Fall Application of Herbicides Improves Macartney Rose-infested Coastal Prairie Rangelands

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Highlight: *Picloram combined with 2,4,5-T (1:1) at 0.56 or 1.12 kg/ha was the most effective of several herbicides and herbicide combinations applied in the fall for control of Macartney rose. Aerial application of the 2,4,5-T/picloram combination at 1.12 kg/ha reduced Macartney rose canopies on Texas Coastal Prairie rangeland by 70 to 80% after a year. The same rate of 2,4-D, the standard treatment, reduced the canopies by 40 to 50%. The herbicide combination was equally effective whether applied in water containing 0.5% (v/v) of commercial surfactant or in a diesel oil:water (1:4) emulsion. Herbicides more effectively controlled undisturbed Macartney rose than plants that previously had been shredded or sprayed. Increasing the volume of carrier from 47 to 94 liters/ha did not adequately increase Macartney rose control to justify extra application costs associated with the higher spray volume.*

Macartney rose (*Rosa bracteata*) is a severe range management problem on over 200,000 ha of highly productive rangeland in southeast Texas. It reaches greatest proportions in the humid Gulf Prairies and western portions of the Post Oak (*Quercus stellata*) Savannah. Also called "Cherokee rose," "hedge," "wild-rose," or "Chickasaw rose" (Hoffman et al., 1964), it is estimated to have increased to the present level of infestation from about 16,000 ha in 1948 (Hoffman, 1966). Native to China, Macartney rose was evidently introduced into the United States in the early 1800's for use as hedge. Macartney rose has some value as food and cover for wildlife. At certain periods, the young shoots are browsed by cattle.[1] Unless controlled, however, Macartney rose spreads until grazing of livestock is severely limited. It not only competes with desirable species but restricts accessibility of grazing animals to herbage.

Macartney rose is spread by livestock, birds, and wildlife, which eat the mature rose hips. The seeds readily germinate after passage through the digestive tracts of most birds and animals (McCully, 1951). The long spreading canes of Macartney rose may also take root at the nodes after being trampled into damp soil. Undisturbed individual Macartney rose plants form dense clumps that may exceed 3 meters in height and several meters wide. As the infestations thicken, the clumps merge, forming dense thickets (Fig. 1). Macartney rose occurs on a range of soil types but is most common on heavy clays.

Upon disturbance of the top-growth, Macartney rose sprouts profusely from the base, cane sections, and from shallow lateral roots (Haas, et al., 1970). Livestock tend to avoid grass near the Macartney rose plants or about the long trailing canes which may extend several meters from the parent clumps. Mechanical methods such as shredding or bulldozing generally have not been found effective for permanent control of Macartney rose. Repeated annual mowing may increase the area occupied by the dense thorny growth which further reduces the amount of usable grazing land. This may result from the canes being cut and spread over moist soil where they take root and increase the Macartney rose stand density.

From early research (McCully et al., 1959), 2,4-D [(2,4-dichlorophenoxy) acetic acid] was developed as the primary herbicide treatment for Macartney rose control. A single application of 2,4-D as an individual-

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[1] Durham, A. J., and M. M. Kothmann. 1974. Unpublished data.

Fig. 1. *Macartney rose is a severe range management problem on the Texas Coastal Prairie. If not controlled, the clumps rapidly increase in size forming almost impenetrable thickets.*

plant treatment or ground broadcast will control seedlings and young plants. However, older growth usually requires several successive annual treatments for effective control.

Mowed Macartney rose should have at least 6 months but no more than 3 years to develop topgrowth following disturbance before herbicides are applied (Hoffman et al., 1964). Amine formulations of 2,4-D at 2.24 kg/ha may be used effectively from March 1 to May 1 for Macartney rose control. If treatment is delayed until May 1 through June 15, a low volatile ester should be applied. The ester formulation is also used in the early fall, from early September to mid-October, when growing conditions are conducive to herbicide effectiveness. The initial 2,4-D application usually must be followed by a minimum of two consecutive annual applications of at least 1.12 kg/ha to effectively control the Macartney rose.

