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CHEMICAL BRUSH CONTROL on LATOUR STATE FOREST

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INTRODUCTION

Latour State Forest is a 9,013 acre experimental and demonstration forest supervised by the California Division of Forestry in southeastern Shasta County, California. The Forest lies between 3,880 and 6,740 feet in elevation in the southern portion of the Cascade Mountain Range.

A striking feature of this property is its 2,250 acres of dense brush fields (fig. 1). These brush fields are composed mainly of manzanita (Arctostaphylos parryana var. pinetorum), chinkapin (Castanopsis sempervirens), and snowbrush (Ceanothus velutinus) in varying proportions. On certain sites bitter cherry (Prunus emarginata), service berry (Amelanchier alnifolia), and scrubby California black oak (Quercus kelloggii) are components of the brush fields. Bracken fern (Pteridium aquilinum) is an aggressive invader following clearing. The brush is extremely dense in most areas. Much of it is almost impossible to walk through, and varies in height from four to twelve feet. Most of the stands reach a height of six to eight feet.

Fig. 1. Edge of clearing showing height of brush.

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Although some of the brush fields are on shallow soils not suited to tree growth, much of the brush is on soils with adequate depth and other characteristics favorable for timber production. In fact, some of the brush fields are being invaded by coniferous trees, although natural restocking of trees in the brush fields has been a slow and uncertain process.

Attempts to reforest a large brush field were started on a test basis in 1955 after previous small trials. Experience over many years of State and Forest Service planting trials had shown that complete removal of the brush cover followed by planting offered some hope for successful conversion of brush to timber. Accordingly, an area of about seven acres was cleared in 1955. Two methods of clearing were used. Half the area was completely cleared by bulldozer and the brush pushed into windrows. On the remainder of the area, the standing brush was mashed down by running over it with a tractor. Both the windrows and the mashed brush were burned in the following autumn of 1956 (fig. 2). Five tree species were then planted on the area following burning. As a test, another area was reserved for direct seeding experiments and sowed to tree seed in 1957. The tests are located on the crest of a northwest facing broad ridge at an elevation of 5,520 feet.

In the spring after the tree seedlings had been planted it was apparent that some measures to control the vigorous regrowth of the brush would be necessary (fig. 3). The sprouting brush was still competing vigorously with

Fig. 2. Mashed brush after burning. October 1956.

Fig. 3. Dense chinkapin sprouts. Same area as figure 2. October 1957.

the planted trees. Another reason for controlling the brush sprout regrowth is that the regrowth forms a cover for small rodents that forage beneath it, destroying coniferous seed spots and damaging the terminal buds of young growing stock. 3/ Chinkapin was the worst offender. This species not only sprouts from the root crown and reseeds but it also sprouts from the roots

3/ LUDEMAN, J. 1958. Personal communication

and may reproduce from short sections of stem or roots accidentally buried during the clearing process. Although the manzanita in this area is a non-sprouter, it is a prolific and vigorous seeder and the seed is viable for long periods. Snowbrush is not a serious competitor in this region. It is a relatively minor component of the brush fields and is a preferred browse species for deer. Once the mature snowbrush was reduced, sprout growth was closely hedged by deer. Service berry and bitter cherry are also favored browse species and were present only incidentally on this site. Bracken fern covered portions of the area with a dense cover, but it did not seem to seriously affect growth of the planted trees.

PURPOSE

In order to control the heavy sprout growth of chinkapin, experiments in application of herbicidal sprays were initiated.

Chemicals Used

From the experience and personal knowledge of Dr. O. A. Leonard, Associate Botanist in the California Agricultural Experiment Station, Davis, California, four growth regulators appeared especially promising. These were:

2,4-D - dichlorophenoxyacetic acid, propolene glycol butyl ester.
2,4,5-T - trichlorophenoxyacetic acid propolene glycol butyl ester.
2,4,5-TP - trichlorophenoxypropionic acid.
Amino triazol - 3-amino 1,2,4 triazol.

The herbicides were applied as mixtures, except for amino triazol. Each of the first three chemicals listed above was paired with one of the other esters at the rate of two pounds acid equivalent mixed with 100 gallons of water and two quarts of summer oil (Volck oil emulsion) as a spreading agent. This resulted in a total mix of four pounds acid equivalent of hormone spray per 100 gallons of water. Amino triazol was mixed at a rate of 12 pounds of 50 percent commercial powder to 100 gallons of water. No spreading agent was used. Tables 1 and 2 show the chemical combinations used.

