AN ECONOMIC STUDY OF WEED CONTROL WITH SOIL FUMIGANTS IN A FOREST NURSERY

Harry W. Anderson
Washington State Department of Natural Resources
Olympia, Wash.

Introduction

During the fall of 1959 and the spring of 1960, a series of fumigation trials was conducted in a loamy fine sand soil at the L. T. "Mike" Webster Forest Nursery near Olympia, Wash. These trials were established in co-operation with the Dow Chemical Company, Neal MacLean Chemical Company, and Stauffer Chemical Company. The objective of the study was to test the effectiveness of several fumigants for weed control. This was accomplished by comparing weeding costs on fumigated and nonfumigated soil.

Materials and Application Technique

Four fumigants were used in this experiment (table 1), and two methods of application were employed. Trizone and Pathofume were applied by a specially designed fumigating and tarp laying implement, whereas Vapam and Telone were applied with a fumigating implement, but the tarp was not used.

Tarped beds

Trizone and Pathofume were applied at 140 and 200 pounds per acre by a fumigating implement which injected the chemical and automatically tarped and sealed the bed. The fumigates were released through eight soil chisels at a depth of 6 to 8 inches below the soil surface. Six pairs of 5- by 165-foot strips were fumigated, and each of the sample area's fumigant and rate were sown to Douglas-fir, noble fir, and Scotch pine. Control beds were established alongside each fumigated bed.

Untarped beds

Vapam and Telone were applied at 50 gallons per acre through eight soil chisels mounted on a tractor drawbar. The chisels released the chemical 6 to 8 inches below the soil surface. No tarping was necessary as overhead irrigation was utilized to seal

TABLE 1.--Rates and composition of four soil fumigants tested for weed control at the Webster Forest Nursery

Fumigant (trade name)	Company	Composition	Rate
Pathofume	MacLean	methyl bromide	140 lbs./acre
Do	Do	chloropicrin	200 lbs./acre
Trizone	Dow	methyl bromide	140 lbs./acre
Do	Do	chloropicrin	200 lbs./acre
Do	Do	propargyl bromide	Do.
Telone	Do	chlorinated C_3 hydrocarbons.	50 gals./acre
Vapam	Stauffer	sodium n-methyl dithiocarbamate dihydrate.	Do.

the soil surface. A Vapam-Telone combination of 25 gallons per acre of both Vapam and Telone was also tried and similarly applied.

Six pairs of 5- by 50-foot strips were fumigated. The Vapam treated beds were sown to Douglas-fir; the Vapam and Telone combination beds were sown to noble fir; and the Telone treated beds were sown to Scotch pine. Controls were laid alongside each fumigated bed.

Results

Actual weeding costs for each fumigant and control were determined by a timed hand-weeding study. These plots were time-weeded three times during the summer of 1960, and the data were converted to weeding costs per acre.

Before any direct cost evaluations could be made, the following assumptions were necessary:

1. Trizone and Pathofume cost approximately $1 per pound.

2. Vapam and Telone cost $2 and $1.65 per gallon, respectively.

3. Two men can fumigate one-half acre an hour (sixteen and one-half 330-foot beds).

The data in table 2 were calculated from these assumptions and the actual weeding costs.
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Two facts are obvious from the data presented in these tables. First, in all cases, the cost per acre for hand weeding was higher in nonfumigated ground than in fumigated ground. The average cost of weeding an acre of nonfumigated ground was $88, compared to $52 for fumigated ground. Second, the cost of fumigation (materials and application labor and hand weeding) was two to three times the cost of weeding nonfumigated ground. i Therefore, the high cost of fumigants ($100-$200 per acre) has greatly overbalanced their effectiveness as a weed control agent.

The cost per thousand seedlings reflects the high cost of fumigants. Douglas-fir weeding costs for the first year varied from $.03 per thousand (control) to $.10 per thousand (200 pounds per acre of Trizone and Pathofume). Noble fir varied from $.11 per thousand (control) to $.41 per thousand (200 pounds per acre of Pathofume). Scotch pine varied from $.06 per thousand (control) to $.17 per thousand (200 pounds per acre of Pathofume). The cost per thousand differences between species was due to seedling bed densities. In general, the cost per thousand seedlings from fumigated beds was two to three times the cost of seedlings from nonfumigated beds, depending on the rate per acre.

