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Brushkiller to Control Scrub Oak Sprouts . . .

combinations of broadcast and individual plant applications tested

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ABSTRACT: Combinations of three annual broadcast and individual plant spray applications of brushkiller (a 50-50 mixture of 2,4-dichloro- and 2,4,5-trichlorophenoxyacetic acid) in water-oil emulsion were compared to find the most effective, economical sequence of treatments to kill sprouting scrub oak (*Quercus dumosa* Nutt.) plants. No one treatment combination had a clearcut advantage. Regardless of treatment combination, three successive applications were needed to obtain satisfactory control.

RETRIEVAL TERMS: Broadcast herbicide application; brushkiller; chaparral control; herbicide application; *Quercus dumosa*; scrub oak control; 2,4-dichlorophenoxyacetic acid; 2,4,5-trichlorophenoxyacetic acid.

OXFORD: 268.44:414.1:176.1 *Quercus dumosa*:(794).

Both broadcast and individual plant applications of brushkiller[1] are widely used to kill sprouting woody plants in California. Low volume broadcast applications are rapid and relatively inexpensive.[2] They may cost from $10 to $15 per acre compared to $25 to $100 for individual plant spraying. They generally kill certain chaparral species, such as chamise (*Adenostoma fasciculatum* H. & A.), sages (*Salvia* spp.), and most brush seedlings. But regrowth of scrub oak (*Quercus dumosa* Nutt.) and other chaparral species may be very difficult to kill. Usually two or three annual individual plant sprayings with brushkiller are needed to kill these plants.[3]

When dealing with regrowth from a stand of mixed chaparral, a fairly standard treatment has been the use of one or two broadcast applications of brushkiller to eliminate the susceptible plants and seedlings and to "hold back" the resistant plants. Follow-up individual plant treatment is then used on those plants which survive broadcast spraying. But what is the most effective, economical sequence of treatments on areas where the cover is made up predominantly of resistant plants?

In a preliminary test in the San Gabriel Mountains in southern California, we tried various combinations of broadcast and individual plant spraying over a 3-year period to determine the most economical way to kill sprouting scrub oak plants. No one treatment combination had a clearcut advantage in killing scrub oak. But the results suggested that this hard-to-kill shrub could be controlled satisfactorily--although not eliminated--with three annual broadcast spray applications.

Methods

The test site was a small bench of land overlooking the city of La Cañada, at an elevation of about 3,000 feet. The original brush cover was predominantly scrub oak and interior live oak (*Quercus wislizenii* A. DC.). It was burned by wildfire in fall of 1959. A few chamise, ceanothus, toyon (*Heteromeles arbutifolia* M. Roen.), manzanita (*Arctostaphylos* spp.) plants, and yerba

[1] Brushkiller is a 50-50 percent mixture of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T).

[2] Green, L.R., White, V.E., and Plumb, T.R. *Some brush conversion costs on southern California fuel-breaks.* U.S. Forest Serv. Pacific SW. Forest & Range Exp. Sta. Fuel-Break Rep. 12, 18 pp. 1963.

[3] Plumb, T.R., Bentley, J.R., and White, V.E. *Chemical control of brush regrowth on fuel-breaks.* U.S. Forest Serv. Pacific SW. Forest & Range Exp. Sta. Fuel-Break Rep. 11, 41 pp. 1963.

Figure 1.--*The initial broadcast treatment applied by this 2-man boom sprayed a 10-foot swath. A lighter, 1-man boom was used for subsequent spraying.*

santa seedlings (*Eriodicton* spp.) also grew on some plots. The charred snags remaining after the fire were cut down and burned that winter. Spraying was begun in June 1960 and repeated in July 1961 and June 1962. Most oak regrowth when first treated was 2 to 3 feet tall. New succulent growth 1 to 8 inches long had developed along the stems of the older more woody sprouts.

The eight treatment combinations ranged from three annual broadcast to three annual individual plant applications (table 1). They were applied to unreplicated plots 20 feet wide and 200 feet long. To make the first spraying easier, the individual plant treatments were arbitrarily assigned to plots 1 through 4 and broadcast spraying to plots 5 though 8. Subsequent treatments for these two areas were selected at random.

The broadcast spray mixture consisted of 2 pounds acid equivalent (a.e.) of low volatile esters[4] of both 2,4-D and 2,4,5-T, 1 gallon of diesel oil, and 18 gallons of water applied at a volume of 20 gallons per acre. The herbicide mixture used to spray individual plants consisted of 2 pounds a.e. each of 2,4-D and 2,4,5-T, 1 gallon of diesel oil, and 98 gallons of water. We sprayed all leaves, stems, and root crown portions of the plants to the point of runoff. A 100-gallon power sprayer supplied herbicide for both methods of application. Broadcast spraying was accomplished with a portable boom (fig. 1) outfitted with six #80015 Tee-jet nozzles, which treated an effective swath 10 feet wide. An aluminum wand equipped with a Tee-jet nozzle #8006 was used for individual plant spraying.

