Redberry Juniper Control with Picloram

JOSEPH L. SCHUSTER

Highlight: *Individual-plant treatments with picloram at 0.5 lb/100 gal controlled redberry juniper when applied as wetting sprays to foliage from April through September. Picloram pellets as an individual plant treatment effectively controlled redberry juniper at rates equivalent to 2 and 4 lb/acre.*

Redberry juniper (*Juniperus pinchotii*) is common on breaks and rimrocks of mesas in western Texas and the Texas Panhandle (Vines, 1960). In many areas redberry juniper has spread from its original habitat in the breaks and rimrocks onto adjacent, and formerly brush-free, grasslands (Ellis and Schuster, 1968). Because of their dense, low canopies and vigorous rooting characteristics, redberry junipers compete strongly with herbaceous vegetation. Therefore, considerable effort has gone into devising control methods in Texas (Bell and Dyksterhuis, 1943; Allred, 1949; Wolfe, 1950; Rechenthin et al., 1964). Dozing has been the primary method of control, although chaining, roller chopping, cutting, and fire are also commonly used. Redberry juniper is difficult to control because it sprouts from both roots and root crown after top removal. Herbicides have generally been ineffective, but picloram (4-amino-3,5,6-trichloropicolinic acid) has recently shown potential for redberry juniper control (Balduzzi, 1969; Robison and Cross, 1969; Scifres, 1972).

Initial studies using foliar sprays of picloram indicated that 1 lb of picloram + 2,4,5-T (1:1) in an oil:water (2:98) solution as a wetting spray killed redberry juniper (Balduzzi and Schuster, 1968). That study also indicated that June applications were not as effective as July applications. Because of the apparent effectiveness in previous studies, additional experiments were initiated in 1969 to obtain information on the control of redberry juniper with picloram in both liquid and dry form.

Methods and Materials

The study area was located on the Post-Montgomery Ranch in Lynn County, Texas. An area along the Caprock of the Llano Estacado, which separates the High Plains from the Rolling Plains of Texas, was selected as representative of redberry juniper-infested lands of northwest Texas. The soil is weakly developed Potter clay loam ranging in depth from very shallow to moderately deep. The area has a southwest exposure and is approximately 3,000 ft in elevation. The terrain is relatively steep with slope gradients of 6 to 30%. The area supports a mixed-aged stand of redberry juniper ranging from 1 to 15 ft in canopy diameter and up to 12 ft in height. The principal understory grass species were sideoats grama (*Bouteloua curtipendula*), threeawns (*Aristida* spp.), rough tridens (*Tridens elongatus*), and sand dropseed (*Sporobolus cryptandrus*).

Herbicide treatments were applied to 30 trees at monthly intervals from April through October, 1969. The two treatments applied were: (1) picloram at 0.5 lb/100 gal of an oil:water carrier; and (2) picloram + 2,4,5-T [(2,4,5-trichlorophenoxy)acetic acid] (1:1) at 1 lb/100 gal of carrier. The herbicide carrier was 2 gal diesel oil, 1 pint emulsifier and enough water to make 100 gal. Spray was applied with a power sprayer at 40 pounds per square inch to completely wet the redberry juniper foliage.

The growing season for redberry juniper in this region is April through October. The temperature and moisture conditions in May and June generally favor rapid growth of redberry juniper. The summer months are hot and dry, but cooler temperatures and rainy periods in September usually favor late summer and fall growth.

The effects of these treatments were evaluated in October, 1971, at the end of the second growing season after treatments were applied. Percentage canopy reduction was estimated for each tree. Plants were recorded as dead only if 100% dead tissue was observed. Mean canopy reduction and percent plant kill was determined for each treatment.

In a second study, installed in May, 1970, at the same location, soil-applied picloram at rates equivalent to 0.5, 1, 2, and 4 lb/acre as pellets was applied to individual trees. The area occupied by each tree, based on canopy diameter, was used as the basis for determining the actual amount of picloram pellets to apply to each tree. Each treatment was duplicated using 0.25-acre plots containing a minimum of 25 trees. At the end of two growing seasons, percent plant kill and percent canopy reduction was determined as in the foliar spray study. All data are averages of two workers making individual estimates. Analyses of variance were used to determine significant differences among treatments. Differences among means were separated with Duncan's multiple range test.

Results and Discussion

Individual Spray Treatments

Foliar sprays, except for October and August applications, reduced redberry juniper canopy by at least 95% (Table 1).

Author is professor and head of the Department of Range Science, Texas A&M University, College Station, 77843. At the time the research was conducted he was professor and chairman, Range and Wildlife Management Department, Texas Tech University, Lubbock, 79409.

This study is published as Texas Tech University, College of Agriculture publication TTA-9-158 and Texas Agricultural Experiment Station Technical Article TA 12252. The contribution of the Post-Montgomery Estate, Levelland, Texas, on whose ranch this study was conducted is greatly appreciated. Special thanks are due Tom Copeland, assistant manager, and to students Bob Karr, Robbie Graves, and Mike Smith for their technical assistance.

