Shredding and Spraying Honey Mesquite

W. E. BOYD, RONALD E. SOSEBEE, AND E. B. HERNDON

Highlight: Shredding and spraying honey mesquite is an effective method of control. Overall, the highest percent root mortalities were obtained from treatments applied in May, but shredding and spraying were effective when applied during other months of the year, even during the fall and winter. Root mortalities obtained from aqueous solutions of either 2,4,5-T amine or picloram plus 2,4,5-T during the year were dependent upon water content and temperature in the upper 15 cm of the soil (2,4,5-T, R=0.88; picloram plus 2,4,5-T, R=0.82). Average root mortalities for all months were consistently the greatest from picloram plus 2,4,5-T (57%), followed by dicamba (34%) and dicamba plus 2,4,5-T (31%). Root mortalities obtained from 2,4,5-T amine (26%) and 2,4,5-T ester (25%) were the lowest obtained in the study.

Encroachment of noxious weeds and brush has accompanied overuse of many grasslands in the Southwest. Several early scientists in Texas (Smith 1896; Bray 1904; Cook 1908) and in Arizona (Griffiths 1904; Thornber 1910) reported the invasion of mesquite (*Prosopis*) on rangelands in the Southwest.

Rechenthin et al. (1964) reported that 56 million acres of Texas grasslands are infested with honey mesquite (*P. glandulosa* var. *glandulosa*). Thirty to 35 million acres of brush have been controlled by various methods. However, the brush on only 15 million acres is considered to be effectively controlled. Reinfestation is a constant problem.

The authors are graduate research assistant and associate professor, Department of Range and Wildlife Management, Texas Tech University, Lubbock 79409; and research associate, Department of Range and Wildlife Management, Texas Tech University, Quanah.

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Hand and mechanical methods of brush control are effective over the long term but they are costly. A disadvantage to chemical control is that it leaves standing obstructions to the subsequent movement and working of livestock; and it presents the danger of chemical drift to susceptible field crops (Rechenthin 1964). Shredding is reasonably inexpensive but it has a marked tendency to stimulate plant growth by causing a "pruning" effect (Carpenter 1970). If shredding could be combined with an effective spray program, brush might be controlled less expensively.

Goen and Dahl (1971) sprayed only the stumps of shredded honey mesquite with 2,4,5-T ((2,4,5-trichlorophenoxy) acetic acid) propylene glycol butyl ether esters, 2,4,5-T trimethyl amine salts, and 2,4,5-T plus picloram (4-amino-3,5,6-trichloropicolinic acid). Their results indicated that treatments applied during October and April were about twice as effective as those applied during other months. They also found that 2,4,5-T plus picloram was more effective than either the ester or salt formulation of 2,4,5-T. Beck et al. (1975) found that simultaneous shredding and spraying honey mesquite was an effective method of control.

Ethephon (2-chloroethylphosphonic acid) applied with 2,4,5-T or picloram was used in California to control basal sprouts on citrus stumps (Boswell et al. 1973). Ethephon has also been used to control sucker growth on pruned trees (Gardner 1971), to stimulate lowbush blueberry (*Vaccinium augustifolium*) growth (Kender 1969), and to defoliate Pin oak (*Quercus palustris*) and red maple (*Acer rubrum*) (Sterret et al. 1971). Morey et al. (1976) showed that ethephon and 2,4,5-T (trimethylamine salt formulation) were synergistic and increased seedling honey mesquite stem mortality compared to 2,4,5-T alone.

This study continued the investigation of the effects of various herbicide treatments, including combinations of ethephon, applied to honey mesquite stumps immediately following shredding. Specifically the objectives were to:

1) Evaluate the influence of 2,4,5-T propylene glycol butyl ether ester, 2,4,5-T trimethylamine salt, 2,4,5-T plus picloram, dicamba (3,6-dichloro-*o*-anisic acid), and 2,4,5-T plus dicamba applied alone and in combination with ethephon on root mortality of shredded honey mesquite;
2) Determine the time of year that shredding and spraying can be most effectively used; and
3) Estimate the volume of herbicide solution necessary to prevent sprouting following shredding.

Experimental Procedures

This study was conducted in the northern Rolling Plains on the Koch ranch 28.3 km (17 miles) west of Quanah, Texas, on a Shallow Redland site (Richardson et al. 1974) with a 1 to 3% slope. The soil, a Vernon clay loam, is a moderately deep, very slowly permeable calcareous clay loam with moderate water availability.

The plant community is dominated by tobosagrass (*Hilaria mutica*) and honey mesquite. Common broomweed (*Xanthocephalum dracunculoides*) was also prevalent during this study.

