Effect of Herbicidal Control of Saw Palmetto On Associated Native Forage Plants In Peninsular Florida

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Native plants have been the basic livestock food since the introduction of beef cattle into Florida by Ponce de Leon in 1521 and Hernando de Soto in 1539. Approximately 10.2 million acres are used as native rangeland in peninsular Florida. Another million acres in this region have been improved by partial or total destruction of native vegetation and planted with more productive and nutritious grasses and legumes.

Livestock producers in south-central Florida flatwoods are becoming more concerned about methods of controlling saw palmetto and associated shrubby plants. This is the result of rising value of grazeable land coupled with the increasing need for higher quality cattle feed.

Trials were started at the Range Cattle Experiment Station in August 1955 to determine: (1) response of saw palmetto to treatment with herbicides; (2) changes in species composition and density of native plants in treated areas and (3) comparison of carrying capacity per acre and productivity of beef cattle in areas with and without herbicidal control of saw palmetto and associated shrubby plants. Only the second objective will be discussed in this manuscript.

Review of Literature

The native vegetation has been grouped by Davis (1943) into four logical range types. They are as follows: (1) pine flatwoods, (2) dry prairies, (3) wet prairies and (4) vegetational types of minor importance such as oak-cabbage, palm, ham-

mock, and oak-scrub sites.

The pine flatwoods cover approximately six million acres in central and south peninsular Florida. The soils of the region are poorly drained, inherently low in plant nutrients with a pH of 4.5 or below. Rainfall ranged from 36.6 to 78.74 inches and averaged 55.27 inches for the 18-year period, 1942 through 1959. For the same period 60.7 percent of the total precipitation fell in four months, June through September. Average temperatures for this same period ranged from a low of 49.1°F. in January to a high of 91.5°F. in June. Relatively high humidity prevails throughout much of the year. Dominating plants in this range type are saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*), staggerbush (*Lyonia* spp.), huckelberry (*Vaccinium* spp.), papaw (*Asimina* spp.) grass genera such as *Aristida, Andropogon, Panicum, Paspalum, Axonopus, Sorghastrum,* and other grasses and grasslike plants.

Rummell (1957) found that a highly complex vegetation exists in Charlotte County, Florida. During the summer of 1954 he listed a total of 354 plants that showed evidence of being grazed by cattle, including 147 grass and 77 grasslike species. Existing forbs and shrubs have little grazing value compared with grasses and grasslike plants.

Saw palmetto (Small, 1933 and Baker, 1955) grows throughout the pine flatwoods region in Florida and occurs on many different sites from Louisiana to South Carolina. Plants vary in size with the stems normally creeping and copiously rooted along the underside. In more fertile areas single plants or colonies may have oblique to erect stems rooted only at the base. Contrary to the growth habit of most palms, the stems are frequently much branched. The leaves, cordate at the base and ranging from green to glaucous in color, have petioles with sharp recurving spines. This plant is unpalatable and is not eaten by cattle except in periods of critical forage supply or when there is a lack of bulk in the ration. The thicker clumps, however, provide some protection against cold wind and/or rain, and small undisturbed areas are desirable for this purpose. Eradication of 70 to 80 percent of this species is within the desired control range. The remaining stands will provide adequate shelter to livestock and wildlife.

TABLE 1. Plant Kill and Canopy Area Reduction of Saw Palmetto by Check and Treatment Plots.

Treatment[1]	Water: Oil Carrier	Saw Palmetto	
		Killed	Reduction Canopy Cover
		— — — (Percent) — — —	
Check	———	00.0	00.0
dalapon	100-0	38.8	65.0
20 lbs.[2]	50-50	83.0	75.0
2, 4, 5-T	100-0	74.9	66.6
4 lbs[2]	50-50	52.5	73.1
	0-100	44.2	48.3
2,4,5-TP	100-0	69.3	74.3
4 lbs.[2]	50-50	66.5	78.7
	0-100	49.8	68.4
2,4-D	100-0	21.8	17.9
6 lbs.[2]	50-50	63.7	59.5
	0-100	63.7	60.9
erbon	100-0	86.0	91.0
120 lbs.[2]	50-50	80.4	73.0
	0-100	66.5	68.5

[1] Dalapon=2,2-dichloropropionic acid; 2,4,5-T=2,4,5-trichlorophenoxyacetic acid butoxy ethanol ester; 2,4,5-TP=2-(2,4,5-thrichlorophenoxy) propionic acid; 2,4-D=2,4-dichlorophenoxy acetic acid butyl ester; erbon=2-(2,4,5-trichlorophenoxyl) ethyl 2,2-dichloropropionate.

