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CHEMICAL CONTROL OF HARDWOOD SPROUTS USING AMMONIUM THIOCYANATE CRYSTALS

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In recent years the chemical industry has produced a succession of effective herbicides which have been quite successful in controlling woody plant growth. A partial list of these includes 2, 4-D, 2, 4, 5-T, amino-triazol, sodium arsenite, sodium chlorate, ammonium sulphamate and ammonium thiocyanate. With few exceptions, application of these chemicals is effected in solution using some type of hydraulic sprayer or the more recently popular shoulder-mounted mist blower. Foliage spray, though effective, is a laborious method of brush control in rugged, inaccessible terrain.

Tree injectors, using concentrated solutions of herbicides in very small doses, have been quite successful in eliminating the drudgery of killing inferior hardwoods. Injectors are simple to operate, reliably selective and they effectively deaden when care is exercised in frilling the entire circumference of a tree.

Ammonium thiocyanate (NH_4SCN) has been recognized as an effective herbicide for many years. It has proven effective when used as a solution in axe frills (1). Ammonium and sodium thiocyanate solutions have been used in agriculture for weed control and temporary soil sterilization (2).

The use of any chemical as a solution creates immediate problems of bulk and weight which cannot be lightly discounted. It would seem that a direct, on the ground, application of concentrated crystals of a recognized herbicide might be successful. Ease of application as well as efficiency in transporting the concentrate would be two obvious advantages of this technique.

The following account describes both methods and results obtained from a study where ammonium thiocyanate crystals were broadcast or dumped at the base of hardwood sprout clumps at Harvard Black Rock Forest. Eight combinations were tested on as many plots in order to determine optimum application rates and techniques needed to produce an efficient control of sprouts.

Description of the flora

The study plots were staked out in an area supporting predominantly mixed northern red and white oak. Three years prior to the establishment of the experiment the stand was heavily thinned. Cordwood was harvested leaving a widely spaced residual stand of 12-14 inch DBH oaks whose crowns occupied about 50 percent of the canopy. At the time of cutting, all brush was cut and piled in order to facilitate the logging operation.

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In June 1960, rank sprout growth covered the area with the exception of small patches where slash had been piled. The more vigorous red maple sprouts had grown to as much as 12 feet in height. Witch hazel and the oaks had attained about 8 or 9 feet; the remaining species were about 6 to 7 feet tall. Underneath the rapidly growing sprouts there were numerous seedlings of red and white oak. One hoped-for by-product of this experiment was the desire to release the seedling reproduction by either killing or enervating the dominant sprout growth.

Experimental design

A total of nine 1/20-acre plots were staked out in May 1960. All but one of these 66' x 33' plots were treated; plot #8 was untreated to test the effect of lateral movement of the ammonium thiocyanate in the soil. The chemical was applied on June 1 and 3, 1960. A description of the method of application and the quantity of chemical administered to each sprout clump appears in Table 1.

To qualify for treatment a minimum sprout height of approximately 5 feet was decided upon in advance. All time expended in spreading the crystals was carefully recorded so that some reliable per acre figures could later be calculated.

AMMONIUM THIOCYANATE USED IN SPROUT CONTROL
Treatments and Results

Treatment	No. of Sprouts Treated	Results in Percent		
		Not Affected	25%-75% Defoliated	Killed
4 oz. at stump	68	65	29	6
4 oz. 1 ft. Rad.	32	78	19	3
4 oz. 2 ft. Rad.	37	100	-	-
8 oz. 1 ft. Rad.	50	60	6	34
8 oz. 2 ft. Rad.	36	56	25	19
12 oz. at stump	53	19	24	57
12 oz. 1 ft. Rad.	34	26	21	53
12 oz. 2 ft. Rad.	41	69	24	7

Species treated included: red maple, witch hazel, black birch, red and white oak, sugar maple, dogwood, ash, hickory and American chestnut.

Results

The effectiveness of the eight different treatments varied from negligible to a maximum of 57 percent kill in the 12 ounce per clump direct application to the base of stumps. Apparently best kills can be realized by concentrating the chemical application close to the base of each sprout clump. It is also evident that a minimum dose per sprout of 8 to 12 ounces is to be recommended.

Ammonium thiocyanate in its dry form is actively deliquescent; therefore soon after application it is absorbed into the upper soil horizon. Rainfall is not needed to activate it by dissolving the crystals. Excess rainfall soon after treatment may, in fact, dilute it to such an extent that its killing action may be somewhat impaired.

Abnormally heavy precipitation during the summer of 1960 was measured at this forest. June produced 4.40 inches; July, 7.91; August, 4.98 and September, 7.39. Heavy rain may partially account for some of the drift effect reflected in the slight browning of leaf margins along the edge of the untreated plot (#8). This condition was most noticeable in September about four months after treatment. The damage was temporary, however, since in 1961 these untreated individuals developed healthy leaves.

