U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, DIRECTOR
Research Note

Number 104 Portland, Oregon September 1954

SOME RESULTS OF CHEMICAL DEBARKING ON SITKA SPRUCE, WESTERN HEMLOCK, AND RED ALDER

By

Carl M. Berntsen 1/

Chemical treatment of standing trees to facilitate bark removal has received a great deal of attention in Eastern United States and Canada during the past decade. The potential advantages of removing bark or extending easy peeling throughout the year have stimulated tests of many chemicals and methods of application.

Some advantages of complete debarking of logs in the woods would be: Elimination of costs for debarking and bark disposal at the mill; lighter logs for handling and hauling, and fewer "sinkers" when logs of heavy species are stored or transported in water. Chemical debarking might also improve general utilization practices since bark-free logs and chunks could be chipped in the woods with portable equipment.

Organizations that have studied chemical debarking intensively include: The Canadian Pulp and Paper Association at Vancouver, B.C., the Forest Products Laboratory at Ottawa, and the Chemical Debarking Research Project at Syracuse, New York.

1/ Acknowledgment is made to Van Waters and Rogers, Inc., Portland, Oregon; Pennsylvania Salt Company, Tacoma, Washington; and the Dow Chemical Company, San Francisco, California, for supplying chemicals and for providing information on methods of application. Treated trees were cut and harvested through the cooperation of the Neskowin Timber Company, contract loggers for the Publishers' Paper Company, Oregon City, Oregon.

This note summarizes the results of an exploratory study on the Cascade Head Experimental Forest to test the effect of chemical treatment on three Oregon coast species--Sitka spruce (Picea sitchensis), western hemlock (Tsuga heterophylla), and red alder (Alnus rubra).

Treatments

During July and August 1952, trees of 100-year-old spruce and hemlock, and 30-year-old alder were girdled and treated with one of the following chemicals:

1. Sodium arsenite. Undiluted solution, containing about 55 percent arsenic trioxide.

2. Sodium monochloroacetate. Twenty-five percent solution made by dissolving 1.2 pounds of powder containing 86 percent sodium monochloroacetate in enough water to make one-half gallon of solution.

3. Borate. Solution made by mixing 6 pounds of powder containing 77 percent sodium pentaborate and 21 percent borax in 1 gallon of water.

4. Chlorate borate. Solution made by mixing 6 pounds of powder containing 59 percent sodium pentaborate, 15-1/2 percent borax, and 25 percent sodium chlorate in 1 gallon of water.

5. 2, 4-D and 2, 4, 5-T. Two-percent solution made by adding 5 ounces of liquid compound containing 2 pounds of acid equivalent of 2, 4-D and 2 pounds of acid equivalent of 2, 4, 5-T per gallon, to 1 gallon of diesel oil.

Spruce and hemlock trees were girdled about 4-1/2 feet above ground level by removing a 6- to 8-inch band of sap-peeled bark. A spud, fashioned from an automobile spring leaf, and a hand pruning saw were used to remove the band of bark. The lower cut was made with the saw, and the bark was then pried loose with the spud. The upper edge of the girdle was formed wherever sections of loose bark broke off. This method left an uneven edge at the top of the girdle (figure 1), but damage to the sapwood was minimized. Earlier studies indicated that movement of chemical away from the girdle is slower and more gradual if the sapwood has been cut or scored. Jahn[2]

2/ Jahn, Edwin C. Chemical debarking of trees. South. Lumberman 187 (2336): 41-42. Aug. 1, 1953.

reports, however, that cutting or scoring the sapwood seems to have no effect on ultimate peelability of the tree provided ample chemical is applied to the girdle. Immediately after girdling, chemicals were applied liberally to the exposed sapwood with a paint brush.

Most red alder trees were treated in the same way, but three additional methods were tested on a limited scale. These were: (1) use of frills (slanting axe cuts) in the sap-peeled girdle, (2) use of frills alone, and (3) a drenching basal spray on the bark surface. In the spray treatment, a 2-gallon pressure unit was used to apply the chemical to the basal 2-foot section of the trunk.

Figure 1. --Sodium arsenite-treated girdle on western hemlock, 18 inches d. b. h.

Table 1.--Results of chemical debarking treatment

Date treated	Species	No. of trees	Average d. b. h. (inches)	Treatment: Method	Treatment: Chemical	Results - 1953: Percent of dead trees	Results - 1953: Bark looseness
7-24-52	Hemlock	9	24	Sap peeled	Sodium arsenite	100	Good[1]
8-12-52	Spruce	10	26	Sap peeled	Sodium arsenite	100	Medium to good[2]
7-30-52	Hemlock and spruce	15	20	Sap peeled	Sodium monochloro-acetate	27	Poor[3]
7-30-52	Hemlock and spruce	7	19	Sap peeled	Borate	0	No effect
7-30-52	Hemlock and spruce	7	18	Sap peeled	Chlorate borate	0	No effect
8- 5-52	Alder	3	11	Sap peeled & frills	Sodium arsenite	100	Poor
8- 5-52	Alder	3	11	Sap peeled	Sodium arsenite	66	Poor
8- 5-52	Alder	4	13	Frills	Sodium arsenite	100	Poor
8- 5-52	Alder	3	12	Sap peeled & frills	Sodium monochloro-acetate	0	No effect
8- 5-52	Alder	3	15	Sap peeled	Sodium monochloro-acetate	0	No effect
8- 5-52	Alder	6	10	Frills	Sodium monochloro-acetate	17	No effect
7-11-52	Alder	10	11	Basal spray	2, 4-D and 2, 4, 5-T in diesel oil	[4] 10	No effect

1/ Good bark looseness: Sections of bark could be removed in lengths up to 30 feet along clear portion of bole, and in smaller sections through limby portion.

