Redberry Juniper Control with Soil-Applied Herbicides[1]

C. J. SCIFRES[2]

Assistant Professor, Department of Range Science, Texas A&M University, College Station.

Highlight

Soil-applied picloram was more effective than dicamba for control of redberry juniper in northwest Texas. From 0.02 to 0.08 oz picloram pellets per ft of canopy diameter killed over 95% of redberry juniper foliage by a year and 100% by 2 years after treatment. From 0.041 to 0.08 oz/ft dicamba controlled about 30 to 40% of the redberry junipers 1 and 2 years after treatment. Monuron did not control redberry juniper.

Control de Enebro de Fruta Roja con los Herbicidas Granulados Aplicados en el Suelo.

Resumen[3]

El estudio se llevó a cabo en el Noroeste de Texas, E.U.A. para determinar la efectividad de los granulados de picloram, dicamba y monuron aplicados en el suelo sobre el control de enebro de fruta roja (*Juniperus pinchoti* Sudw.).

Picloram fué más efectivo que dicamba y monuron no fué efectivo.

Dosis de 0.02 a 0.08 onzas de los granulados de picloram por pié de diámetro de cubierta de cada planta resultó en 95% de arbustos muertos un año después de la aplicación.

Various species of *Juniperus* were estimated to occupy more than 21.5 million acres of Texas rangeland in 1964 (Smith and Rechenthin, 1964). This represents an increase of more than 3.5 million acres in 15 years. Primary problem junipers on rangeland are redberry juniper (*Juniperus pinchoti* Sudw.), blueberry juniper (*J. ashei* Buchholz) and eastern redcedar (*J. virginiana* L.).

Blueberry juniper occurs mostly on limestone sites of the Edwards Plateau (Smith and Rechenthin, 1964). It is also listed as one-seeded juniper (*J. mexicana* Spreng.) by Fernald (1950) with copper colored to dark blue fruit. This species may be used for fence posts and is sometimes referred to as "post cedar" (Smith and Rechenthin, 1964).

Eastern redcedar is distributed from southern Maine to northwestern Texas and hybridizes freely with Rocky Mountain juniper (*J. scopulorum* Sarg.) in certain areas (Van Haverbake, 1968). Hybridization of *Juniperus* in Texas has not been reported.

Redberry juniper produces bright red fruit and is most common in north and west Texas. It usually occurs as many-stemmed bushes (Fig. 1). Evidently there are few practical uses for redberry juniper wood.

At one time, junipers evidently were restricted primarily to shallow, rocky sites on well-drained slopes called "cedar brakes." Ellis and Schuster (1968) found that north-facing, midslopes were the centers of distribution of redberry juniper on an isolated butte in Texas. Initial establishment probably occurred on the slopes around 1800. About 10% of the trees infesting lower portions of the slope was established in the last 15 years. Mason and Hutchings (1967) found that Utah juniper (*J. osteosperma* (Torr.) Little) produced more foliage and fruit-per-unit crown spread on upland, shallow hardpan sites than on more mesic sites. The recent invasion of fertile, lowland ranges by redberry juniper observed across Texas has been attributed to the cessation of fire (Ellis and Schuster, 1968).

Dozing is effective for redberry juniper control (Rechenthin et al., 1964). Sprays of chlorophenoxy acid herbicides are usually ineffective. Robison and Cross (1969) reported aerial sprays of 4-amino-3,5,6-trichloropicolinic acid (picloram) were ineffective but that broadcast applications of 2 or 4 lb./acre of picloram pellets controlled redberry juniper. Objectives of this study were a) to compare the effectiveness of various herbicides in dry formulations and b) to establish dosage rates of each required for lethality of individual trees.

---

[1] Published with approval of the Director, Texas Agricultural Experiment Station, as Technical Article 9252. Received July 9, 1971.

[2] This study was conducted on the 6666 Ranch, Guthrie, Texas. The technical aid of J. C. Halifax, Russ Hahn and John Brock, Texas Agricultural Experiment Station, in plot installation, evaluation and maintenance is greatly appreciated.

[3] Por Edmundo L. Aguirre y Donald L. Huss, Dept. do Zootecnia, Instituto Tecnológico y de Estudios Superiores de Monterrey, Monterrey, N.L., México.

