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Basal Spraying of Red Alder[1]

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Abstract. Red alder (*Alnus rubra* Bong.) was readily killed by growing season treatments with a 1 to 1 mixture of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) in diesel oil. Except for 1-inch-diameter trees, it was resistant to dormant season treatments. Treatments applied during moderate rain were less effective than during rain-free periods.

WHEN stands of Sitka spruce (*Picea sitchensis* (Bong.) Carr.) and western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) are harvested in coastal Oregon, red alder (*Alnus rubra* Bong.) often invades the land, suppresses conifer reproduction, and becomes at least temporarily the dominant tree species.

Berntsen (1) compared alder and conifer growth on one area in coastal Oregon and concluded that native conifers on that site would produce considerably more wood per acre unless managed on rotations so short as to be impractical under present utilization standards. Many landowners, realizing the inadequacy of alder growth on some sites, would welcome an economical method of converting submarginal alder stands to conifer forest.

Large areas of alder can be treated by aerial application of herbicide (3, 8), but individual trees or trees in small groups may be controlled more efficiently by ground methods including cutting, girdling, or herbicide application to foliage, lower boles, or stumps (2). This study, conducted on the Cascade Head Experimental Forest, Otis, Oregon, was of the effectiveness of several basal sprays on red alder under a variety of conditions.

GROWING SEASON TESTS

A stand of 6-year-old red alder, averaging 2.5 inches diameter breast high (dbh) and 20 feet tall, that had encroached on a clear-cut area following removal of a conifer stand, was treated with three different basal sprays early in the growing season. Treatments were propylene glycol butyl ether (PGBE) esters of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) in two concentrations and a mixture of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-T, each in a diesel oil carrier. Each treatment was applied in a randomized block design to 3 plots of 20 trees each. Herbicides were applied during clear weather using a backpack sprayer equipped with a horseshoe-shaped applicator (Figure 1). Solutions were sprayed on the lower 12 inches of stems 3 inches or less dbh. Larger trees were sprayed to a height equal to four times their dbh in an effort to keep spray volume in proportion to tree size. Each stem was thoroughly wetted on all sides until the herbicide solution ran down around the root crown. For one man, working alone, 2 gallons of herbicide and 1 hour were required to treat 90 trees.

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Figure 1. Equipment for basal spraying red alder.

After two growing seasons, all treatments had resulted in satisfactory kill of red alder (Table 1). Some trees leafed out the second season after treatment, but 96 percent of them were dead in September of the second year, and no subsequent resprouting occurred (7). The few trees that remained alive after 2 years were largely defoliated, and most of these were dead 3 years after treatment.

Table 1. Percent of kill and cost of basal sprays on 6-year-old red alder averaging 2.5 inches dbh, PGBE esters in a diesel oil carrier.

Herbicide	Date treated	Concentration lb aehg	Average percent of crown killed after 2 growing seasons	Treatment cost, cents per tree
2,4,5-T.....	Apr. 15	32	90	4.4
2,4,5-T.....	June 2	32	100	4.4
2,4,5-T.....	June 28	32	100	4.4
2,4,5-T.....	June 28	16	93	3.5
2,4,5-T and 2,4-D[a].....	June 28	16	97	3.1

[a](1:1 mixture)

DORMANT SEASON TESTS

Basal sprays using two concentrations of a 1:1 mixture of PGBE esters of 2,4-D and 2,4,5-T in diesel oil were tested on 8-year-old red alder in the winter and spring. A randomized block design was used with each treatment applied to 3 plots of 20 trees each using the same equipment and spray volumes as in the growing season tests. Results were measured in September after two growing seasons by ocular estimate of percent crown kill. Tree diameters at the time of treatment ranged from 1.8 to 3.4 inches.

The only treatment providing satisfactory alder control was the 16 aehg concentration applied on April 11 (Table 2). This date was about the end of the dormant season for the year, and many of the trees were just beginning to show new leaves.

Table 2. Crown kill measured 2 growing seasons after basal spraying 8-year-old red alder with a 1:1 mixture of PGBE esters of 2,4-D and 2,4,5-T in diesel oil.

