Ground Treatments for Control of Winged Elm on Rangeland

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Highlight

A few soil, basal bark, and foliar-applied herbicides caused good control of small winged elm trees but many did not. However basal injection treatments appeared to be very promising. Undiluted injected herbicides were very successful. Picloram and 2,4,5-T generally gave the best results.

Woody plants severely compete with native grasses on eastern Oklahoma rangeland. Brush control has been focused primarily on the scrub oaks (*Quercus* spp.) because of their dominance in the area. The present recommendation of 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) for brush control is fairly satisfactory for control of the oaks. However, once the oaks are removed, winged elm (*Ulmus alata* Michx.) often becomes a dominant species. Winged elm is a prolific seed producer and is resistant to aerial treatment with 2,4,5-T (Kirby, 1964). Since winged elm cannot presently be controlled by aerial treatments, other methods and herbicides must be found to control this species. Ground control methods, such as injection, basal bark spray, soil treatments, and foliage wetting spray are some of the possibilities.

To some degree winged elm less than 10 ft tall could be controlled by basal bark treatments (Behrens et al., 1961). It has been suggested that control could be achieved by injecting 5 ml of a 1:9 dilution of 2,4,5-T ester in diesel oil per injection (Peevy, 1964). Winter injection may be superior to spring injection (Smith, 1966). Foliar treatment of picloram (4-amino-3,5,6-trichloropicolinic acid) gave satisfactory control where 2,4,5-T did not (Watson and Wiltse, 1964).

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Table 1. Percent defoliation of winged elm at various intervals after basal spray treatment with various herbicides.

			Percent Defoliation			
			1963-1964		*1965-1966*	
	Height	*Rate*	Weeks after tmt.		Weeks after tmt.	
Herbicide	ft	aihg[1]	34	84	28	71
2,4,5-T ester	2	16	100	100	—	—
2,4,5-T ester	4	16	100	90	—	—
2,4,5-T ester	6	16	100	100	100	100
2,4,5-T ester	12	16	76	72	67	89
2,4,5-T amine	12	16	0	49	11	18
2,4-D ester	12	16	5	31	—	—
Picloram	12	6	—	—	34	41
Picloram	12	8	—	—	65	67
Tordon 101	12	7.5	—	—	24	33
Tordon 101	12	10	—	—	43	56
Untreated	12	—	0	0	0	0

[1] aihg is the abbreviation for active ingredient per hundred gallons of carrier.

Materials and Methods

Two sites in southern Oklahoma were selected for this study. One was an undisturbed area in which winged elm was the dominant species. Spring injection and foliar treatments were applied here. The winter injection, basal bark, and soil treatments were applied in an area where winged elm was the understory species. The basal bark treatments were applied in diesel oil using a hand sprayer, spraying the lower 8 to 10 inches of the trunk until runoff. The treatments are listed in lb active ingredient/100 gal (aihg) of carrier. The treatments were applied December 21, 1962, and December 29, 1964, to at least 10 replications.

The soil treatments were applied as commercially available herbicides with the exception of the dicamba (2 methoxy-3, 6-dichlorobenzoic acid) liquid. Picloram was used as the 10% granule and fenuron (phenyldimethyl urea) was a 25% granule (gran). Granular dicamba was applied around the base of the tree without concern for tree size. The liquid dicamba (liq) was applied at the rate of 4 lb aihg in water to an area within 6 inches of the trunk. Fifty-seven ml of solution was applied to the soil per inch diameter breast high (dbh) of the tree.

Winter injection treatments were applied using diesel oil or water as a carrier. The trees were notched with one notch/ft dbh, using a Ruell Little Injector and then 5 ml of solution was applied to each notch with a syringe. The treatments were applied December 21, 1962 and December 29, 1964 to at least 10 replications.

Spring injections were applied on March 26, 1965. A comparison was made between diluted and undiluted herbicides, using water as the diluent. 5 ml of diluted material were applied to each cut. Undiluted materials were applied at one and two ml per notch, with the exception of picloram which was applied at 0.15 and 0.30 ml per notch.

The foliage-wetting treatments were applied with a hand sprayer, using water as a carrier. Herbicide was sprayed on until it began to drip from the foliage. The various mixtures used were combinations of 2,4,5-T ester and additives which it was hoped would enhance activity or act as a penetrant. Paraquat (1,1'-dimethyl-4,4'-dipyridylium cation), picloram and ammonium thiocyanate (NH_4CNS) were used as additives. Treatments were applied June 6, 1963 and June 2, 1965.