Apparently the use of fumigants for weed control in the Webster Nursery is prohibitive because of the high cost of materials. However, these trials were some of the first fumigation attempts in Northwest nurseries, and inexperience in application techniques, calibration of fumigating apparatus, and knowledge of proper fumigants and rates to use in this particular soil could partly account for the failure to obtain economical results in weed control.

TABLE 2.--The effect of Trizone, Pathofume, Vapam, and Telone on weeding costs per acre and cost per thousand seedlings for 1-0 Douglas-fir, noble fir, and Scotch pine seedbeds

Species	Trizone			Pathofume		
	Control	140 pounds per acre	200 pounds per acre	Control	140 pounds per acre	200 pounds per acre
Douglas-fir:						
Weeding cost[1]	$70.00	$43.75	$48.25	$66.50	$42.25	$42.25
Material cost[2]	--	140.00	200.00	--	140.00	200.00
Labor cost[3]	--	13.50	13.50	--	13.50	13.50
Total	70.00	197.25	261.75	66.50	195.75	255.75
Cost/M	.03	.08	.10	.03	.08	.10
Production per acre.	2,609 M	2,609 M	2,609 M	2,609 M	2,609 M	2,609 M
Noble fir:						
Weeding cost[1]	$72.50	$22.75	$37.75	$99.75	$54.25	$51.25
Material cost[2]	--	140.00	200.00	--	140.00	200.00
Labor cost[3]	--	13.50	13.50	--	13.50	13.50
Total	72.50	176.25	251.25	99.75	207.75	264.75
Cost/M	.11	.27	.39	.15	.32	.41
Production per acre.	646 M	646 M	646 M	646 M	646 M	646 M
Scotch pine:						
Weeding cost[1]	$84.75	$36.25	$39.25	$69.90	$60.50	$45.50
Material cost[2]	--	140.00	200.00	--	140.00	200.00
Labor cost[3]	--	13.50	13.50	--	13.50	13.50
Total	84.75	189.75	252.75	69.90	214.00	259.00
Cost/M	.06	.12	.16	.05	.14	.17
Production per acre.	1,533 M	1,533 M	1,533 M	1,533 M	1,533 M	1,533 M

See footnotes at end of table.

TABLE 2.--The effect of Trizone, Pathofume, Vapam, and Telone on weeding costs per acre and cost per thousand seedlings for 1-0 Douglas-fir, noble fir, and Scotch pine seedbeds--continued

Species	Vapam		Vapam and Telone		Telone	
	Control	50 gallons per acre	Control	50 gallons per acre	Control	50 gallons per acre
Douglas-fir:						
Weeding cost[1]	$102.25	$72.75	--	--	--	--
Material cost[4]	--	100.00	--	--	--	--
Labor cost[3]	--	13.50	--	--	--	--
Total	102.25	186.25	--	--	--	--
Cost/M	.04	.07	--	--	--	--
Production per acre	2,609 M	2,609 M	--	--	--	--
Noble fir:						
Weeding cost[1]	--	--	$131.75	$97.75	--	--
Material cost[5]	--	--	--	91.25	--	--
Labor cost[3]	--	--	--	13.50	--	--
Total	--	--	131.75	202.50	--	--
Cost/M	--	--	.20	.31	--	--
Production per acre	--	--	646 M	646 M	--	--
Scotch pine:						
Weeding cost[1]	--	--	--		$102.00	$88.75
Material cost[6]	--	--	--		--	82.50
Labor cost					--	13.50
Total					102.00	184.75
Cost/M	--	--	--		.07	.12
Production per acre	--	--	--		1,533 M	1,533 M

[1] Cost based on two women at $1.25 per hour.
[2] Approximate cost, $1 per pound.
[3] Two men fumigated one-half acre per hour: Foreman, $2.50 per hour; tractor rental, $2 per hour; and tractor driver, $2.25 per hour.
[4] Approximate cost, $2 per gallon.
[5] Approximate cost, $2 per gallon of Vapam; $1.65 per gallon of Telone.
[6] Approximate cost, $1.65 per gallon.