

Chemical Control of Brush

field experiments in eradication of range brush by chemical treatment promising but more work needed

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The economics of chemical control of range brush revolve around the price of effective chemicals, the cost of application, and the relative value of the land after the brush has been killed and removed.

Woody species of brush generally are large perennial plants, irregular in shape and size, and vary greatly in density and distribution.

The dense foliage of the brushy types makes it difficult to penetrate their interiors effectively with spray solutions. The more resistant species require more thorough wetting with strong solutions. The concentration of the solution used is one of the important keys to obtaining a kill. Another is that of obtaining a thorough coverage of the brush plants with spray solutions.

Much field experimentation is being done in California in testing new chemical agents for brush control. This is a summary of results reported to date.

A number of chemical agents are used as brush killers, either singly or in various combinations as dusts or sprays. Chief among these are diesel oil; ammonium sulfamate—ammate; sodium chlorate; zinc chloride; the di-nitro—DN—compounds; and hormone-type formulations.

The hormone compounds show considerable promise—if used properly—as killers of certain species of brush. Of these compounds, 2,4-D and 2,4,5-T are attracting the most attention.

The following trends have been noted during the experimentation:

1. Indication that heavily browsed sprouting plants and seedlings are more susceptible than unbrowsed plants.

2. Because of the cost per acre for materials, the chemical killing of brush may find only specialized use: *a*, to kill brush to prepare for fireguard lanes; *b*, to prepare brush fields for burning; *c*, to control brush where fire or mechanical tools can not be used; *d*, to spray brush regrowth areas after burns; and *e*, to check encroaching brush.

3. Dusts of 2,4-D have not proven fully effective in controlling even known susceptible species. Best results were obtained where the active agents were applied in water or oil solutions, or emulsions.

4. The esters of 2,4-D have proven

much more effective against most woody species than the salt forms.

5. 2,4,5-T formulations are proving more effective against brushy species than 2,4-D formulations. A combination of 2,4-D and 2,4,5-T may have some advantages.

6. Experience to date shows the desirability of applying control chemicals when the plants are in a vigorous growing condition, usually in the spring.

7. In the case of somewhat resistant species it may be necessary to respray the year following the first application to achieve full control.

8. The use of oil as carrier for herbicides appears promising.

Several research workers report that oils are better carriers of plant growth regulators for brush than water when used at low gallonages and that there is very little difference in effectiveness between phytotoxic oil and nontoxic oils as carriers of 2,4-D or 2,4,5-T when applied at the rate of five to 10 gallons per acre.

Tested Brush Species

Coyote brush—*Baccharis pilularis*—seems quite susceptible to the hormone-type brush killers.

In San Mateo County, two pounds of acid equivalent per acre of the sodium or amine salt of 2,4-D in 100 gallons of water—applied as a spray during May and June to mature coyote brush—gave a good kill within six months after application. A good kill on 25 acres of coyote brush was obtained in 1949 by helicopter spray of four pounds of actual acid—as the sodium salt of 2,4-D—in 10 gallons of water per acre.

In Monterey County, approximately 300 acres of old brushland were sprayed in the middle of May, 1949. The brush, which ranged from six to 12 feet in height, consisted of coyote brush, poison oak, California sage, wedgeleaf ceanothus, purple sage and chamise.

The mixture used per acre was two quarts of Esteron 44 plus two quarts of Esteron 2,4,5-T in nine gallons of water. This was applied by helicopter at a total cost of \$11.50 per acre. Indications of percentage kill, four months after spraying, were as follows: coyote brush, 80%; California sage, 95%; poison oak, 90%;

purple sage, 30%; ceanothus, 75%; and chamise, 5%.

In San Benito County the Farm Advisor found that 1½ quarts per acre of the butyl ester of 2,4-D—50%—gave practically complete control of coyote brush when applied during April and May.

Most California species of sage appear susceptible.

Reports from Ventura County indicate that purple sage—*Salvia leucophylla* and California sage—*Artemisia californica*—can be killed by the use of one to 1½ pounds of 2,4-D applied in 100 gallons of water per acre in May. This was on areas where regrowth of these species was about two feet high following a burn the previous fall.

Work in San Diego County on Manzanita—*Arctostaphylos* spp.—reveals that 2.08 pounds of isopropyl ester of 2,4,5-T per acre killed from 80% to 90% of the plants. This same concentration was ineffective when applied to scrub oak—*Quercus dumosa*—but resulted in a 75% to 90% kill of wild rose—*Rosa californica*.

Chamise and wedgeleaf ceanothus seem difficult to kill by spraying. In experiments in San Benito County a series of one-eighth acre plots containing both chamise and wedgeleaf ceanothus—*Ceanothus cuneatus* were sprayed with a ground rig. The brush was mature, ranging from one foot to 12 feet in height, with an average height of six feet.

At the time of spraying, approximately 25% of the chamise was in full flower while the ceanothus had completed flowering and was setting fruit.

The spray materials used consisted of: 1, sodium salt of 2,4-D in water; 2, sodium salt of 2,4-D in water plus diesel oil added in the proportion of one gallon of oil to twenty gallons of water; 3, butyl ester of 2,4-D in diesel oil and 4, diesel oil alone.