[2] Pounds active ingredients per acre.

Method of Procedure

Five herbicides selected from preliminary trials involving 25 chemical materials and formulations, as reported by McCaleb *et al* (1960), were applied with a boom-type ground sprayer to replicated plots 12 x 60 feet in September and October 1957. The herbicides used were dalapon, 2,4,5-T, 2,4,5-TP, 2,4-D and erbon (Table 1) in cut-over pineland without tree canopy at the Range Cattle Experiment Station. Treatments were completed before mid-day to provide maximum light and temperature. Diesel fuel was mixed with water to provide three carriers containing 0.0, 50.0 and 100.0 percent oil. Equal amounts of an emulsifying agent (Dyna-wet) were used with all mixtures. Spray equipment was calibrated to deliver 60 gallons of liquid per acre. Immokalee fine sand soils prevailed throughout the plot areas.

Percent species composition and plant cover at soil level were determined in May 1959 or approximately 20 months after treatment by a modification of the line intercept method developed by Canfield (1941). Eight transect lines, each 10 feet in length, were randomly located in each treatment replication to measure the area covered by grasses and grasslike plants. An equal number of belt transects, 1 x 10 feet, were used to determine numbers of forbs and woody shrubs. Canopy cover and ground density of saw palmetto were determined by meas-

uring the distance along the line intercepted by fronds and buds. Checks were left between each treatment area and the average measurements in six adjoining untreated plots were computed for comparison with the enclosed sprayed areas. Counts for all categories were averaged and shown as percent for each herbicidal treatment.

For purposes of further evaluation of effects of different herbicidal treatments, plants were grouped in the following major categories and sub-divisions.

Grasses

A. Decreasers: Primarily perennial species of *Aristida, Stipa, Andropogon, Sorghastrum* genera and some *Panicum* and *Paspalum* species which decrease rapidly when heavily grazed and which disappear if subjected to continued heavy grazing. These are the most desirable native plants from the stand-point of both quality and quantity of forage produced.

B. Increasers: Grass species of intermediate grazing value which first increase under heavy grazing and then decrease with continued misuse. Representative increasers in flatwoods pinelands include numerous species of *Panicum* and *Paspalum.*

C. Invaders: Grasses of low forage production and usually sod-forming if perennial. Representatives of this group are *Axonopus, Cynodon, Eremochloa* and most annual *Panicum* and *Paspalum* species. *Muhlenbergia* and *Eragrostis* also supply some feed but are relatively unimportant.

Grasslike Plants

This group is composed of a large number of annual, biennial and perennial species of *Cyperus* and *Juncus.* Some provide grazing throughout the year. These plants increase under heavy utilization and are serious invaders of improved pastures.

Forbs

This division contains all the non-toxic broad-leaved plants. Species composition within this group changes rapidly and frequently through-out the year. Forbs usually comprise less than two percent of the native upland vegetation.

Woody Shrubs

These plants are undesirable because they compete directly with grass, grasslike plants and forbs for light, moisture and nutrients. However, they do furish shelter and seasonal feed for quail and other wildlife.

Results and Discussion

The May 1959 counts of native vegetation on plots treated in September and October 1957 with five herbicides and three water to oil carriers are shown in Tables 1, 2, 3 and 4.