Herbicide treatments were applied each month to stumps of trees that were shredded January through December, 1975. Herbicides commonly used in honey mesquite control including the propylene glycol butyl ether esters and trimethyl amine salts formulations of 2,4,5-T, picloram plus 2,4,5-T (triethylamine salt), dicamba, and dicamba plus 2,4,5-T (propylene glycol butyl ether ester) were applied to stumps of honey mesquite within 3 hours after shredding. Dicamba, dicamba plus 2,4,5-T and both formulations of 2,4,5-T were basically mixed at the rate of 29.6 ml/3.785 l (1 oz/gal). Picloram plus 2,4,5-T was mixed at the rate of 59.2 ml/3.785 l. All herbicides were packaged at 1.8 kg a.e./3.785 l except picloram plus 2,4,5-T which was packaged at 0.9 kg a.e./3.785 l. Picloram plus 2,4,5-T and 2,4,5-T ester were dissolved in equal quantities of diesel oil before emulsifying them in water. Dicamba, 2,4,5-T amine, and picloram plus 2,4,5-T were dissolved in aqueous solutions. Ethephon was added to the herbicide mixtures at rates of 0, 0.1, 1.0, and 10.0% (v/v). A surfactant was added to all mixtures to approximate 0.02% (v/v) of the total volume.

The stumps of the area immediately surrounding the stumps were sprayed "to wet" with an average maximum 375 ml (0.1 gal) herbicide. Compressed air garden sprayers were used to apply the herbicide. Each treatment was replicated 15 times (individual stumps). No trees were shredded or treated more than once.

An auxiliary study was also conducted to estimate a sufficient amount of picloram plus 2,4,5-T applied to stumps at different times of the year to kill honey mesquite. The herbicide was applied in aqueous solution with a surfactant added to approximate 0.02% (v/v) of the total volume. Stumps of honey mesquite were treated with 50, 100, 200, 400, and 600 ml of herbicide solution. Each treatment was replicated 5 times (individual stumps) with no stump being treated more than once.

On each treatment date, soil water content (measured gravimetrically), soil temperature, air temperature, relative humidity, and phenological stage of the trees were recorded. Root mortality was evaluated in October, 1976. Any evidence of sprouting constituted a live tree.

Results and Discussion

Addition of ethephon to the herbicide mixtures produced no significant interactions; therefore, the data were pooled. Root kills (average for all treatments) were greatest from treatments applied in May (Table 1). Root mortality from treatments applied during other months were dependent upon the environmental conditions at the time of application.

Picloram plus 2,4,5-T applied throughout the year was significantly more effective in controlling honey mesquite than

Table 1. Average root mortality (%) of honey mesquite shredded and sprayed with 2,4,5-T ester, 2,4,5-T amine, picloram plus 2,4,5-T, dicamba plus 2,4,5-T, or dicamba during January through December, 1975.

Treatment date	2,4,5-T ester	2,4,5-T amine	Picloram plus 2,4,5-T	Dicamba plus 2,4,5-T	Dicamba
January 15	B[1] 12 d	B 25 b	A 50 cd	B 18 c	B 14 c
February 21	C 19 cd	BC 20 bc	A 78 a	BC 25 bc	B 35 ab
March 14	C 20 cd	C 23 b	A 72 a	C 24 bc	B 44 ab
April 18	B 28 bc	B 33 b	A 55 bc	B 32 bc	AB 45 ab
May 23	AB 55 a	B 49 a	A 70 ab	B 48 a	A 31 bc
June 17	A 34 bc	A 33 b	A 30 e	A 34 abc	A 18 c
July 18	AB 44 ab	B 32 b	AB 44 de	B 32 bc	A 50 a
August 19	B 27 c	B 32 b	A 53 c	B 33 abc	B 17 c
September 19	C 19 cd	BC 34 ab	A 70 ab	B 36 ab	B 36 ab
October 17	C 5 d	BC 15 c	A 36 de	AB 26 bc	AB 30 bc
November 21	D 12 d	CD 15 c	A 70 ab	C 25 bc	B 46 ab
December 12	B 21 cd	C 5 c	A 50 cd	A 39 ab	A 42 ab

[1] Treatment means per date with the same superscript are not significantly different ($P < 0.05$). Treatment means per herbicide followed by the same lower case letter are not significantly different ($P < 0.05$).

other herbicides. Overall, dicamba and dicamba plus 2,4,5-T were intermediate in effectiveness, while 2,4,5-T amine and 2,4,5-T ester were the least effective. Picloram plus 2,4,5-T was as effective when applied during the "dormant" or quiescent period as when it was applied during the growing season. Dicamba was quite effective if applied when honey mesquite was actively growing.