Chemical control of Macartney rose significantly increases forage production (Hoffman, 1966; Hoffman et al., 1968). However, many area ranchmen have applied 1.12 kg/ha of 2,4-D annually for the past 7 to 10 years without completely controlling severe infestations.[2] These repeat annual applications progressively increase the hazard of damaging adjacent agricultural crops, reduce the economic feasibility of Macartney rose control, and virtually eliminate forbs from the rangeland. Therefore, research was initiated in 1970 to a) develop more effective herbicide treatments which could reduce the herbicide load introduced into the range ecosystem and b) concentrate on fall applications when hazard to nontarget agricultural ecosystems is minimal.

Materials and Methods

Initial chemical control studies were installed near Benchley in Robertson County, Texas, with ground spraying equipment. The study area had not been grazed by livestock for 5 years. Topography was level to gently rolling and the soil was Wilson clay. The area supported about 250 Macartney rose plants/ha which had been shredded 3 years previous to initiation of the experiments described herein. The Macartney rose plants averaged 1 meter tall and 2.5 meters in diameter.

Herbicides and herbicide combinations evaluated at 1.12 kg/ha for Macartney rose control near Benchley were: 2,4-D, 2,4-D combined with picloram (4-amino-2,3,6-trichloropicolonic acid) or dicamba (3,6-dichloro-*o*-anisic acid); 2,4,5-T [(2,4,5-trichlorophenoxy) acetic acid] and silvex [(2,4,5-trichlorophenoxy) propionic acid] each alone or combined with picloram or dicamba; and dicamba combined with picloram. Combinations contained equal amounts of each herbicide and all but 2,4,5-T + picloram were tank mixed in the field. Herbicides were applied broadcast in 94 liters/ha of water plus 0.5% (v/v) commercial surfactant to 10- by 35-meter plots. Treatments were applied on September 26, 1970, in a randomized complete block experiment with three replications. This date of treatment was chosen based on previous study of spray dates for Macartney rose control (Haas et al., 1970). At 1 and 2 years after treatment, reduction of live canopy of each plant within the plots was estimated.

On October 3, 1972, and October 11, 1973, various herbicides, herbicide combinations, application rates, and formulations were aerially applied to dense stands of Macartney rose near Bloomington, Tex. Soils of the nearly level grassland are predominately Lake Charles and Victoria clays. The area is poorly drained such that standing water is common from late fall through the winter. However, conditions are usually droughty during July and August. Herbaceous vegetation was dominated by little bluestem (*Schizycharium scoparium*) with scattered clones of switchgrass (*Panicum virgatum*). Knotroot bristlegrass (*Setaria geniculata*), dallisgrass (*Paspalum dilatatum*) and longtom (*Paspalum lividium*) were also common. During the study, the area was grazed by cows and calves at approximately 1 AU/4 ha from late October or early November to late March.

Herbicides applied in 47 liters/ha of a diesel oil:water (1:4) emulsion in 1972 to disturbed (topgrowth previously removed by shredding, treated with 2,4-D at 4.48 kg/ha the following year and with 1.12 kg/ha each year thereafter for 7 years) Macartney rose included 2,4-D, dicamba and 2,4-D + dicamba (1:1) at 1 kg/ha and 2,4,5-T + picloram (1:1) at 0.28, 0.56, and 1.12 kg/ha. In addition, the 2,4,5-T + picloram combinations were applied in water containing 0.5% (v/v) of the commercial surfactant, 86% *a*-(*p*)-nonylphenyl-*w*-hydroxypoly (oxyethylene). The 2,4,5-T + picloram combinations in the two carrier systems were also applied to undisturbed Macartney rose to compare the reaction to that of disturbed growth. Using the diesel oil:water emulsion and 0.56 kg/ha of 2,4,5-T + picloram, carrier volumes of 47 and 94 liters/ha were compared on disturbed growth. The 2,4,5-T + picloram in combination were formulated as triethylamine salts, 2,4-D and 2,4,5-T were applied as the propyleneglycol butyl ether esters and dicamba as the dimethylamine salt. All herbicide combinations except 2,4,5-T + picloram were tank mixed at the application site. In 1973, all herbicides were applied in 47 liters/ha of water and 0.5% commercial surfactant.

