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Summary

In a range improvement study, both liquid and pelleted forms of Picloram were effective in controlling pricklypear cactus. Higher rates of chemical hastened control and gave more complete control. At lower rates, cactus was recovering in 1985, the fourth year of study, suggesting that higher rates may be most cost effective.

In 1983 noncactus vegetation response was minor. In 1984, "all perennial grass" production increased by more than 50% (312 lb/A) at higher rates of Picloram. Shifts in "cool season" and "warm season" grass components were nonsignificant. In 1985, "cool season grass" was not generally affected by treatments, but "warm season grass" increased at several rates of Picloram. Cactus continued to decrease.

Grass utilization by cattle in 1984 increased greatly at higher rates of Picloram. It appears likely that desirable grazable forage can be increased when cactus is decreased. Access to forage appears to improve substantially as cactus pads collapse. Based only on 1984 livestock grazing utilization estimates and on 1984 increases in perennial grass production, potential reductions in acreages required for livestock grazing ranged from 49 to 72%. Economic analyses will be conducted at the end of the study.

Key Words: Range Improvement, Pricklypear Control, Picloram.)

Introduction

Pricklypear cactus occurs in moderate to heavy levels of infestation in 1.3 million acres in the western part of South Dakota. Especially after a series of dry years, requests for information on the control of pricklypear are received. Interest usually centers on which herbicides are best, how long the cactus will be controlled and whether associated perennial grass production will increase. Additionally, livestock are known to avoid stepping on cactus pads or grazing the grass among them, which effectively decreases the acreage available for grazing.

This interest prompted a study on pricklypear control in Fall River County. The study was started in 1982 and is expected to continue through 1987 or 1988. This report is through the 1985 growing season. The objectives of this research are to examine (1) the effectiveness of pricklypear control with Picloram using two formulations at several rates; (2) the response of noncactus vegetation; and (3) to establish some estimate of cost effectiveness (not reported here) considering (a) possible increases in forage production and (b) better forage accessibility to grazing animals once cactus pads collapse.

Picloram is the generic name of Tordon, a product of Dow Chemical USA. Its use in this project should not be considered an endorsement.

Experimental Procedure

The study site selected was a clayey range site with (1) moderate levels of pricklypear, (2) representative of pricklypear areas, (3) vegetationally uniform, and (4) large enough to receive livestock grazing impact. The principal cool season perennial grass was western wheatgrass and warm season grasses were buffalograss and blue grama. Annual grasses were Japanese brome and sixweeks fescue. The principal perennial forbs were American vetch and scarlet globemallow.

Picloram treatments were applied once only in early July 1982 while vegetation was actively growing and pricklypear was in blossom. In 1983, 1984, 1985 and 1986 (not reported) peak standing crop was estimated for principal vegetation components. Additionally, in 1984, grass utilization by cattle was estimated for each treatment.

Liquid formulations of Picloram 22K were applied using a pressurized field plot sprayer. Pelleted formulations of Picloram 2K were applied using a small, hand cranked fertilizer spreader.

A total of eight treatments were created including a control. The herbicide rates were intended to bracket the known effective rates for both formulations (22K and 2K):

Treatment rate (lb/A)	Treatment formulation
0	-
1/8	22K
1/4	22K
3/8	22K
1/2	22K
1/4	2K
1/2	2K
3/4	2K

The field design was a randomized block with four replications and eight treatments. Individual plots were 25 x 100 feet. Subplots for vegetation sampling were 1 x 4.8 feet. Each year, five subplots per plot were clipped to ground level for peak standing crop estimates. Visual estimates of pricklypear cover were taken from 20 subplots per plot. Additionally, in 1984, an experienced estimator evaluated perennial grass utilization by livestock at season's end. Each plot was visually inspected and use determined. The estimator did not know the treatment identity of the plots.

Results and Discussion

Over the years, precipitation variation has had a major impact on vegetation production. About 10 inches is average for April-July, which are the most critical months for range forage production. The variation in April-July precipitation shown in table 1 is worthy of notice. In 1983, peak standing crop (PSC) was 1,607 lb, which may be somewhat above average, probably a result of 3.9

inches of rain in October, 1982. The 1984 production of 1,214 lb may be closer to average. The 1985 value of 205 lb reflects the severe drought of that year.

Perennial grasses contributed the greatest share of PSC for the noncactus vegetation at 63% (table 2), while annual grasses, annual forbs and perennial forbs contributed 37%. When all vegetation, including pricklypear was considered, pricklypear contributed an overwhelming 76% of the PSC, due principally to the long life span of the pads.

Aerial cover of cactus never exceeded 7% in 1983, the first year of the study (figure 1). In focusing on the control, cactus cover decreased naturally over the three years (1983-1985) for unknown reasons. For the Picloram treatments, the amount of live cactus decreased steadily over the years. Decreases were greatest and most rapid at the highest rates. Both the liquid (22K) and pelleted (2K) formulations of Picloram were effective in cactus control. At the higher rates, especially for 22K, there was essentially no live cactus by 1985. Also by 1985, there was some evidence of pricklypear recovery, particularly at the lower rates of Picloram.

