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COMBINING FIRE AND CHEMICALS FOR THE CONTROL OF RHODODENDRON THICKETS [1]

Abstract. --A combination of fire and silvicides will control rosebay rhododendron growing on lands primarily valuable for timber production. The numerous sprouts that typically follow prescribed burning are readily killed by several different silvicides applied either with a basal sprayer or a mist blower.

On many thousands of wooded acres from Canada to Alabama, rosebay rhododendron (*Rhododendron maximum* L.) is more a forest weed than an aesthetic asset. While the species presents an attractive floral display in summer and also has wildlife and watershed values, it too often takes complete control of timberlands needed for the production of mountain hardwoods and pines. Its dense thickets cast so much shade on the forest floor that tree species cannot reproduce, and eventually the site is lost as a timber-producing area. The long-lived thickets can endure for many decades, reproducing by seed, layering, and sprouting.

Efforts at controlling rhododendron are always hampered by the rough mountain terrain favored by the plant, where reduced accessibility naturally increases the cost of any control effort. There are three general methods available for the suppression of this evergreen species: mechanical clearing, chemical applications, and fire.

(1) Mechanical clearing. --The stems can be cut or broken off close to the ground with an ax, saw, or tractor equipped with a brush blade or a chopper.[2] Such mechanical methods are costly. Tractors may also be dangerous to operate on sloping terrain, and their use can readily accelerate soil erosion. Finally, cutting or breaking the plants off at the groundline is only a temporary measure; they sprout readily and in abundance, often replacing a single stem with 10 or more in a clump.

(2) Chemical applications. --A number of chemicals have been tried, but these have generally been unsuccessful or too costly. The most satisfactory results have come from basal sprays of 2,4,5-T esters in a fuel

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[1] Mention of commercial products in this Note is for identification only and does not constitute endorsement by the U. S. Department of Agriculture.

[2] Wahlenberg, W. G., and Doolittle, W. T. Reclaiming Appalachian brush lands for economic forest production. J. Forest. 48: 170-174. 1950.

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oil or kerosene carrier, but these, too, are quite expensive.[4] Pelleted chemicals such as fenuron and picolinic acid, which may require an expenditure of $50 to $75 per acre for chemicals alone, are usually considered too costly. One advantage of chemicals over mechanical methods is that the proper chemical applied at the right time kills the entire plant, below as well as above the ground, so that no sprouts are produced.

(3) Fire. --Prescribed burning, commonly used in the Coastal Plain and the Piedmont, is now being cautiously employed with success in the mountain areas.[5] Under the proper conditions, a skillful forester can burn a forested or brushy area and kill the understory plants and small trees without damaging the soil. Such burns are often cheaper than mechanical or chemical control, and they are easier on the land than is heavy equipment. As with mechanical methods, however, only the aerial portions of the rhododendrons are killed or damaged, and subsequent heavy sprouting often gives severe competition to desired species.

Although each method has its disadvantages, the forester or land manager can often combine two of these methods and thus achieve satisfactory topkill and root kill with both reasonable costs and little site disturbance. Such a combination treatment was tested on a forested hillside on the Bent Creek Experimental Forest near Asheville, North Carolina. The irregular overstory, consisting mainly of oaks (Quercus spp.), red maples (Acer rubrum L.), and a few yellow-poplars (Liriodendron tulipifera L.), was killed with injected silvicides in order to approximate the effect of logging. The understory consisted of a dense thicket of rhododendron with an intermixture of mountain-laurel (Kalmia latifolia L.). After death or removal of the overstory, such an understory will usually seize control of the site and prevent or suppress any tree regeneration.

In the fall of 1964, the rhododendron-covered hillside was prescribe burned. The objective of the fire was to control the rhododendron so that pine seedlings could be planted, returning the site to timber production. The fire burned well and produced a generally good topkill of the rhododendron. That winter, 1-0 eastern white pine (Pinus strobus L.) seedlings were planted; they survived and grew well the first year, with little competition and slight shade from the rhododendrons whose tops were partly alive. However, heavy sprout growth developed around the bases of the burned rhododendrons, and it seemed likely that the fast-growing sprouts would offer serious competition to many of the pine seedlings (fig. 1).

In July of 1966, 21 months after the burn, the decision was made to apply chemical treatments to the burned area. It was clear that the sprouts, which were only 1 to 3 feet high, could be sprayed more cheaply and quickly

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[3] Sluder, E. R. Control of cull trees and weed species in hardwood stands. USDA Forest Serv. Southeast. Forest Exp. Sta. Pap. 95, 13 pp. 1958.

[4] Yawney, H. W. Control of rhododendron by basal spray. USDA Forest Serv. Northeast. Forest Exp. Sta. Res. Note 132, 7 pp. 1962.

