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EFFECTS OF DICAMBA AND PICLORAM ON SOME NORTHERN IDAHO SHRUBS AND TREES

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ABSTRACT

Two recently developed herbicides, dicamba and picloram, used alone and in mixture with 2,4-D, gave promising results in tests on six shrub species common to northern Idaho brushfields. The treatments damaged conifers, and so apparently are unsuitable for broadcast spraying to release established trees from shrub competition.

Shrub species are ever present in the understory vegetation of northern Idaho forests. They are aggressive and can quickly dominate a site if the forest cover is partially or totally removed by cutting, fire, or pests. A heavy cover of shrubs makes it difficult to regenerate a forest, particularly with less tolerant species. Even more shade-tolerant species, such as Rocky Mountain Douglas-fir [*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco] and grand fir [*Abies grandis* (Dougl.) Lindl.]--which eventually will replace shrubs--may grow slowly, lengthening the time needed for seedlings to attain harvestable size.

We have used various means (e.g., machine scarification, fire, and herbicides) to remove or to control the spread of shrubs prior to planting trees. Of these, machine scarification probably has been most successful, but is not suited to steep terrain. In steep country, we have relied on fire--sometimes preceded by herbicide application. Upon occasion, however, subsequent herbicide treatment has been called for because shrubs often recover rapidly during the first growing season following a burn.

If a highly successful herbicide were available, it might be the only site preparation treatment needed on some areas. Elimination of a second treatment, such as burning, would reduce reforestation costs. Herbicides also have a use in brushfields where an adequate number of trees have become established beneath the shrubs. If these areas could be chemically treated without damaging conifers, such trees could be released from excessive shrub competition.

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With these needs in mind, we compared the performances of picloram mixed with 2,4-D,[2] dicamba,[3] and dicamba mixed with 2,4-D.[4] Two of these, dicamba and picloram, only recently have been developed for shrub control; the other, 2,4-D, has been used extensively for years. We tested the herbicides[5] on six shrub species in a northern Idaho brushfield area and on seven tree species planted in pots and grown under partly protected conditions. While they varied in their effectiveness on different species of shrubs, all damaged conifers. Consequently, we question their suitability for broadcast spraying to release established trees. However, these herbicides should be tested further for use in reducing shrub vegetation prior to planting trees.

METHOD

The shrubs tested during this study were growing in brushfield areas on the St. Joe National Forest. Thirty individuals[6] of each of the following species were selected: menziesia (*Menziesia ferruginea* Sm.); mountain maple (*Acer glabrum* Torr.); ninebark [*Physocarpus malvaceus* (Greene) Kuntze]; oceanspray [*Holodiscus discolor* (Pursh) Maxim.]; redstem ceanothus (*Ceanothus sanguineus* Pursh); willow (*Salix scouleriana* Barratt). Shrubs selected ranged in height from about 2 to 12 feet.

Five individual plants were assigned randomly to each of six treatments. Treatments were:

No. 1, dicamba (2 pounds)[7];
No. 2, dicamba (8 pounds);
No. 3, dicamba (1 pound) + 2,4-D (2 pounds);
No. 4, dicamba (4 pounds) + 2,4-D (8 pounds);
No. 5, picloram (1/2 pound) + 2,4-D (2 pounds);
No. 6, control (no spray).

Since we had used picloram successfully prior to this study,[8] we decided to stay with the application level recommended by the manufacturer. Little information was available about dicamba effects on shrubs; so we decided to try the herbicide alone and in mixture with 2,4-D at different concentrations.

Using a 4-gallon hand sprayer, we applied the chemical solutions to the foliage of individual plants until dripping started. Shrub condition and height were recorded at the time of treatment in July 1966, and on two other occasions, in August 1966 and again in August 1967.

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[2]This formulation contains 1/2 pound per gallon of 4-amino-3,5,6-trichloropicolinic acid (picloram) and 2 pounds per gallon of 2,4-D, both in the form of triisopropanolamine salt. It is sold by Dow Chemical Company under the registered trademark "Tordon-101." (Mention of trade names herein does not necessarily imply endorsement by the USDA Forest Service.)

[3]This formulation contains the equivalent of 4 pounds per gallon of 2-methoxy-3, 6-dichlorobenzoic acid, in the form of dimethylamine (DMA) salt. It is sold by the Velsicol Chemical Corporation under the registered trademark "Banvel."

