

Influence of Mowing and Spraying Dates on Herbicidal Control of Macartney Rose¹

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Abstract. We compared foliage sprays of (2,4-dichlorophenoxy)acetic acid (2,4-D) and 4-amino-3,5,6-trichloropicolinic acid (picloram) for control of Macartney rose (*Rosa bracteata* Wendl.) applied with ground equipment and airplane. Picloram at 0.5 lb/A was more effective than 2,4-D at 2 lb/A at all dates of application on mowed roses; however, time of application was important. Picloram was most effective in late April and early May, but 2,4-D was most effective in late May and early June. Combinations of picloram and 2,4-D were effective from late April to late June. If mowing is followed by foliage treatment of 2,4-D, the interval between mowing and spraying should be at least 1 year if mowing is done in the spring. The interval between mowing and spraying was not critical when picloram was applied not later than early May. Mowing in the summer reduced the effectiveness of subsequent 2,4-D and picloram treatments applied the following year. Aerial applications of 2,4-D and picloram on undisturbed Macartney rose plants in the fall were not as effective as spring applications; however, two successive fall applications of picloram at 1 lb/A resulted in control equivalent to that obtained with a single 2 lb/A application in spring.

INTRODUCTION

MACARTNEY rose (*Rosa bracteata* Wendl.) is a pernicious woody plant in many pastures of the Gulf Coast states. In Texas alone, it occurs on about 500,000 acres of productive rangeland⁵. Both mechanical and chemical methods have been used for control. Mowing is popular because it eliminates large hedges, permits greater utilization of forage around the plants, and improves the appearance of infested pastures. However, mowing does not kill this plant; in fact, canes cut by a rotary mower are spread over the pasture and often root if the soil is moist. Macartney rose also spreads by seeds disseminated by grazing animals and wildlife (4, 5, 7).

Spraying the foliage with amine salts of (2,4-dichlorophenoxy)acetic acid (2,4-D) has controlled Macartney rose only if applied in 3 or more successive years (2, 3, 5, 6). Preliminary work with 4-amino-3,5,6-trichloropicolinic acid (picloram) showed that this herbicide might control Macartney rose (1). Combinations of mowing and spraying with 2,4-D are commonly used, but McCully *et al.* (5) and Searcy (6) found mowed Macartney rose plants more difficult than undisturbed plants to control with 2,4-D.

Our studies were conducted to determine (a) the effectiveness of picloram and 2,4-D for Macartney rose control,

(b) the optimum rates and times of application, and (c) the influence of date of mowing on subsequent control of Macartney rose with foliage sprays of 2,4-D and picloram.

MATERIALS AND METHODS

Dates of application study. On April 26, May 1, May 20, June 3, and June 22, 1964, we applied the alkanolamine salts of 2,4-D at 1 and 2 lb/A, potassium salt of picloram at 0.25 and 0.50 lb/A, and a mixture of triisopropanolamine salts of picloram and 2,4-D at 0.25 + 1.00 and 0.50 + 2.00 lb/A, respectively, to Macartney rose. Each treatment was applied in water equivalent to 20 gpa with a 3-nozzle hand boom attached to a compressed-air sprayer. Each treatment was replicated three times on plots 15 by 40 ft. The experimental area had been mowed in June, 1963, 1 year prior to treatment. Macartney rose plants were actively growing and canes were from 12 to 18 inches long when the first treatments were applied in April, 1964.

Estimates of Macartney rose ground cover were made on each plot prior to the first herbicide applications in April. Ground cover estimates were made again 15 months after treatment. Percentage of the original ground cover for each plot was calculated from original and final ground cover values. In addition, we marked 10 plants on selected plots; and during a 15-month period after treatment, we recorded the number of new shoots initiated.

