Application of Herbicides on Rangelands with a Carpeted Roller: Timing of Treatment in Dense Stands of Honey Mesquite

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Abstract

Several herbicides were evaluated for control of honey mesquite (*Prosopis glandulosa* Torr.) when applied with a tractor-mounted carpeted roller. Experiments were placed in stands with relatively high honey mesquite densities (2,850 to 4,930 plants/ha). An ester of 2,4,5-T was ineffective at concentrations ranging from 3 to 240 g/L when applied monthly from April through September. Equal-ratio mixtures of 2,4,5-T and picloram provided up to 80% mortality (root-kill) when applied at a total concentration of 24 g/L in June, but did not control honey mesquite if applied in September. Mortality obtained with picloram applied alone in June as a 12 g/L solution varied with year and location from 42 to 61%. Picloram provided 61 to 91% mortality at a concentration of 60 g/L when applied in June, and up to 99% mortality when applied as a 120 g/L solution. Picloram was highly effective when applied in July and August in a year of favorable growing conditions, providing 94 and 96% mortality as 60 g/L solutions, respectively. Mortality was reduced to a maximum of 79% when picloram was applied from April through September in a drought year. Clopyralid and a 1:1 mixture of picloram and clopyralid were usually equal or superior to picloram in effectiveness.

Carpeted rollers are an effective method of applying herbicide solutions to perennial weeds (Cramer and Burnside 1981, Messersmith and Lym 1985), small shrubs (Mayeux and Crane 1984), and woody brush species such as honey mesquite (*Prosopis glandulosa* Torr.) (Mayeux and Crane 1985) on rangelands and improved pastures. The tractor-mounted carpeted roller is an efficient alternative to hand-treating individual brush plants with diesel oil, herbicide sprays, or soil-applied herbicides, especially for regrowth following mechanical treatments or new infestations of small plants that do not yet justify more intensive reclamation practices. Advantages of these applicators include the absence of drift and the application of herbicides only to the taller growing weeds, shrubs, or brush. Better control of some species is obtained by wiping the herbicide onto foliage than by spraying (Mayeux and Crane 1984), and the amount of herbicide required per unit area may be reduced in comparison with other methods (Messersmith and Lym 1985).

Previous evaluations of herbicides applied with a carpeted roller for control of honey mesquite indicated that excellent control could be obtained with picloram (4-amino-3,5,6-trichloropicolinic acid) or clopyralid (3,6-dichloropicolinic acid). Mortality varied from about 60 to 100% when these herbicides were applied under favorable conditions (Mayeux and Crane 1985). Such levels of control compare favorably with other alternatives, but response of honey mesquite varied with year and location. Some of the inconsistency occurred because small, widely spaced honey mesquites were more easily controlled than were larger plants growing in dense stands. The effectiveness of the carpeted roller in dense stands is of particular concern because of current interest in using these applicators to control honey mesquite on degraded pastures where repeated mowing has resulted in very thick stands of decumbent, multistemmed plants up to 2 m in height, the maximum size that can effectively be treated with carpeted rollers as currently constructed. Stems of taller plants are not flexible enough to pass beneath the tractor without breaking at the soil surface, and these invariably resprout from basal buds. In Texas, these pastures are commonly near homesites and fields of herbicide-susceptible crops, and drift limits the use of herbicide sprays. Individual plant treatment by conventional means is precluded by the large numbers of plants and the extensive areas involved.

Timing of herbicide application may be less critical with the carpeted roller than with broadcast sprays (Mayeux and Crane 1985). Percent canopy reduction at the end of the second growing season after treatment was similar when herbicides were applied in May or in August and September, and mortality was slightly but significantly less following late summer applications. Acceptable control of honey mesquite with foliar sprays is obtained from

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about mid May to early July in Texas, and later applications are not recommended (Scifres et al. 1973). Flexibility in the timing of applications would be an important advantage, and additional information is needed in regard to this possibility.

The primary objective of this study was to evaluate the carpeted roller for control of honey mesquite in dense stands of plants that approach the maximum size that can pass beneath the tractor without breaking off at the ground and resprouting. The influence of timing of application was also investigated. A third objective was to compare the effectiveness of the herbicide 2,4,5-T [(2,4,5-trichlorophenoxy)acetic acid] with a standard, picloram, applied alone and in combination. Although 2,4,5-T is no longer commercially available, there was much interest in its effectiveness if applied in this manner when the study was initiated, and questions concerning its use still arise. The herbicides were applied as solutions of varying concentration to provide additional information regarding the concentration required to give acceptable control in different situations.