[4]One pound per gallon of the DMA salt of dicamba plus 2 pounds per gallon of the DMA salt of 2,4-D.

[5]This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

[6]An individual plant is defined for this study as having one stem or several stems if no more than 6 inches separate any one stem from others at ground line.

[7]Amount of chemical per 100 gallons of aqueous solution.

[8]R. A. Ryker, Herbicides fail to insure success of a brushfield prescribed burn. U.S. Forest Serv. Res. Note INT-55, 7 p., illus. 1966.

Sixty 2-year-old conifer seedlings of the following species were obtained from nearby Forest Service nurseries: Rocky Mountain Douglas-fir; Engelmann spruce (*Picea engelmannii* Parry); grand fir; lodgepole pine (*Pinus contorta* Dougl.); ponderosa pine (*Pinus ponderosa* Laws.); western white pine (*Pinus monticola* Dougl.); western redcedar (*Thuja plicata* Donn). Ten trees for each species were selected for each treatment; 10 others, the control group, were untreated.

Trees were planted in pots in May 1966. They were kept in a lathhouse, except for the winter of 1966-1967 when anticipation of cold weather prompted us to move them into a greenhouse. Conditions inside the greenhouse were regulated to maintain dormancy. We treated the trees during the period July 6-11, 1966, and measured them in August 1966 and again in August 1967, recording leader elongation and plant condition.

RESULTS

SHRUBS

We evaluated the effects of herbicides on shrub growth by means of a 5-point rating system described by Gantz and Laning[9] (table 1).

For each species-herbicide combination five observations were made. Because of this low number of observations, comparisons using proportions drawn from the five response categories would give little indication of differences among species-herbicide combinations.

Since the scores assigned to the rating categories increase in magnitude as the severity of the response increases, these scores were used as criteria in an analysis of variance model. The analysis revealed a highly significant species-treatment interaction. Though the analytical results agree with field evaluation and with data summaries, we cannot be sure that scores are proportional to differences in response. Consequently, the analysis may not be valid. For this reason, we derived the following information from the data summary table.

Mountain maple resisted all treatments (table 1). Even the high-concentration treatment of dicamba plus 2,4-D (No. 4), which killed nearly 100 percent of the plants of other species, was ineffective against maple.

Dicamba was more effective when mixed with 2,4-D than when used alone. Even the highly concentrated treatment No. 2 was little better than treatment No. 3, for which a small amount of dicamba was mixed with 2,4-D. When used alone, the low concentration of dicamba was the least effective of all treatments.

Effects of the two treatments most comparable in formulation and concentration, Nos. 3 and 5, did not differ greatly among species. However, picloram (No. 5) seemed a little better for controlling ninebark, oceanspray, and redstem ceanothus than dicamba (No. 3), which was more effective on willow.

The degree of reduction in shrub height also reflects differences in species susceptibility to different treatments (table 2). Live stem height was reduced most in menziesia (94 percent) and willow (90 percent). Somewhat less reduction was obtained in ninebark (85 percent), oceanspray (76 percent), and redstem ceanothus (84 percent). Mountain maple, which was little affected, showed only a 31-percent reduction.

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[9] R. L. Gantz and E. R. Laning, Jr. Tordon for the control of woody rangeland species in the western United States. Down to Earth 19(3): 10-13. 1963.

Table 1.--Mean condition values[1] for shrubs in August of the second growing season after treatment

Shrub species	Treatment						No treatment (control)
	Dicamba (2 lbs.)	Dicamba (8 lbs.)	Dicamba (1 lb.) + 2,4-D (2 lbs.)	Dicamba (4 lbs.) + 2,4-D (8 lbs.)	Picloram (1/2 lb.) + 2,4-D (2 lbs.)	Mean	
Menziesia	3.6	4.8	5.0	5.0	5.0	4.7	1.0
Mountain maple	2.0	3.4	1.8	3.2	2.4	2.6	1.0
Ninebark	4.0	4.6	4.2	5.0	4.6	4.5	1.0
Ocean spray	2.6	4.4	4.4	5.0	4.6	4.2	1.0
Redstem ceanothus	4.2	4.4	4.4	5.0	4.8	4.6	1.0
Willow	4.6	5.0	4.8	4.8	4.4	4.7	1.0
Treatment means	3.5	4.4	4.1	4.7	4.3		1.0

[1]Each treatment-species value represents the mean condition class of five plants. The condition class of each plant was evaluated as follows:

Value	Condition class
1	Little or no effect
2	Fifty percent or less of top growth killed
3	Over 50 percent of top growth killed
4	Complete top kill; sprouts from root collar or lateral roots
5	Complete top kill; no sprouting

Table 2.--Shrub heights[1] in August of the second growing season after treatment

Shrub species	Treatment						No treatment (control)
	Dicamba (2 lbs.)	Dicamba (8 lbs.)	Dicamba (1 lb.) + 2,4-D (2 lbs.)	Dicamba (4 lbs.) + 2,4-D (8 lbs.)	Picloram (1/2 lb.) + 2,4-D (2 lbs.)	Mean	
	Percent						
Menziesia	29	2	0	0	0	6	107
Mountain maple	84	37	97	46	81	69	121
Ninebark	30	12	20	0	14	15	104
Ocean-spray	68	18	19	0	13	24	129
Redstem ceanothus	20	25	18	0	16	16	136
Willow	20	0	2	7	21	10	121
Treatment means	42	16	27	9	24		120

[1]Percent of before-treatment height.

CONIFERS

On August 19 of the first growing season, the effects of treatments on different species varied widely. Douglas-fir appeared to be the only species resisting all treatments, except the high-concentration mixture of dicamba and 2,4-D (treatment No.4). September 8, Douglas-fir still showed little damage, but the other six species were dying. By November, even the Douglas-fir showed discoloration. In August of the second growing season, most treated plants were dead (table 3); a few lodgepole pine, Douglas-fir, and western redcedar trees were still alive, but they were in poor condition and were not growing in height.

DISCUSSION AND CONCLUSIONS

At the end of the first growing season (approximately 1-1/2 months after treatment), dicamba appeared to be more effective than picloram. For example, dicamba treatments apparently had killed all ninebark plants while picloram treatments had not. However, the following year, some of the ninebark plants treated with dicamba sprouted, but most of those treated with picloram died. By the end of that growing season, picloram seemed to be the better of the two herbicides for controlling ninebark.

Menziesia showed little damage from any treatment during the first growing season; a few leaves died and fell from branch tips, but this was the only visible sign. However, the next year, all plants died back to the ground. Moreover, no sprouting followed treatment Nos. 3, 4, and 5. Treatments with dicamba alone (Nos. 1 and 2) were not as effective.

Because of their toxicity to the coniferous species, none of the herbicide treatments seems to have promise for use as a spray to release established trees from competing vegetation.

Because of their effectiveness at relatively low concentrations, two of the treatments, No. 3 (1 pound dicamba plus 2 pounds 2,4-D) and No. 5 (1/2 pound picloram plus 2 pounds 2,4-D), appear to deserve further study for use in brushfield spray projects where removal of shrubs is the primary objective. Although the two herbicides were similarly effective on the species studied, picloram was more effective on ninebark, oceanspray, and redstem ceanothus, while dicamba was better on willow. The choice of treatment for a specific area would depend on which species predominate and on prevailing chemical costs. However, more experimentation is needed before we can recommend use of these herbicides on anything other than a trial basis.

Table 3.--Mean condition values[1] for conifers in August of the second growing season

Tree species	Treatment						No treatment (control)
	Dicamba (2 lbs.)	Dicamba (8 lbs.)	Dicamba (1 lb.) + 2,4-D (2 lbs.)	Dicamba (4 lbs.) + 2,4-D (8 lbs.)	Picloram (1/2 lb.) + 2,4-D (2 lbs.)	Mean	
Engelmann spruce	5.0	5.0	5.0	5.0	5.0	5.0	1.0
Grand fir	5.0	5.0	5.0	5.0	4.9	5.0	1.0
Lodgepole pine	2.9	3.9	3.8	5.0	4.1	3.9	1.0
Ponderosa pine	5.0	5.0	5.0	5.0	5.0	5.0	1.0
Rocky Mountain Douglas-fir	3.2	4.2	3.2	5.0	3.8	3.9	1.6
Western redcedar	4.5	4.9	4.1	5.0	4.5	4.6	1.0
Western white pine	5.0	5.0	5.0	5.0	5.0	5.0	1.0
Treatment means	4.4	4.7	4.4	5.0	4.6		1.1

[1]Each treatment-species value represents the mean condition class of 10 trees. The condition class of each tree was evaluated as follows:

Value	Condition class
1	No observable damage
2	Foliage discolored and thin
3	Leader deformity
4	Tip killing only
5	Dead