Table 1 gives the percent plant kill and canopy area reduction of saw palmetto by herbicidal agent and percent water to oil in the carrier. Plant height ranged from 12 to 48 inches at time of chemical application. Check plots for the two dates of treatment averaged 21.8 plants per 100 feet of intercept line and 45.7 percent canopy cover. The highest percentage plant kill or control, 86.0 percent, was obtained with erbon, a soil sterilant at the rate used. When the general area was burned in December 1959, the erbon plots did not have sufficient vegetation to burn satisfactorily. Of the translocated herbicides, 2,4,5-T in water gave the best control. It is interesting to note that percent plant kill decreased as the amount of oil in the carrier was increased from 0 to 50 to 100 percent with 2,4,5-T, 2,4,5-TP and erbon. The low percent of plant kill with 2,4-D without oil in the carrier indicates the ineffectiveness of the herbicide and that a large share of the control was contributed by oil. Apparently, a synergistic action occurs when 2,4-D and oil are combined and applied to palmetto. Diesel fuel without herbicides in the solution was applied to a series of plots at rates of 30 and 60 gallons per acre without damage to saw palmetto other than moderate leaf burn at the higher vol-

TABLE 2. Species Composition by Plant Categories.

Treatment	Water: Oil Carrier	Grass	Grass-like[1]	Forbs[2]	Woody Shrubs
			(Percent)		
Check	——	81.4	17.0	.9	.8
dalapon	100-0	67.1	32.3	.5	.1
	50-50	82.8	16.7	.4	.1
2,4,5-T	100-0	78.7	20.3	1.0	.0
	50-50	79.3	18.6	1.6	.5
	0-100	79.2	19.0	1.1	.7
2,4,5-TP	100-0	78.3	20.3	1.3	.2
	50-50	88.2	10.5	.4	.9
	0-100	83.5	15.4	.5	.7
2,4-D	100-0	63.1	35.4	1.4	.2
	50-50	78.7	19.9	.7	.7
	0-100	79.9	19.0	.7	.4
erbon	100-0	78.0	18.9	3.0	.1
	50-50	68.7	28.3	2.8	.2
	0-100	66.7	30.1	2.9	.3

[1] *Carex* and *Juncus* spp.

[2] Non-toxic broad-leaved plants.

ume. Another series of trials in a different area showed that oil in excess of 25 percent resulted in decreased plant kill. This possibly resulted from excessive burn of leaf tissues and decreased herbicidal translocation; however, the manner and rate of translocation of herbicides in palmetto are not fully understood.

Percent species composition is of interest since it reflects changes which have occurred within treatment areas when compared with adjoining checks. It also shows control of plant species and/or forage groups. However, in areas subject to continuous grazing the results may be influenced by preferential feeding in the comparatively open plot areas. Use of oil in the carrier also may delay forage consumption until its odor and/or taste have dissipated. The percent species composition by major plant groups in treated and check plots are given in Table 2. Forbs made up a small percentage of the total plant population in the check. The soil sterilizing action of erbon was reflected in the higher percentage of forbs. Data given in Tables 2 and 3 must be compared and evaluated in relation to ground density as tabulated in Table 4.

TABLE 4. Ground Density of Forage Plants per 100-Foot Line Transect.

Treatment	Water: Oil Carrier	Grass Decreaser	Grass Increaser	Grass Invader	Grasslike Plants	Total Intercept	Percent of Check
Check	——	4.5	3.0	.4	1.0	8.9	100.0
dalapon	100-0	4.8	2.6	.7	.7	8.7	97.7
	50-50	5.0	5.0	.4	.6	11.1	124.0
2,4,5-T	100-0	5.7	5.3	.1	1.4	12.4	139.0
	50-50	7.8	3.5	.4	1.0	12.6	141.4
	0-100	8.5	2.5	.2	1.0	12.3	137.5
2,4,5-TP	100-0	6.8	5.1	.3	3.8	15.9	178.0
	50-50	10.0	2.1	.6	2.3	15.1	169.0
	0-100	11.5	.9	.3	1.0	13.6	152.3
2,4-D	100-0	5.0	4.8	.2	1.7	11.7	131.2
	50-50	9.8	1.5	.4	1.3	12.9	144.6
	0-100	9.7	2.6	.2	2.3	14.8	162.3
erbon	100-0	6.3	3.0	.9	3.8	14.0	156.2
	50-50	.8	4.8	.2	.7	6.5	72.3
	0-100	2.2	3.0	.0	2.5	7.6	85.4

The percent species composition of grass, grasslike plants and forbs are shown in Table 3. The highest percentages of desirable grasses were in plots with 50:50 and 0:100 water to oil carrier mixtures. The increase of forbs and grasslike plants on plots with 100 percent water in the carrier, with the exception of broad-leaved plants in 2,4,5-T and grasslike plants in the erbon-treated plots, shows there was less soil surface occupied by woody species after treatment and increased opportunity for plant invasion.