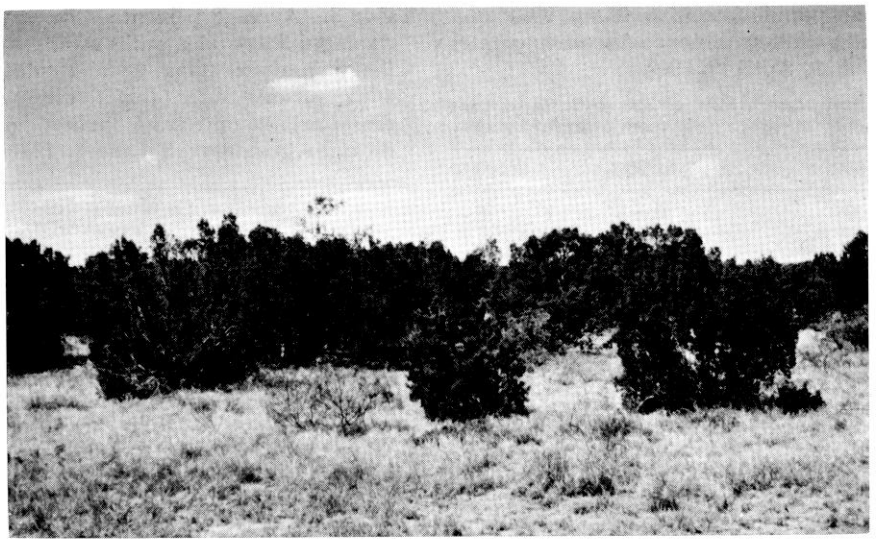

FIG. 1. Typical redberry juniper infestation in the Rolling Plains of northwest Texas.

Materials and Methods

The study area was located on a typical "rough break" range site in the Rolling Plains physiographic province of northwest Texas (Gould, 1962). These sites are typified by tight clays or red-bed clays and shales, neutral to slightly calcareous in reaction, and support primarily buffalograss (*Buchloe dactyloides* (Nutt). Engelm.) and tobosa (*Hilaria mutica* (Buckl.) Benth.). Soil of the study site was slightly basic and contained 39% sand and 44% clay in the surface 3 inches. Clay content increased to 75% and sand decreased to about 11% at 3 to 6 inches.

In April, 1969, canopy diameter at 4 to 5 ft was recorded for 360 redberry juniper trees. Herbicide rates were related to tree size in oz active ingredient per ft canopy diameter (oz/ft). Sets of 120 trees were treated with granular 3,6-dichloro-*o*-anisic acid (dicamba), pelleted picloram, or pelleted 3-(*p*-chlorophenyl)-1,1-dimethylurea (monuron). Herbicides were applied by hand to the redberry juniper trunk bases and dosages categorized according to tree size. No fewer than 20 trees fell into each treatment category of <0.01, 0.01 to 0.02, 0.021 to 0.03, 0.031 to 0.04, 0.041 to 0.8 oz/ft. In April and July of 1969, June of 1970 and May of 1971, three workers individually estimated the percentage of necrotic foliage as a result of herbicide treatment.

In June, 1970, plots containing at least 10 to 12 redberry juniper trees were established near the 1969 study area. Plots were 100 by 100 ft with treatments triplicated in a completely random design. Treatments were 0, 0.01, 0.02 or 0.04 oz/ft canopy diameter of picloram or dicamba applied to the base of all redberry junipers in the plot. In a third study established June, 1970, picloram pellets at the rate of 0.04 oz/ft canopy diameter were applied to the trunk base or in concentric rings at 1, 2, 3, 5, 7 or 9 ft from the base of 10 trees. In August of 1970 and May of 1971, these studies were evaluated by four workers individually estimating the percentage canopy damaged by the herbicides. Rain gauges were established in the immediate plot areas.

Results and Discussion

Canopy diameters of redberry junipers within the study population were distributed normally and averaged 8.8 ft. Height ranged from 2 to 10 ft and the average density was 50 trees per acre.

Effectiveness of soil-applied herbicides is often dependent upon distribution and intensity of rainfall. The herbicides must be leached into the soil and made available for root uptake. In 1969, moisture conditions at the study area were adequate for herbicide dissolution and movement. Over 6 inches precipitation was recorded within 30 days after treatment. In 1970, however, little rainfall occurred during June, July and August—the 90 day period following treatment. No rainfall was recorded from January through May, 1971.

Monuron was ineffective for control of redberry juniper (Table 1). Slight foliar necrosis was noted on treated trees 30 days after monuron application but only traces of damage were observed 2 years following treatment. Therefore, monuron was not included in subsequent experiments.

Little foliar damage to redberry juniper was observed a month following the application of dicamba (Table 1). After 13 months and 2 years, about one-third of the overall canopy areas was necrotic where

Table 1. Percentage redberry juniper foliage damaged 30 days and 1 and 2 years after application of various rates (oz/ft canopy diameter) of dicamba granules or monuron pellets to individual trees on April 17, 1969.

Herbicide rate	Dicamba			Monuron		
	30 days	1 year	2 years	30 days	1 year	2 years
0	0	0	0	0	0	0
<0.01	1	1	<1	1	0	0
0.01 to 0.02	1	1	3	4	0	0
0.021 to 0.03	1	2	3	6	1	<1
0.031 to 0.04	2	20	17	2	2	<1
0.041 to 0.08	3	36	31	1	2	<1

Table 2. Percentage of redberry juniper population with 95 to 99% and complete foliar damage 13 and 24 months after treatment with various rates (oz/ft canopy diameter) of picloram pellets on April 17, 1969.