The rate of each herbicide is listed in each treatment. The evaluation of a herbicide was based on percent defoliation of the trees compared to

Table 2. Percent defoliation of winged elm with soil applied herbicides, at various intervals after treatment.

			Percent Defoliation			
			1963-1964		*1965-1966*	
			Weeks after tmt.		Weeks after tmt.	
Herbicide	Form	Rate	48	64	28	71
Fenuron	gran.	1279 lb/A	79	86	41	39
Dicamba	gran.	2 tblspn/tree	69	84	14	14
Dicamba	gran.	4 tblspn/tree	—	—	22	21
Picloram	gran.	1.5 lb/A	—	—	55	34
Picloram	gran.	2.5 lb/A	—	—	55	34
Picloram	gran.	10 lb/A	100	100	90	100
Dicamba	liq.	4 lb aihg	87	75	—	—
Dicamba	liq.	8 lb aihg	100	97	—	—
Untreated	—	—	0	0	0	0

Table 3. Comparison of percent defoliation from several herbicides for the control of winged elm by basal injection. All herbicides used at 40 lb aihg in diesel oil.

	1963-1964		*1965-1966*	
	Weeks after tmt.		Weeks after tmt.	
Chemical	18	65	28	71
2,4,5-T amine	70	99	88	97
2,4-D ester	85	100	100	100
2,4,5-T ester	50	62	100	100
Dacamine 2,4,5-T	88	100	100	100
Dacamine 2,4-D	—	—	90	92
Picloram	—	—	100	100
Tordon 101	—	—	95	91
Picloram + 2,4,5-T	—	—	100	89

an untreated check. Ten to 30 trees were treated with each treatment.

Another study was concerned with the effect of the stage of leaf development on control. The plants were treated when the leaves were approximately half developed and at full leaf development. The treatments were applied as a foliage wetting spray using water as a carrier in a hand sprayer. The trees were sprayed until runoff occurred on the leaves. Treatments were applied April 28, 1965 and June 9, 1965, respectively.

Results and Discussion

The use of basal bark treatments to control trees 12 ft high or taller was not very satisfactory (Table 1). However, the use of diesel oil as a carrier may have been part of the problem since the amine form of 2,4,5-T was a water soluble rather than an oil soluble formulation. Picloram and Tordon 101 (a 4:1 commercial mixture of 2,4-D (2,4-dichlorophenoxyacetic acid) and picloram) both settled out very rapidly in diesel oil. Control of 2, 4, and 6-ft trees was very good with 2,4,5-T ester.

The soil treatments were also somewhat erratic (Table 2). This can be seen in the comparison of fenuron at the two different dates. Dicamba showed promise in 1963 but not in 1965. The use of picloram resulted in excellent control at 10 lb/acre, and was only slightly poorer at 5 lb/acre both years. The dicamba soil spray treatment should have been continued since the higher rate gave satisfactory results.

An attempt to dilute 2,4,5-T ester with water or oil beyond the normally used concentration (1:9, or 40 lb aihg) was not conclusive as far as water was concerned. Dilutions of 40, 20 and 13 lb aihg (1:9, 1:18, 1:27) in water and in oil were tried. In oil there was 100% defoliation after 71 weeks with all dilutions, both in 1963-64 and in 1965-66 treatments. However, water dilutions were less successful in 1965-66 than in 1963-64. One hundred percent defoliation was obtained with all water dilutions in 1963-64. The 40 lb aihg treatment caused this in 1965-66, but the others varied from 65 to 92% defoliation.

Several herbicides were compared in an effort to find one which might be more consistent than 2,4,5-T ester in diesel oil for control of winged elm by basal injection (Table 3.). The use of both 2,4,5-T amine and 2,4-D ester resulted in good control. Picloram and Dacamine 2,4,5-T (an oil soluble diamine formulation) also caused excellent control.