Date of application	Average percent of crown killed	
	8 lb aehg	16 lb aehg
December 20	19	39
February 28	1	10
April 11	54	94

An effort was made to have treatments uniformly spaced during the dormant season and apply them during rain-free periods. However, no rain-free period occurred in February, so a treatment was applied the last day of the month even though rain water was running down the alder stems.

A separate randomized block experiment was used to compare treatments applied during clear weather and during moderate rain. Using the same treatments as the 16 aehg seasonal treatments above, 3 plots of 20 trees each were sprayed during moderate rain on February 19. Rain continued until March 4 when three additional plots were treated during a part day of intermittent sunshine which dried the bark surface. Rainfall started again a few hours after treatment. After two growing seasons, crown kill was 32 percent for the dry weather plots compared to 5 percent for the wet weather plots.

Substitution of the March 4 dry weather treatment into the seasonal test (Table 2) in lieu of the February 28 treatment permits an evaluation of seasonal effects under uniformly dry weather conditions at time of treatment. Although not part of the same experimental design, the March 4 treatment was applied to alder trees that were nearby and of the same age class. Making this substitution, the December and early March results were similar but both inferior to the April application near the beginning of the growing season.

Tree size apparently influenced effectiveness of basal sprays. When trees ranging from 1 to 10 inches dbh were sprayed with a 1:1 mixture of 2,4-D and 2,4,5-T at 16 aehg in diesel oil during light rain on February 28, only the smallest were effectively killed.

Tree dbh inches	No. trees	Tree age years	Per cent crown kill two seasons after treatment
1	40	3–4	98
3–4	40	10–12	17
5–10	160	13–35	—

Dormant season screening tests were conducted in March to determine the relative effectiveness of several herbicides on the 8-year-old red alder. On March 1, 4 treatments were applied during moderate rain and 5 others during light rain on March 19, each on 3 plots of 20 trees each in a randomized block design. None of these dormant season, wet weather treatments provided satisfactory kill of alder (Table 3).

Table 3. Crown kill measured 2 growing seasons after basal spraying of 8-year-old dormant red alder in wet weather.

Herbicide[a]	Concentration lb aehg	Average percent crown kill
Treated March 1 during moderate rain.		
2,4-D, PGBE esters	16	2
2,4-D + 2,4,5-T, PGBE esters (1:1)	8	0
2,4-D + 2,4,5-T, PGBE esters (1:1)	32	13
2,4-D + 2,4,5-T, solubilized acid (1:1)	16	0
Treated March 19 in light rain.		
2,4,5-T, PGBE esters	16	55
2,4-D + 2,4,5-T, PGBE esters (1:3)	16	38
2,4-D + 2,4,5-T, PGBE esters (3:1)	16	7
2,4-D + 2,4,5-T, amine salt (1:1)	16	6
Silvex, PGBE esters	16	0

[a]Carrier was diesel oil except for the 2,4-D + 2,4,5-T amine which was in a water carrier.

Discussion

Red alder was resistant to dormant season basal treatments with phenoxy herbicides in oil, yet was readily killed by growing season treatments. This contrasts to species in other areas where dormant season basal sprays often give best control. The reasons for this difference merit further investigation. Rediske (5) found in a recent screening trial with an emulsifiable acid formulation of 2,4,5-T applied to red alder as a total-stem spray that a toxic oil was better than a nontoxic oil carrier. In another study (4) basal sprays in diesel oil carrier applied to salmonberry *(Rubus spectabilis* Pursh.), a brush species associated with red alder, showed seasonal effects similar to alder. The reduced effectiveness of basal sprays applied to wet alder bark agrees with experience on other species (6).

The cost of the herbicide treatments approximated the cost of cutting down the red alder, but such treatments avoid the vigorous sprouting of alder stumps that often follows cutting. Cutting the trees also causes a large accumulation of stems and limbs on the ground for a period of time which interferes with tree planting and other management activities. A tree killed with herbicides, on the other hand, remains standing during the planting period then breaks down slowly without the accumulation of dead material.

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