Mowing and spraying study. We studied Macartney rose plants, transplanted from wild stands to an irrigated nursery in 1963, to determine the influence of pretreatment mowing on herbicidal effectiveness. After irrigation in 1963 to establish the plants and again in 1964 to aid their development, the plants received water only from natural rainfall during 1965, 1966, and 1967. In 1965, the Macartney rose plants were mowed once in May, July, or October, and one-fourth of the plants were left unmowed. In 1966, we applied the alkanolamine salts of 2,4-D at 2 lb/A and the potassium salt of picloram at 0.50 lb/A as foliage sprays April 10, May 1, May 14, June 10, or July 10 to each of the date-of-mowing treatments. Treatments were assigned in a randomized block, split-plot design; dates of herbicide application were the main plots, kind of herbicide were the sub-plots, and dates of mowing were the sub-sub-plots. Each mowing and spraying combination was replicated four times.

Herbicides were applied with a 3-nozzle boom attached to a compressed-air sprayer to plots 5 by 15 ft. Water was used as the carrier and all treatments were applied at a total volume equivalent to 20 gpa.

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⁵Hoffman, G. O. 1960. Texas Agricultural Extension Service, unpublished survey.

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Permanent evaluation sites were established in each plot before treatment in April, 1966, and the percentage of Macartney rose ground cover was determined prior to treatment. Percentage ground cover was determined again on all plots in September, 1966, and finally in June, 1967. Percentage Macartney rose control on each plot was visually estimated in September, 1966, and June, 1967.

Aerial application study. Three experiments were conducted near Greenlake, Texas, in a dense stand of large, undisturbed Macartney rose. All plots were 160 by 1320 ft, and all treatments were applied at a volume of 15 gpa with a Model C Snow⁶ airplane.

We initiated the first experiment September 24, 1963. The propylene glycol butyl ether ester of 2,4-D at 3 lb/A, the potassium salt of picloram at 1 and 2 lb/A, and a mixture of the triisopropanolamine salts of picloram and 2,4-D at 0.54 + 2 lb/A were applied to the dense stand of Macartney rose. All treatments were applied in water except the mixture of picloram and 2,4-D which was applied in both water and water with Norbak⁶, a water-swallowable polymer used as a drift control agent. All plots were retreated in October, 1964, using the same herbicide and rate treatments, except one picloram and 2,4-D treatment which was retreated with 1 lb/A picloram.

In a second experiment, we applied the propylene glycol butyl ether ester of 2,4-D at 3 lb/A and picloram at 1 and 2 lb/A to Macartney rose October 14, 1964, to compare the effectiveness of the ester of 2,4-D with picloram applied in water and the drift control carrier.

In the third experiment, applied April 7, 1964, we compared the alkanolamine salt of 2,4-D at 4 lb/A, potassium salt of picloram at 0.7, 1.3, 2.0, and 2.7 lb/A, and a mixture of picloram and 2,4-D at 0.7 + 2.6 and 1.4 + 5.4 lb/A. This test was applied to determine the relative effectiveness of spring applications and the most efficient rate of picloram application for Macartney rose control.

We evaluated the aerial treatments by establishing permanent belt transects (50 by 200 ft) within each plot. Plants or clumps within each belt were inventoried at the time of treatment. Periodically, percent control was visually evaluated on each plant. Plants showing no regrowth at the time of final evaluation were considered dead.

RESULTS AND DISCUSSION

Dates of application study. Picloram was most effective when applied during the period from late April to late May but not effective in June (Table 1). The 0.25 lb/A rate was ineffective May 1, 1964 because of a hard rain that fell within 30 min after treatment. The 2,4-D treatments were relatively ineffective in late April and early May, most effective in late May and early June, but again ineffective in late June. The mixture of picloram and 2,4-D gave about the same control regardless of application date. The 0.50 + 2.00 lb/A rate of the mixture was most effective at all dates of application.

⁶Use of trade names is for purposes of identification of equipment employed and does not constitute endorsement by either the U. S. Department of Agriculture or Texas A&M University.

Table 1. Ground cover of Macartney rose in July, 1965, as the percentage of stand in April, 1964, following application of 2,4-D, picloram, and a mixture of picloram and 2,4-D.