Table 1.--*Treatment combinations tested*

Treatment[1]	1961	1962	1963
1	I	I	I
2	I	B	I
3	I	I	B
4	I	B	B
5	B	I	I
6	B	I	B
7	B	B	I
8	B	B	B

[1] I = Individual plant application
B = Broadcast application.

Herbicide effect was determined about 1 year after each application by recording the condition of all plants in two transects 4.4 feet wide and 200 feet long in each plot. Only the number of live plants was tallied after the third spray application.

Results

All combinations of application methods gave excellent control of scrub

[4] Butoxy ethanol esters of 2,4-D and propylene glycol butyl ether esters of 2,4,5-T.

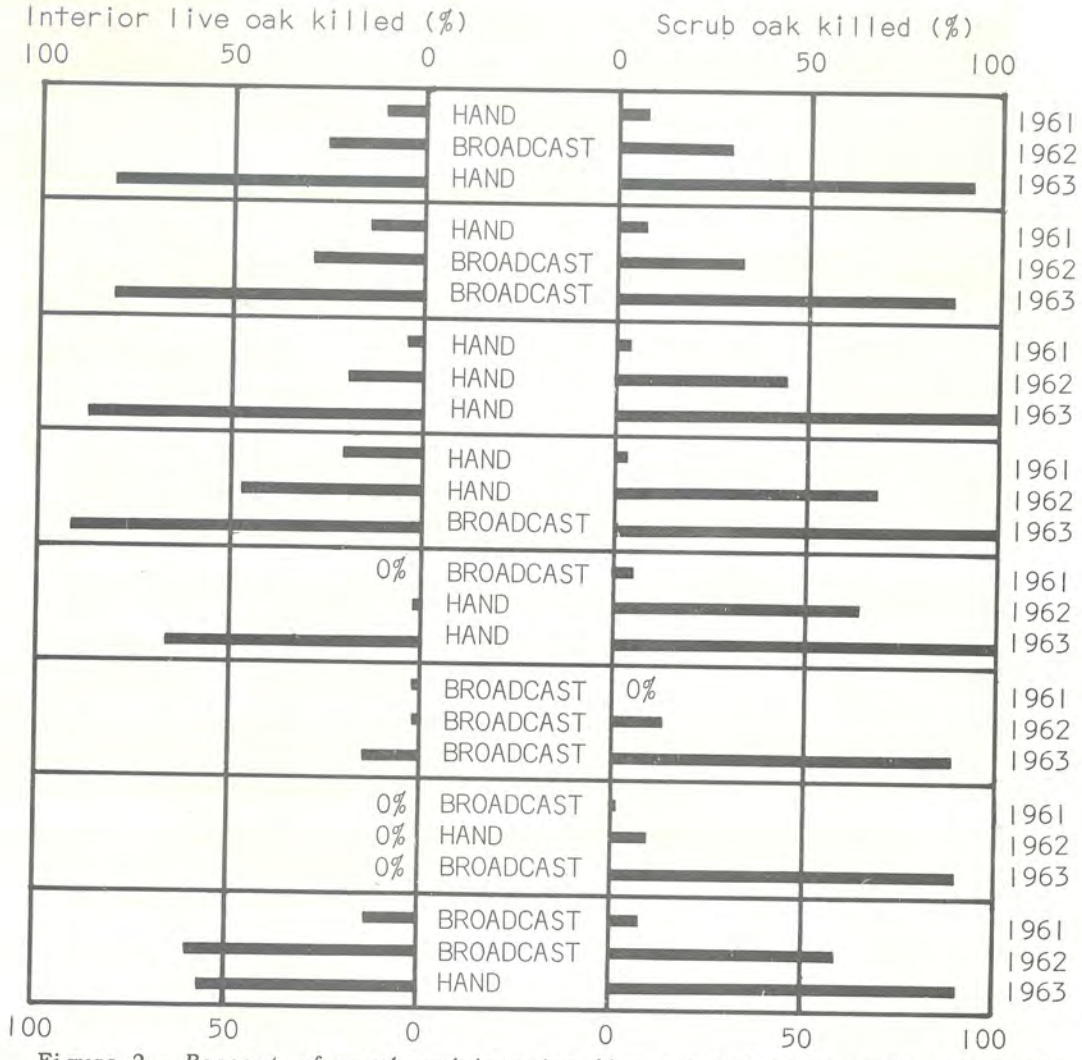

Figure 2.--*Percent of scrub and interior live oak killed by combinations of broadcast and individual plant spraying applied 3 successive years.*

oak--provided three successive annual applications were used (fig. 2). Interior live oak was more resistant to herbicide control than scrub oak, especially on the plots which received an initial broadcast application. All other woody plants were killed before or by the third spray application, except one manzanita plant on the plot that received three broadcast applications.