TABLE 3. Species Composition by Forage Plant Categories.

Treatment	Water: Oil Carrier	Grass Decreaser	Grass Increaser	Grass Invader	Grasslike Plants	Forbs
		(Percent)				
Check	——	39.4	42.0	.6	17.1	.9
dalapon	100-0	38.3	27.9	1.0	32.3	.5
	50-50	22.8	54.1	6.0	16.7	.4
2,4,5-T	100-0	29.6	46.4	2.7	20.3	1.0
	50-50	48.4	29.5	1.8	18.7	1.6
	0-100	42.5	35.0	2.4	19.1	1.0
2,4,5-TP	100-0	36.6	38.8	3.0	20.3	1.2
	50-50	50.6	36.5	2.0	10.5	.4
	0-100	53.2	28.0	2.8	15.5	.5
2,4-D	100-0	34.8	41.0	2.1	21.3	.8
	50-50	51.0	26.1	1.2	20.0	.7
	0-100	50.8	28.7	.8	19.1	.7
erbon	100-0	36.7	37.9	3.6	18.9	3.0
	50-50	6.8	58.1	4.1	28.4	2.8
	0-100	18.4	36.7	11.8	30.2	2.9

Ground density or percent of the soil surface covered by grass and grasslike plants is given in Table 4. A comparison of the total intercept in treated plots with the check shows an increase in forage plants for all treatments except where dalapon in 50:50 and erbon in 50:50 and 0:100 carriers were used. The largest percent increase in density of grass and grasslike plants for any herbicide was on plots treated with 2,4,5-TP. This ranged from 152.3 to 178.0 percent of the check, with the total rising as the amount of oil in the carrier was increased. Erbon with 50 and 100 percent oil was the only treatment with less ground cover than the checks. Use of oil in the carrier increased the percentage of desirable grasses in all treatments except erbon.

Summary

The effect of five herbicides in three water-oil carrier solutions, applied in September and October 1957, on species composition and ground density of native forage plants growing in association with saw palmetto without serious damage to forage plants, was determined in May 1959. The largest percent of buds killed was in plots treated

with 2,4,5-T in 100 percent water. Larger amounts of oil in the carrier decreased palmetto kill with 2,4,5-T, 2,4,5-TP and erbon but increased control with 2,4-D and dalapon. The same relationship occurred in total intercept of grass and grasslike plants. Preferential grazing by cattle on plots without oil in the carrier may account for a portion of the rise in density of decreaser grasses. Woody shrubs were fewer in all herbicidal treatments compared with the check. Shrubs increased in percent species composition when greater amounts of oil were used in the carrier. Grazing trials on treated and untreated pasture areas must be conducted to determine the economic value of chemical control of saw palmetto and other woody shrubs in pine-flatwoods ranges of peninsular Florida.

LITERATURE CITED

BAKER, MARY F. 1955. Florida wild flowers. The Macmillan Co. New York. 245 pp.

CANFIELD, R. H. 1941. Application of the line interception method in sampling range vegetation. Jour. For. 39:38-394.

DAVIS, JOHN H. 1943. The natural features of southern Florida, especially the vegetation and the Everglades. Fla. Geol. Surv. Geol. Bul. No. 25, 311 pp.

McCALEB, J. E. AND E. M. HODGES. 1959. Rainfall and temperature records from 1942 through 1958 at Range Cattle Experiment Station, Ona, Florida. Fla. Exp. Sta. Circ.

McCALEB, J. E., E. M. HODGES AND C. L. DANTZMAN. 1960. The response of saw palmetto *(Serenoa repens)* to several herbicides. Proc. Sou. Weed Conf. 13:113-117.

RUMMELL, ROBERT S. 1957. Beef cattle production and range practices in south Florida. Jour. Range Mangt. 10:71-78.

SMALL, JOHN K. 1933. Manual of southeastern flora. Univ. of North Carolina Press, Chapel Hill. 1554 pp.