One of the overstory red oaks (12" DBH) in plot #9 began to show leaf discoloration by late summer of 1960. A sprout clump near its base had been treated, so the assumption must be made that a sizable quantity of ammonium thiocyanate was absorbed by the root system of the large tree. Aside from discoloration, the only other evidence of distress displayed by the oak was premature defoliation. During the 1961 growing season this same red oak developed healthy leaves but showed a slight tendency toward sparseness in its crown.

On none of the eight treatments attempted was there any noticeable damage inflicted to the seedling reproduction within the plots. A considerable stocking of red and white oak in the 1 to 3 foot class escaped injury in spite of their close proximity to sprouts which were given doses of 4, 8 or even 12 ounces of ammonium thiocyanate.

Cost data

Combined labor and chemical costs per sprout clump for each of the three doses tried (4, 8 and 12 oz.) totaled 6, 11 and 16 cents respectively. The breakdown is as follows:

Chemical and Labor Cost Data
Using Three Strengths of Application

Dose per Clump (ounces)	Ammonium Thiocyanate	Labor Cost (cents)	Total
4	5	1	6
8	10	1	11
12	15	1	16

It is obvious from the above table that the cost of the ammonium thiocyanate compared to that of labor costs in applying it is quite high. One must, therefore, give primary consideration to consumption of the chemical which will depend upon dosage administered as well as stems per acre to be treated.

Specifically, the high density of sprouting in the study area, if given a thorough treatment, would raise costs to a high level. Average sprout stocking on the eight plots using a minimum height of 5 feet was 875 clumps per acre. Using 4, 8 or 12 ounce doses of ammonium thiocyanate crystals to treat such dense stocking would cost $52.50, $96.25, and $140.00 respectively. The foregoing amounts are based on NH_4SCN priced at 20 cents per pound.

Summary

Ammonium thiocyanate in crystalline form was tested to determine its ability to kill hardwood brush. Three dosages -- 4, 8 and 12 ounce -- were attempted using three techniques of application. These were scattering crystals around stump to a radius of 1 foot, 2 feet, and dumping directly at the base of a sprout clump.

An analysis of the results was made 15 months after treatment. The 4 ounce treatments resulted in very light kills with some partial defoliation. The 8 ounce dose was moderately successful having produced as much as a 34 percent kill. Most effective of the three strengths used was the 12 ounce. Two plots thus treated yielded 53 percent and 57 percent kills.

A direct, one-lump, application of 12 ounces NH_4SCN crystals was the most successful method tested.

None of the species tested showed evidence of resistance to the chemical. Ammonium thiocyanate seems to be non-selective in its toxicity toward many local broadleafed tree species.

Chemical and labor costs for 4, 8 and 12 ounce treatments were 6, 11 and 16 cents per individual sprout clump.

Conclusions

1. Preliminary tests using dry ammonium thiocyanate crystals to control hardwood sprouts in the 5 to 12 foot height class were reasonably successful.

2. Direct one-lump application at the base of a sprout clump appears to be most effective of the three techniques attempted.

3. A minimum quantity of 12 ounces (18 fluid ounces by volume) is needed to deaden more than 50 percent of actively growing sprouts.

4. Trees in the overstory may be affected by ammonium thiocyanate in cases where crystals are applied in heavy doses (12 oz.) within 3 or 4 feet of their trunks.

5. The cost of ammonium thiocyanate is relatively high if complete eradication is desired under conditions of medium to heavy stocking of sprouts. Labor cost in applying the crystals is comparatively low. The ease of employing this brush control method may attract adherents among individuals who have experienced the difficulties of spraying vegetation with back-pack spraying devices.

Addendum: Second year results

After two years, it was not possible to collect exact data on the behavior of all treated sprouts since growth had partially masked the initial effect of the herbicide. Some generalizations can be made, however, and these may be of some value to prospective users of this chemical.

The vast majority of sprouts which fell into the 25 to 75 percent defoliated class regained their foliage in 1962 after a one-year setback. The sprouts which were classified as dead in 1961 remained in this state with only a few exceptions. About 10 or 15 percent of the "dead" sprouts sent out weak shoots from their root systems during the 1962 growing season. This proves once again that in working with living organisms one rarely, if ever, subdues his adversary.

Literature cited

1. Tryon, H. H. and R. F. Finn, 1942, Tests of chemical control of hardwood sprouts: Black Rock Forest Paper no. 18, p. 112-113.

2. Ahlgren, G. H., G. C. Klingman and D. E. Wolf, 1951, Principles of weed control: John Wiley & Sons, Inc., p. 253-254.