

plants with roots not in water were controlled as expected. No other unusual treatments or results were noted.

The Poughkeepsie district has had continuing success in the control of poison ivy, using 2,4-D and water in the proportion of 1:200. Control has averaged about 90 percent.

The economy of efficient methods and equipment is indicated by data from the Babylon district. Two miles of roadside overgrown by brush to such an extent that shoulders were reduced in effectiveness was brushed out and the stumps sprayed on February 9 and 10, 1955. Cutting brush required 288 man-hours. Spraying with equipment provided only 30 psi. required 60 man-hours. Control was effective except for regrowth of sumac, honeysuckle, and smilax. A foliage spray was made on September 27, 1955, to control this regrowth and some additional depth of honeysuckle and smilax growing into trees. With equipment delivering 300 psi., this work required 4 man-hours. Control appears to be effective.

Sodium Arsenite

Control of brush on islands in the Chemung River as part of flood-control measures has been successful with the use of sodium arsenite since 1948. Effective control of ash coppice has been obtained by stump treatment. Stumps so treated disintegrated readily when bulldozed three years later. The methods of application and materials were those recommended by the Department of Forestry of Cornell University.

CHEMICAL WEED CONTROL on OHIO'S HIGHWAYS

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With so wide a general acceptance of the spray operation as a boon to roadside maintenance, overenthusiasm must be guarded against. Herbicidal material remains a potent and deadly force when applied to areas abutting, or misdirected into, fields, gardens, or home plantings containing susceptible plants or crops, with large damage claims resulting. Further, application to valuable plants on the right-of-way can arouse public criticism of the destructiveness of the material and operations. It is also necessary to guard against excessive use of the material, either by too many applications on any given area per season, or too high strength of mixture. It is not true that if some does a good job more will do better. This only raises costs and increases the danger of damaging nearby plants and property. Third, and very important, the spraying and mowing operations must be coordinated if a reduction in costs is to be realized. Failure to do so can make spraying just another added and costly operation.

The Ohio chemical weed-control program was started in 1945 when experiments were begun in use of herbicides to eradicate poison ivy. The following year areas that could not be mowed by power equipment were included. In 1947 a total of 850.17 miles were sprayed at a cost of \$14.62 per mile. The conclusions at the close of this short period were that time loss and suffering due to ivy poisoning were greatly reduced, the vegetation was more effectively controlled, and the right-of-way was cleaner and more economically maintained.

In 1951 it was decided to spray all the roadsides in an entire county. The 264.55 miles were sprayed at a cost of \$18.37 per mile. The program continued to expand because of results obtained.

In 1955 the Department made the greatest effort to date to lower the cost of

CHEMICAL WEED CONTROL: OHIO

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OHIO HERBICIDE WEED-CONTROL TOTALS

