BRUSH CONTROL ALONG NATIONAL FOREST ROADS

C. A. Betts, Engineer
U. S. Forest Service

General Problem: With over 117,000 miles of roads in the National Forests, not to mention 120,000 miles of trails, it is inevitable that a brush-control problem must be contended with. It may be a rough and ready type of clearing to maintain safe road widths and sight distances, but it must be well planned to fit the limited maintenance allotment. There is also the necessity of reducing fire hazards on power transmission lines as well as preserving the natural beauty of the forests for the enjoyment of the traveling public. Therefore, the Forest Service has a peculiar interest in silvicides and herbicides insofar as they prove cheaper and more effective than conventional cutting or mowing.

During the past three years the Forest Service has conducted extensive research on roadside spraying to determine the most effective techniques in different parts of the country, as well as the costs involved. A resume of the tests of 1951 and 1952 may prove helpful to road men studying the same problem under similar conditions. To facilitate this, results are given geographically, beginning with the Northeast.

NEW ENGLAND

Procedure: Investigation into the merits of chemicals for the control of vegetation along roadsides, trails, power lines, and telephone lines in the National Forests have been handled jointly by the research and operational personnel. Much of the work in New England has centered in the Gale River Experimental area in the White Mountain National Forest and has extended over a two-year period -- 1951 to 1952. The scope of the work covered the selection of silvicides, their concentrations, carrier mediums, spraying seasons, methods of application, and effects on various types of trees and brush. Roadside areas, 4 to 6 ft. wide, that had been mowed to reduce fire hazard, were sprayed in strips up to $\frac{1}{4}$ mile in length.

Sprays: Silvicides experimented with included 2,4,5-T trichlorophenoxyacetic, ACP 904 2-methol-4-chlorophenoxyacetic acid, Weedone 64 (2,4-D dichlorophenoxyacetic and 2,4,5-T mixture), TCA (sodium trichloroacetate and Weedone 64 mixture), Ammate, and combinations of these. Water was used as a carrier for most of the sprays in this humid area except for the basal dormant spraying where oil was used. However, some of the Weedone was tried in both oil and water for foliage sprays. Replicate spraying for foliage included applications in June and August. Dormant spraying was done in April and October. Test series included $\frac{1}{2}$, 1, 2, and 3 percent of chemicals by weight.

Application: The chemicals were applied by pumping through nozzles of various patterns at 60 psi. This necessitated slow spraying on foot whereas it was later discovered that better coverage could be obtained in the future by spraying from the truck at 150 psi.

Equipment: (1) Hudson Peerless Super-Power sprayer with 1½ hp. gas engine and 50-gal. tank which will deliver up to 400-lb. pressure with capacity of 3-4 gpm. through a single nozzle; (2) Monarch type 50 F-94 nozzles; (3) Spraying Systems nozzles No. 6504 (flat spray pattern, angle 65 deg.); (4) Spraying Systems Trigger Teejet shut-off valve No. 4674; and (5) Parco back-pack sprayer.

Results: 1. Complete kill of vegetation with no resprouting was not fully achieved in such resistant species as red and sugar maple, ash, elderberry, blackberry, and bush honeysuckle, but the more sensitive types, such as yellow birch, paper birch, beech, alder, and willow, were generally eliminated. The maples had a survival of 25 to 50 percent. Spruce and fir, when thoroughly wet all over, were susceptible to spray.

2. Dormant spraying in October was much more effective than in April, presumably because more of the chemical reached the living tissue in the fall than when much of the stubble was dead in the spring. Furthermore, individual plants were more easily picked out by the sprayer in October. It is probable that better wetting of the stem and root crowns was accomplished in October than when leaves were on in summer and that this accounts for higher kill in October than August.

3. Of the foliage spraying, June kill exceeded August.

4. No significant difference was noticed between water and oil solvent carrier bases, although where both oil and water were known to reach bark, the oil seemed superior in penetration. Oil cost more, of course.

5. Better results were obtained with 2 percent than with 1 percent mixes.

6. Potency was in the following order: 2,4,5-T, Weedone 64, Ammate, TCA ACP 904. Numerous 100 percent kills were obtained with 2,4,5-T in both 1 and 2 percent concentrations in oil when applied basally to uncut saplings. No treatment gave complete kill on blackberry, although the live cane density was reduced 70 to 90 percent by 2,4,5-T at 1 and 2 percent, both in oil and water. TCA appeared to enhance the effect of Weedone on briars, but not on hardwood tree sprouts. However, 2,4,5-T was the most effective, and mixtures seemed to kill in proportion to the 2,4,5-T content. Since some woody plants are resistant to 2,4-D, which is cheaper, but are killed by 2,4,5-T, a combination of these was found advantageous in some instances. While it is recognized that some resprouting crowns may eventually die and that some sproutless crowns may produce sprouts next season, the overall effect of this is minor and compensating.