In most cases, aerially applied treatments were duplicated or triplicated although plots were randomly located over the study area. Data analysis was handled as a completely random design. Plots ranged from 8 to 20 ha. Average percentage canopy reduction of Macartney rose was estimated after 30 days. At 1 and 2 years after treatment, two to five belts, 15 cm wide and 31 m long, were systematically located down the center of each plot. Macartney rose occurring in the belts was evaluated as to percentage canopy reduction and area occupied by new growth.

Results and Discussion

Environmental conditions were excellent for application of herbicides to Macartney rose in all experiments. Application was usually preceded by 5 to 7 days of bright, warm weather. The air temperature was usually around 23°C at the time of herbicide application and the Macartney rose was actively growing.

Ground Herbicide Application

Silvex was less effective than 2,4-D or 2,4,5-T at 1.12 kg/ha applied with ground broadcast equipment for the control of disturbed Macartney rose near Benchley, Tex. (Table 1). Dicamba, 2,4-D and 2,4,5-T reduced Macartney rose canopies from 40 to 50% at a year after treatment. Canopy reduction with combinations of 2,4-D or 2,4,5-T with dicamba a year after application was as expected from either herbicide used alone at the same application rate. The additive effect of 2,4,5-T + dicamba has also been demonstrated with honey mesquite (*Prosopis glandulosa* var. *glandulosa*) (Scifres and Hoffman, 1972) and sand shinnery oak (*Quercus havardii*)

[2] Personal communication with P. H. Welder, Welder Greenlake Ranch, Bloomington, Texas.

Table 1. Canopy reduction (%) of disturbed Macartney rose 1 year after broadcast application of various herbicides alone and in 1:1 combinations at 1.12 kg/ha with ground equipment on September 26, 1970, near Benchley, Tex.

Phenoxy herbicide	Herbicide in combination[a]		
	None	Dicamba	Picloram
None	0 a	38 cd	62 e
2,4-D	53 de	42 cd	50 de
2,4,5-T	40 cd	31 bc	40 cd
Silvex	22 b	5 a	44 cd

[a]Means followed by the same letter are not significantly different at the 95% level.

(Scifres, 1972). Combinations of silvex with dicamba were ineffective for Macartney rose control. Picloram at 1.12 kg/ha was the most effective single herbicide applied with ground broadcast equipment near Benchley. Combining picloram with 2,4-D, 2,4,5-T or silvex reduced the level of Macartney rose control as compared to picloram alone. Based on results from Benchley, silvex was not included in subsequent experiments and treatments containing picloram were expanded.

Aerial Applications

Canopy reduction of disturbed Macartney rose from aerial application of 2,4-D at 1.12 kg/ha in the fall of 1972 near Bloomington, Tex. (Table 2) was roughly equivalent to that resulting from ground broadcast application near Benchley (Table 1). Dicamba or 2,4-D + dicamba were no more effective than 2,4-D alone for Macartney rose control (Table 2). The most effective herbicide treatment aerially applied at 1.12 kg/ha was 2,4,5-T + picloram.

In another experiment, as the rate of 2,4,5-T + picloram was increased from 0.28 kg/ha to 1.12 kg/ha, disturbed Macartney rose canopies were reduced proportionally based on evaluations 1 year after treatment (Table 3). At 0.28 kg/ha, only about 40% canopy reduction occurred at a year after treatment. By 2 years after aerial application of the low rate, less than 15% canopy reduction was apparent. New canes had grown over the sprayed growth such that area occupied, as compared to original canopy cover, had actually increased. Increasing the herbicide rate to 0.56 kg/ha resulted in a 60% canopy reduction at 1 year after application (Table 3) and 50% by 2 years after treatment. Where 1.12 kg/ha of the herbicide combination was applied, Macartney rose canopies were reduced, on the average, by 80%. Level of control was maintained at about 60% canopy reduction by 2 years after treatment. However, less than 20% of the disturbed Macartney rose plants were completely defoliated and not resprouting 2 years after treatment with the high rate of the herbicide combination, indicating the need for subsequent treatment.

