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INTERIM RECOMMENDATIONS FOR INJECTING HARDWOODS ON
BOTTOM-LAND SITES WITH UNDILUTED 2,4-D AMINE

Fred A. Peevy
Southern Forest Experiment Station
Forest Service, U. S. Department of Agriculture
Alexandria, Louisiana

My paper gives interim guides for controlling hardwoods on bottom-land sites by injection with small doses of undiluted 2,4-D amine. The recommendations are based on studies started in 1964 and 1965. Observations for another growing season will be necessary before final refinements can be made. It is expected, however, that the present recommendation will prove conservative.

Many landowners in the South and East have successfully used undiluted 2,4-D amine on upland hardwoods in the past few years. Savings over the cost of injecting diluted herbicides range from \$1.50 to \$3.00 per acre, depending on species and on number and size of stems. Work on bottom-land species was started when prescriptions were perfected for hardwoods in the uplands.

The Studies

A study installed during 1964 tested six treatments in each of three seasons on water oak (Quercus nigra L.), bitter pecan (Carya aquatica (Michx. f.) Nutt.) and winged elm (Ulmus alata Michx.). Treatments consisted of all combinations of 1- and 2-ml. dosages of undiluted 2,4-D amine (4 pounds acid equivalent per gallon) at 1-, 3-, and 5-inch spacings of incisions measured edge-to-edge. Applications were made in May, September, and December to trees 8 to 16 inches in diameter at breast height (d.b.h.). The plots consisted of 10 trees, and each treatment was replicated three times in a completely randomized design.

A second study, installed in May 1965, tested a 1-ml. dosage at 3-, 5-, and 7-inch spacings on trees 4 to 9 inches d.b.h. Species included sweetgum (Liquidambar styraciflua L.), post oak (Q. stellata Wangenl.), hickory (C. tomentosa Nutt.), white oak (Q. alba L.), and water oak. All spacings were replicated three times in a fully randomized design for each of the five species.

Both studies were on bottom-land sites within 60 miles of Alexandria, La. Injections were made with a commercial meter-type tool having a 1 3/4-inch cutting edge. Incisions were within 4 inches of the groundline.

Treatment efficiency was evaluated in terms of average top-kill and proportion of dead trees. Top-kill was estimated visually to the nearest 5 percent. A tree was considered dead if its crown had been completely killed and there were no sprouts. Injections with either undiluted or diluted herbicides generally control sprouting very well, and in these studies the amount was negligible even with the widely spaced incisions.

Results

Results given below were recorded 8 to 15 months after installation of the 1964 study, and 5 months after initiation of the 1965 study.

The 1964 study.--The first study showed that both season of application and species influence the effectiveness of treatments (Table 1). Bottom-land hardwoods, like upland species, are easier to kill in summer than in winter. Moreover, they are most vulnerable early in the growing season. These trends are most apparent with bitter pecan, which was the most difficult of the three species to kill.

The most economical treatment--1-ml. dosage at 5-inch spacing--gave virtually 100-percent kill of water oak and winged elm at all seasons. Closer spacing or the 2-ml. dosage appeared to offer no advantage, even in speed of kill.

The same treatment was also excellent for bitter pecan in May. Top-kill of pecan from September applications was still marginal after 11 months, but experience with other species suggests that additional trees will die during 1966. December treatments appeared unsatisfactory after 8 months, though here again some additional mortality can be expected. Close spacing or doubling the dosage did not notably improve top-kill on pecan.

The 1965 study.--In the second study, 1 ml. of 2,4-D amine in jabs spaced 3 inches apart gave rapid top-kills with all species (Table 2). It is likely that even the 7-inch spacing will show up satisfactorily after another growing season. For example, in the 1964 study, top-kill of May-treated bitter pecan increased from 52 percent after 4 months to 94 percent after 15 months.

Water oak again was easy to kill; sweetgum appears to be the most difficult although it may be premature to make an evaluation.