	Approx. Rural Highway Mileage	Miles Sprayed	Spray Costs	Mowing Costs	Average Cost per Mile for Spraying	Average Cost per Mile for Mowing	Combined Average Costs per Mile for Spray and Mowing	Gallons of Herbicide Purchased, 2,4-D and 2,4,5-T
(a) 1953								
Div. 1 1 county	159	153.72	\$ 2,337.88	\$ 16,682.77	\$15.21	\$108.53	\$123.74	350 D, 10 T
Div. 2 1 county	255	215.00	987.84	23,608.22	4.59	92.58	97.17	55 D
Div. 3 1 county	208	208.00	1,620.01	9,922.53	7.79	47.70	55.49	320 D, 105 T
Div. 5 3 counties	668	660.09	14,872.32	60,685.18	22.53	90.85	113.38	1,100 D, 330 T
Div. 7 4 counties	731	109.00	554.56	74,090.73	5.09	101.36	106.45	350 D, 50 T
Div. 8 6 counties	1,006	615.01	9,242.88	89,925.07	15.03	89.39	104.42	2,685 D, 275 T
Div. 9 1 county	195	131.00	4,582.73	22,598.02	34.98	115.89	150.87	440 D, 110 T
Div. 10 1 county	186	40.00	858.12	15,796.10	21.45	84.93	106.38	155 D
Div. 11 1 county	165	43.33	604.23	14,630.80	13.94	88.67	102.61	110 D, 220 T
Totals & Averages 19 counties	3,573	2,175.15	\$35,660.57	\$327,939.42	\$16.39	\$91.78*	\$108.17*	5,630 D** 1,160 T**
(b) 1954								
Div. 1 7 counties	1,389	1,339.67	\$ 22,877.61	\$ 91,990.23	\$ 17.08	\$ 66.23	\$ 83.31	2,550 D, 150 T
Div. 2 1 county	229	221.92	6,231.52	10,445.56	28.08	45.61	73.69	50 D, 10 T
Div. 3 3 counties	627	549.41	13,245.84	25,225.24	24.11	40.23	64.34	200 D, 50 T
Div. 4 2 counties	389	142.00	1,125.39	31,188.00	7.93	80.17	88.10	
Div. 5 7 counties	1,422	1,309.91	31,402.18	123,385.83	23.97	86.77	110.74	1,650 D, 550 T
Div. 6 1 county	187	100.00	738.42	30,185.67	7.38	161.42	168.80	
Div. 7 8 counties	1,486	518.43	8,152.17	141,277.67	15.72	95.07	110.79	1,500 D, 200 T
Div. 8 8 counties	1,314	1,236.10	28,442.55	100,474.29	23.01	76.46	99.47	3,000 D
Div. 9 6 counties	1,139	335.50	5,042.92	89,322.59	15.03	78.42	93.45	450 D, 350 T
Div. 10 4 counties	780	148.40	3,710.29	76,805.40	25.00	114.62	139.62	350 D, 50 T
Div. 11 3 counties	524	510.00	4,978.75	61,384.30	9.76	117.15	126.91	650 D, 300 T
Div. 12 1 county	178	104.23	513.24	17,639.39	4.92	99.10	104.02	
Totals & Averages	9,664	6,515.57	\$126,460.88	\$798,324.17	\$ 19.41	\$ 82.61***	\$102.02***	10,400 D 1,660 T
(c) 1955								
Div. 1 8 counties	1,389	1,342.23	\$ 15,624.99	\$ 83,106.27	\$ 11.64	\$ 59.83	\$ 71.47	2,800 D, 300 T
Div. 2 3 counties	650	614.67	15,657.59	27,821.74	25.47	44.59	70.06	
Div. 3 4 counties	826	679.05	16,987.47	41,020.97	25.02	49.66	74.68	100 D, 100 T
Div. 4 2 counties	507	386.62	11,446.53	29,737.68	29.61	58.65	88.26	50 D
Div. 5 7 counties	1,422	1,405.62	34,777.69	90,928.77	24.74	63.94	88.68	1,700 D, 600 T
Div. 6 3 counties	522	426.87	8,505.21	66,196.03	19.92	126.81	146.73	100 D, 25 T
Div. 7 8 counties	1,486	1,064.68	15,116.82	96,101.46	14.20	64.67	78.87	2,500 D, 400 T
Div. 8 8 counties	1,314	1,186.79	30,625.72	78,162.64	25.81	59.48	85.29	600 D, 200 T
Div. 9 5 counties	883	194.00	3,949.67	71,033.35	20.36	80.45	100.81	450 D, 350 T
Div. 10 9 counties	1,693	893.24	17,486.13	153,927.53	19.58	90.92	110.50	1,300 D†, 400 T†
Div. 11 6 counties	1,093	950.11	17,261.78	76,891.03	18.17	70.35	88.52	600 D, 200 T
Div. 12 1 county	178	150.39	3,874.85	14,440.20	25.77	81.12	106.89	
Totals & Averages 64 counties	11,963	9,294.27	\$191,314.45	\$829,367.67	\$ 20.58	\$ 69.33	\$ 89.91	10,200 D 2,475 T

*In 27 other counties throughout the state in which there was no spraying and for which mowing costs are available, the average cost per mile for mowing in 1953 was \$92.75.

**Including: Div. 4, 55 D and 55 T; Div. 6, 10 D and 5 T.

***In 15 other counties throughout the state in which there was no spraying and for which mowing costs are available, the average cost per mile for mowing in 1954 was \$117.89.

†Includes material purchased for dormant brush control in winter of 1954-1955. Costs of material and application not included in Division 10 report.

control of the growth of weeds and brush along the rural state highway right-of-way by herbicide weed spraying. Sixty-four counties participated in the program, and one or more spray applications were made to 9,294 miles of roadsides of the 15,996 miles of the rural mileage in these counties, at a cost of \$191,314.45.

The accompanying table gives a detailed breakdown of this operation, with summaries included for 1953 and 1954. It will be noted that the average cost of spray treatment per mile per season has risen each year: from \$16.39 in 1953, to \$19.41 in 1954, to \$20.58 in 1955. This is due chiefly to more intensified effort to cover the right-of-way completely with spray and to more widespread use of the multiple-type spray program. Of greater interest, however, is the lowering of mowing costs. In 1953 it cost \$91.78 per season to mow each mile (both sides) that was sprayed. In 1954 it cost \$82.61 per mile per season's mowing of sprayed road, against \$117.89 per mile in counties not sprayed. In 1955 the average mowing costs on sprayed roads dropped still further to \$69.33. However, the true cost per mile should be obtained by combining the spray and mowing costs. In 1953 these combined costs were \$108.17 per mile, \$102.02 per mile in 1954, and \$89.91 per mile in 1955. When the rise in labor costs over the past three years is taken into account, the lowering of mowing costs is even greater.