Methods

The tractor-mounted carpeted roller was operated as described earlier (Mayeux and Crane 1985). However, the stem scraper in front of the roller was replaced with a smooth 5-cm diameter pipe. Wetness of the common household carpet was determined by observing the amount of herbicide solution on foliage as it passed beneath or beside the tractor. The carpet was rewetted as needed during use by momentarily activating a solenoid valve which allowed solution to flow by gravity to a perforated pipe placed parallel to and just above the roller. The roller was usually operated at a height of about 30 cm. Tractor speed was about 6 km/hr.

Experiments were established at 3 locations in central Texas. Herbicides were diluted with water to desired concentrations, expressed as acid equivalent. The propylene glycol butyl ether ester of 2,4,5-T was applied alone at 5 concentrations ranging from 3 to 60 g/L and as a 1:1 combination with the triisopropanolamine salt of picloram at 4 total concentrations ranging from 3 to 24 g/L near Little River, Texas. No surfactant or other additives were included in the solutions. These treatments were applied in separate experiments in late September 1981 and 1982 and in mid June of 1982 and 1983. Most honey mesquites were about 2 m tall, but some were as tall as 2.4 m at the time of treatment. Stand density averaged 2,850 plants/ha as determined by counting the number of plants within several 5.5 by 30.5-m plots. Soils near Little River were clay loams of the Wilson series (Vertic Ochraqualfs).

The same ester form of 2,4,5-T was applied at 5 concentrations ranging from 12 to 240 g/L, and the potassium salt of picloram was applied at 4 concentrations ranging from 12 to 120 g/L near Sparks. These treatments were applied in early June and August in 1983 and in mid-April, June, and August in 1984. In addition, 2,4,5-T was applied as 120 and 240 g/L solutions and picloram as 60 and 120 g/L solutions monthly from June through September in 1983 and from April through September during 1984. Height of plants averaged about 1.5 m in 1983 and almost 2 m in 1984. Density ranged from 3,850 to 3,890 plants/ha. Soils at the Sparks site were silty clays of the Lewisville (Typic Calciustolls) and Krum series (Vertic Haplustolls).

Herbicides applied near Temple in mid June and late August of 1983 and 1984 included the potassium salt of picloram, the monoethanolamine salt of clopyralid, and a 1:1 mixture of the same form of clopyralid with the triisopropanolamine salt of picloram, each at 12 and 60 g/L of total herbicide. A commercial surfactant containing a mixture of polyoxyethylene glycols, free fatty acids, and isopropanol was added to herbicide solutions applied at Sparks and Temple at 0.5% by volume. Plant height at the Temple site averaged 2 m and density averaged 4,930/ha. Soils were Bosque clay loams (Cumulic Haplustolls).

Each experiment was a randomized complete block design with 3 replications. Plot size was 5.5 (3 swaths) by 30.5 m in all experiments. Treatments were evaluated by recording visual estimates of percent reduction in live canopy by consensus of 2 observers, compared to untreated plots, at the end of the second growing season after treatment, usually in September. At the same time, all honey mesquite plants in each plot were observed and rated as live or dead. Plants were considered live if any resprouting was apparent. Percent mortality was calculated as the proportion of dead plants in each plot. Live canopy reduction and mortality data were subjected to several analyses of variance without transformation. Results of the 2 experiments conducted near Little River were similar so the data were pooled across years for analysis and presentation. Only results of the 1983 applications at Temple are presented because the experiments were destroyed when the pasture was rootplowed before evaluations were conducted in the fall of 1985. Data were subjected to analysis of variance. The monthly applications at Sparks were analyzed with treatment effects assigned to month of application as well as all combinations of herbicide and concentration to better define the effects of timing of treatment. Means were separated with Duncan's multiple range test at the 5% level.

Rain gauges were maintained at or near each site during the course of the study, and temperature and relative humidity were recorded by hygrothermographs when treatments were applied at Little River and Temple. A remote weather station with a computing data recorder was installed at the Sparks site during the 1984 growing season. Environmental parameters monitored continuously included air temperature, relative humidity, soil temperature, and soil water tension with gypsum blocks at various depths.

