Controlling Bitterweed with Fall and Winter Applications of 2,4-D Amine

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Highlight: *Bitterweed can be effectively controlled in central Texas with 2,4-D (2,4-Dichlorophenoxyacetic acid) amine between November 1 and January 15. To minimize damage to associated annual forbs, 2,4-D should be applied in late December or January. A rate of ½ to 1 lb a.e./acre of 2,4-D will give excellent control of bitterweed. However, spraying with 2,4-D has no long-term benefits under a good range management program. Its primary value is to kill bitterweed during wet winters when it is abundant. This minimizes death losses of sheep and increases the vigor of perennial grasses for 1 or 2 years.*

Bitterweed (*Hymenoxys odorata*) was first recognized as a poisonous plant in 1922 (Sperry, 1949) and has been a serious problem in central Texas for many years. Death losses of sheep average 1 to 6% annually (Sultemeier, 1961). Although it is a problem primarily in central Texas, bitterweed is a native of the United States and is found in central and west Texas, western Oklahoma, and eastern and southern New Mexico (Sperry, 1949).

Good range management has been the best method to control bitterweed (Sperry, 1949). Keeping the soil covered with grass will reduce the problem (Sperry, 1941; Vance, 1958). Despite this recommendation by several researchers, many ranchers in the Edwards Plateau region still have periodic bitterweed infestations. Infestations often occur after grass cover has been reduced by drought, even though a range is being properly managed.

Spraying with an ester formulation of 2,4-D (2,4-Dichlorophenoxyacetic acid) in the pre-bloom or early flowering stage is currently the recommended control measure for dense bitterweed infestations (Sperry and Sultemeier, 1965). But, by this time many sheep may have died from bitterweed poisoning. Recent research by Chambers and Wright (1972) showed that bitterweed can be killed before serious sheep losses occur if 2,4-D amine is applied before February 1.

The following study was designed to determine (a) how early in the fall and winter 2,4-D amine could be applied to obtain a satisfactory kill of bitterweed, (b) the minimum rate of 2,4-D amine required, and (c) whether spraying could be used to accelerate the replacement of bitterweed with perennial grasses.

Methods

Spray treatments were conducted in 1970-71 and 1972-73 on the Hal Noelke Ranch, 45 miles west of San Angelo, Texas. Vegetation in 1970 was in fair condition and consisted primarily of red grama (*Bouteloua trifida*), threeawns (*Aristida* spp.), buffalograss (*Buchloe dactyloides*), tobosa (*Hilaria mutica*), bitterweed, and various annual forbs. The ranch had a history of heavy grazing, but a four-pasture deferred rotation system was put into effect in 1969.

The study was conducted on a bottomland site of the Nuvalde clay loam series. This soil is moderately deep, underlain with limestone or caliche. Topography of the area is gently rolling. Annual precipitation averages 19 inches.

Methods of application and preliminary results of the 1970-71 study were reported by Chambers and Wright (1972). Only the long-term effects of the 1.25 and 2.50 lb a.e./acre of 2,4-D amine treatments applied on January 10, 1971, will be included in this report. This information answers the question as to whether the control of bitterweed plants can speed up succession in bottomland sites that have a thin stand of resident perennials.

The experimental design used in 1972-73 was a completely randomized split-plot with 4 replications, 4 dates of application, and 5 rates of application. The dates of application were September 1, 1972, October 15, 1972, December 1, 1972, and January 15, 1973. The treatments included four rates of 2,4-D amine—0.5, 1, 1.5, and 2 lb a.e./acre—and a control. They were applied on 25 X 25 ft plots. To evaluate rates of application on a larger scale, the 1, 1.5, and 2 lb a.e/acre rates were aerially applied to 100 acre tracts on October 24, 1972. Information from these trials provided answers to questions

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Table 1. Bitterweed yield (lb/acre) on May 23, 1973, one growing season after application of 2,4-D amine at various rates.[1]

Dates	Treatments (lb a.e./acre of 2,4-D) 0	0.5	1	1.5	2
Sept. 1	149[2] a	100 a	357 a	126 a	251 a
Oct. 15	149 a	267 a	79 a	59 a	1 b
Dec. 1	149 a	2 b	42 b	2 b	0 b
Jan. 15	149 a	6 b	34 b	15 b	1 b

[1] Means within a row followed by the same letter are not significantly ($P < .10$) different.
[2] An average for 160 plots from all control treatments (Sept. 1 to Jan. 15).

Table 2. Plant measurements on May 23, 1973, one growing season after aerial spraying on October 24, 1972.[1]

Plant measurements	Treatments (lb a.e./acre of 2,4-D 0	1	1.5	2
Bitterweed yield (lb/acre)	351 a	2 b	2 b	2 b
Grass cover (%)	58 a	66 a	74 a	78 a
Frequency of all forbs (%)	114 a	58 b	74 b	64 b
Frequency of desirable forbs (%)	106 a	56 b	72 a	62 b

[1] Means within a row followed by the same letter are not significantly ($P < .10$) different.

about season and rate of 2,4-D amine application.