Root mortalities resulting from most herbicides applied in May exceeded 40%. Buds (aerial) began to burst in mid-April. By late May, the trees had both mature and immature leaves and flowers that were in the early stages of development. Apparently, the direction of photosynthate translocation was to the immature leaves and developing flowers. Therefore, the level of carbohydrates was depressed (Wilson et al. 1975). Root kills during this period seem to be related to the physiological condition of the plant rather than to environmental parameters.

Honey mesquite is most easily controlled during periods when the energy reserves (carbohydrates) within the plant are lowest (Fisher et al. 1959). Beck et al. (1975) also reported very high root mortalities obtained from shredding and spraying honey mesquite in May. Wright (1968) removed shoot growth from honey mesquite every 2 weeks April through January and then weighed the regrowth the following year. He found the most detrimental time of top removal was correlated with the

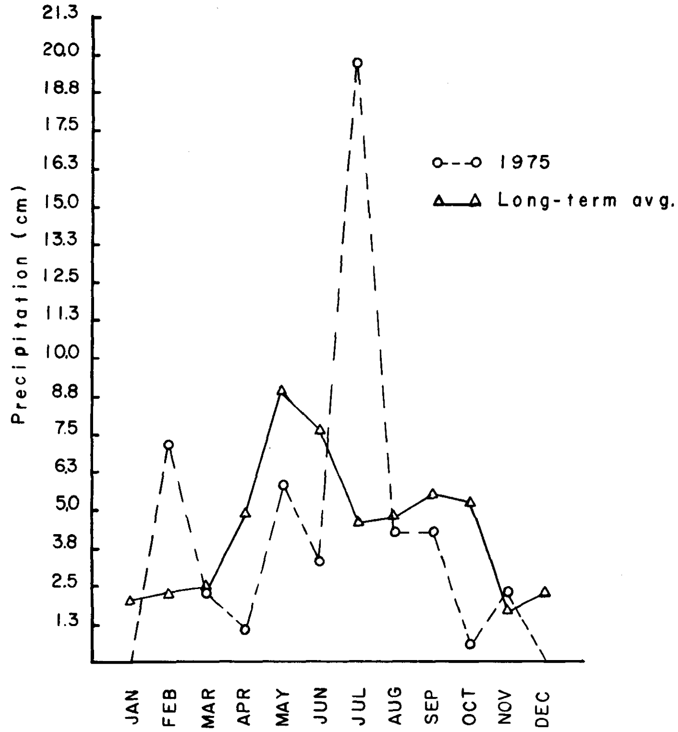

Fig. 1. *Long-term average precipitation of Quanah, Texas, compared to the amount and distribution of precipitation on the Koch Ranch during this study, 1975.*

termination of leaf growth and that production of basal sprouts following treatments applied in May was the lowest.

Root mortalities obtained in July were higher than expected. These results may be related to either a depressed level of carbohydrates in the roots and basal crowns (Fisher et al. 1959; Wilson et al. 1975) or an unusual amount of precipitation (Fig. 1). Herbicides applied in aqueous solution (primarily 2,4,5-T amine and picloram plus 2,4,5-T) throughout the year were dependent upon the soil temperature and soil water content in the upper 15 cm (Fig. 2) at the time of herbicide application (2,4,5-T amine, $R=0.88$; picloram plus 2,4,5-T, $R=0.82$). These data support those obtained by Beck et al. (1975), where honey mesquite was effectively controlled during October when the soil water content exceeded 20% on a similar soil. It is apparent soil water should be adequate to incorporate the herbicide into the soil solution that envelopes the basal bud zone

Table 2. Average root mortality (%) of honey mesquite shredded and sprayed with different volumes (50, 100, 200, 400, and 600 ml) of picloram plus 2,4,5-T January through December 1975.

Treatment date	Volume of herbicide (ml)				
	50	100	200	500	600
January 14	100	90	90	100	100
February 21	75	60	80	75	100
March 14	60	100	80	75	80
April 18	80	75	60	60	40
May 23	80	60	80	100	100
June 17	40	75	40	60	60
July 18	100	60	80	80	60
August 19	20 b[1]	60 ab	100 a	60 ab	20 a
September 19	100	80	80	100	100
October 17	40	60	60	40	40
November 21	40	40	40	80	60
December 12	40	60	60	100	80

[1] The only significant differences in root mortality resulting from different volumes occurred in August. Values having the same letter is not significantly different ($P < 0.05$).