A detailed look at 1983 production (peak standing crop, table 3) reveals that there was no change in "perennial grass" due to Picloram. The amounts of change in the "annual forb" component represented a small portion of the total production. However, especially at the higher rates of Picloram, all forbs were nearly eliminated. Forbs are known to be sensitive to Picloram. Even though there was no significant difference in "cactus" production, trends for decreased cactus were quite evident in some treatments.

Some important features were evident in the 1984 PSC (table 4). For example, there were few significant differences in production for either the "cool season" or "warm season grass" components. By contrast, when cool and warm season grasses are totaled in "all perennial grass," several of the Picloram treatments yielded substantial increases in production--up to 70%. In reviewing "annual grass" production, individual comparisons revealed that the two highest rates of Picloram, namely 1/2 22K and 3/4 2K, significantly reduced production when compared to the control. Also, cactus production was greatly reduced, especially at higher rates.

In 1985 (table 3), some rates of Picloram tended to decrease production of "cool season grass." For "warm season grass," some Picloram treatments increased production. For "all perennial grass," several treatments increased production much like 1984. "Cactus" was nearly eliminated in 1984 so that the 1985 "total no cactus" response paralleled the "all perennial grass" response. Picloram greatly reduced "total" production, which included cactus.

Grass utilization estimates at the end of the grazing season in 1984 showed a consistent pattern of increased livestock use with higher rates of Picloram (table 6). In comparing the means (averages), it is apparent that grass utilization was significantly increased in the Picloram treatments. This was the first year in which cactus pads had collapsed, providing greater accessibility to the grass.

TABLE 1. PRECIPITATION IMPACTS ON PRODUCTION

Year	April-July precipitation	Peak standing crop[1]	PSC[1] with cactus
	Inches	Pounds/acre	Pounds/acre
1982	15.1		
1983	10.3	1,607	5,249
1984	10.3	1,214	3,096
1985	5.5	205	3,095

[1] Peak standing crop is from "control."

TABLE 2. RELATIVE PRODUCTION (1983-1985) EXPRESSED AS PERCENTAGES

Production components	Peak standing crop without cactus[1]	PSC with cactus[1]
Cool season grasses	39	10
Warm season grasses	24	6
(all perennial grasses)	(63)	(16)
Annual grasses and forbs and perennial forbs	37	8
Pricklypear cactus	--	76
Total without cactus	100	--
Total including cactus	--	100

[1] Control, 1983-1985.

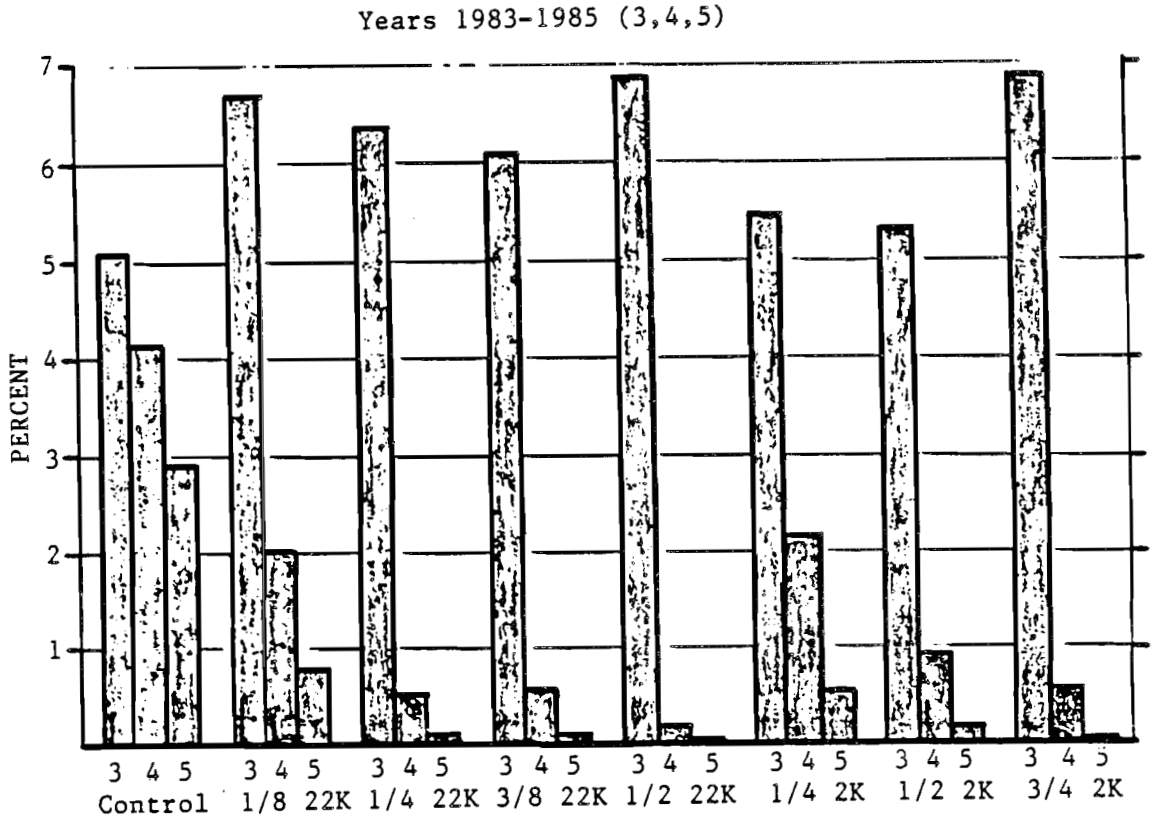

Figure 1. Live cactus cover.