Application was made with hand-operated five gallon capacity pressure back pumps. Foliage was wet down to the drip point. Rates of application varied somewhat due to unequal amounts of foliage per acre and with individual operators. Some operators tended to spray at a heavier rate. Average rate of application was about 150 gallons per acre.

TEST METHODS AND RESULTS

Since chinkapin, the principal brush problem, had been found difficult to control with herbicides applied in the spring, the Latour spray tests were made in late summer and fall.

Test number 1 with brush sprouts

This test was in an area of very dense one year old chinkapin sprouts. The sprouts originated from a broadcast burn of mashed brush (figs. 2 and 3). The test plot consisted of 16 squares 25 feet on a side. Each of the four herbicide mixtures was applied August 24, 1956 to four different plots selected at random. Rate of spread varied between 100 and 175 gallons per acre. Planted trees were temporarily covered with milk cartons to protect them from possible damage from the spray. The effects of the spray mixtures 12 months after application are shown in table 1.

Table 1. One year old chinkapin sprouts sprayed August 24, 1956; results in August 1957.

Chemical	Percent of plants top-killed which resprouted (after 12 months)	
	Range	Average
2,4,5-T and 2,4,5-TP	30-80	55
2,4-D and 2,4,5-TP	50-75	56
2,4-D and 2,4,5-T	75	75
Amino triazol	60-90	80

As shown, the 2,4,5-T plus 2,4,5-TP and 2,4-D plus 2,4,5-TP spray mixtures were equally effective. The results seem to indicate that the 2,4,5-TP component was the primary killer. Amino triazol at the concentration used was ineffective. All the chemicals used resulted in nearly 100 percent top kill but the resprouting was variable as shown.

Test number 2 with brush sprouts

This test was in an area of dense two year old chinkapin sprouts. Only 12 plots (25 feet square) were laid out to confine the test to areas of dense sprouts. Each spray mixture was applied to three plots selected at random. The area was sprayed October 19, 1956. This plot was comparable to Test 1 except for the date of spraying and age of sprouts. The two year old sprouts were in an area where the brush had previously been completely cleared and windrowed. Since they were larger and had more leaf and root area this should have made the sprouts more difficult to kill than the one year old sprouts. Rates of application were between 75 and 300 gallons per acre. The variation was largely due to different densities of sprout regrowth. More chemical was required to cover the two year old sprouts on this plot than the one year old sprouts in plot 1. The two year old sprouts were about twice as tall and had considerably more foliage. The effects of applying the sprays in October are shown in table 2.

It will be noted that October treatment (table 2) was considerably more successful than the August spraying (table 1) for all mixtures except amino triazol. There did not seem to be significant differences in the effectiveness of the ester sprays as had occurred in the August spraying.

Table 2. Two year old chinkapin sprouts sprayed October 1956: results in August 1957

Chemical	Percent of plants top-killed		Percent of plants top-killed which resprouted (after 10 months)	
	Range	Average	Range	Average
2,4,5-T and 2,4,5-TP	80-90	87	10-15	12
2,4-D and 2,4,5-T	90	90	10-30	20
2,4-D and 2,4,5-TP	60-85	76	5-20	18
Amino triazol	5-90	62	75-95	87

Tests in mature brush

Two tests were made in mature brush in conjunction with spraying sprouts. Small areas alongside the plantation clearing were sprayed with back pumps, with an attempt to distribute the spray onto the vegetation as evenly as possible. One test was made in August, another in October. All four chemicals were used in the same mixtures as previously mentioned. Little difference was noted between any of the treatments. About 15 percent top-kill was noted after 10 months. This increased to about 50 percent during the second year. All species of brush were top-killed to some extent. Bitter cherry seemed to be most susceptible to spraying.

Inadequate spray coverage of the foliage seemed to be a major factor in the poor results. Brush plants had entire limbs on one side of the crown killed and other branches or areas of crown unaffected. Manzanita appeared easier to kill than chinkapin but the over-all results were inconclusive. Again, coverage was apparently the most important factor. Best kill and defoliation was achieved on the open side of the brush adjacent to the cleared area. This was where the spray operator was able to move around and direct his spray nozzle most effectively. On the denser side of the brush top-kill was patchy as the operator could not maneuver effectively and in some cases had merely permitted the spray to drift out onto the brush. The interior portions of the plants were not affected. Because coverage of the foliage seemed to be a critical factor the design of nozzles, or the possibility of mist blowers or other devices to get better spray coverage should be investigated. Spray coverage is especially important at the base of sprouts and in difficult to reach areas of mature brush. White fir saplings sprayed with 2,4-D plus 2,4,5-TP in August were scorched slightly and defoliated but were not permanently damaged.