7. On the average, about 75 percent of plants can be eliminated by one application on sprout growth one year after mowing.

Recommendations: The most effective single formula found from these tests would be 2 percent 2,4,5-T in oil or 1 gal. of concentrate containing 4 lb. acid in 25 gal. From a practical standpoint, however, this strength of acid is overly expensive.

Where feasible, let woody species grow two years after mowing in order to attain conspicuous size, then spot-spray with 2,4,5-T in the fall.

Follow-up spraying to catch scattered survivors may or may not pay, depending on objective.

SOUTH CAROLINA

Applications of 2,4,5-T (30.5 gal. in 6,100 gal. of water) to 41 miles of roadside (one side) on the Francis Marion National Forest in South Carolina during the latter half of July, 1952; resulted in good kill on sweet gum, about 60 percent kill of oak, and none of maple.

Obviously this foliage treatment must be followed by cutting the resistant species of the dense growth in the dormant season and spraying the stump with 2,4,5-T in an oil carrier.

ARKANSAS

Foliage spraying of 3.8 miles of forest roadsides in the Ouachita National Forest with 2,4,5-T (1 qt. 2,4,5-T with 1 gal. of emulsion oil and 100 gal. of water) at a cost of $8.63 per mile (both sides) was disappointing. No pine was killed, and there was little kill except to weeds.

By comparison, the cost of mower and operator is about $5.74 per mile (both sides).

MONTANA AND IDAHO

As a result of 367 miles of trial spraying along forest roads in Montana and Idaho, the conclusion was reached that, with 1 qt. of 2,4,5-T, having an acid content of 4 lb. per gal. of 2,4,5-T, to 100 gal. of water plus 4 gal. of emulsion oil, kills of from 55 to 70 percent can be obtained. Mountain maple and willow were found to be resistant; Ceanothus and alder were more susceptible to treatment. By spraying two years in succession, however, sufficient kill can be obtained to last at least five years. The average cost of one spraying per mile was $11.72, which is equivalent to $23.44 per mile of road where both sides are sprayed.

In this same backwoods area, hand brushing averages about $150 per mile.

COST OF BRUSH CONTROL ALONG NATIONAL FOREST ROADS - 1952

National Forest	State	Miles Treated	Cost per Mile	Remarks
Clearwater	Idaho	56.6	$10.16	Av. hand mowing cost = $150/mi.
Coeur d'Alene	Idaho	125.3	12.51	
Lolo	Montana	88.2	12.25	
St. Joe	Montana	71.3	10.80	
Colville	Washington	26.0	12.00	

One factor contributing to the low costs was the specially designed equipment with spray controls in the cab of the truck - a two-man outfit.

CALIFORNIA

Based on the spraying of 595 miles of roadside in eight forests in California, it was estimated that, at $52.40 per mile, chemical treatment using oil carrier compared favorably with roadside machine mowing and disposal of brush at $104. Similarly $95.00 per mile for trails is less than the comparable cost of $200.00 for hand brushing. Furthermore, mowing cultivates rather than kills, and the frequency of cutting the vigorous sprouting after mowing exceeds the frequency of chemical treatment which decreases year after year as brush density is reduced. A combination of first cutting brush and then spraying when sprouts are about a foot high gives good results.

SOUTHEASTERN ALASKA

Over ½ mile of the Gold Creek Trail near Juneau was sprayed with Ammate (1 lb. and ½ lb. per gal. with and without spreader-sticker). The spreader-sticker increased the effectiveness of the spray and reduced the Ammate requirement. For the rainy season this additive would be a must.

Salmonberry, alder, willow, elderberry, and other brush, not very dense, succumb to periodic spraying. It is estimated that the annual cost of spraying a mile of trail would average $40 at present wage and chemical costs. The corrosive properties of Ammate make it hard to handle.

GENERAL SUMMARY

Numerous refinements in spraying techniques have been found to apply nationwide; others, such as oil in lieu of water in dry climates, have limited application.

For one thing, there appears to be some advantage in regulating the concentration of sprays so that chemicals will be absorbed into the plant before leaves are killed and drop off.

Spraying after cutting should be timed for when the second growth is ready. This may not be until sprouts are easily identified and well started.

The extent of late kill the year after spraying, like subsequent resprouting, are unknown factors but compensating.

Repetitive spraying usually pays as each successive application becomes more effective and lasting.

