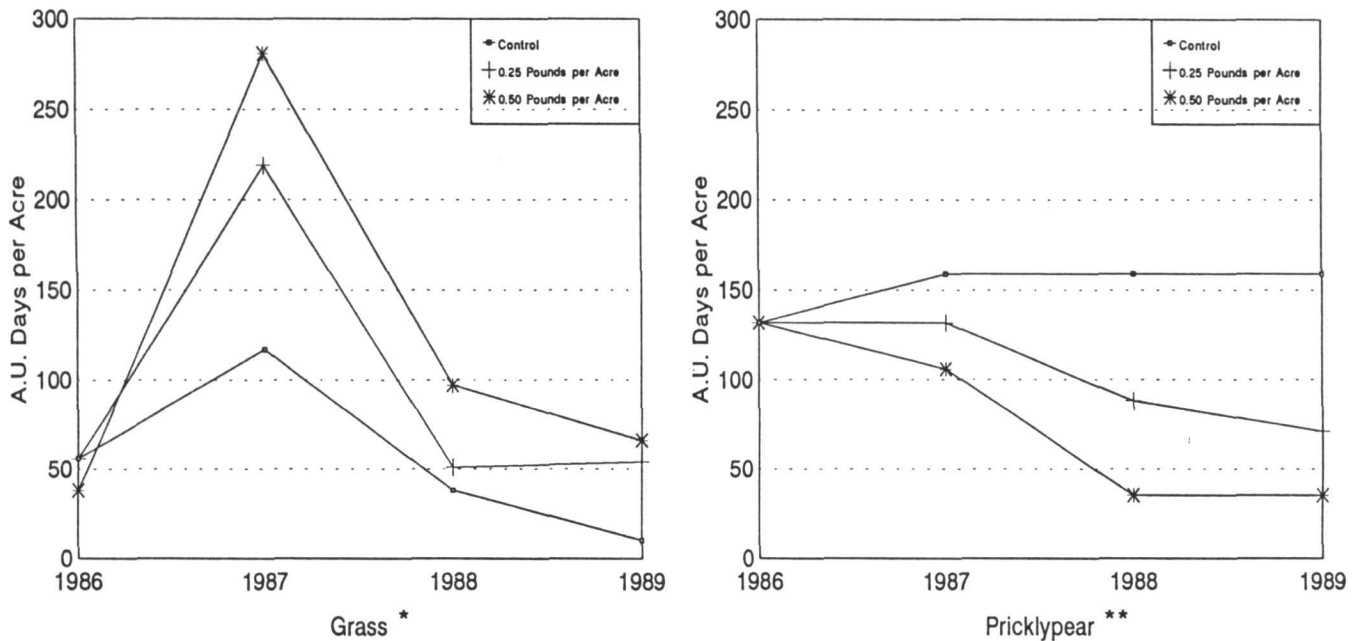
Depending on labor availability, cactus supply and fuel cost, pricklypear may be fed in place by singeing the spines with a "pear burner" and allowing livestock free choices access. "Burning" treatment options include: (1) carrying an individual pear burner and moving from plant to plant; (2) carrying a propane tank in a truck and burning with a long hose and burner (this requires one person to move the hose and one to burn); or (3) pulling a tank with several burners attached to a farm tractor (Fig. 1.)

A 5-gallon pear burner will hold only about 4 gallons of propane and usually provide one day's feed for about fourteen cows on dense pricklypear. In warm, dry weather an experienced individual can burn enough pricklypear for two hundred or more cows in a day

Vegetation Responses to Management

In November, 1986, a pricklypear management system was initiated in South Texas. A *Prosopos-Acacia* mixed brush community was rootplowed in 1980 and seeded to Buffelgrass. Pricklypear populations exploded and dominated the community (approximately 15,000lb/acre, wet weight). The pricklypear area was aerially sprayed with .25 lb/ac (low rate) and .50 lb/ac (high rate) of picloram in 1986. There were no important differences between the two herbicide rates in total numbers of plants killed, but the high rate affected pricklypear faster than the lower rate. The two treatments had achieved similar results by the third year. Approximately 20% to 40% of the pricklypear canopy remained three years after the herbicide treatments. More canopy cover remained on the low rate area which resulted in more residual biomass than on areas sprayed at the higher rate. It was estimated that the non-sprayed areas supported over 18,000 lb/ac (wet weight) of pricklypear. Almost 8,000 lb/ac and 4,000 lb/ac pricklypear remained three years after spraying with the half and full rates of picloram, respectively.

Grass densities and production increased as pricklypear stands were reduced. An average of 1,000 lb/ac grass forage was produced on non-treated areas and this doubled during periods of above average rainfall. However, grass forage production increased to 4,500 lb/ac and 5,500 lb/ac, respectively, on areas treated with the two rates of picloram. These increases in forage availability improved cattle carrying capacities (Fig. 2). The low-rate treatment of picloram allowed significant increases in carrying capacity based upon grass availability with pricklypear residuals maintaining a buffer during fluctuations in grass production. Grazing capacities increased in the pasture treated with the high rate of herbicides, but were not much higher than that of the low-rate treatment because of less pricklypear residual.



