

# Delayed Kill of Interior Live Oak by Fall Treatment with 2,4-D and 2,4,5-T

WALTER E. EMRICK AND OLIVER A. LEONARD

*Madera County Farm Advisor, University of California; Associate Botanist, University of California, Davis.*

DENSE woodland stands of interior live oak (*Quercus wislizenii*) constitute a major problem on large areas of the rangeland and potential rangeland of the Sierra Nevada foothills. Attempts to clear stands of this species by controlled burning have generally been unsuccessful because of the ability of the trees to sprout from the trunk base below the soil line. In recent years, numerous tests of chemical herbicides have been conducted on this species.

In cut-surface applications, interior live oak has been found to respond more to 2,4-D than to 2,4,5-T. In foliage spray applications, however, combinations of the esters of 2,4-D and 2,4,5-T were more effective than the ester of 2,4-D alone. Many foliage applications of 2,4,5-T have resulted in a partial to complete topkill, followed by considerable sprouting. Three successive yearly applications have resulted in a high degree of kill.

Current recommendations by Leonard and Carlson (1954) for the control of this species include foliage spray application of four pounds acid equivalent of the combination of esters of 2,4-D and 2,4,5-T (brushkiller mixture) in 1 gallon of diesel oil and 98 gallons of water. Three successive yearly applications may be necessary to give a high degree of control.

The present study reports the results of foliage spray applications of 2,4-D and 2,4,5-T on 1-year-old sprout growth of interior live oak in tests conducted on the E. Moran Ranch in Madera County.

## Procedure

The sprouts selected for treatment originated from large trees which had been cut for wood, and the stumps burned about 30 years previous. The second growth was again cut for wood in 1949, and the stumps burned during the spring of 1950. A large number of sprouts had developed from each stump and had attained a height of two to three feet at the date of treatment, October 10, 1950. As many as 22 stems were counted in clumps around the original tree stumps. At the date of application, stem elongation had practically ceased and the sprouts were in full foliage.

Four herbicidal solutions were applied as foliage sprays on individual sprout clumps. The herbicides used were: (1) 2,4,5-T amine, (2) 2,4-D amine, (3) 2,4,5-T propylene glycol butyl ether ester, (4) 2,4-D propylene glycol butyl ether ester. Applications were made at the rate of two pounds of acid equivalent per 100 gallons of water. The sprays were applied with a power sprayer at 250 pounds pressure. The stumps and foliage of each clump of sprouts were thoroughly wet with one-half to three-quarters of a gallon of spray solution. A spreader-sticker consisting of free and combined fatty acids in odorless kerosene was used at the rate of one pint per 100 gallons. From 80 to 100 clumps of sprouts were sprayed with each of the spray solutions.

## Results and Discussion

The results of the foliage spray tests as observed in July, 1953 are

summarized in Table 1. Noticeable damage to foliage was not observed on any of the treatments until the spring following treatment. The amine of 2,4-D was considerably superior to the other herbicides tested in the percentage of clumps of live oak killed. The plants exhibited a delayed response to treatment with this herbicide. On October 10, 1952, only 5 percent of the clumps treated with 2,4-D amine were dead. At the last observation, nearly three years after treatment, 56% of the clumps were dead (Figures 1 and 2). The remaining living plants exhibited deformed growth, suggestive of the continued action of the herbicide. Delayed kill was much less pronounced for the other chemical treatments, and the plants showed little response to herbicides at the date of the last observation.

Unpublished experiments with radioactive 2,4-D placed on the underside of live oak leaves have demonstrated that the herbicide moves rapidly out of the leaves and downward in the bark during the dormant season. Furthermore, active root growth occurs at this time. It seems reasonable to assume that a maximum quantity of 2,4-D should be accumulated in the root system at a time when translocation is being directed downward. The active translocation during this period probably explains, in part,

**Table 1. Effects of foliage spray applications of 2,4-D and 2,4,5-T on 1-year-old sprouts of interior live oak. Plants treated October 10, 1950; observations made July 27, 1953**

Chemical Treatment	No. of clumps treated	Percent killed	Height of regrowth ft.
2,4,5-T amine	100	14	4-7
2,4-D amine	80	56	1-3
2,4,5-T ester	106	20	1-3
2,4-D ester	83	11	2-4
Untreated	100	0	6-8