Herbicide	Rate lb/A	Date of application in 1964					Mean ^a
		4/26	5/1	5/20	6/3	6/22	
Picloram	0.25	47	255	42	100	207	130 ^w
Picloram	0.50	11	17	22	45	126	44 ^{yz}
Picloram + 2,4-D	0.25 + 1.00	79	75	83	46	89	74 ^{xy}
Picloram + 2,4-D	0.50 + 2.00	0	9	2	37	9	11 ^x
2,4-D	1.00	164	252	60	131	140	149 ^w
2,4-D	2.00	126	286	44	93	198	149 ^w
Check	0.00	195	244	202	276	206	225 ^v
Mean ^a		89 ^c	162 ^d	65 ^c	104 ^{bc}	139 ^{ab}	

^aMeans followed by the same letter do not differ significantly at the 5% level using Duncan's multiple range test.

The number of new shoots initiated from the crowns during the 15 months after treatment emphasize the importance of timely application of the herbicides (Table 2). When poorly timed applications are made, all of the

Table 2. Number of new canes per plant initiated from the crown of Macartney rose plants 15 months after treatment with 2,4-D, picloram, or a mixture of picloram and 2,4-D.

Herbicide	Rate lb/A	Date of application in 1964 ^a			
		4/26	5/20	6/3	6/22
Picloram	0.50	0.5 ^{fe}	0.6 ^{fe}	5.0 ^{bed}	9.0 ^a
Picloram + 2,4-D	0.50 + 2.0	0.03 ^z	0.3 ^{fe}	2.8 ^{def}	2.4 ^{efe}
2,4-D	2.00	6.4 ^b	2.5 ^{defe}	3.2 ^{ede}	5.5 ^{bc}

^aMeans followed by the same letter do not differ significantly at the 5% level using Duncan's multiple range test.

shoots arising from the crowns of plants may be killed, but retreatment will be necessary the next year to control sprouting. The superior control obtained with the mixture of picloram and 2,4-D suggests that it may have certain advantages when proper timing of the treatments is not possible or when a long spraying period is needed to spray infested acreages.

Mowing and spraying study. In April, 1966, prior to the first chemical treatments, unmowed and May-mowed plots had a greater percentage of Macartney rose ground cover than plots mowed in July and October (Figure 1).

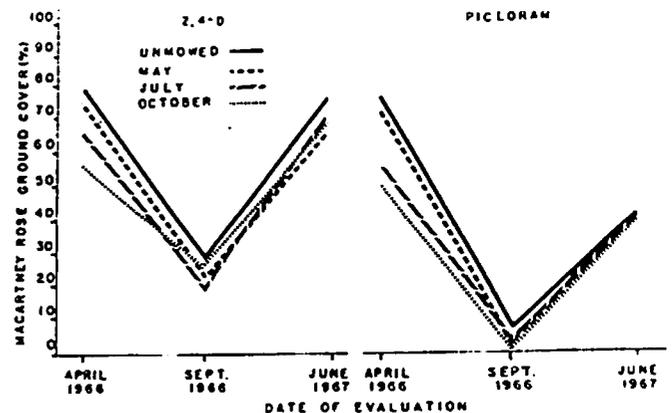


Figure 1. Percentage ground cover of Macartney rose at three dates of evaluation on unmowed plots and plots mowed in May, July, and October, 1965. Picloram and 2,4-D applied at rates of 1/2 and 2 lb/A, respectively, April 10, May 1, May 14, June 10, and July 10, 1966. Values are averages of all dates of application.

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Evaluations in September, 1966, show that both herbicides reduced Macartney rose ground cover. By June, 1967, the Macartney rose ground cover on plots treated with 2,4-D had increased to about the April, 1966, level. Like mowing, 2,4-D treatments did not reduce Macartney rose stands for long. Regrowth on plots treated with picloram was less than on the 2,4-D plots.