There are other operational costs proportionately lower with reduced mowing. One division which sprayed 53 percent of its rural mileage in 1955 estimated a saving of \$3,000 in the maintenance and repair of the mowing equipment, plus the fact that more labor time can be spent otherwise. The program established the facts that the roadsides need less mowing, that hand mowing is almost entirely eliminated, and that the roadsides present a neater appearance.

Large damage claims can result if the spray reaches susceptible plants in fields, gardens, or home plantings. In the past year Ohio had a total of 37 damage claims. Nineteen occurred on the 3,752 miles of contract spraying. Of these, seven were for cattle, five for trees and shrubs, five for vegetables, and two for crop damage. Eighteen occurred on 6,542 miles of force-account spraying. Of these, three were for cattle, five for trees and shrubs, six for vegetables, and four for crop damage. After contacting the owners, two of the field-crop and two of the vegetable claims were dropped. By quick action and cooperation of the State Veterinarian, the cattle were diagnosed as having died from other causes not due to spray. We have yet to be found guilty of killing cattle. These findings will be made available for the personnel doing the spraying and for all local veterinarians.

Will such a program meet the needs of other state highway departments? This will depend on the extent to which they develop it and their knowledge of some of the problems. Qualified personnel will have to be trained, as the success of the operation depends greatly upon how well-informed are the men who are actually doing the spraying.

When a spray program is adopted, consideration will have to be given to contract vs. force-account spraying. The advantages of contract spraying are lower costs, greater saving on equipment, speed of application, and claims for damage handled by contractor. For force-account spraying they are control, application to all needed parts of right-of-way, and heavier application where needed, but criticism and complaints from organizations and individuals will have to be answered and claims for damages will have to be met.

Based on the success of herbicide control on Ohio's roadsides, the following recommendations can be made:

1. That a three-year program of three sprays per season be used.

2. That the first spray be applied early in the season and that the mixture contain a minimum of 3 lb. acid equivalent of a polypropylene glycol butyl ether ester or a butoxyethanol ester of 2,4-D per 100 gal. of water at a minimum rate of 100 gal. per mile ($2\frac{1}{2}$ to 3 acres).
3. That the second application be made by July 1 and contain 2 lb. of 2,4-D, and 1 lb. of 2,4,5-T.
4. That the third spray be applied before September 1 and contain 3 lb. of 2,4-D.
5. That the equipment be prequalified 1,000-gal. sprayers.
6. That after a three-year period only one application per year be made.
7. That trained crews and accurate amounts of material be used and that wind, atmospheric conditions, and susceptible vegetation be considered.
8. That, prior to spraying, the areas should be investigated and that slopes subject to erosion should not be sprayed. Likewise, desirable vegetation should be designated not to be sprayed.
9. That spraying and mowing operations be coordinated and a fertilizing program be included.
10. That when cattle claims arise, close coordination be the rule with the State University and with the Department of Agriculture, especially the Veterinary Division.
11. That all damage claims should be investigated.
12. That no opportunity be overlooked to promote good public relations. Publicity should stress safety, economy, and efficiency.

OREGON'S HERBICIDE PROGRAM

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The Oregon State Highway Department is confronted with a dual problem in the control of vegetation on its rights-of-way. First, it is concerned with the control of vegetation that is detrimental to drainage areas, obstructs sight distance, or otherwise interferes with the operation and maintenance of highways. Second, it is obligated by law to control vegetation that has been declared noxious to agricultural crops, although these species may actually be of benefit in controlling erosion on highway slopes.

Prior to introduction and use of translocated herbicides, undesirable vegetation had to be removed by costly hand methods. In the moist western section of the state regrowth and natural reseeding of trees and shrubs were vigorous, normally requiring recutting within a five-year period. Consequently, the introduction of herbicides which could be utilized to eradicate unwanted vegetation through mechanized operations was welcomed. Their use, first on an experimental basis and then more generally, was successful in killing vegetation, but, through overzealousness and lack of experience of operators, criticism of the method was received from the public. A restudy of the value and use of herbicides on highway rights-of-way was made and a basic policy formulated and adopted.

Simply stated, Oregon's maxim is: "Cut, then spray." Spraying of green foliage in excess of 3 feet in height is prohibited except in the species of poison