TABLE 3. 1983 PEAK STANDING CROP - PERTINENT COMPARISONS

Treatment	All perennial grass	Annual grass	Annual forb	Perennial forb	Cactus[2]	Total
			Pounds/acre[1]			
Control	1,108 NS	429 NS	67[a]	4[ab]	3,642 NS	5,249 NS
1/8 22K	1,201 NS	325 NS	22[ab]	8[a]	3,649 NS	5,205 NS
1/4 22K	1,189 NS	472 NS	2[b]	4[ab]	3,627 NS	5,295 NS
3/8 22K	1,092 NS	499 NS	1[b]	1[ab]	2,862 NS	4,455 NS
1/2 22K	1,144 NS	420 NS	1[b]	0[b]	2,225 NS	3,790 NS
1/4 2K	1,004 NS	479 NS	23[ab]	2[ab]	2,959 NS	4,466 NS
1/2 2K	991 NS	404 NS	12[b]	1[ab]	3,652 NS	5,058 NS
3/4 2K	995 NS	457 NS	4[b]	0[b]	2,580 NS	4,036 NS

[1] NS = values within the same column are not significantly different (P>.05). [a,b] = values within the same column followed by different letters are significantly different (P>.05).

[2] Many values in this column show a strong trend for being less than the control.

TABLE 4. 1984 PEAK STANDING CROP - PERTINENT COMPARISONS

Treatment	Cool season grass	Warm season grass	All perennial grass	Annual grass	Cactus	Total no cactus
			Pounds/acre[1]			
Control	502 NS	120 NS	622[c]	573 NS	2,883[a]	1,214[bc]
1/8 22K	603 NS	289 NS	892[ab]	570 NS	1,069[bc]	1,472[ab]
1/4 22K	415 NS	322 NS	738[bc]	435 NS	481[c]	1,175[c]
3/8 22K	626 NS	313 NS	938[ab]	424 NS	856[bc]	1,366[abc]
1/2 22K	774 NS	190 NS	964[a]	302 NS	412[c]	1,278[abc]
1/4 2K	511 NS	320 NS	830[abc]	440 NS	2,116[ab]	1,273[abc]
1/2 2K	611 NS	379 NS	990[a]	525 NS	949[bc]	1,518[a]
3/4 2K	594 NS	283 NS	876[ab]	286 NS	315[c]	1,168[c]

[1] NS = values within the same column are not significantly different (P>.05). [a,b,c] Values within the same column followed by different letters are significantly different (P<.05).

TABLE 5. 1985 PEAK STANDING CROP - PERTINENT COMPARISONS

Treatment	Cool season grass	Warm season grass	All perennial grass	Cactus	Total no cactus	Total
			Pounds/acre[1]			
Control	116^{abc}	64^{b}	180^{c}	2,890 NT	205^{c}	3,096^{a}
1/8 22K	107^{abc}	115^{ab}	222^{ab}	576 NT	258^{ab}	884^{b}
1/4 22K	85^{bc}	121^{ab}	207^{bc}	89 NT	231^{abc}	320^{b}
3/8 22K	75^{bc}	126^{a}	201^{bc}	88 NT	217^{bc}	304^{b}
1/2 22K	140^{a}	92^{ab}	232^{ab}	0 NT	238^{abc}	238^{b}
1/4 2K	87^{bc}	128^{a}	214^{abc}	780 NT	243^{abc}	1,023^{b}
1/2 2K	132^{ab}	120^{ab}	253^{a}	238 NT	256^{ab}	495^{b}
3/4 2K	132^{ab}	123^{a}	255^{a}	0 NT	267^{a}	267^{b}

[1] Within a column, values followed by different letters are significantly different (P<.05).
^{a,b,c} Values within the same column followed by different letters are significantly different (P<.05).
NT = no test, too many zero values.

TABLE 6. 1984 GRASS UTILIZATION BY CATTLE

Treatment	Replications				
	1	2	3	4	Avg[1]
	% use				
Control	15	15	20	20	17.5^{g}
1/8 22K	25	40	15	20	25.0^{fg}
1/4 22K	40	35	40	20	33.8^{abcd}
3/8 22K	30	30	40	35	33.8^{abcde}
1/2 22K	40	40	35	35	37.5^{abc}
1/4 2K	20	35	25	40	30.0^{bcdef}
1/2 2K	40	40	30	45	38.8^{ab}
3/4 2K	40	30	40	50	40.0^{a}

[1] Values followed by different letters within a column are significantly different (P<.05).
^{a,b,c,d,e,f,g} Values within the same column followed by different letters are significantly different (P<.05).