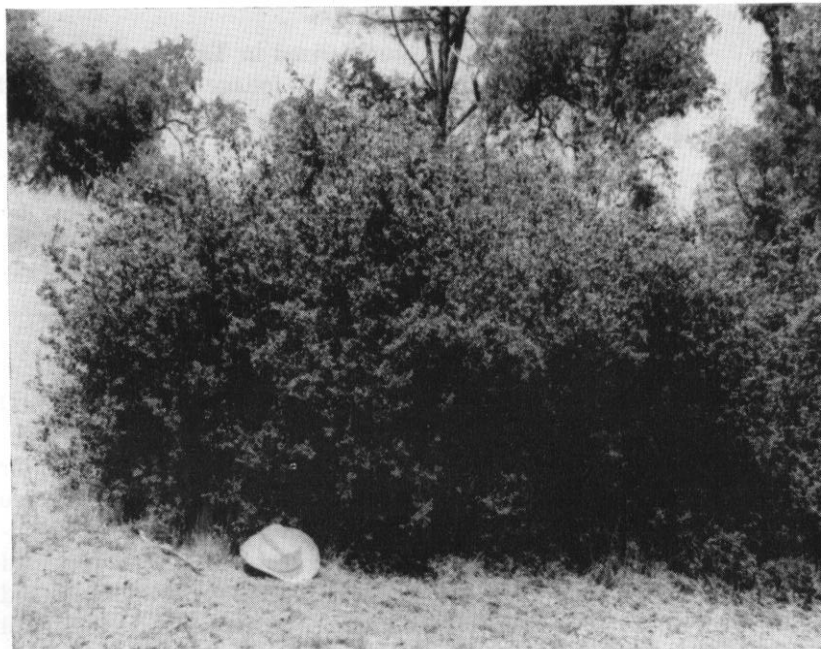


FIGURE 1. Three and one-half years of regrowth from an untreated stump of interior live oak.

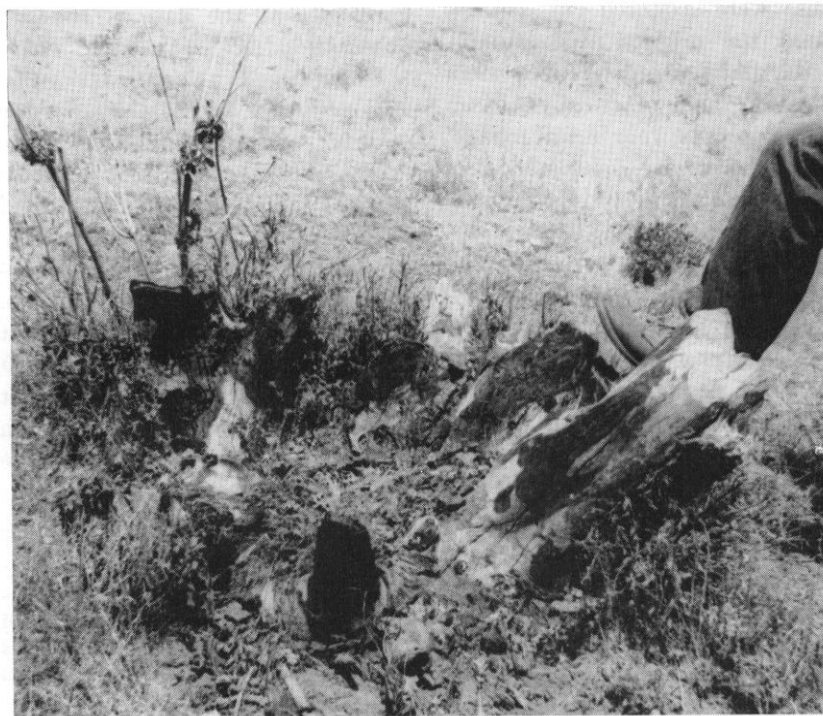


FIGURE 2. Live oak stump almost decomposed following treatment with the amine of 2,4-D.

the effectiveness of fall treatment in this species.

Maintenance of functional leaves following spray applications with hormone-type herbicides is an additional factor favoring effective treatment. The damage to living

leaf cells with the amine of 2,4-D is probably less than with the ester of 2,4-D because of the greater fat (plasma membrane) solubility of the latter.

Bark penetration is also a factor that may influence the herbicidal

action. When applied as basal sprays in diesel oil, the esters of 2,4,5-T have resulted in a greater kill of live oak than the esters of 2,4-D. In the present test, a slightly higher kill is noted with the ester of 2,4,5-T than with the ester of 2,4-D. These results are apparently due to the superior penetration of bark by 2,4,5-T ester and not to any inherent herbicidal superiority of this chemical. In cut-surface applications in which the factor of bark penetration is not involved, 2,4-D appeared to be more toxic than 2,4,5-T on live oak. The results from these tests will be reported at a later date.

### Summary

Foliage spray applications of 2,4-D amine in solutions containing two pounds of acid equivalent per 100 gallons of water were more effective in the control of 1-year-old sprouts of interior live oak than comparable rates of 2,4-D ester, 2,4,5-T amine and 2,4,5-T ester.

Death of most of the sprout clumps treated with 2,4-D amine occurred between two and three years following treatment. This delayed kill was much less pronounced for the other herbicidal treatments, and has not been previously observed on live oak.

The significant factors which contributed to the effective action of 2,4-D amine on interior live oak appear to have been:

- a. Application during the fall, after cessation of shoot growth.
- b. Use of a high-volume and high-pressure spray which assured wetting the underside of the leaves.
- c. Use of water-soluble growth regulators and additives in water which produced a minimum of contact kill of the leaf tissues.

### Literature Cited

1. LEONARD, OLIVER A. AND C. E. CARLSON. 1954. Chemical brush control techniques on California range lands. California State Division of Forestry Progress Report. (*In press*).