Chemical Control of Foothill Deathcamas[1]

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Foothill deathcamas (*Zigadenus paniculatus* (Nutt.) S. Wats.), a poisonous plant for cattle and especially sheep (U.S. Forest Service, 1937, p. W209), has required the exclusion of spring grazing on certain ranges to prevent livestock losses. Such restrictions in range utilization and management might be alleviated if herbicides could be used to eliminate the undesirable plants. Parker (Range Seeding Equipment Committee, 1959) summarized the available information on the chemical control of deathcamas species and advised that fair kills could be obtained with 2,4-D (2,4-dichlorophenoxyacetic acid) ester at 3.0 lb/A. Bohmont (1952) reported that 2,4-D ester at 3.0 lb/A applied at the bud to bloom stages of development killed virtually all old deathcamas plants and that 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) appeared to be less effective than 2,4-D. Blaisdell and Mueggler (1956) reported that foothill deathcamas was severely damaged by 2,4-D at 1.5 to 2.0 lb/A applied on large areas for controlling big sagebrush. Species differences and seasonal changes in the susceptibility of deathcamas to foliage sprays may be important in control recommendations.

The present paper includes data on mortality resulting from foliage sprays containing 2,4-D or 2,4,5-T applied to foothill deathcamas at various stages of vegetative and reproductive development. Strong seasonal changes in herbicidal effectiveness constitute new information that will be important to successful chemical control of this species.

Procedure

Two split-plot experiments were established with 4 replications in each and 6 spraying dates randomized by whole plots. In the first experiment the treatments were applied on April 30, May 14, June 2, June 13, June 23, and July 9, 1958, and in the second experiment the plots were treated on April 28, May 6, May 23, May 28, June 3, and June 10, 1959. The intervals between spraying were shorter in 1959 than in 1958 because the 1959 season was much drier than normal. Individual 1/50-acre subplots were sprayed with 2,4-D or 2,4,5-T propylene glycol butyl ether esters[2] at 1.5 or 3.0 lb/A emulsified in water containing 0.2 percent spreader[3] at a total spray volume of 10 gal/A. The spray emulsions were applied with a 4-nozzle (800067 tips), 4-foot, hand-held boom operated from a back-pack, compressed-air sprayer at 35 psi.

Both experiments were established on a deep pumice-pebble deposit having a weakly developed loamy-soil profile located about 2 miles west of Burns, Oregon, at an elevation of 4,300 feet in the foothills adjacent to the Ochoco National Forest. Precipitation at Burns in crop-year periods of September-June, inclusive, was 13.19 inches in 1957-1958 and 7.12 inches in 1958-1959 as compared with a median amount of 11.6 inches.

The vegetation on the experimental site included a shrub overstory of big sagebrush (*Artemisia tridentata* Nutt), bitterbrush (*Purshia tridentata* (Pursh) DC.), and occasional plants of *Tetradymia canescens* DC. and *Ribes cereum* Dougl. *Juniperus occidentalis* Hook is common to the area, but is intermitten in distribution. The herbaceous vegetation included Sandberg bluegrass (*Poa secunda* Presl), *Agropyron spicatum* (Pursh) Scribn. & Smith, *Stipa thurberiana* Piper, *Festuca idahoensis* Elmer, *Sitanion hystrix* (Nutt.) J. G. Smith, and foothill deathcamas.

The area was grazed by cattle during April, May, and June each year. All herbaceous plants including deathcamas were grazed closely by the end of June when the cattle were moved to higher elevation ranges within the Ochoco National Forest. Cattle poisoning was not evident, and deathcamas bulbs, which were located about 10 inches below the surface of the pumice-pebble material, apparently were not pulled by grazing animals.

The vegetative and reproductive development of deathcamas and associated species were observed at each date of spraying. The deathcamas on 8- by 80-foot strips centered within each subplot were counted a year after spraying. The largest treatment-mean density per subplot each year (120 in 1958 and 61 in 1959) was arbitrarily assigned a stand value of 100, and mean densities for other treatments were expressed in percentage comple-

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[1] *A contribution from Squaw Butte Experiment Station, Burns, Oregon. This station is financed cooperatively by the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Oregon Agricultural Experiment Station, Corvallis, Oregon. Technical Paper No. 1453, Oregon Agricultural Experiment Station.*

[2] *Esteron Ten-Ten and Esteron 245 O. S. were provided for this experiment by the Dow Chemical Company. The trade names given do not constitute preference or recommendation over comparable products.*

[3] *The spreader used was X-77, Colloidal Products Corporation, San Francisco, California.*

Table 1. Mortality of foothill deathcamas after spraying with 2,4-D or 2,4,5-T.