At the 3-inch spacing, the percent of trees dead after 5 months ranged from 87 to 100 for all species. The 5-inch spacing gave 100-percent kill on water oak.

Table 1.--Top-kill of hardwoods injected during three seasons in 1964
and evaluated in August 1965

Dosage per : : :									
incision, : Water oak : Winged elm : Bitter pecan									
and spacing: May : Sept.: Dec. : May : Sept.: Dec. : May : Sept.: Dec.									
-----Percent-----									
<u>1 ml.</u>									
1 inch	99	100	100	100	100	100	98	81	62
3 inches	100	100	100	100	100	97	94	75	31
5 inches	99	100	100	100	100	93	90	92	36
<u>2 ml.</u>									
1 inch	100	100	100	100	100	97	99	93	44
3 inches	100	100	100	100	100	100	99	81	32
5 inches	100	100	100	100	100	92	92	97	36

Table 2.--Kill of hardwoods injected in May 1965 with 1 ml. of
2,4-D amine per incision at several spacings, and examined
in October 1965

Species	: Spacing of : incisions Inches	: : Top-kill -----Percent-----	: Trees dead
Post oak	3	99	97
	5	92	73
	7	68	55
Sweetgum	3	99	97
	5	86	73
	7	56	23
Hickory	3	95	87
	5	71	50
	7	73	47
Water oak	3	100	100
	5	100	100
	7	92	83
White oak	3	95	93
	5	80	67
	7	69	50

Costs

Costs of treating a theoretical stand of 50 trees per acre with an average diameter of 9 inches are given in table 3. These costs are for the chemical and the time required to jab the trees, plus an allowance for overhead. Walking time is excluded, because it varies widely with season, density of stand, size of trees, topography, and other factors. Labor is figured at \$1.50 per hour. On the same basis the standard treatment with diluted herbicide--2,4,5-T ester mixed 1:9 with diesel oil and injected in 5-ml. dosages at 1-inch spacing--would cost \$2.66 per acre.

Even the most intensive treatment with the undiluted herbicide--2 ml. at a 1-inch spacing of incisions--is 50 cents per acre cheaper than the old method. For 1-ml. injections at 5-inch spacing, the cost will average about half of that for treatment with diluted 2,4,5-T.

Conclusions

Hardwoods on bottom-land sites are no more difficult to kill by injection with undiluted 2,4-D amine than are upland species. They may be easier to control. For both studies in this report, the least intensive treatments were efficient or are expected to be, except with bitter pecan. Hence 9- and 11-inch spacing of incisions should be tried in the future.

As with upland hardwoods, the effectiveness of treatments varies by seasons and species. Hardwoods are more readily controlled during the spring and summer than in the dormant season. For greatest economies, work should be scheduled for May through July, when bottom-land sites are usually most accessible.

Water oak was the easiest to kill of the seven species tested. Bitter pecan seems most difficult; the other species are probably intermediate. For injection in the first part of the growing season, 1 ml. at 5-inch spacing of incisions seems most efficient for all species. The same treatment can be recommended for water oak and winged elm in late summer or during winter, and for bitter pecan in late summer. If bitter pecan is to be treated in winter, injections should be edge-to-edge. Data obtained so far do not permit recommendations for late-summer or winter application on other species. On a trial basis, however, a 1-ml. dosage at 1-inch spacing might be attempted on white oak, hickory, and sweetgum, with a 3-inch spacing of the same dosage for post oak.

Table 3.--Approximate cost per acre (excluding walking time) for injecting undiluted 2,4-D amine in 50 trees averaging 9 inches d.b.h.

Dosage per :		Distance between incisions			
incision :	1 inch	: 3 inches	: 5 inches	: 7 inches	
<u>Ml.</u>					<u>Dollars</u>
1.0	1.71	1.04	0.86	0.68	
2.0	2.16	1.31	1.08	.86	

Reprinted from NINETEENTH SOUTHERN WEED CONFERENCE PROCEEDINGS,
pp. 270-275. 1966.