[5] Hooper, R. M. Prescribed burning for laurel and rhododendron control *in the* Southern Appalachians. Southeast. Forest Exp. Sta., USDA Forest Serv. Res. Note SE-116, 6 pp. 1969.

Figure 1. --Prolific sprouting developed after the prescribed fire had caused considerable damage to the aerial portions of these rosebay rhododendrons.

than could the 8- to 12-foot-high foliage that had survived the fire; it also seemed likely that the succulent, fast-growing sprouts and new foliage might absorb and translocate the silvicidal chemicals better than the waxy, heavily cutinized older leaves. If so, the chemicals would completely kill the fire-damaged plants, thus preventing new sprouts from developing.

Seven groups of 10 representative stems or stem clumps were measured for number and length of sprouts and amount of fire-caused top-kill, and immediately afterwards a different chemical treatment was applied to each of the seven groups. These treatments provided (1) a comparison of the standard use of 2,4,5-T as a basal spray and as a foliar spray applied by a mist blower with oil or water as carriers and (2) an assessment of several new silvicide formulations applied by a mist blower. Use of a portable, one-man mist blower permitted thorough but fast applications of small amounts of the chemicals, reducing labor and chemical costs markedly. These treatments were:

Treatment number	Chemical[1]	Carrier	Concentration[2]	Application
1	None	None	None	None
2	2,4,5-T esters	Fuel oil	20 lb. AEHG	Basal sprayer
3	2,4,5-T esters	Fuel oil	20 lb. AEHG	Mist blower
4	2,4,5-T & 2,4-D & 2,3,6-TBA[3]	Fuel oil	15 lb. AEHG	Mist blower
5	2,4,5-T esters and ammonium thiocyanate[4]	Water	40 lb. AEHG	Mist blower
6	Same as No. 5 with two surfactants[5]	Water	40 lb. AEHG	Mist blower
7	2.4.5-T esters and detergent	Water	20 lb. AEHG	Mist blower

[1]The chemicals for treatments 4, 5, and 6 were provided by Amchem Products, Inc., of Ambler, Pennsylvania.

[2]Based on manufacturer's recommendations or commonly used concentrations. AEHG = acid equivalent per hundred gallons of carrier.

[3]Amchem 65-321, containing $\frac{1}{2}$ lb. 2,4,5-T; and 1 lb. 2,4-D; and 1 lb. 2,3,6-TBA acid equivalent per gallon of concentrate.

[4]Amchem 65-314.

[5]Amchem 66-8B.

Sprays were applied to the point of runoff on all sprouts; the basal spray also covered the lower boles of each stem.

Almost 3 full years later, at the end of May 1969, the treated stems and clumps were remeasured and the success of the chemical treatments was assessed (table 1). The incidence of deer browsing prevented an accurate assessment of the effect of the chemicals on sprout length, but living sprouts were counted and their size noted in relative terms. The final measurements show that topkill increased even without .the use of chemicals, as illustrated by the increase in average topkill from 65.5 to 91.5 percent in the unsprayed plants (treatment 1). This effect is almost surely due to delayed mortality as a result of the prescribed burn. Topkill increased from 19.5 to 100 percent in treatment 2, from 55.3 to 98.0 percent in treatment 4, and from 51.0 to 100 percent in treatment 5. Less successful were treatment 6, in which topkill increased from 44.5 to 74.9 percent, and treatment 7, in which it increased from 34.5 to 71.5 percent.

More impressive than changes in topkill were the changes in sprout number, because sprout reductions are more direct indicators of the

Table 1. --Measurements of the rhododendron in July 1966, just before chemical treatment, and in May 1969, 3 years after chemical treatment

Treatment[1]	Average topkill per plant		Total sprouts		Average sprouts (live) per plant		Average sprout length	
	Before	After	Before	After	Before	After	Before	After[2]
	- - Percent - -		- Number -		- Number -		Inches	
1	65.5	91.5	134	73	13.4	9.1	5.93	Large
2	19.5	100.0	460	0	46.0	0	5.46	--
3	20.0	85.0	186	62	18.6	6.2	6.26	Medium
4	55.3	98.0	320	5	32.0	.5	6.53	Small
5	51.0	100.0	443	3	44.3	.3	6.56	Small
6	44.5	74.9	362	24	36.2	2.4	5.45	Small
7	34.5	71.5	394	33	39.4	3.3	5.62	Small

[1]Each treatment was applied to 10 representative stems or stem clumps.

