

244

REDUCING HARDWOOD CONTROL COSTS BY INJECTING

UNDILUTED 2,4-D AMINE

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At last year's Southern Weed Conference, I gave interim recommendations for injection of upland scrub hardwoods with undiluted 2,4-D amine.^{1/} They were based on preliminary data from a comprehensive study that was less than a year old. Subsequent measurements, after the second growing season, confirm earlier conclusions and permit broader and firmer prescriptions. Moreover, results from two studies started in 1963 extend our knowledge. In this paper I will summarize the most pertinent findings from these studies and discuss practical ways of using them to cut the cost of killing unwanted hardwoods.

Procedures

All studies were installed near Alexandria, La., on rolling upland sites with a variety of hardwood species. Injections of 2,4-D amine (4 lbs. acid equivalent per gallon) were made with a commercial meter-type injector having a 1-3/4-inch cutting edge or bit. Trees were injected within 2 inches of the groundline except in one study.

The 1962 study comprised 57 treatments, each replicated three times. Variables were dosage per incision, spacing of incisions, seasons, species, and tree size. Since the number of variables was too great to test all combinations in a complete factorial design, the study was skeletonized into five separate and interlocking tests. Each test included all combinations of 0.5, 1.0, and 2.0 ml. dosages and of 1-, 3-, and 5-inch injector spacings measured edge-to-edge. A 7-inch spacing with each dosage was tested in May on blackjack oaks 4 to 9 inches in diameter at breast height. Relative difficulty of killing different species was

^{1/} Peevy, Fred A. Injecting undiluted 2,4-D amine to control woody plants. Proc. South. Weed Conf. 16: 257-262. 1963.

tested with blackjack oak (Quercus marilandica), red oak (Q. falcata), and sweetgum (Liquidambar styraciflua). Trees 4 to 9 inches d.b.h. were injected in May. Red oaks 10 to 15 inches d.b.h. were also injected to determine if larger trees are harder to kill than small ones.

The first of the 1963 studies extended tests of injector spacings to 7 inches for red oak and sweetgum, and to 9 inches for blackjack oak. The second study compared two heights of incisions, groundline and 12 inches, made in small red oaks in three seasons. The objective was to determine if incisions could be placed above large butt swells.

In October 1963 top-kill in all studies was estimated to the nearest 5 percent. Consequently, results given here are after the second growing season for the 1962 study, and 1 to 8 months after establishment for 1963 studies. They are probably conservative for the 1963 studies because experience has shown that rate of kill increases substantially in the second year after treatment. Sprouting is not reported since it has been negligible, even with high or widely spaced incisions.

Results

The 1962 study.--All five tests are summarized in table 1, and major findings are discussed below.

Small red oaks were killed more readily in May and September than in February. Though in May slightly more trees were killed than in September for some treatments, it is safe to prescribe a single treatment for the major part of the growing season. The best treatment was injections of 1 ml. 5 inches apart. In contrast, either 1 ml. injections at 3-inch intervals or 2 ml. at 5 inches were required in February for high kills.

Larger red oaks were harder to kill than small ones when treated in May. A treatment of 2 ml. doses 5 inches apart was equally effective for both size classes. But with 1 ml. injections, a 3-inch spacing was necessary to kill large trees satisfactorily, compared with 5 inches in small trees. Need for closer spacing in larger trees was also found with the 0.5-ml. dosage.

Sweetgum was the hardest species to kill with May applications, and blackjack oak was the easiest. Dosages of 1 and 2 ml. at all spacings killed all species satisfactorily. Injections of 0.5 ml. had to be spaced 1 inch apart for sweetgum, though 3- and 5-inch spacings were adequate for red oak and blackjack oak. Very high kills of blackjack oak were obtained at a 7-inch spacing of the two higher dosages.

Table 1.--Top-kill of hardwoods injected in 1962 with undiluted 2,4-D amine (4 pounds acid equivalent per gallon)

:February appli-:		May applications		: September		
Dosage per :cations to red :		Red oak		:Blackjack oak: Sweetgum :applications		
incision :oak 4-9 inches :		4-9 inches :10-15 inches:		4-9 inches :4-9 inches: to red oak		
and spacing: d.b.h. :		d.b.h. :		d.b.h. : d.b.h. :4-9 inches d.b.h.		
-----Percent-----						
<u>0.5 ml.</u>						
1 inch	98	100	98	100	92	99
3 inches	68	100	84	100	67	93
5 inches	42	79	61	99	53	90
7 inches	--	--	--	90	--	--
<u>1.0 ml.</u>						
1 inch	100	100	97	100	99	100
3 inches	97	97	99	100	96	99
5 inches	78	100	79	99	90	91
7 inches	--	--	--	100	--	--
<u>2.0 ml.</u>						
1 inch	100	100	100	100	100	100
3 inches	98	100	97	95	97	100
5 inches	92	100	100	100	99	94
7 inches	--	--	--	98	--	--

Wide injector spacings.--Combined data from both 1963 studies indicate that hardwoods can be killed with wider incision spacings than heretofore tested (Table 2). Good kills of red oak were obtained with 1 and 2 ml. doses injected at 7-inch intervals in May. The same treatments applied in the winter gave kills of 80 and 79 percent, which during the next growing season will probably increase by 10 to 15 percentage points--enough to give satisfactory kills. Winter injection of sweetgum with both doses at 7-inch intervals failed. But the 80 percent kill from the May injections of 2 ml. at 7-inch intervals was promising.