Dates of spraying	Mortality for indicated herbicides and acid rates (lb/A)								
	2,4-D		2,4,5-T		Means by acid rates		Means by herbicides		Grand mean
	1.5	3.0	1.5	3.0	1.5	3.0	2,4-D	2,4,5-T	
1958	(Percent)								
April 30	96	98	80	89	88	93	97	85	91[1]
May 14	90	94	68	75	79	85	92	72	82
June 2	38	45	30	11	35	28	42	21	31
June 13	22	38	6	20	13	29	30	12	22
June 23	20	22	4	10	12	16	21	8	14
July 9	4	4	13	0	8	2	4	7	5
1958 mean	45	50	33	34	39	42	48[2]	34	41
1959									
April 28	98	100	84	95	92	97	99[1]	90[1]	94[1]
May 6	100	100	80	90	90	95	100	85	94
May 23	85	94	48	34	67	64	89	41	66
May 28	76	89	20	16	48	52	82	18	51
June 3	62	84	38	15	51	49	72	26	49
June 10	41	52	0	7	20	30	48	3	25
1959 mean	77	87	44	43	61	64	82[2]	44	62

[1]Data groups that include significant variation (95 percent) have non-significant means connected by vertical lines.

[2]The difference between means by herbicides was highly significant (99 percent) each year.

ments and reported as mortality percentages.

Results and Discussion

Spraying dates and herbicides introduced highly significant differences in mortality each year, and the date by herbicide interaction introduced highly significant differences in 1959.

The mortality of foothill deathcamas was higher after spraying with 2,4-D at 1.5 lb/A than after spraying with 2,4,5-T at 3.0 lb/A on each date of application (Table 1). Nevertheless, time of spraying introduced the most important differences in mortality. The date by herbicide interaction in 1959 data resulted from a more rapid seasonal decline in the effectiveness of 2,4,5-T as compared with that of 2,4-D. The effectiveness of both herbicides decreased to virtually zero in 1958, when the spraying season was extended until the time of seed dissemination—one month later than in 1959.

Foothill deathcamas was highly sensitive to 2,4-D in vegetative-growth stages and became yellow and wilted within a week after spraying. The lack of significant difference between herbicide rates of 1.5 and 3.0 lb/A emphasizes the dominant importance of proper timing. Mortality with 2,4-D remained above 90 percent until the flower buds appeared and decreased rapidly during reproductive development (Table 2). Applications of 2,4-D at either 1.5 or 3.0 lb/A in late April and early May, when foothill deathcamas had 3 to 6 leaves, killed all plants except a few protected from the spray by an overstory of shrubs.

Table 2. Developmental stages of growth of foothill deathcamas and Sandberg bluegrass in 1958 and 1959.

Spraying dates	Foothill deathcamas	Sandberg bluegrass
1958		
April 30	3 or 4 leaves	heads low in boot
May 14	5 or 6 leaves	heads completely emerged
June 2	full bloom, partially grazed	late anthesis
June 13	full pods, heavily grazed	herbage curing
June 23	pods dry	herbage completely cured
July 9	seed shattering	herbage completely cured
1959		
April 28	4 to 6 leaves	heads in the boot
May 6	6 or 7 leaves	heads completely emerged
May 23	flower buds 2-3 inches high	early anthesis
May 28	early bloom, some grazed	full anthesis
June 3	late bloom	herbage curing
June 10	full pods, heavily grazed	herbage completely cured

The high sensitivity of deathcamas to 2,4-D during early vegetative development as compared with relatively high tolerance during reproductive stages of development is similar to the results obtained on low larkspur in previous trials (Hyder, Sneva, and Calvin, 1956). A rate of 1.5 lb/A of 2,4-D ester applied before the appearance of flower buds is sufficient for the control of foothill deathcamas. Since big sagebrush can be controlled effectively with 2,4-D ester at 2.0 lb/A applied as early as the head-emergence stage of development on Sandberg bluegrass (Hyder and Sneva, 1955), big sagebrush and foothill deathcamas may be controlled simultaneously by spraying at that time. Many desirable forbs also appear to be highly susceptible to 2,4-D during vegetative stages of growth; consequently, range areas need to be considered carefully before deciding whether and when to spray (Blaisdell and Mueggler, 1956).

The occurrence of complete grazing of foothill deathcamas without apparent pull-up of bulbs or poisoning symptoms indicates that deathcamas control might be unnecessary on the spring range selected for these experimental trials.

Summary

Spray applications of 2,4-D and

2,4,5-T at rates of 1.5 and 3.0 lb/A were made on 6 dates each during 1958 and 1959 to evaluate their effects on foothill deathcamas at various stages of vegetative and reproductive development. Applications of 2,4-D at 1.5 lb/A were more effective than applications of 2,4,5-T at 3.0 lb/A throughout the season. Foothill deathcamas was highly sensitive to 2,4-D during vegetative development, in late April and early May. Effectiveness remained high during the 3- to 6-leaf stage of development but decreased rapidly after the flower buds appeared.

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