[2]Because of deer browsing on the plants between July 1966 and May 1969. these size classes do not accurately reflect the effect of chemical treatment on sprout size. Large sprouts were 24 to 48 inches long, medium sprouts were 6 to 24 inches long, and small sprouts were less than 6 inches long. By May 1969, all sprouts in treatment 2 were dead.

success of the chemical applications. In the treatments in which chemicals were applied, the average number of sprouts per plant dropped from 36.1 to 2.1. On the unsprayed plants (treatment 1), the average number of sprouts also decreased, but only from 13.4 to 9.1; this decrease in sprout number, like the increase in topkill, was apparently a delayed effect of the fire. Treatment 2 had no sprouts left alive (fig. 2), and treatments 4 and 5 averaged only small fractions of one sprout per plant.

The sprouts surviving the chemicals were almost always small in size and, consequently, unable to affect the planted white pine adversely. Some of these sprouts will probably die in the near future. The treated area is now well-stocked with rapidly growing pine, with scattered yellow-poplar and oak volunteers also profiting from the increased growing space and decreased competition (fig. 3).

The treatments ranked as follows in sprout reduction: 2, 5, 4, 7, 6, 3, and 1. Number 2, a basal spray of 2,4,5-T in oil, is the currently accepted treatment, but it is slower and more costly than the mist blower treatments. Treatments 5 and 4, therefore, offer good promise for the future. Number 5 consisted of esters of 2,4,5-T plus ammonium thiocyanate (which appears to improve translocation of the 2,4,5-T within the plant). Number 4 was a mixture of three silvicidal chemicals: the more usual 2,4-D and 2,4,5-T plus 2,3,6-TBA (trichlorobenzoic acid). Although treatments 7 and 3 were both based on 2,4,5-T, treatment 7 was more effective, apparently because its carrier, water plus detergent, was more effective than the fuel oil used in treatment 3. The silvicide used in treatment 6 was hard to dilute and hard to keep in suspension. Because treatments 6 and 3 met with only modest success, they do not seem to merit further study.

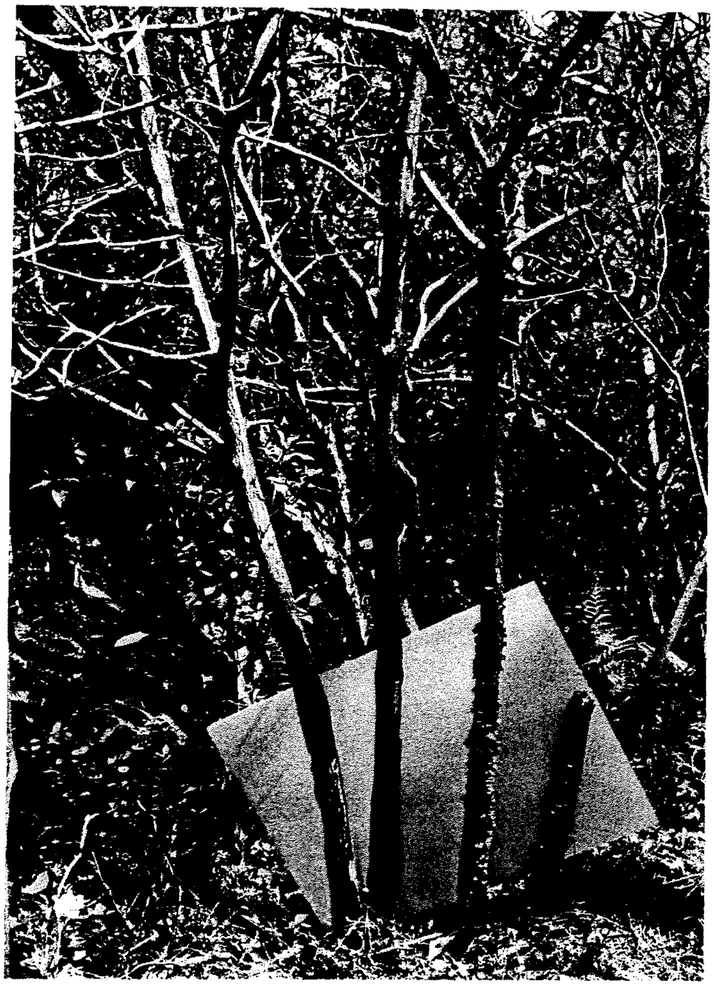

Figure 2.--The main stems that survived the prescribed burning and the dense sprouts that developed after the burning were killed by followup silvicide treatments.

Figure 3. --Planted white pine making rapid height growth in the treated areas.

In summary, the results illustrate the effectiveness of a fire-chemical treatment for the control of rosebay rhododendron on land primarily valuable for timber production. Two years after prescribed burning, vigorous sprouts proved very susceptible to basal spraying with 2,4,5-T esters in oil or to mist blower applications of either 2,4,5-T esters in water with ammonium thiocyanate or a mixture of 2,4-D and 2,4,5-T and 2,3,6-TBA in oil.

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