Picloram rate	1 year after treatment		2 years after treatment	
	95 to 99%	100%	95 to 99%	100%
0	0	0	0	0
<0.01	17	3	10	11
0.01 to 0.02	43	27	25	52
0.021 to 0.03	44	56	25	75
0.031 to 0.04	36	64	17	83
0.041 to 0.08	5	95	0	100

0.041 to 0.08 oz/ft dicamba was applied.

Thirty days after application in 1969, all picloram treatments damaged the redberry juniper canopies. Over 80% canopy damage resulted from the application of picloram at 0.01 to 0.04 oz/ft. Total canopy necrosis was observed where more than 0.04 oz/ft picloram was applied. Where at least 0.02 oz/ft of picloram was applied, 95 to 100% of foliar area of all trees was necrotic one and two seasons following treatment (Table 2). In all cases, a greater percentage of the population was completely damaged 2 years after treatment than after a year. This response can probably be attributed to persistence of picloram in soil, a necessity for effectiveness of soil-applied herbicides.

Necrotic foliar area of trees receiving 0.04 oz/ft picloram pellets in June, 1970 averaged 96% in August (Table 3). The same rate of dicamba damaged an average of only 15% of each canopy. Where 0.02 or 0.04 oz/ft picloram was applied, average canopy reduction improved a season after treatment as compared to reaction after 3 months. Responses to 0.02 and 0.04 oz/ft picloram were similar. Foliar damage from dicamba did not increase a year after treatment.

There were no differences in canopy damage when picloram pellets were placed at 0, 1, 2 or 3 ft away from the base of redberry juniper trunks. Canopy damage was reduced when the pellets were applied at least 5 ft away. However, 1 year after treatment, over 50% of the canopies were damaged from picloram pellets placed 7 to 9 ft away from the trunk bases. This indicates that redberry juniper roots, functional in picloram uptake, cover a sizeable radial area. Since there was little rainfall after treatment, redberry juniper apparently absorbed much of the herbicide from the upper soil profile.

No grass damage was observed following any herbicide treatment. In many cases, woody species close enough to the redberry junipers were affected by the herbicides. Plains prickly-pear (*Opuntia polyacantha* Haw.) was controlled by high rates of picloram and dicamba. Tasajillo (*O. leptocaulis* DC.) was killed by 0.041 to 0.08 oz/ft of picloram but was not affected by dicamba. Agarito (*Mahonia trifoliolata* (Moric.) Fedde) and honey mesquite (*Prosopis glandulosa* Torr., var. *glandulosa*) were not affected by the herbicides.

From a practical standpoint, soil-applied herbicides have promise for control of redberry juniper either as broadcast or individual-tree treatments. Practicality of applications to individual trees would depend primarily on population density. Based on size distribution and density of trees in the study area, about 1.1 lb./acre active ingredient was required to treat each tree with 0.02 oz herbicide per ft canopy diameter. Application of dry herbicides to individual trees would allow selective thinning or could be used in the early stages of invasion to control the spread of redberry juniper.

Table 3. Average percentage canopy damaged 3 and 11 months after redberry juniper trees were treated with various rates (oz/ft canopy diameter) of picloram pellets or dicamba granules on June 1, 1970.

Herbicide	Rate	Months after treatment[1]	
		3	11
Untreated	—	0 a	0
Picloram	0.01	87 b	74 b
Picloram	0.02	88 b	94 bc
Picloram	0.04	96 b	99 c
Dicamba	0.01	1 a	3 a
Dicamba	0.02	8 a	6 a
Dicamba	0.04	15 a	9 a

[1] Means within a column followed by the same letter are not significantly different at the 5% level.

Literature Cited

Ellis, D., and J. L. Schuster. 1968. Juniper age and distribution on an isolated butte in Garza County, Texas Agr. Exp. Sta. MP-585. 112 p. 343–348.

Fernald, M. L. 1950. Gray's Manual of Botany. American Book Co., New York. 1632 p.

Gould, F. W. 1962. Texas Plants—A checklist and ecological summary. Texas Agr. Exp. Sta. Mp-585. 112 p.

Mason, L. R., and S. S. Hutchings. 1967. Estimating foliage yields on Utah juniper from measurements of crown diameter. J. Range Manage. 20:161–166.

Rechenthin, C. A., H. M. Bell, R. J. Pederson, and D. B. Polk. 1964. Grassland: Grassland restoration. Park II. Brush Control. U.S. Dep. Agr., Soil Conserv. Serv., Temple, Texas. 39 p.

Robison, E. D., and B. T. Cross. 1969. Juniper control with aerially applied picloram pellets. Proc. So. Weed Conf. 22:270.

Smith, H. N., and C. A. Rechenthin. 1964. Grassland Restoration. The Texas brush problem. U.S. Dep. Agr., Soil Conserv. Serv., Temple, Texas. 17 p.

Van Haverbake, D. F. 1968. A population analysis of Juniperus in the Missouri river basin. Univ. Nebr. Studies, Series 38. 82 p.