* Calculated on 26 pounds of dry forage daily and 25% grazing efficiency.

** Calculated on 112 pounds of pricklypear per day.

Fig. 2. Changes in grazing capacities (A.U. days/ac) following treatment of a pricklypear community with picloram at .25 and .5 lb/ac.

There are several trade-offs in these scenarios. A lack of pricklypear control results in "boom and bust" grass responses between wet and dry years, with relatively stable pricklypear production. However, greater biodiversity exists when pricklypear competition is lessened by herbicide treatments. Grass responses and grazing capacities are more stable. Although fluctuations in total forage production do occur, they are not as drastic. Enough pricklypear residual remains to use as an emergency feed, if necessary, following herbicide applications.

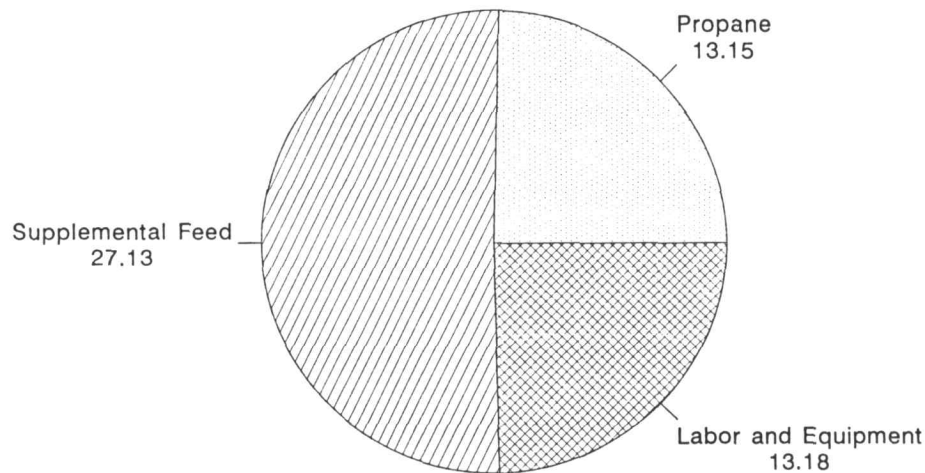
The Economics of Pricklypear Management

To make management decisions with respect to pricklypear the ranch manager needs to estimate: 1) the value of grass production that may be lost to dense stands of pricklypear, 2) the net value (after preparation costs) of pricklypear as an emergency feed, 3) the value of pricklypear to wildlife habitat and 4) the cost of reducing pricklypear densities and amount of reduction desired.

The cost of using pricklypear as a feed depends upon several factors. These include the quality of the pricklypear, the density of the stand, the equipment used to prepare it for feeding, and the cost of fuel required to singe the spines from the pricklypear. Propane is the primary fuel used to "burn" pricklypear and has a sharply

defined seasonal price pattern. Prices are lowest in the summer and highest in winter months primarily due to competing demands from heating uses. South Texas producers have reported usage rates ranging from .2 to .33 gallons of propane/cow/day to prepare pricklypear for feeding. Fuel costs range from \$.10–\$.26/head/day during periods of seasonally strong propane prices. Labor required to prepare pricklypear varies from one man being able to prepare sufficient feed for 125 cows in .5 day to two men being able to prepare enough for 400 cows/day. Assuming a wage rate of \$5.00/hour plus a 25% charge for employment taxes and other benefits, labor costs would range from \$.20/head/day to \$.25/head/day. Repairs required to keep burning equipment in service normally range from \$75 to \$100 per year.

These values would total to cost estimates of preparing pricklypear for feeding that range from \$.30 cents/head/day to \$.41/head/day. However, these cost estimates may not represent all the cost involved in a total feeding program (e.g. as protein supplements). Pricklypear-based rations allow cost-effective weight gains on steers. A stocker cattle enterprise near Laredo, Texas, gained .7 lbs/head/day on pricklypear and supplemental feed in early 1993. Direct cash costs per pound of gain were \$.53/pound (Fig. 3) (Hanselka and Falconer 1993).



Costs shown in cents per pound.
Total cost of gain of 53.46 cents per pound.

Fig. 3. Stocker steer costs of gain (per pound) on pricklypear-based rations.

Economic feasibility of pricklypear stand reduction was analyzed using capital budgeting techniques. Three capital budgeting methods, payback period, internal rate of return (IRR), and adjusted benefit-cost ratio were applied to this management system to determine the economic feasibility of picloram application to pricklypear (Workman 1981).

