IMPROVEMENTS IN HERBICIDAL CONTROL OF SAGEBRUSH AND RABBITBRUSH[1/]

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Effective treatments have been developed for control of big sagebrush (Artemisia tridentata) and rabbitbrush (Chrysothamnus spp.) on rangelands of eastern Oregon. However, application of this technology has not always given consistent results. In the early 1970s we observed unsatisfactory results, particularly in control of sagebrush, when it appeared all guidelines had been observed carefully. We have not yet seen consistently good results in control of green rabbitbrush (Chrysothamnus visicidiflorus). In 1976, we began a series of field trials to reexamine herbicides that may be effective in brush control for eastern Oregon. We thank leaders of the Hampton Grazing Cooperative, the Les Schwab Ranch near Prineville and the J Spear Ranch near Paisley for making lands available for our studies.

METHODS

Sixty-two plots were established in Crook, Deschutes, and Lake counties on the ranches identified above. Herbicidal treatments included various combinations of herbicides at different rates (the basic treatments are identified in Table 1). These were combined in different combinations and with varying rates of the additives, X-77, Tronic, 5 percent diesel oil, M 4168 (an oil substitute), and niacin to give 51 different treatments. Eleven non-treated plots were established as controls. Plot size varied from one-eighth acre for sagebrush and green rabbitbrush to a maximum of 300 acres for gray rabbitbrush (C. nauseosus).

Herbicidal treatments were applied from 1976 to 1980 with both ground and aerial techniques. Each treatment was established in relation to phenological growth stage of each shrub species. These were: before development of ephemeral leaves, after development of ephemeral leaves in the spring, and also in the fall for Wyoming sagebrush (A. t. wyomingensis); before bud break and at the early leaf stage for green rabbitbrush; and in the early leaf stage for gray rabbitbrush. Plots were established in spring as early as late March and no later than mid-May. We recorded phenology of associated vegetation at the time of each treatment but none of these measurements were useful in interpreting results.

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Table 1. Herbicide treatments

Herbicides	Rate (lbs/A)
2,4-D	2, 3, 4
M 4021	1, 2
Picloram	1/4, 3/8, 1/2
2,4,5-T	1, 3
Dicamba	1

Effects of treatments were initially evaluated at the end of the first growing season after herbicidal treatment. However, it became apparent that responses were different after the second growing season so all results reported are from measurements made after the second full growing season. In each plot we randomly selected 25 to 50 plants and recorded if it was alive and estimated the percent of the canopy that had been defoliated. If any living tissue could be observed, the plant was recorded as alive.

Results were statistically analyzed using standard analysis of variance and Student's t test technique. In all cases, the level of significance accepted was 95 percent.

RESULTS AND DISCUSSION

Wyoming Sagebrush

When examined within a phenological stage all herbicidal and additive treatments produced similar results with no statistical differences. In 1976, addition of niacin appeared to strongly enhance control before development of ephemeral leaves but this advantage was not apparent in subsequent treatments applied in 1979. Most treatments included 2,4-D with another herbicide which did not yield additional benefits.

Comparison of results in different phenological stages indicated the value of presence of ephemeral leaves as an indicator for timing of herbicidal application. The treatments applied in fall were completely ineffective. After observation of the plots, no data were collected. Early spraying before development of ephemeral leaves did provide a significant kill and defoliation, but delaying spraying until ephemeral leaves developed significantly improved results (Table 2). Sagebrush in this area is usually sprayed a month or more after development of ephemeral leaves. It is clear that effective control is likely when herbicides are applied as soon as possible after development of ephemeral leaves. This varies according to annual weather patterns but occurs from early to mid-May in the study area.

Table 2. Percent kill and defoliation related to phenology for Wyoming sagebrush

Phenology	% Kill	% Defoliation
No ephemeral leaves present	42	71
Ephemeral leaves present	93	96
Control	1	22

As we observed responses of plants sprayed and compared them to responses from the general spray programs that commenced 2 to 3 weeks later, we noted the rate of defoliation and death varied considerably. The plants treated soon after ephemeral leaves developed defoliated slowly and often didn't appear substantially damaged until a year later. Plants treated later at the more normal time defoliated rapidly in the first summer after treatment but sometimes refoliated in the first fall or spring following treatment. The slower herbicidal action from the early spray appeared more efficient since it produced less variable responses. During the course of these studies, the general spray program in Crook County was adjusted to our results and substantial improvements were observed. We also noticed improved kills in the adjusted program for low sagebrush (A. arbuscula), mountain big sagebrush (A. t. vaseyana), and basin big sagebrush (A. t. tridentata).

Green Rabbitbrush

Herbicidal treatments did result in significant kills of green rabbitbrush when compared to controls in the early leaf stage but results were not as good as for sagebrush. Addition of picloram, in the phenological stage after early leaves were formed, resulted in a 54 percent kill and 74 percent defoliation which was not significantly different than the 31 percent kill and 46 percent defoliation for the combination of other treatments. The experimental herbicide M 4021 killed 52 percent of the plants in the early leaf stage and resulted in 64 percent defoliation, which was not a significant improvement over the other herbicidal treatments.

Comparison of results based on phenological stage at time of treatment indicated treating in the bud stage was ineffective although the percent defoliation was significantly greater than for controls (Table 3). Deferment of spraying until the early leaf stage resulted in significantly higher kill and defoliation than for controls. However, the kill was not satisfactory to maintain long-term control. Observations in the first growing season after treatment suggested a high level of control but plants resprouted and grew in the second growing season.

Table 3. Percent kill and defoliation related to phenology for green rabbitbrush

Phenology	% Kill	% Defoliation
Bud	6	17
Early leaves	34	48
Control	0	3

Gray Rabbitbrush

Control was effective with both picloram combined with 2,4-D and 2,4-D alone. Treatments were only applied in the early leaf stage (Table 4). Addition of picloram improved efficacy of treatments but 3 pounds per acre of 2,4-D alone was satisfactory. Our studies of gray rabbitbrush are only beginning and we have examined results at only two locations on plots sprayed by ground equipment over about 150 acres and by aircraft on about 300 acres.

Table 4. Percent kill and defoliation related to phenology for gray rabbitbrush

	Picloram + 2,4-D		2,4-D only	
Phenology	% Kill	% Defoliation	% Kill	% Defoliation
Early leaves	99	99	90	95
Control	0	3	0	3

MANAGEMENT IMPLICATIONS

Wyoming big sagebrush can be effectively controlled when sprayed after ephemeral leaves have developed in the spring. We have sprayed brush much later than necessary in the past which can give erratic results. Earlier spraying allows a longer period of good growing conditions for the herbicide to act in the year of application and will give more consistent results.

Gray rabbitbrush can be controlled with early sprays, and when in mixed stands with Wyoming sagebrush both species should be effectively controlled.

Green rabbitbrush is resistant to herbicidal control and we expect risk of failure to remain high until a more effective treatment is developed.