Sufficient solution was used so that plants were well wetted but not to the point where there was runoff or drip. Water solution was applied at 200 gallons per acre to achieve this. Oil was used at the rate of 120 gallons per acre.

From seven to 10 days after spraying, foliage had turned brown and plants appeared dead. This occurred on chamise and ceanothus when sprayed with only two pounds of 2,4-D per acre. The brown-

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Cereal Breeding

This is the fifteenth article in a series of brief progress reports on the application of the science of genetics to commercial agriculture.

investigations show awned wheat exceeds awnless in yield, kernel weight and test weight per bushel

Coit A. Suneson

The grain of the awned varieties of Baart wheat and of Onas wheat weighs about one pound per bushel more than the grain of the awnless varieties.

Regional tests during the years 1943 to 1945, and tests at Davis from 1943 to 1949 showed that yield per acre and individual kernel weight in either Baart or Onas averaged 5% to 8% higher when the variety had awns—the slender bristles which form the beard.

Awnless wheats are generally preferred by California growers. The choice of awnless wheat is largely related to personal convenience in handling, or for animal palatability.

The two series of tests illustrated two significant applications of the science of genetics to commercial agriculture.

The awnless or the awned condition in wheat may be interchanged by the trans-

fer of only two genes—those factors which determine the heritability of characters; such as disease resistance, conformation, color.

The gene transfer may be accomplished by several methods but in these studies two methods of hybrid population management were used.

An awned variety of Baart wheat and an awnless variety of Onas wheat were selected for use in the experiments. Baart is more widely grown than Onas although Onas has a higher yield under certain conditions.

An experimental hybrid wheat was obtained by crossbreeding the Baart and the Onas varieties.

The F_1 —first generation—hybrid was tip-awned. The second generation— F_2 —produced numerous awned segregates—specimens in which awn genes were pres-

ent so the plants bred true to the awned characteristic. At the same time and in the same generation, there were many specimen segregates which bred true for the awnless characteristic.

All the true breeding segregates of like type were mixed together—awned segregates in one mixture and awnless types in a second mixture. The mixtures were made without regard for qualities other than the contracted true breeding awn types.

No two plants in either mixture were exactly alike for all characters, but it was assumed that good and bad qualities from both parents were distributed at random in the two populations.

The two mixtures were tested for yield and compared with each other and the differences in performance observed at

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ing of the foliage was more rapid when the salt form of 2,4-D was used.

New growth in the form of sprouts was observed on the lower portions of many stems of chamise and ceanothus several months after spraying. These sprouts had extremely short internodes and an erratic growth form. After a period of approximately six weeks numerous sprouts dried and fell from the stems. Some plants appeared dead within six months after spraying.

In many cases subsequent examination, following the next growing season, revealed vigorous sprouting on the stems and from the basal portions of the plants.

Miscellaneous tests involving chemical sprays have been made in an endeavor to control sprouts of liveoak, scrub oak, and blue oak. Generally, results have been discouraging where various forms of 2,4-D have been used.

A spray mixture of diesel oil and a commercial brush killer has been reported to reduce oak stump sprouting by as much as 75% in a single application; but much remains to be learned as to how best to chemically control oak sprouts.

Observations made of various tests over the state point to the probability that poison oak—*Rhus diversiloba*—can be controlled by applications in the

spring—during period of vigorous growth—of 2,4,5-T and brush killers of formulations containing both 2,4-D and 2,4,5-T. Ammate also has been used effectively on poison oak.

Poison oak is frequently heavily browsed in the summer. Spraying of the regrowth in late summer may prove particularly effective on browsed poison oak.

Seedlings of Yerba Santa—*Eriodictyon californicum*—seem susceptible to the amine salt and isopropyl ester of 2,4-D at the rate of two pounds of active ingredient per acre, according to reports. In Ventura County these materials were tried on Yerba Santa and mature plants seemed moderately susceptible.

Solutions of 2,4,5-T and commercial brush killers have given promising results in the control of California blackberry—*Rubus vitifolius* C. & S. Best results have been obtained where sprouts were spring sprayed following burns or mowing.

Extensive California experiments have been conducted by many investigators on wild current—*Ribes* spp.—control with chemicals.

Chief objective of one series of trials was to test new formulations of growth-regulating substances on *Ribes* species not readily killed by 2,4-D.

The herbicide was applied by: spraying leaves and stems of intact plants; decapitating plants near the ground line

and applying phenoxy concentrate in oil or water to the freshly cut surface of the root crown, and; by applying phenoxy concentrate in diesel oil or kerosene to the intact basal stems.

Most *Ribes* species were killed effectively by all methods of treatment. 2,4,5-T proved to be significantly better than 2,4-D as a general purpose herbicide, being much less selective than 2,4-D.

Erratic results have been obtained by various workers in tests with 2,4-D and 2,4,5-T and combinations thereof on the following California species: juniper, sumac, southern California black walnut, coffee berry, lemonade berry, wild lico-rice, and elderberry. All appear to have some degree of susceptibility.

As yet chemical control has not found its exact place in the over-all brush control program. Much experimental work and field testing remains to be done.

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That portion of the foregoing article concerned with *Ribes* spp. is based upon work reported by H. R. Offord and V. D. Moses of the United States Department of Agriculture.