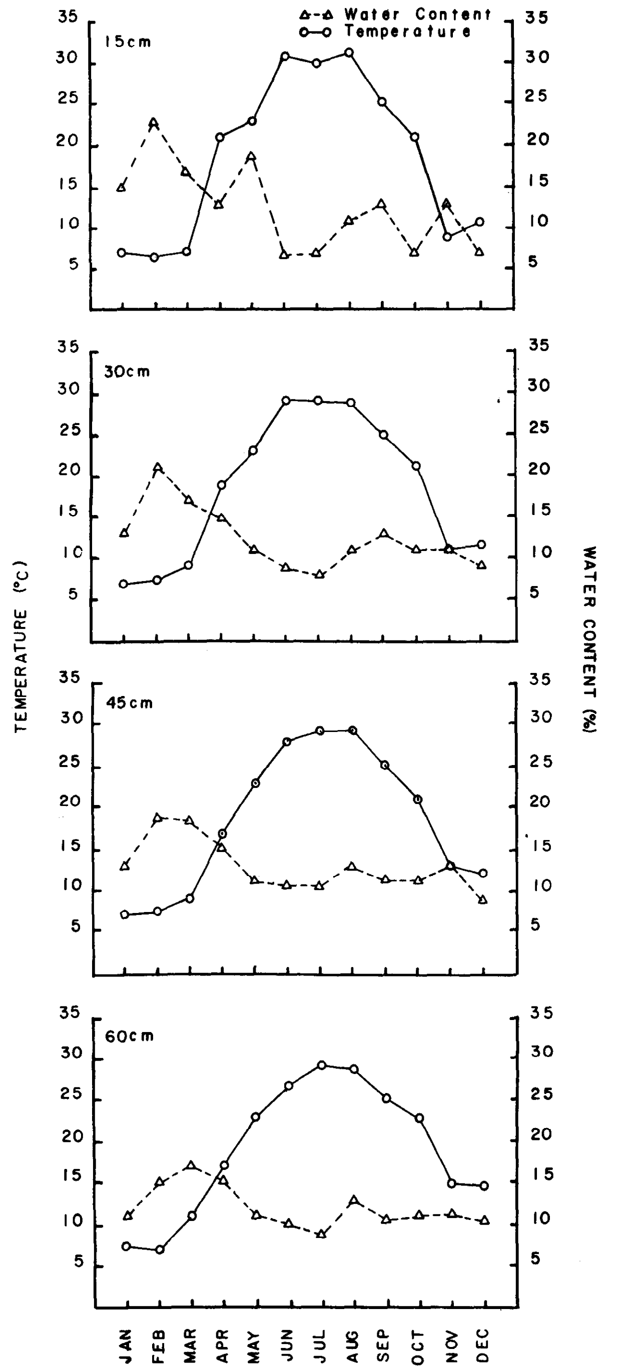

Fig. 2. *Soil temperature (°C) at four depths (15, 30, 45, and 60 cm) and soil water content (%) at four depths (0 to 15, 15 to 30, 30 to 45, 45 to 60 cm) on dates (January through December, 1975) of herbicidal application to stumps of shredded honey mesquite. Each value represents the average of three replications.*

and that soil water content and soil temperature be conducive for basal bud activity following shredding.

Shredding and spraying honey mesquite, especially with picloram plus 2,4,5-T during the "dormant" or quiescent period were quite effective in controlling resprouting. This adds a dimension to brush control programs that presently does not exist.

Results of the auxiliary study comparing various volumes of picloram plus 2,4,5-T (50, 100, 200, 400, and 600 ml) applied monthly to shredded stumps indicated that there were no significant differences between the volumes except when applied in August (Table 2). Theoretically, in a stand of 750 single-stemmed honey mesquite trees/ha, 50 ml of herbicide solution per stump would represent a minimum application rate of approximately 37 l (10 gal)/ha. However, it will be difficult to achieve such low application volumes because of "trash," clumps of grass, etc., that tend to activate the spraying mechanism.

Conclusions

Shredding and spraying are not the universal solution to the mesquite infestation of Southwestern rangelands. Combination of the two treatments offers a dimension to an integrated program of brush control that presently is not being utilized. May appears to be the month during which most success can be achieved. However, one can expect a relatively high degree of success from shredding and spraying during other months of the year, depending upon the soil temperature and soil water content. Since 2,4,5-T plus picloram produces a relatively high percent root mortality of honey mesquite during the fall and winter months, these treatments can be applied when labor and farm machinery are available. Also, by shredding and spraying during the fall and winter, one can generally avoid danger of herbicide injury to susceptible cultivated crops. Shredding and spraying potentially provides an economical and safe means of honey mesquite control to the small land owner. It also allows selective honey mesquite control for habitat manipulation for wildlife.

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