Results

Average temperatures and relative humidity prevailed when treatments were applied near Little River in June and September of 1981 through 1983, and rainfall received during the months immediately prior to each application was average or above (data not shown). Growing conditions appeared to be favorable for herbicide effectiveness on all treatment dates. Considerably higher live canopy reduction and mortality (root-kill) were obtained by treating in mid-June than in late September (Table 1). Mortality was 80% when averaged over both years in plots treated in June with the mixture of picloram and 2,4,5-T at a concentration of 24 g/L. The same treatment killed only 11% of the honey mesquites when applied in September. Effectiveness of the combination of picloram and 2,4,5-T generally increased with increasing concentration in June. The relatively low concentrations of 6 and 12 g/L provided 48 and 57% mortality, respectively, and the 80% mortality obtained with the highest concentration, 24 g/L, would be considered acceptable. Applications of 2,4,5-T alone were not effective at these relatively low concentrations, even in June.

Table 1. Percent canopy reduction and mortality of honey mesquite at the end of the second growing season after herbicides were applied with a carpeted roller on two dates in 1981 through 1983 near Little River, Texas. Stand density averaged 2,850/ha.

Herbicide(s)	Concentration (g/L a.e.)	Canopy reduction (%)[1] June	Canopy reduction (%)[1] September	Mortality (%)[1] June	Mortality (%)[1] September
Picloram + 2,4,5-T	3	34 a	15 abc	13 a	0 a
Picloram + 2,4,5-T	6	77 cd	23 cd	48 bc	0 a
Picloram + 2,4,5-T	12	77 cd	29 d	57 c	6
Picloram + 2,4,5-T	24	98 d	55 e	80 d	11 a
2,4,5-T	3	42 ab	4 a	14 a	0 a
2,4,5-T	6	63 bc	12 abc	23 a	0 a
2,4,5-T	12	75 cd	20 bcd	43 bc	0 a
2,4,5-T	24	81 cd	9 ab	34 ab	0 a
2,4,5-T	60	76 cd	16 abc	32 ab	3 a

[1]Means within a column followed by the same letter do not differ significantly at the 5% level according to Duncan's multiple range test.

Table 2. Percent mortality of honey mesquite at the end of the second growing season after herbicides were applied with a carpeted roller on two dates in 1983 near Sparks, Texas. Stand density averaged 3,850 plants/ha.

Herbicide	Concentration (g/L a.e.)	Mortality (%)[1]	
		June	August
Picloram	12	42 b	30 b
Picloram	24	51 bc	66 c
Picloram	60	61 bc	96 d
Picloram	120	70 c	99 d
2,4,5-T	12	12 a	8 a
2,4,5-T	24	10 a	7 a
2,4,5-T	60	7 a	11 a
2,4,5-T	120	14 a	7 a
2,4,5-T	240	9 a	15 ab

[1]Means followed by the same letter do not differ significantly at the 5% level according to Duncan's multiple range test. Canopy reduction ranged from 93 to 100% and did not vary significantly with herbicide treatment.

Applications of 2,4,5-T at the same and even higher concentrations were no more effective near Sparks in 1983 (Table 2) than at Little River, based on mortality. The maximum mortality obtained with 2,4,5-T applied in June or August at concentrations as high as 240 g/L was only 15%. However, estimated live canopy reduction was high during the year following treatment, averaging 93% or more in all treated plots, regardless of herbicide, concentration, or month of application (data not shown). Most resprouting at Sparks occurred as small shoots arising at the base of main stems, which were not visible during estimates of live canopy reduction. Although canopy reductions were similar, picloram was significantly more effective than 2,4,5-T at each concentration when compared on the basis of mortality. Mortality in plots treated with picloram in June 1983 ranged from 42 to 70% and increased only slightly with increasing concentration, despite a 10-fold difference in the least and greatest concentrations applied, 12 and 120 g/L.

Table 3. Percent mortality of honey mesquite at the end of the second growing season after herbicides were applied with a carpeted roller on four dates in 1983 near Sparks, Texas. Stand density averaged 3,850/ha.

Herbicide(s)	Concentration (g/L a.e.)	Canopy reduction (%)[1]		Mortality (%)[1]	
		June	July	August	September
Picloram	60	61 a	94 b	96 b	76 ab
Picloram	120	70 a	96 b	99 b	93 b
2,4,5-T	120	14 a	11 a	7 a	4 a
2,4,5-T	240	9 ab	24 c	15 bc	2 a

[1]Means within a row followed by the same letter do not differ significantly at the 5% level according to Duncan's multiple rate test. Canopy reduction ranged from 88 to 100% and did not vary significantly with month of application.