Picloram at 0.50 lb/A was more effective than 2,4-D at 2 lb/A at all dates (Figure 2). The greatest control of

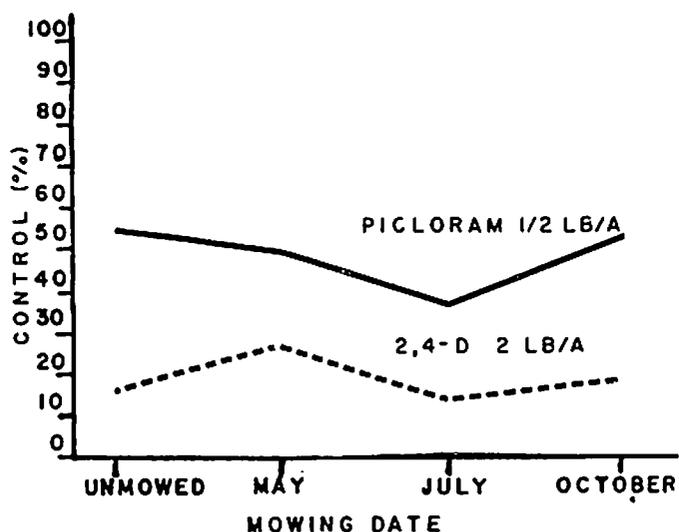


Figure 2. Percentage control of Macartney rose obtained with picloram and 2,4-D on unmowed plots and plots mowed at three dates in 1965. Herbicides applied April 10, May 1, May 14, June 10, and July 10, 1966. Control evaluated in June, 1967.

Macartney rose with picloram was on unmowed plots, but control on plots mowed in October was essentially equal to that on the unmowed. There was a slight decline in effectiveness from the May to the July mowing dates. The 2,4-D treatments were most effective on the plots mowed in May.

The different dates at which Macartney rose is most susceptible to picloram and 2,4-D is illustrated in Figure 3. On unmowed plants, 2,4-D was most effective in June and July; whereas, picloram gave highest control and greatest reduction in ground cover when applied May 14. These data are in general agreement with those of the date-of-application study—picloram was most effective at the earlier dates and 2,4-D at the late May and early June dates. A 2-inch rain within 24 hr after application of the May 1 treatments may explain the reduction in effectiveness of both picloram and 2,4-D at this date.

Control and ground cover estimates approach being mirror images, i.e., when percentage control increases, percentage ground cover decreases and vice versa (Figure 3). For this reason, only data on percentage control are presented for the other dates of mowing (Figure 4). On plots mowed in May, July, and October, picloram was generally far more effective than 2,4-D. Picloram was most effective when applied May 14, irrespective of the date of mowing. For sprays applied July 10, and June 10 to the October mowing treatments, 2,4-D was equal to picloram (Figure 4).

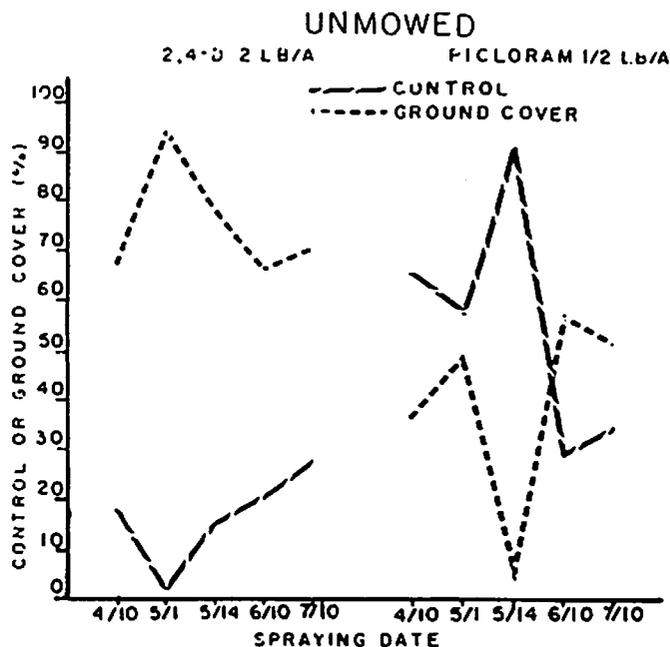


Figure 3. Percentage control and ground cover of Macartney rose obtained with picloram and 2,4-D applied on unmowed plots at five dates in 1966. Control and ground cover evaluated in June, 1967.