Other treatments

About two acres were sprayed with the various mixes from hand pumps on the north edge of the plantation area in October 1956. This portion of the area had come back to manzanita seedlings and bracken fern following clearing. The spraying was done to attempt to control competing vegetation prior to spot seeding of conifer species (fig. 4). A control of bracken was not contemplated as it was mostly dormant (with brown leaves) prior to spraying. Good control of manzanita seedlings was accomplished. The few chinkapin sprouts on the area were effectively top-killed. Some snowbrush plants were top-killed. This species resprouted but the sprouts have been closely browsed and hedged by deer. Snowbrush is a favored browse species.

Operational spraying

In October and November 1958 the entire area that had been cleared, planted and seeded was sprayed and test plots resprayed to attempt to finally release the planted and seeded stock from competition of resprouting brush. This spraying was done with a power wagon fire truck. A "brush-killer": equal amounts of 2,4-D and 2,4,5-T totaling four pounds acid equivalent per 100 gallons of water with one-half percent summer oil and diesel was the concentration of herbicide used.4/ Application rate was about 100 gallons per acre. This spray job resulted in good top-kill of chinkapin sprouts and complete kill of manzanita seedlings. Again bracken fern was not affected. The surviving planted seedlings are beginning to grow rapidly. Some 8 to 12 inch leaders are appearing above the herbaceous cover (fig. 5). The spray did not seriously affect planted or seeded conifer stock. Some slight defoliation and distortion

Fig. 4. Successful seed spot.

Fig. 5. Planted tree successfully established.

(swelling) of small coniferous trees was noted. Much of the worst damage to small trees appeared to be mechanical; that is, accidental crushing from the spray machinery crossing or running over a row of planted trees.

4/ The actual mix was 5.8 quarts of ester mix with 5.8 quarts diesel, 8 ounces sticker spreader, 4.5 pounds Titanox (a dye) to 145 gallons of water.

DISCUSSION

The experience at Latour has resulted in the following spray program to control chinkapin sprouts and manzanita seedlings after mechanical brush clearing.

Allow one growing season following clearing before spraying. This allows most brush seedlings and sprouts to develop before spraying. Then spray with two pounds acid equivalent each of 2,4-D and 2,4,5-T mixed with an equal amount (4 quarts) of diesel and 100 gallons of water. One-half of one percent sticker spreader agent and a dye are added. This results in a "standard brush killer" mix of 4 pounds acid equivalent to 100 gallons of carrier with one-half of one percent sticker spreader. The dye is helpful in application to control coverage of the area. Spraying in late October or early November produces best results. Forty-eight hours of clear weather following spray application is desirable to keep the chemicals from washing off the vegetation.

Plant trees during the first fall or spring after clearing and spraying. Trees are planted in the fall of the year at Latour due to difficult access problems in the spring. Deep snow and heavy drifts prevent access to plantable areas until early summer after the best planting season.

Plans should be made for one respray or second application one or two years following initial spray application. This would be one or two years after trees were planted or seeded.

Although it is doubtful if complete control of brush can be accomplished (or is necessary), this program should effectively release planted trees from brush sprout and seedling competition.

SUMMARY

1. Chinkapin is the most difficult brush species to control at the Latour State Forest. Chinkapin sprouts offer serious competition to trees planted in cleared areas.

2. A mixture of 2,4,5-T and 2,4,5-TP was the most lethal spray on chinkapin sprouts sprayed in August and October. Mixtures of 2,4-D plus 2,4,5-T and 2,4-D plus 2,4,5-TP were about equally effective in top-kill. Amino triazol gave the poorest kills. Results of spraying with a mixture of 2,4-D and 2,4,5-T were nearly equal to the best treatment in late October applications. This last mixture is recommended for use because it is cheaper.

3. Good top-kill of sprouts was achieved in both August and October spraying. However, regrowth was least following the October spraying. Spraying in late October or early November is recommended.

4. Two applications, one to three years apart, may be required to release planted trees from competition with chinkapin sprouts. Continued emergence of manzanita seedlings over a two or three year period may also require a respray.

5. Late fall sprays did not seriously affect planted coniferous trees. Covering the trees with milk cartons or other protection does not seem to be necessary when the spraying is done on the ground using normal care to avoid spraying small trees.

6. Spraying of mature brush from the ground with back pumps in limited trials was mostly ineffective. In spraying mature brush, and to a less extent sprout regrowth, coverage of the foliage by the spray material appears to be a critical factor. Methods to achieve better spray coverage especially at the base of sprouts and in the difficult to reach areas of mature brush should be investigated.

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