Picloram was especially effective when applied in August 1983 at Sparks (Table 2). Solutions containing 60 and 120 g/L of picloram root-killed 96 and 99% of the treated honey mesquites, respectively. A comparison of higher concentrations applied monthly from June to September in 1983 (Table 3) indicated that 60 g/L solutions of picloram were significantly more effective in July and August than in June, and 120 g/L solutions were most effective from July through September. Conversely, June applications of picloram were more effective than August applications in 1984 at all concentrations, especially 12 and 24 g/L (Table 4), in terms of mortality. However, no significant differences were apparent among monthly applications of higher concentrations of picloram from May through September in 1984, based on percent canopy reduction (Table 5). Considerably more variation in response to monthly applications of high concentrations of picloram at Sparks in 1984 was evident in the mortality data. Mortality in plots treated

Table 4. Percent canopy reduction and mortality of honey mesquite at the end of the second growing season after herbicides were applied with a carpeted roller on three dates in 1984 near Sparks, Texas. Stand density averaged 3,890 plants ha.

Herbicide	Concentration (g/L a.e.)	Canopy reduction (%)[1]			Mortality (%)[1]		
		April	June	August	April	June	August
Picloram	12	43 a	87 abc	70 bc	3 a	60 c	14 a
Picloram	24	38 a	90 bc	73 bc	6 a	53 c	19 a
Picloram	60	57 a	90 bc	95 d	29 b	79 d	64 b
Picloram	120	67 a	99 c	88 cd	37 b	93 e	50 b
2,4,5-T	12	52 a	82 ab	38 a	5 a	27 b	2 a
2,4,5-T	24	50 a	72 a	52 ab	4 a	15 a	3 a
2,4,5-T	60	37 a	75 ab	45 a	8 a	14 a	2 a
2,4,5-T	120	53 a	83 ab	73 bc	5 a	14 a	4 a
2,4,5-T	240	58 a	80 ab	57 ab	11 a	15 a	3 a

[1]Means within a column followed by the same letter do not differ significantly at the 5% level according to Duncan's multiple range test.

Table 5. Percent canopy reduction and mortality of honey mesquite at the end of the second growing season after herbicides were applied with a carpeted roller on six dates in 1984 near Sparks, Texas. Stand density averaged 3,890 plants/ha.

Herbicide	Concentration (g/L a.e.)	April	May	June	July	August	September
		Canopy reduction (%)[1]					
Picloram	60	57 a	98 b	90 b	87 b	95 b	97 b
Picloram	120	67 a	94 b	99 b	95 b	88 b	98 b
2,4,5-T	120	53 ab	72 bc	83 c	55 ab	73 bc	37 a
2,4,5-T	240	58 ab	80 b	50 ab	57 ab	43 a	
		Mortality (%)[1]					
Picloram	60	29 a	76 b	79 b	25 a	64 b	75 b
Picloram	120	37 a	63 abc	93 c	58 ab	50 ab	86 bc
2,4,5-T	120	5 a	9 a	14 a	1 a	4 a	3 a
2,4,5-T	240	11 a	7 a	15 a	3 a	3 a	3 a

[1]Means within a row followed by the same letter do not differ significantly at the 5% level according to Duncan's multiple range test.

Table 6. Percent canopy reduction and mortality of honey mesquite at the end of the second growing season after herbicides were applied with a carpeted roller on two dates in 1983 near Temple, Texas. Stand density averaged 4,930 plants/ha.

Herbicide(s)	Concentration (g/L a.e.)	Canopy reduction (%)[1]		Mortality (%)[1]	
		June	August	June	August
Picloram	12	95 a	57 a	61 a	11 a
Picloram	60	100 a	87 b	91 ab	56 bc
Clopyralid	12	99 a	93 b	99 b	76 c
Clopyralid	60	100 a	99 b	84 ab	48 bc
Picloram + clopyralid	12	98 a	73 ab	76 ab	30 ab
Picloram + clopyralid	60	100 a	95 b	94 b	70 c

[1]Means within a column followed by the same letter do not differ significantly at the 5% level according to Duncan's multiple range test.

with 60 g/L solutions in May, June, August, and September ranged from 64 to 79% and did not differ significantly, while mortality in plots treated in April or July was less than 30%. The 120 g/L concentration of picloram provided best control in June and September, and mortality in plots treated in May was not statistically less. Although 2,4,5-T substantially reduced the live canopy of honey mesquite at Sparks in 1984, mortality in plots treated with 2,4,5-T was low and poorly associated with herbicide concentration (Tables 4, 5).