Payback period analysis was used for producers who are primarily concerned with financial liquidity when making investment decisions. By selecting the pricklypear control method with the shortest payback period, the producer will increase the liquidity of his operation relative to choosing other control options. However, pay-

back period analysis may not lead to the selection of the most profitable control alternative over time. By selecting the control method with the largest IRR, the producer will maximize profitability of the firm over time. The adjusted benefit-cost ratio analysis is included to take into account the size of the investments made in pricklypear control. By selecting control alternatives with the highest benefit-cost ratio, the producer will maximize profit to his/her entire credit base.

Tables 1 and 2 show the changes in cash flows for low rate and high rate pricklypear control options. Cash flows for the low and high rate control methods were calculated by multiplying the estimated changes in grass carrying capacity by \$98.28/head. This value per head is the aver-

Table 1. 0.25 pounds/acre Picloram Application Economic Analysis per 247 acres.

Increase in Hunting Lease Revenue per Acre	Change in Annual Cash Flow				Payback Period (Years)	Internal Rate of Return	Adjusted Benefit-Cost Ratio (5%)
	1986	1987	1988	1989			
\$0.00	(\$3,829.00)	\$1,474.20	\$98.28	687.96	5.08	-25.60%	0.76
\$1.00	(\$3,829.00)	\$1,721.20	\$345.28	\$934.96	3.83	-12.69%	0.88
\$2.00	(\$3,829.00)	\$1,968.20	\$592.28	\$1,181.96	3.07	-1.27%	1.00
\$3.00	(\$3,829.00)	\$2,215.20	\$839.28	\$1,428.96	2.56	9.21%	1.13
\$4.00	(\$3,829.00)	\$2,462.20	\$1,086.28	\$1,675.96	2.20	19.03%	1.25
\$5.00	(\$3,829.00)	\$2,709.20	\$1,333.28	\$1,922.96	1.93	28.36%	1.38

Initial investment at \$15.50 per acre.

Table 2. 0.50 pounds/acre Picloram Application Economic Analysis per 247 acres.

Increase in Hunting Lease Revenue per Acre	Change in Annual Cash Flow				Payback Period (Years)	Internal Rate of Return	Adjusted Benefit-Cost Ratio (5%)
	1986	1987	1988	1989			
\$0.00	(\$5,681.00)	\$2,260.44	\$786.24	\$884.52	4.34	-19.22%	0.66
\$1.00	(\$5,681.00)	\$2,507.44	\$1,033.24	\$1,131.52	3.65	-10.60%	0.78
\$2.00	(\$5,681.00)	\$2,754.44	\$1,280.24	\$1,378.52	3.15	-2.71%	0.91
\$3.00	(\$5,681.00)	\$3,001.44	\$1,527.24	\$1,625.52	2.77	4.65%	1.03
\$4.00	(\$5,681.00)	\$3,248.44	\$1,774.24	\$1,872.52	2.47	11.62%	1.16
\$5.00	(\$5,681.00)	\$3,495.44	\$2,021.24	\$2,119.52	2.23	18.28%	1.28

Initial investment at \$23.00 per acre.

age annual grazing cost per cow derived from the National Cattlemen's Association SPA database (McGrann et al.). Cash flows are also developed for 6 alternative levels of increase in hunting lease values. With no increase in cash flows from hunting lease values none of the control methods are economically feasible over the 3 year planning horizon. However, the payback period, IRR and adjusted benefit-cost ratio indicates that if hunting lease rates are increased \$3.00/acre by pricklypear control, then the low rate treatment is economically feasible and preferred to the high rate treatment option.

Management Implications

There are several reasons that support inclusion of pricklypear in South Texas range management strategies. Total removal of pricklypear would undoubtedly damage the potential revenue that could be generated from hunting leases since properly managed pricklypear stands can add value to wildlife leasing enterprises. These are an increasingly important source of revenue to ranch operators. As shown in the economic analysis, some value must be added from sources beside livestock grazing from the control of pricklypear with picloram to be economically feasible.

Pricklypear can also serve as a cost effective feedstuff in drought situations. However, livestock carrying capacities can be doubled during good rainfall years by reducing pricklypear densities and lessening competition for forage grasses. Forage grass response is immediate but is highly dependent on rainfall. This forage base declines during drought years with concomitant reduction in livestock carrying capacity but a forage base remains in the form of pricklypear. The residual pricklypear can add many additional Animal Unit days/ac to ranch carrying

capacities. Preparation and supplemental feeding of pricklypear will add to the costs/cow but may avoid herd liquidation during extended drought.

It is clear that use-values of land with extremely dense stands of pricklypear can be feasibly increased by picloram applications. If, by opening up the pricklypear canopy, hunting lease values can be increased by \$3.00 to \$4.00/acre and livestock carrying capacities also increase, then the control of pricklypear with picloram becomes economically feasible. It is generally advisable to treat dense pricklypear stands with a low rate of picloram in order to decrease pricklypear stand canopies and grow more grasses. Also, it is our opinion that portions of pastures or small traps should be left untreated as nutrient banks for emergency use.

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