The first herbicide application killed a maximum of only 7 percent of the scrub oak plants whether application was by broadcast or individual plant spraying. With individual plant spraying, however, most of the sprouts of each scrub oak plant were completely killed; resprouting occurred either from the root crown or from the lower stem portions of the original sprouts. Broadcast spraying killed only the tips of the sprouts and most of the leaves; new sprouts developed along most of the length of the original sprouts.

After 2 years of spraying, the best control was obtained with two individual plant treatments which averaged 57 percent plant kill. Some scrub oak plants were killed by two broadcast applications of brushkiller, but this combination often had about the same effect as a single application (fig.3). All other spray combinations usually top-killed the plants, and sprouting

Figure 3.--*In scrub oak regrowth that received two broadcast applications of brushkiller, only the sprout tips and leaves were killed. New shoots and leaves later developed along the old sprout stems.*

Figure 4.--*A combination of one individual plant and one broadcast application of brushkiller top-killed this scrub oak plant. A few new sprouts, 6 to 8 inches tall, developed from the root crown.*

was from the root crown (fig. 4). Scrub-oak kill after three annual spray applications ranged from 88 to 100 percent among all the treatment combinations.

After three spray applications, kill of interior live oak was about the same as that of scrub oak on all plots that received an initial individual plant application (fig. 2). Plant kill ranged from 80 to 91 percent. In contrast, live oak kill on plots receiving an initial broadcast application was considerably lower. And on one plot, none was killed. The overall response of both oak species to broadcast and individual treatment was similar; however, stem and leaf kill of interior live oak was at least one week later. Eight days after spraying, leaves on scrub oak were dead while those on most live oaks were still green.

Discussion

Tests with three annual individual plant applications have not consistently given satisfactory plant control. As a general rule, each application is expected to kill about one-third of the resistant plant population,[5] but results from one test or plot have varied widely with results from others. The low amount of kill (7 percent maximum) from the initial application in this test already has been pointed out. But the average scrub oak kill of 57 percent obtained with two individual plant applications is almost the amount usually expected.

Spray programs should be planned on a 3-year basis when resistant plants are a part of the control problem. This is an expensive proposition, but one which must be faced if satisfactory control is to be obtained.

The use of three broadcast applications is the most desirable combination because it normally would be much less expensive than three individual plant applications. In addition to treatment cost, broadcast spraying has these desirable characteristics: (a) treatment is rapid--up to 60 acres per hour for helicopter and 6 acres per hour for tractor spraying; (2) a low volume of spray material is required--usually ranging from 5 to 20 gallons per acre; and (3) good coverage of smaller plants and seedlings can be obtained--hitting plants that are easily missed by individual plant spraying. Broadcast spraying does have some limitations: (a) it has a limited effective season of application--usually one or two months in late spring and early summer, (b) it is often grounded by adverse weather conditions, and (c) it poses the potential hazard of chemical drift that may seriously limit or even prohibit spraying.

Individual plant spraying is now the only acceptable alternative to broadcast spraying. Its advantages include these: individual plant spraying can be done at any time of the year, poor visibility is not a problem, and the hazard of spray drift is greatly reduced. Its chief limitations are the high cost of using individual plant spraying, and the slow rate of production--rates may range from 1/2 to 1-1/2 acres per day per man. Both the volume of spray and the rate of application and consequently treatment cost will depend on both the size and the number of plants treated.

Usually there will be an opportunity to choose the method to be used. This study suggests that three broadcast applications may satisfactorily control scrub oak, but until more information is available about when this combination can be used successfully, we recommend a combination of broadcast and individual spraying. On areas with a predominance of susceptible plants, an initial broadcast followed by one broadcast and one individual plant treatment can be used.

[5] Graham, C. A. *Killing brush sprouts on open rangeland in California.* U.S. Forest Serv. Calif. Forest & Range Exp. Sta. Res. Note 36, 5 pp. 1958.

Where scrub oak and other resistant plants predominate, an initial broadcast treatment should probably be followed by one or more individual plant treatments as needed.

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