Air temperature, relative humidity, and soil water availability appeared to be more normal for the seasons when herbicides were applied with the carpeted roller near Temple in 1983. Live canopy reduction averaged 95 to 100% at the end of the second growing season after picloram, clopyralid, and their combination were applied as 12 or 60 g/L solutions in June (Table 6). After application in August, more live canopy was visible in plots treated with lower concentrations of picloram, compared to plots receiving other treatments, but canopy reductions in plots treated with picloram alone and in combination with clopyralid at a total concentration of 12 g/L were not significantly different. Little differences were noted in canopy reduction obtained by the higher concentration applied in June or August.

Clopyralid was substantially more effective than picloram when each was applied as 12 g/L solutions in June, based upon mortality (Table 6). The lower concentration of clopyralid killed 99% of the treated honey mesquites, compared to only 61% mortality where picloram was applied alone in the dense stand. The mixture of the 2 herbicides was intermediate in effectiveness, averaging 76% mortality at the lower concentration in June (Table 6). Picloram, clopyralid, and the 1:1 mixture were highly effective when applied in June at the higher concentation. Clopyralid also provided higher mortality than picloram when applied alone as 12 g/L solutions in August, and the mixture was again intermediate in effectiveness. Mortality in August tended to be higher where clopyralid was applied as 12 g/L than as 60 g/L solutions, but differences were not statistically significant. The mixture of picloram and clopyralid root-killed 70% of the honey mesquites when applied in late August at a concentration of 60 g/L.

Discussion

Although the herbicide 2,4,5-T eliminated much of the live canopy of honey mesquite when applied with a carpeted roller in several experiments, it failed to completely kill an acceptable proportion of treated plants when applied in these dense stands at concentration as high as 240 g/L, regardless of timing of application. Basal regrowth of top-killed plants would soon replace honey mesquite's ability to compete with forage species. Applications of the 1:1 mixture of 2,4,5-T and picloram in June were as effective as picloram applied alone, but the mixture was not effective when applied late in the growing season. Clopyralid was more effective than picloram at a low concentration, but not at a higher concentration, and the mixture of the 2 herbicides was as acceptable as either applied alone.

Direct comparisons between the results of experiments reported here and those reported earlier (Mayeux and Crane 1985) are tenuous, but levels of control obtained in these dense stands did not approach those sometimes observed when sparse stands were treated in the previous study. Still, the relatively high levels of mortality obtained with picloram and clopyralid applied alone or in combination indicate that the carpeted roller is an acceptable alternative for use in management of range and pastures dominated by dense stands of honey mesquites up to 2 m in height if effective herbicides are used. However, greater quantities of herbicide solutions are required to treat dense stands, relative to sparse stands, which would increase the cost of application.

Some variability occurred among experiments in the degree of honey mesquite control obtained with picloram, the herbicide included in each experiment as a standard, as was also noted in previous research. Mortality ranged from 42% where picloram was applied in June as 12 g/L solution at Sparks in 1983 to 60 and 61% where it was applied at the same concentration at Sparks in 1984 and near Temple in 1983. Mortality obtained with 60 g/L solutions applied in June ranged from 61 to 91% in the various experiments. Comparable variation occurred in the results of applications made in August and September; mortality obtained with 12 g/L solutions varied from 11 to 30% and from 56 to 96% where 60 g/L solutions were applied. Such variation is typical of the response of honey mesquite to herbicides, regardless of method of application (Scifres et al. 1973), and reflects time and site specific differences in environmental conditions, physiological status, and other variables which are difficult to assess. The failure of this practice to provide complete control of honey mesquite in dense stands or sparse stands (Mayeux and Crane 1985) documents the need for eventual retreatment, as with all other methods of control.

The variability in control that was associated with month of application, within a year and location, appeared to be equal to that observed among years and locations. Mortality obtained with picloram in a solution containing 60 g/L ranged from 61 to 96% when applied monthly from June through September in 1983 (Table 3) and from 25 to 79% when applied from April through September in 1984 at Sparks (Table 5). Much of this variation can

Table 7. Environmental conditions on dates in 1984 when herbicides were applied to honey mesquite with a carpeted roller near Sparks, Texas.