Table 2. Canopy reduction (%) of disturbed Macartney rose a year after aerial application of various herbicides and combinations of 1.12 kg/ha on October 3, 1972, near Bloomington, Tex.[a]

Herbicide(s)[b]	Canopy reduction
2,4-D	39
Dicamba	21
Dicamba + 2,4-D[b]	26
2,4,5-T + picloram	71

[a]Applied in 46 liters/ha of a diesel oil:water emulsion.

[b]Herbicide combinations were applied with components in equal proportions.

Table 3. Canopy reduction (%) of disturbed Macartney rose 1 year after aerial spraying with various rates of 2,4,5-T + picloram (1:1) on October 3, 1972, near Bloomington, Tex.[a]

Rate (kg/ha)	Canopy reduction[b]
0	0 a
0.28	38 b
0.56	60 c
1.12	78 d

[a]Applied in 46 liters/ha of a diesel oil:water emulsion.

[b]Means followed by the same letter are not significantly different at the 95% level.

Regardless of herbicide rate, disturbed Macartney rose was generally more tolerant of 2,4,5-T + picloram treatments than were the original undisturbed stands (Table 4). The differential reaction was similar to that described by McCully et al. (1959) from applications of 2,4-D. Comparing the average response to 2,4,5-T + picloram at 0.56 kg/ha at 1 year after treatment, canopies of disturbed Macartney rose were reduced by about 50% whereas reduction of undisturbed canopies exceeded 70%. This reaction was presumably due to the greater foliar area in relation to the root mass on undisturbed as compared to disturbed plants. Within a growth type regardless of herbicide rate, there was little difference in reaction of Macartney rose whether the herbicides were applied in 47 liters/ha of a diesel oil:water emulsion or with water containing surfactant (Table 4).

Table 4. Canopy reduction (%) of Macartney rose growth types 1 year after aerial application of various rates of 2,4,5-T + picloram (1:1) in water containing surfactant or in diesel oil:water emulsions on October 3, 1972, near Bloomington, Tex.[a]

	Disturbed growth[b]		Undisturbed growth	
(kg/ha)	Diesel oil: water	Water	Diesel oil: water	Water
0	0 a	0 a	0 a	0 a
0.28	29 b	29 b	45 c	50 c
0.56	48 c	50 c	74 de	71 d
1.12	76 de	71 d	83 e	–

[a]Means followed by the same letter are not significantly different at the 95% level.

[b]Initially shredded, sprayed with 4.48 kg/ha of 2,4-D two years later, and then treated with 1.12 kg/ha of 2,4-D for 7 consecutive years.

In previous work, the importance of carrier volume in providing complete coverage of Macartney rose foliage with herbicide was stressed (Haas et al., 1970). Where 0.56 kg/ha of the 2,4,5-T + picloram mixture was applied in 47 liters/ha of total solution, Macartney rose canopies were reduced by about 75% at a year after treatment. Where the carrier volume was doubled, canopy reduc-

Fig. 2. *Spraying will control much of the above-ground Macartney rose growth, but standing dead canes present management problems. Prescribed burning effectively removed Macartney rose debris following the sprays.*

Fig. 3. *Rangeland in Figure 1 after spraying with 2,4,5-T + picloram at 1.12 kg/ha in October, 1970, followed by a prescribed burn 18 months later. Photo taken 7 months following burn.*

tion was about 85% from the same herbicide treatment. Considering internal variation in the study, it is doubtful that the increase provided by the additional carrier would justify the reduction in application time and increased application cost.

Although combinations of 2,4,5-T and picloram (1:1) at 0.56 and 1.12 kg/ha total herbicide were more effective than other treatments evaluated for Macartney rose control, in no case was complete control achieved. Also, application of the herbicide mixture does not remove the mechanical hindrance resulting from dead standing canes (Fig. 2). In subsequent studies, these canes have been removed by a prescribed burn in the winter 18 months after herbicide application. The prescribed burn eliminated the old dead Macartney rose debris (Fig. 3) and increased oven-dry native grass production to over 2,000 kg/ha as compared to 690 kg/ha with no treatment and 1,790 kg/ha from areas sprayed only (Scifres, 1975). Also, in burned areas, forbs such as Texas croton (*Croton texensis*) reappeared in abundance where previously they had been greatly reduced by the sprays. The combination of prescribed burning following herbicide application appears promising for extending the herbicide effectiveness for Macartney rose control.

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