Herbicide solutions for both ground and aerial application were mixed with water to a total volume of 3 gal/acre. Herbicides were applied to the plots with an 80-inch boom mounted on bicycle wheels. The nozzles, spaced at 20-inch intervals, contained 100-mesh screens. Nitrogen gas was used to regulate pressure. The aerial applications were applied commercially with standard equipment.

On May 23, 1973, bitterweed was clipped from ten 1.2 ft^2 plots per replication. Also, cover of grasses by species was estimated on each of the ten plots per replication, and frequency of all species was measured. On the large aerial sprayed tracts, ten 1.2 ft^2 plots were sampled on each of five stands in each treatment. The yield data were normalized with a $\sqrt{X + 1}$ transformation before analysis. Frequency data were analyzed using a Chi-square analysis.

Results and Conclusions

Based on bitterweed yield data from the hand-sprayed plots and aerial-sprayed tracts (Tables 1 and 2), November 1 to January 15 is the best time to spray bitterweed with 2,4-D amine. No rate of 2,4-D killed bitterweed when applied in September and only the 2 lb a.e./acre rate was effective when applied on October 15 (Table 2). However, all rates were effective when applied in late October, December, and January.

The September 1 and January 15 applications of 2,4-D did the least damage to the forbs that are important forage for sheep (Table 3).

Similar results were reported by Chambers and Wright (1972) for the January 15 application. Thus, to control bitterweed with minimum damage to the desirable forbs, we recommend spraying bitterweed in late December or early January. The 0.5 lb a.e./acre of 2,4-D amine seems adequate and the 1 lb a.e./acre treatment is more than adequate to kill bitterweed.

The long-term effect of spraying on grass cover was not significant (Table 4). There was a 200% increase in cover for all treatments between 1970 and 1973, but this was attributed to the deferred rotation grazing system initiated in 1969. This supports Sperry's (1949) and Vance's (1958) findings that good range management is the best method to control bitterweed.

High rates of 2,4-D will have a long-term detrimental effect on associated forbs (Table 5). Since forbs are important to sheep, it is best to keep spray rates at 1 lb a.e./acre or less.

If a rancher is using a good range management program, there are no long-term benefits from spraying bitterweed. However, there are short-term benefits. Spraying dense patches of bitterweed during "bitterweed years" will minimize livestock losses. It will also help conserve winter moisture for early spring growth of grasses and thereby increase the vigor of perennial grasses for one or two growing seasons. Where no perennial grasses exist, spraying suppresses bitterweed for only 1 to 2 years.

Table 3. Frequency (%) for all forbs except bitterweed one growing season after application of 2,4-D at various rates and dates of application in 1972-73.[1]

Date of application	Treatments (lb a.e./acre of 2,4-D) 0	0.5	1	1.5	2
Sept. 1	41[2] a	35 a	18 b	30 a	60 a
Oct. 15	41 a	22 a	20 a	40 a	18 b
Dec. 1	41 a	18 b	18 b	12 b	12 b
Jan. 15	41 a	32 a	45 a	28 a	25 a

[1] Means within a row followed by the same letter are not significantly ($P < .10$) different.
[2] An average for 160 plots from all control treatments (Sept. 1 to Jan. 15).

Table 4. Cover (%) of grasses before treatment (1970) and 3 years after treatment (1973).

Treatments (lb a.e./acre of 2,4-D)	Year 1970	1973
0	14	62
1.25	20	57
2.50	19	74

Table 5. Frequency (%) of all forbs except bitterweed on May 23, 1973, one and three growing seasons after application of spray treatments.[1]

Treatments (lb a.e./acre of 2,4-D)	Year 1971	1973
0	15 a	92 a
1.25	14 a	95 a
2.50	15 a	48 b

[1] Means within a row followed by the same letter are not significantly ($P < .10$) different.

Literature Cited

Chambers, R. C., and H. A. Wright. 1972. Early winter chemical control of bitterweed. Proc. of Southern Weed Sci. Soc. 25:320-323.

Sperry, O. E. 1949. The control of bitterweed (*Actinea odorata*) on Texas ranges. J. Range Manage. 2:122-127.

Sperry, O. E., and G. W. Sultemeier. 1965. Bitterweed...its control in relation to soil moisture. Sheep and Goat Raiser. 2(3):122-127.

Sultemeier, G. W. 1961. Responses of bitterweed (*Hymenoxys odorata*) to 2,4-D in relation to soil moisture. MS Thesis. Texas A&M Univ., College Station, Texas. 68 p.

Vance, J. E. 1958. Controlling bitterweed. Texas Agricultural Progress. 4:17, 19.