On plots mowed in May, 1965, the most effective 2,4-D treatments were applied May 14 and July 10, 1966 (Figure 4A). On plots mowed in July, 1965, the early 2,4-D treatments were ineffective (Figure 4B). Plants mowed in July were in a relatively dormant condition for the rest of the 1965 growing season and did not begin growing until late in the fall and winter of 1965-66. Consequently, relatively little ground cover existed on the plots at the early application dates. The amount of foliage increased as the 1966 growing season progressed. This parallels increased effectiveness of 2,4-D with later dates of treatment.

The 2,4-D treatments applied June 10 to plots mowed in October, 1965, were more effective than those applied at other dates (Figure 4C). Again, the increase in effectiveness through June 10 appears to be parallel to the increase in Macartney rose ground cover. Why the effectiveness diminished again after June 10 is not readily apparent.

Aerial application study. All aerial treatments in the fall of 1963 gave complete defoliation; however, by April, 1964, regrowth had occurred on all plots (Table 3).

Table 3. Percentage control of Macartney rose from aerially-applied 2,4-D, picloram, or a mixture of picloram and 2,4-D.

Treatments*	Carrier	Rate lb/A	Date of evaluation		
			Apr. 1964	Aug. 1964	Nov. 1965
Ester of 2,4-D	water	3.00	70	29	20
Picloram	water	1.00	90	56	91
Picloram	water	2.00	92	45	90
Picloram + 2,4-D	water	0.54 + 2.00	89	35	62
Picloram + 2,4-D ^b	Norbak + Water	0.54 + 2.00	60	26	45
Picloram + 2,4-D	Norbak + Water	0.54 + 2.00	83	27	40

*Initial treatments applied September, 1963, and all plots retreated using the same herbicide and rate October, 1964, except as indicated below.
^bRetreated with picloram at 1 lb/A in Norbak October, 1964.