Manuscript received November 28, 1975.

Table 1. Mean canopy reduction (%) of redberry juniper at the end of second growing season after treatment in 1969 with wetting sprays of 0.5 lb picloram/100 gal or picloram + 2,4,5-T (1:1) at 1 lb/100 gal in the Rolling Plains of Texas.[1]

Application date	Picloram	Picloram + 2,4,5-T
April 8	95 c	99 c
May 10	98 c	96 c
June 7	99 c	100 c
July 12	98 c	95 c
August 12	86 b	96 b
September 16	98 c	100 c
October 18	74 a	82 a

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

Table 2. Mean canopy reduction (%) and plant kill (%) of redberry juniper at the end of the second growing season after treatment in May, 1969, with various rates of soil-applied picloram pellets in the Rolling Plains of Texas.[1]

Herbicide rate[2] (lb/acre)	Canopy reduction	Plant kill
0.5	49 a	6 a
1	69 b	38 b
2	94 c	76 c
4	94 c	80 c

[1]Means within a column followed by the same letter are not significantly different at the 5% level.
[2]Equivalent to lb per acre if broadcast at same rate, but amount applied per plant was determined by percentage of acre occupied by the plant.

Applications in October were preceded by an early freeze, and reduction of canopy by picloram and picloram + 2,4,5-T treatments were 74 and 82%, respectively. Although picloram + 2,4,5-T was as effective in August as when applied in other months, canopy reduction from picloram alone was 86%, significantly less than from any other month of application except October. Generally, there was no difference in effectiveness between picloram alone versus picloram + 2,4,5-T, indicating that the 2,4,5-T had no effect on redberry juniper.

Chi square analysis comparing effectiveness of plant kill during the 2 summer months of July and August versus any other 2-month period indicated that foliar spray applications during these hot, dry summer months were not as effective in obtaining plant kill as those in the early and late spring months and in September. August was the only month when low soil moisture conditions were noted at time of application. Apparently growth and stage of plant development were most favorable for redberry juniper susceptibility to foliar applications in late spring and again in early autumn after the rainy season commenced.

Apparently 0.5 lb picloram/100 gal oil:water mixture applied as a wetting foliar spray is an effective treatment for redberry juniper control. It might be most useful as a follow-up treatment after some initial broadcast treatment had reduced stand density or where original stand density is low enough to make individual plant treatment feasible. Applications can be made throughout the growing season but appear to be less effective during hot summer months of July and August, especially if low soil moisture reduces active growth.

Grass growth was reduced during the year that picloram was applied where spray contacted grass around the trees in June through October treatments. Grass around trees was not affected by the spray from the April and May treatments. Evidently, most grass growth had not commenced at the time of the earlier treatments, and that which had was protected by dormant previous year's growth. This could be a consideration when selecting spray dates.

Soil-applied Treatments

Canopies of redberry juniper covered an average of 11% of the area (range 4.8% to 16.7%) within the experimental plots. The number of trees per acre varied from 96 to 192 and tree canopy diameters ranged from 1 to 14 ft, averaging 6.2 ft. The amount of picloram applied per acre varied directly with percent canopy cover since applications were made on the basis of area occupied by each plot.

There was no difference in percent canopy reduction of redberry juniper between the 2- and the 4-lb/acre rates (Table 2). One pound/acre was not as effective as the 2 or 4 lb/acre, but was more effective than 0.5 lb/acre. The 69% control attained with the 1 lb/acre would perhaps be acceptable but control was erratic due to placement of the chemicals. The 10% pellet formulation was too concentrated to allow uniform distribution to all portions of the soil beneath the juniper canopies. Poor distribution of picloram pellets resulted in erratic results at the two lower rates of application. At 0.5 lb/acre picloram was fairly effective in reducing overall redberry juniper growth, but was ineffective relative to plant kill. Therefore, 2 lb/acre is considered the optimum rate for redberry juniper control with dry form picloram applied as 10% pellets.

The amount of picloram applied per plant varied with area occupied by the plant. For example, a tree with a canopy 3 ft in diameter occupies 7.1 ft^2 and would receive .05 oz ae picloram at the 2 lb rate, whereas a tree 5 ft in diameter would receive .14 oz, etc. This rate compares favorably with the 0.02 oz ae per ft of canopy diameter reported earlier by Scifres (1972) for redberry juniper control with picloram. The per acre rate would then vary with tree size and number per acre, or the percent ground cover of juniper. In this study, ground cover of redberry juniper averaged 11%, thus only .22 lb ae picloram or 2.2 lb of the 10% pellets was required per acre at the 2 lb rate. Thus, herbicide costs could be calculated, although neither herbicide costs nor application costs were determined for this study.

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