On trails, the cost of transportation of materials and equipment has an important bearing on the feasibility of spraying.

Careful planning often keeps costs from becoming prohibitive.

Roadside clearing along forest roads usually involves control of young trees, as well as shrubs, vines, herbaceous ground covers,and grasses. The objective of mowing, cutting or spraying is safety, adequate visibility for driving at legal speeds, and minimum fire hazard along with preservation of natural attractiveness of the landscape.

Questions and Answers on Mowing and Herbicides

Brant: What is the degree of kill on resistant species secured by Forest Service?

Betts of U.S. Forest Service: The Forest Service has found difficulty in obtaining satisfactory kills of such resistant species as red and sugar maple, ash, elderberry, blackberry and bush honeysuckle. In another area, it may be scrub oak that only partly succumbs.

Brant: Does the term legumes refer to clover?

Garmhausen: The term legumes, as used in this paper, applies to clovers and hairy vetch.

Brant: What effect has the use of herbicides on Lespedezas?

Garmhausen: Native Lespedezas are somewhat resistant, and so I am assuming that Korean, Kobe, and Sericea will also be slightly resistant. A concentration just sufficient to kill the weeds would be recommended. I would suggest you use 1 lb. of 2,4-D acid equivalent per acre.

Iurka: This report is very timely. Highway engineers are becoming conscious of the great economies possible with the proper use of herbicides. More use of the several regional Weed Control Conferences by these engineers would aid in assuring the best applications already formulated for good sound control practice in other fields. Knowledge of these principles is essential. Improper use of some of the herbicides can not only cause damage to valuable plants but can result in rulings or legislation,which would prevent the proper use of these materials. Furthermore, improper use can result in disappointing results which might militate against future efficient applications.

Neale: I think the report is too optimistic. It should stress the need for caution in use of these weed-control materials.

Gordon: Are there not some localities and certain conditions where weed killers should not be used at all?

Garmhausen: Generally speaking, yes. Conditions adjacent to the right-of-way may make it advisable not to spray. Then there are conditions within the right-of-way where spraying would kill plants that you wish to retain.

Hicks (Va.): Virginia experienced a good theoretical program but ran into a snag. MH-40 had serious effects on grass. There is a need for caution when using high pressure and high-volatile material.

Kiltz (Army Engineer): Does not the effect of volatile material continue over a period of time?

Garmhausen: Yes, spraying may have a damaging effect many weeks after the actual spraying has been done. As long as any material is left on the plant there is a possibility of having harmful effect on such very susceptible plants as cotton, tobacco, etc. Many times, though, the damage is caused by drift but may not be recognized as such.

Grau: I want to ask Mr. Hottenstein what the effect of spraying has been on crown vetch?

Hottenstein: I have no data on this. I can advise you, though, that I have had no complaints of any damage.

Lawrence (N.Y.): What about costs if repeated spraying is necessary? How does this effect savings?

Garmhausen: There is a balancing point between the cost of spraying and the saving in reduced mowing operations. It could be that too many applications of spraying would run up the cost so that no savings might result. This is often the case when the program is put into effect the first year. Our engineers feel that, even though this condition might arise, the saving effected over the future years will offset this.

Betts: Discussion on the subject of herbicides is likely to prove especially valuable because it will bring out the wide difference in conditions between various parts of the country and the resulting spraying problems. For example, it is a far cry from the "asbestos" White Mountain National Forest of New Hampshire to the explosive Angeles National Forest of California, where high fire hazards have required special fire precautions, including cutting before spraying, a practice followed for a number of years in California. Another example of the variation in conditions over the 117,000 miles of roads and 120,000 miles of trails in the National Forests is found in the use of oil base for sprays in the dry West while water is more generally used in the humid East. The difference in reaction of vegetation in the different areas requires special study.

SPECIAL TASK COMMITTEE ON MOWING AND HERBICIDES

W. J. Garmhausen, Chairman; Chief Landscape Architect, Ohio Department of Highways, State Office Building, Columbus 15, Ohio
Eckert, E. C., Chief Forester, Michigan State Highway Department, Lansing 13, Michigan
Betts, Clifford A., Engineer, U. S. Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

Holmes, A. E., Landscape Engineer, Mississippi State Highway Department, Jackson 114, Mississippi

McManmon, John V., Landscape Engineer, Massachusetts Department of Public Works, 100 Nashua Street, Boston 14, Massachusetts

Rose, Franklin T., Landscape Engineer, State Highway Commission of Kansas, Masonic Temple, Topeka, Kansas

Slack, Torbert, Roadside Development Engineer, Louisiana Department of Highways, Baton Rouge 4, Louisiana