Reprinted from **PROCEEDINGS, TWENTY-FOURTH ANNUAL MEETING SOUTHERN WEED SCIENCE SOCIETY, pages 251-254. 1971.**

OTHER BRUSH-CONTROL SPRAYS COMPARED TO 2,4,5-T ESTER

Homer A. Brady
Research Soil Scientist
Southern Forest Experiment Station
USDA Forest Service, Pineville, Louisiana 71360

ABSTRACT. Dicamba and picloram, alone or in mixture with 2,4,5-T, were as effective as 2,4,5-T ester in killing hardwood brush. Of 15 formulations tested, at least one excelled 2,4,5-T on every species except dogwood. Many of the formulations damaged loblolly pine, however, and therefore would not be suitable for pine release in forest management. Ammonium nitrate as a spray additive did not increase herbicidal effectiveness.

Reports that excessive amounts of 2,4,5-T in the environment may be hazardous have intensified the search for formulations containing little or none of this controversial herbicide. Picloram and dicamba in mixtures with 2,4,5-T have shown considerable effectiveness on a broad array of woody species (1, 2, 4, 6). Information is lacking, however, on the optimum amount of each herbicide needed in these mixtures to accomplish specific brush-control jobs.

While testing the herbicides alone and in mixtures, it seemed timely to include a trial of ammonium nitrate as an additive. Agronomists (5) have noted that the phenoxyacid herbicides are more effective on herbaceous plants when applied in fertilizer solutions than when applied in water formulations. Ammonium nitrate in 2,4,5-T solutions increases absorption and translocation of the herbicide in several woody species (3). It was reasoned that if the effectiveness of 2,4,5-T is increased, the amount required can be reduced. If the nitrate also increases the effectiveness of other herbicides, one of them might be substituted for 2,4,5-T in many brush-control situations.

Materials and Methods

Sixteen herbicidal sprays were tested on a stand of mixed hardwood brush in central Louisiana. The basic phytocides were 2,4,5-T ester, dicamba, and picloram. They were applied as single chemicals, as two-chemical mixtures of 2,4,5-T with dicamba and picloram, and as a three-chemical mixture. All formulations were tested with and without 0.1 percent of ammonium nitrate. Table 1 lists the treatments and the amounts of herbicide contained. Sprays were applied at 8 gallons per acre during the first week in June; a backpack mist blower was used. Each of the 16 formulations was replicated on three 0.1-acre plots.

Ten trees of each of the most prevalent species were tagged on each plot, and topkill of each tree was estimated in August 1970, about 14 months after spraying. The three oak species--southern red oak (Quercus falcata Michx.), post oak (Q. stellata Wangenh.), and blackjack oak (Q. marilandica Muenchh.)--were grouped since they are usually found growing together and they make up the dominant hardwood stand in many upland oak-pine forests. All oaks and huckleberry

(Vaccinium virgatum Ait.) are rated as intermediate in response to 2,4,5-T. Smooth sumac (Rhus glabra L.) and American beautyberry (Callicarpa americana L.) are easy to kill and flowering dogwood (Cornus florida L.) is quite resistant.

Results

Average topkills of all hardwoods ranged from 43 to 68 percent for the 16 formulations, but differences between treatments were not significant (table 1). The 64-percent topkill by 2,4,5-T is about average for foliar spraying during early summer in this region.

The effect on the oaks was slightly less than that on all hardwoods. Oak topkill ranged from 29 percent for dicamba to 52 percent for the mixture of 2,4,5-T with dicamba at 1 pound each plus 0.1 percent ammonium nitrate; the differences were not significant. Treatments containing ammonium nitrate averaged 40 percent topkill, while those without it averaged 39 percent.

Only three formulations failed to perform satisfactorily on sumac and American beautyberry. They were 2,4,5-T with ammonium nitrate, dicamba with nitrate, and the mixture of these two chemicals at 2 pounds each, again with nitrate. Although there were significant differences between the best and the poorest treatment on these easy-to-kill species, no treatment differed from the 2,4,5-T control. The addition of ammonium nitrate reduced topkills by dicamba, but had no significant effect on the other formulations.

Topkills of huckleberry ranged from 39 to 95 percent. Four formulations gave significantly higher topkill than 2,4,5-T, and one was less effective. Ammonium nitrate reduced topkills by dicamba, picloram, the 2,4,5-T + dicamba mixture at 2 pounds each, and the three-chemical mixture.

2,4,5-T was unusually effective on dogwood in this study, giving 68 percent topkill; no other formulation was significantly better. Two treatments, 2,4,5-T plus dicamba at 2 pounds each and 2,4,5-T plus picloram at 1 plus 0.5 pound plus ammonium nitrate, achieved the 75 percent topkill considered adequate for brush control. Ammonium nitrate did not significantly affect topkills of dogwood by any chemical.