Top-kill of blackjack oaks injected in May averaged 85 and 95 percent for 1 and 2 ml. doses at 9-inch intervals. Maximum spacings for 1 and 2 ml. injections during the growing season were not determined for this species (Tables 1 and 2).

High and low incisions.--Injections at 12-inch heights were nearly as effective as those at ground level on small red oaks (Table 3). For all but one treatment in the growing season, kills exceeded 90 percent. The exception was September injection of 1 ml. at 5-inch spacings, with 79 percent kill. However, this relatively low kill is probably due to the lapse of only 1 month between application and evaluation, and in another year it will probably be substantially higher.

Kills from high and low injections in January were comparable for three dosages and spacings. The fourth--2 ml. at 5 inches--gave 97 percent kill at ground level contrasted with 71 percent at the 12-inch height. Here again, it is anticipated that both treatments will be equally effective after another growing season. It seems safe to conclude that injecting above root swells or deep furrows in the trunk near the rootcollar is effective.

Costs

It is necessary to know the approximate costs of undiluted 2,4-D amine treatments when deciding between two that are equally effective. For example, is it more economical to inject 1 ml. at 3-inch or 2 ml. at 5-inch spacing? Of course, many factors affect these costs, such as season, size and number of stems per acre, species, topography, and labor efficiency.

Table 4 lists the approximate costs of treating a hypothetical acre of 200 hardwood trees that average 4 inches d.b.h. The cost of walking between trees is excluded. The standard treatment of injecting 5 ml. of 2,4,5-T ester diluted 1:9 in diesel oil in this stand would cost approximately \$4.32. Hence, even with the most expensive treatment from table 4, \$3.52 per acre for 2 ml. at 1-inch intervals, a 19-percent saving would be realized. A more realistic treatment would be 1 ml. at 3-inch spacings, which was generally effective on all species in all seasons. This treatment would cost \$2.32, a 46-percent saving.

Table 2.--Top-kill of hardwoods 4 to 9 inches d.b.h. injected with undiluted 2,4-D amine in three seasons, 1963

Dosage per	January		May			September		
incision	Red:	Sweet-	Red:	Sweet-	Black-	Red:	Sweet-	Black-
and spacing	oak:	gum	oak:	gum	jack oak:	oak:	gum	jack oak
-----Percent-----								

1.0 ml.

3 inches	96	75	97	60	--	98	57	--
5 inches	74	42	95	66	96	92	65	89
7 inches	80	35	94	26	93	81	48	85
9 inches	--	--	--	--	85	--	--	87

2.0 ml.

3 inches	100	69	100	95	--	97	79	--
5 inches	97	70	97	87	99	95	51	98
7 inches	79	38	86	80	92	91	72	93
9 inches	--	--	--	--	95	--	--	94

Table 3.--Effect of height of injections on top-kill of red oak 4-9 inches d.b.h. in three seasons, 1963

Dosage per	Ground level			12 inches above ground		
incision						
and spacing	January	May	September	January	May	September
	-----Percent-----					
<u>1.0 ml.</u>						
3 inches	96	97	98	96	100	94
5 inches	74	95	92	71	91	79
<u>2.0 ml.</u>						
3 inches	100	100	97	96	100	93
5 inches	97	97	95	71	95	92

Table 4.--Approximate costs per acre (excluding walking time) for
injecting undiluted 2,4-D amine in 200 trees averaging
4 inches d.b.h.

Dosage per incision : Ml.	Distance between incisions				
	1-inch	3-inches	5-inches	7-inches	9-inches
	-----Dollars-----				
1.0	2.80	2.32	1.84	1.44	0.96
2.0	3.52	2.96	2.40	1.76	1.20

If hardwood control operations are scheduled during the growing season, 1 ml. injections at 5-inch spacings may give an excellent kill of 4- to 9-inch trees. By injecting trees then instead of in the winter, costs can be cut to \$1.84 per acre, 57 percent lower than the \$4.32 cost for diluted 2,4,5-T ester.

Further savings are attainable if crews are properly trained and supervised. For example, in summer, spacing of incisions can be widened to 7 or 9 inches for easy-to-kill species like blackjack and post oak, cutting costs of killing individual trees by 20 to 40 percent. Similar savings are possible by raising incisions on swell-butted trees to 12 inches above the ground. Unless crew members are given greater latitude in treating individual trees, they will need blanket instructions geared to the trees in the stand that are most difficult to kill.

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