2/ Medium to good bark looseness: Bark could be flaked off in sections 1 to several square feet large along entire length of tree.

3/ Poor bark looseness: Bark could be flaked off in sections of 1 square foot or less for a short distance above treated area.

4/ A reexamination of basal sprayed alder in 1954 (2 years after treatment) showed all trees dead or dying, but bark was tight.

Results

Sodium Arsenite

Where spruce and hemlock were treated with sodium arsenite, a noticeable browning of needles occurred within 2 weeks. Within 2 months all trees were dead. Spruce did not respond as rapidly as hemlock, possibly because the spruce trees were treated nearer to the end of the growing season. Bark on treated spruce was likewise tighter than on hemlock (table 1), but bark of both species normally remained intact during falling, yarding, and loading. One year after treatment 2-foot sections of bark could be flaked off by prying with an axe blade (figure 2). When severed longitudinally on one side, bark could sometimes be pried off in one piece (figure 3). Bark was more easily removed from the lower part of the bole, except the portion below the girdle, which was virtually unaffected by treatment. Breakage during falling was more severe for treated trees. Even though falling was carefully conducted, some treated trees broke into 6- to 10-foot lengths.

Sodium arsenite was very effective in killing red alder trees, but bark removal was unsatisfactory (table 1). In contrast to the almost uniform bark-peeling qualities of treated spruce and hemlock, bark of treated alder was highly variable. In some cases, the bark would slough off on one section of the bole, could be pried off on a second section, and remained tight on a third.

Sodium Monochloroacetate

Only 4 of the 15 spruce and hemlock trees treated with sodium monochloroacetate died within one year (table 1). The remaining 11 trees showed varying degrees of vigor from "healthy" to "dying." From some trees bark could be pried loose for a short distance above the girdle, but debarking properties were generally unsatisfactory.

Bark was tight on all 12 of the treated alder trees and only one died within a year.

Borate, Chlorate Borate, and 2, 4-D and 2, 4, 5-T

None of the treatments with borate, chlorate borate, and the mixture of 2, 4-D and 2, 4, 5-T caused a quick enough kill to produce satisfactory debarking (table 1). However, the basal application of 2, 4-D and 2, 4, 5-T in diesel oil killed several alder trees within 2 years following treatment, and those still alive appeared to be dying.

Figure 2. --Bark of sodium arsenite-treated spruce and hemlock could be flaked off in large sections but did not slough off by itself.

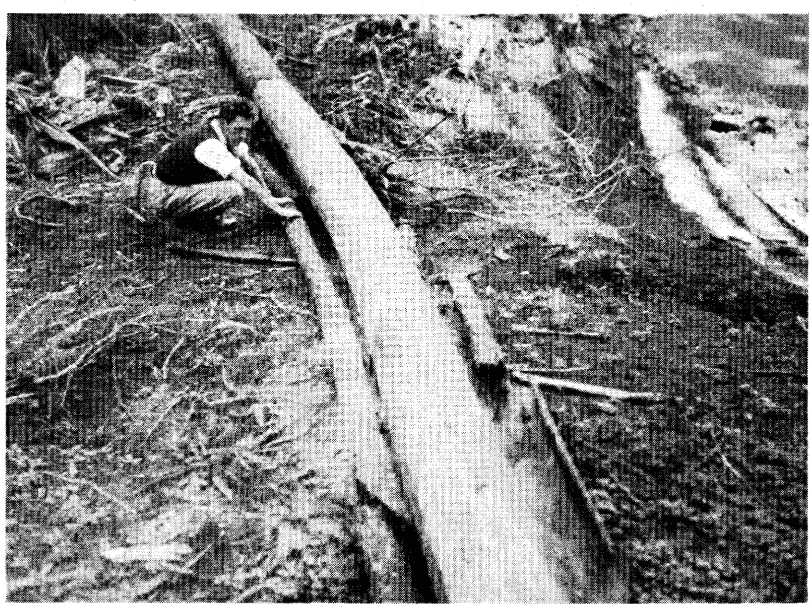

Figure 3. --Bark of sodium arsenite-treated western hemlock was easily removed when severed longitudinally along top of log.

Summary

Sodium arsenite, when painted on a sap-peeled girdle on spruce and hemlock during the growing season, loosened the bark sufficiently to allow peeling of large sections the following year. Increased breakage of treated trees during falling may be of some concern, however.

Sodium monochloroacetate treatments showed only a slight effect on spruce, hemlock, or alder. Although its relatively low toxicity during handling is a desirable feature, continued tests of this chemical in its present form seem unwarranted. Borate, chlorate borate, and the mixture of 2, 4-D and 2, 4, 5-T were even less effective as debarking chemicals.

Red alder bark showed the least response to chemical treatment despite the several types of treatment used. The hormone chemical mixture of 2, 4-D and 2, 4, 5-T was effective in killing alder trees, however, and may be useful as a basal spray with an oil carrier to kill alder in brush control or stand-improvement operations.

Better bark-peeling results could probably have been achieved in this test if wider sap-peeled girdles had been used (more than 8 inches for trees over 12 inches d. b. h.) and if sodium arsenite had been applied early in the natural sap-peeling season. Trees should be girdled as low as practical because bark below the treated area was not loosened.

Prospects for successful chemical debarking of spruce and hemlock using sodium arsenite seem encouraging, and techniques to make the bark slough off before or during logging merit further investigation. Meanwhile, the sodium arsenite treatment may have limited application in facilitating manual bark removal and thereby extending the sap-peeling season.