Date	Maximum air temperature (C)	Minimum relative humidity (%)	Maximum soil temperature (C)		Soil water potential (-MPa)	
			10 cm	46 cm	20 cm	46 cm
April 17	29	13	22	22	1.2	0.7
May 15	32	21	37	29	>2.0	>2.0
June 13	32	51	34	29	0.03	0.2
July 18	38	20	40	35	>2.0	>2.0
August 16	35	26	36	30	0.02	>2.0
Sept. 25	35	39	34	28	>2.0	>2.0

be attributed to the poor control obtained when treating honey mesquite during drought conditions, as occurred in 1984. Even in that year, fairly consistent control was obtained in May, June, August, and September, and mortality was high following application of picloram in June through September in 1983. Highest mortality obtained with 60 g/L picloram solutions occurred in plots treated in July and August of 1983, a year with favorable growing conditions during the entire summer. These results would suggest that application of herbicides with the carpeted roller need not be limted to early summer in order to realize acceptable results, as is the case with broadcast sprays (Scifres et al. 1973).

The variation associated with years and months within years in honey mesquite's response to applications of identical treatments, especially evident at Sparks, can be attributed to wide differences in weather and growing conditions. Both the unusual pattern of response to monthly applications and the generally lower mortality observed at Sparks in 1984, relative to other experiments, were probably due to reduced susceptibility to translocated herbicides associated with water stress and drought conditions. Soil water availability has strongly influenced the response of honey mesquite to herbicides such as 2,4,5-T applied as broadcast sprays in other studies, as summarized by Scifres et al. (1973). Rainfall at Sparks was below the annual average of 85 cm in both years, with 78 cm recorded from January through December 1983 and 75 cm occurring in 1984 (data not shown). However, the monthly distributions were very different. The spring of 1983 was relatively wet, with a total of 24 cm recorded in January, February, and March. Considerable rain occurred during the growing season in 1983, with 20 cm recorded in May, 17 in August, and at least 1.7 cm recorded in each month that herbicides were applied. Little of the total 1983 rainfall occurred after the last application in September. The spring of 1984 was especially dry until 13 cm was recorded in early June.

The distribution of rainfall at Sparks in 1984 was reflected in soil water tension, which was relatively high at -1.2 and -0.7 MPa at 20 and 46 cm depths when treatments were applied in April (Table 7). April applications were not effective (Table 5), possibly because of water stress, immaturity of leaves (Dahl et al. 1971, Scifres et al. 1973), or low soil temperatures. Dahl et al. (1971) reported that acceptable control of honey mesquite with 2,4,5-T sprays occurred only after soil temperature exceeded 27° C at a depth of 46 cm, which did not occur at the study site until 8 May 1984 (Table 7).

Soil water tension was greater than -2 MPa at both depths when treatments were applied in May and July. The 13 cm of rainfall which occurred 1 week prior to treatment in June reduced soil water tension to -0.03 and -0.2 MPa at 20 and 46 cm, respectively, and 3 cm of rain 4 days prior to treatments in August reduced soil water tension at 20 cm to -0.02 MPa, although the soil at 46 cm remained very dry. Mesquite control was not closely associated with soil water potential, in that relatively high mortality and canopy reduction (Table 5) were obtained with picloram in May and September, when the soil was very dry to a depth of at least 46 cm (Table 7). Control was especially poor in July, when soil water potential was high and maximum daily air temperatures were in excess of 38° C for 10 days prior to and during treatment. Air temperatures were also high during August and September.

Treatments applied in August 1983 near Temple were not as effective as those applied in June (Table 6), but the least effective treatments in August at that location were those applied at a concentration of only 12 g/L. That concentration applied in August 1983 at Sparks also provided inadequate control (30% mortality), while 24 and 60 g/L solutions killed 66 and 96% of the honey mesquites in the same experiment (Table 2). It appears that a concentration of 12 g/L, and possibly 24 g/L, is insufficient to provide acceptable control in dense stands under the more stressing conditions in late summer, while 60 g/L solutions provide acceptable mortality when applied through August in normal years. Excellent control was obtained in June with 12 and 24 g/L solutions of picloram in some but not all experiments, as was noted with 30 g/L solutions in the previous report (Mayeux and Crane 1985). These concentrations may be sufficient under favorable conditions, but the ability to accurately identify those periods is currently lacking. The ineffective applications made in late summer near Little River were applied during the last week in September, which is probably too late in the growing season to obtain acceptable control with any reasonable concentration of herbicide in the treatment solution. The presence of honey mesquites up to 2.4 m tall at that site also reduced mortality relative to other sites.

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