As the use of diesel oil adds to the cost of the treatment, an experiment was done using water as a carrier. Also, the carrier is often the most bulky portion of the treatment so undiluted herbicides were included in the tests. The trees were treated in spring just prior to leaf initiation. 2,4-D amine, 2,4,5-T amine, picloram, and dicamba all were effective when diluted in water. However, all these plus 2,4-D ester, 2,4,5-T amine and cacodylic acid were just as effective undiluted. It appears that the cost of purchasing and hauling a carrier can be avoided. In addition 2,4-D amine is inherently cheaper than the other herbicides now being used. Generally the undiluted injection was more effective than the same herbicide used in the diluted form (Table 4).

Several herbicides, alone and in combinations, were applied as foliage wetting sprays. Picloram at 0.5, 1 and 2 lbs aihg proved to be the most satisfactory, causing 88 to 92% defoliation 1 year after treatment. 2,4,5-T at 4 lbs aihg

Table 4. The use of water-diluted and undiluted herbicides as spring injection treatments for control of winged elm; percent defoliation at 4 and 56 weeks after treatment.

	Diluted			*Undiluted*		
	Dilution[1]	Weeks after tmt.			Weeks after tmt.	
Chemical	(aihg)	4	56	rate/cut	4	56
2,4,5-T ester	40	0	2	1 ml	30	82
2,4,5-T ester	20	0	7	2 ml	38	84
2,4-D amine	40	83	90	1 ml	88	100
2,4-D amine	—[2]	—	—	2 ml	98	100
2,4-D ester	40	35	35	1 ml	76	94
2,4-D ester	—	—	—	2 ml	82	100
2,4,5-T amine	40	73	96	1 ml	84	100
Picloram	20	100	100	0.15 ml	96	100
Picloram	10	98	100	0.3 ml	100	100
Cacodylic acid	40	86	71	1 ml	100	100
Cacodylic acid	—	—	—	2 ml	100	100
Dicamba	40	88	99	—	—	—
Dicamba	20	86	97	—	—	—
Paraquat	40	8	43	—	—	—
Paraquat	80	7	57	—	—	—
Tordon 101	—	—	—	1 ml	95	100
Tordon 101	—	—	—	2 ml	95	100
Untreated	—	0	0	—	0	0

[1] 5 ml/cut
[2] no treatment applied

only caused 65% defoliation. The addition of 0.4 lb ammonium thiocyanate did not increase the control. ½ lb (aihg) of picloram or 0.25 lb of Paraquat added to the 2,4,5-T increased the defoliation obtained to 85%. 2,4-D, with and without picloram at 0.5 lb aihg caused from 65 to 78% defoliation one year after treatment.

Picloram, 2,4,5-T, 2,4-D and combinations of picloram with 2,4-D and 2,4,5-T were applied as foliar sprays to trees which the leaves were either in the half-leaf or the full leaf stages of development. In general the defoliation (46 weeks after treatment) was from 3 to 21% better where trees were treated in the half leaf stage, with an average of 9%. Picloram was the most satisfactory treatment.

Summary

Research was conducted to develop procedures for ground control of winged elm. Soil treatments, basal bark treatment, winter and spring basal injection treatments, and foliar wetting treatments are used. Basal bark treatments appear to be satisfactory only on smaller trees with 2,4,5-T in diesel oil the most promising herbicide. Picloram (granular and spray formulations) and the dicamba spray were the only satisfactory soil surface treatments.

The injection treatments were superior to all other methods. Winter injection using 2,4,5-T in diesel oil or water was very good. The amine and oil soluble diamine formulations of 2,4,5-T in diesel oil and picloram also caused good control. The spring injection treatments indicated that undiluted herbicides have considerable potential for winged elm control. Picloram, dicamba, 2,4-D amine, and 2,4,5-T amine gave satisfactory results when diluted in water rather than oil, and even better results when used undiluted.

The results of this study indicate that the injection method is probably the most satisfactory for ground treatments even though considerable labor is required. Undiluted herbicides appear to hold greatest promise for rancher use due to the reduced volume. Picloram showed considerable promise as a herbicide in all methods of treatment. Further research is needed on the time of foliar treatment and the use of undiluted herbicide in all methods of treatment.

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1966 NATIONAL REGISTER STATISTICS

A biennial survey conducted by NSF indicates that in 1966 the highest median salaries among 243,000 scientists were reported by economists ($13,100), statisticians ($12,800), and physicists ($12,500). Lowest median salary ($10,000) was reported by scientists working in agricultural sciences and linguists.

The median for all scientists responding to the inquiry was $12,000, an increase of $1,000 over the figure reported for 1964.