The numerically lowest topkill of loblolly pine followed application of 2,4,5-T ester, but kills from six other formulations were not significantly higher. Ammonium nitrate increased pine topkills by 2,4,5-T and picloram.

Discussion

Although none of the herbicidal formulations gave the 75 percent overall topkill considered essential for satisfactory brush control, all were as effective as the 2,4,5-T control. It is, therefore, possible to reduce the amount of 2,4,5-T used or to substitute one of the other herbicides for it. It must be pointed out, however, that both of the other herbicides tested are considerably more expensive than 2,4,5-T.

Dicamba was almost completely ineffective against blackjack oak. It was also ineffective against dogwood, but this species is seldom a problem and in most situations is considered a desirable component of the stand.

The one major weakness of picloram was its ineffectiveness on post oak. Picloram did not produce excessive topkill of pine in this study, but other work has shown that it is usually quite lethal to southern pines. It is not recommended for pine release spraying.

The effectiveness of mixtures of 2,4,5-T with the other two herbicides was additive when the total concentration of toxin in the formulation remained low. If one component was ineffective on a particular species while the other was effective, the mixture usually was effective on that species. With higher chemical concentrations, however, additive effects were lost. In only two comparisons--2,4,5-T + dicamba on huckleberry and dogwood--was the higher concentration more effective than the lower. Other studies[1/] have confirmed that resistance to foliar sprays is more closely related to the physiology of the plants than to amount of available herbicide.

The data do not reveal that the addition of ammonium nitrate caused an overall change in effectiveness of any formulation. In a few comparisons effects on a particular species were significantly reduced and in one comparison an increase occurred, but these were small and comparatively unimportant when considered from a biological viewpoint. Therefore, ammonium nitrate cannot be recommended as a spray additive for brush treatment.

Literature Cited

1. Bovey, R. W., Morton, H. L., and Baur, J. R. 1969. Control of live oak by herbicides applied at various rates and dates. Weed Sci. 17:373-376.

2. Brady, H. A. 1969. Herbicide mixtures promising for hardwood control by foliar spraying. S. Weed Sci. Soc. Proc. 22:245-250.

3. Brady, H. A. 1970. Ammonium nitrate and phosphoric acid increase 2,4,5-T absorption by tree leaves. Weed Sci. 18:204-206.

4. Chappell, W. E. 1969. Brush control in rights-of-way. S. Weed Sci. Soc. Proc. 22:277-282.

5. Fullilove, H. M., III. 1968. Herbicide & fertilizer combinations found to lower yields. Crops and Soils 20(7):29.

6. Kirch, J. H. 1967. Prescription vegetation control: realistic and necessary. Int. Shade Tree Conf. Proc. 43:186-198.

1/ Hall, O., and Brady, H. A. Mixing herbicides alters their behavior in woody plants. Presented at this conference.

Table 1.--Topkills 14 months after foliar spraying

Treatment	Herbicide rate	All oaks	Sumac and beautyberry	Huckle-berry	Dogwood	All hardwoods	Loblolly pine
	Lbs./acre			Percent			
2,4,5-T ester	2	39	84ab[1/]	63de	68ab	64	6e
2,4,5-T with NH_4NO_3	2	32	67b	75bcd	37bcd	49	44bcd
Dicamba	2	29	91a	86abc	5de	48	10de
Dicamba with NH_4NO_3	2	35	73b	39e	2e	43	46bcd
Picloram	1	34	90a	80abcd	45abc	56	14cde
Picloram with NH_4NO_3	1	31	88ab	50ef	33cde	52	56
2,4,5-T + dicamba	1 + 1	37	99a	74bcd	31cde	59	32abcde
2,4,5-T + dicamba	2 + 2	38	88ab	95a	77a	64	20bcde
2,4,5-T + dicamba with NH_4NO_3	1 + 1	52	89ab	74bcd	42bc	67	43abcd
2,4,5-T + dicamba with NH_4NO_3	2 + 2	37	67b	75bcd	46abc	57	53abc
2,4,5-T + picloram	1 + 0.5	48	93a	60de	65ab	67	65ab
2,4,5-T + picloram	2 + 1	41	93a	91abc	66ab	68	60ab
2,4,5-T + picloram with NH_4NO_3	1 + 0.5	34	99a	70cd	75a	64	32abcde
2,4,5-T + picloram with NH_4NO_3	2 + 1	50	95a	69cd	51abc	64	70a
2,4,5-T + dicamba + picloram	1 + 1 + 0.5	45	99a	94ab	47abc	66	30bcde
2,4,5-T + dicamba + picloram with NH_4NO_3	1 + 1 + 0.5	49	100a	63de	46abc	68	54abc

1/ Values followed by the same letter are not significantly different at the 0.05 level.