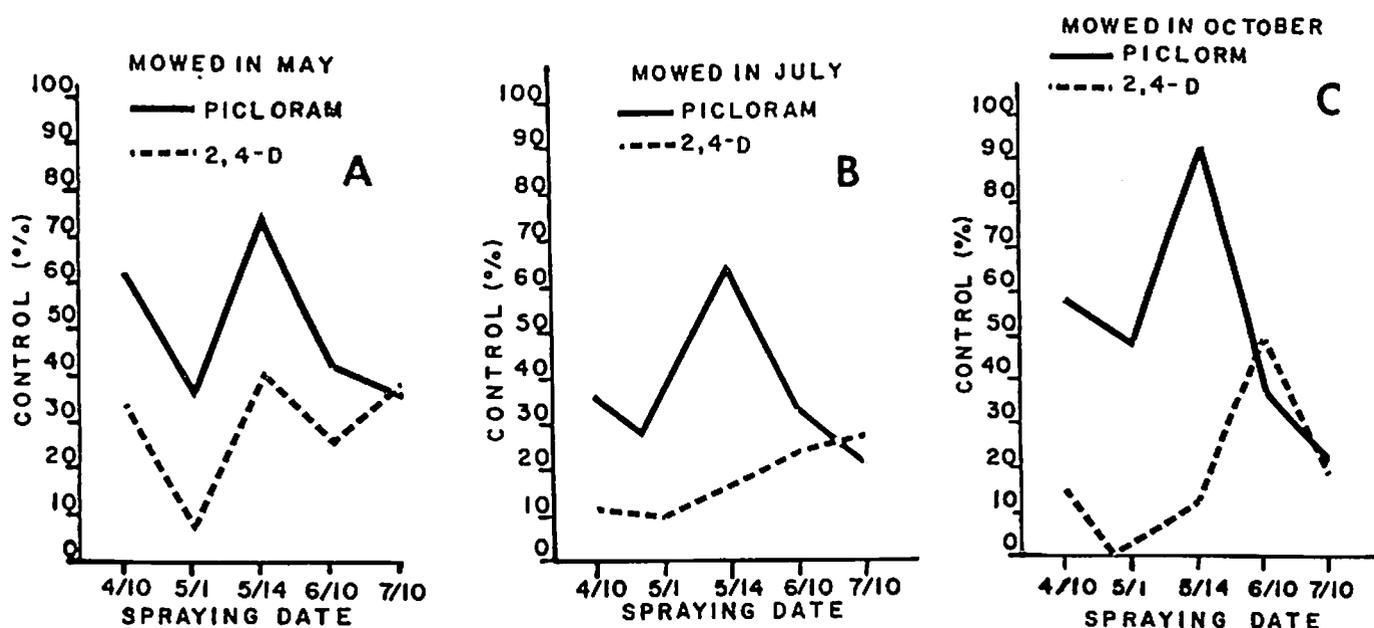


Fig. 4. Percentage control of Macartney rose obtained with sprays of picloram at 1/2 lb/A and 2,4-D at 2 lb/A when applied at five dates in 1966 to plots mowed: A. in May, 1965; B. in July, 1965; and C. in October, 1965.

Nearly all regrowth was from the basal crown of the plants and a few roots near the crowns. Therefore, even though all treatments killed the tops of plants, the differences in control reported in Table 3 reflect mainly differences in suppression of regrowth.

Evaluation of the treatments in November, 1965, showed that the two applications of picloram at 1 lb/A were as effective as two applications at 2 lb/A. All other treatments had regrown to the point that control was considered unsatisfactory.

Picloram treatments applied in the fall of 1963 and repeated in 1964 were generally more effective than 2,4-D treatments; however, control was not satisfactory with any of the single treatments applied in October, 1964 (Table 4). Picloram at 2 lb/A was slightly more effective than 1 lb/A.

Table 4. Percentage control of Macartney rose with one fall application of 2,4-D or picloram.

Herbicide	Rate lb/A	Carrier	Percentage control
2,4-D	3	water	38
Picloram	2	water	66
Picloram	1	water	54
Picloram	1	Norbak	56

Norbak did not influence Macartney rose control with picloram sprays. In the 1963 experiment, results with Norbak in water as a carrier were slightly lower than from an equivalent amount of herbicide applied in water (Table 3). In the 1964 study, 1 lb/A picloram applied either in water or Norbak in water was equally effective (Table 4).

Picloram treatments applied in April, 1964, were much more effective than the fall treatments (Table 5). More plants were killed as the rate of picloram was increased from 0.7 to 2.0 lb/A, but no further increase was obtained

Table 5. Macartney rose control and plants killed 18 months after application of 2,4-D and picloram^a.

Herbicide	Rate lb/A	% control ^b	% plants killed ^c
2,4-D	4.0	17	0
Picloram	0.7	64	14
Picloram	1.3	79	30
Picloram	2.0	94	63
Picloram	2.7	90	62
Picloram - 2,4-D	0.7 + 2.6	75	25
Picloram - 2,4-D	1.4 + 5.2	87	33

^aTreatments applied April 7, 1964.
^bCalculated from visual estimates made on individual plants or clumps within 50 by 200-ft belt transects.
^cCalculated from plants showing no regrowth 18 months after treatment.

with the 2.7 lb/A treatment. Both the 2.0 and 2.7 lb/A rates of picloram gave excellent control 18 months after treatment; however, only slightly more than 60% of the plants were killed. Regrowth was evident as small shoots on the basal crowns and as sprouts from roots of some plants. The lower rates of picloram were more effective than 2,4-D in controlling Macartney rose; however, repeated treatment with low rates of picloram would be necessary for long-term control.

When treatments were made early in the spring, control and percentage of the plants killed with the mixture of picloram and 2,4-D appeared to be closely related to the amount of picloram applied. The mixture of picloram and 2,4-D gave superior control at all dates of application from late April to late June and 2,4-D appears to be essential if optimum control is to be achieved at the late spring dates. With 2,4-D alone, timing spring applications is extremely important for optimum effectiveness; but even at the optimum date, retreatment is necessary for satisfactory control. Timing is not as critical with the mixture.

ACKNOWLEDGMENT

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