Honey Mesquite Control and Forage Response in Crane County, Texas

P.W. Jacoby, C.H. Meadors, M.A. Foster, and F.S. Hartmann

Abstract

Replicated field plots of honey mesquite (Prosopis glandulosa var. glandulosa) were aerially treated with herbicides in 1977 near Crane, Texas. Plots were evaluated for 3 years to determine efficacy of nine herbicide formulations. Of the herbicides studied, 3,6-dichloropicolinic acid was the most effective. Sprayed plots produced twice as much forage as unsprayed areas with several species of grass showing significant increases in production. Forb response was not significantly different between treated and untreated plots. Most of the forage response occurred 1 m from the tree base rather than at 3 and 5 m from the tree.

Herbicides remain an economical and efficient method for controlling large areas of mesquite. However, the controversies surrounding the use of 2,4,5-T [2,4,5-trichlorophenoxy]acetic acid] have threatened its continued use. Two new herbicides, triclopyr [(3,5,6-trichloro-2-pyridinyl)oxyacetic acid] and 3,6-DPA (3,6-dichloropicolinic acid), have recently been evaluated for mesquite control (Jacoby et al. 1980, 1981).

Aerial spraying of mesquite with 2,4,5-T and 1:1 mixture of 2,4,5-T + picloram (4-amino-3,5,6-trichloropicolinic acid) or dicamba (3,6-dichloro-o-anisic acid) has provided temporary suppression of mesquite as well as increased forage production (Scifres 1980). Degree of forage response following mesquite control has been related to: (1) mesquite size and density (Williams 1976); (2) rainfall following treatment (Cable 1976, Martin 1975); (3) degree of control (Dahl et al. 1978), and (4) the condition and composition of the understory herbaceous community (McDaniel et al. 1978, Scifres and Polk 1974). Generally, most dramatic forage responses following brush suppression have occurred in arid to semiarid areas where competition between brush and grass is critical. Studies conducted in Arizona by Cable (1976), Martin and Tschirley (1961), and Parker and Martin (1952) have shown increased forage production from mesquite control over long periods of time following treatment.

Specific competitive factors between mesquite and associated grasses have been delineated. Tiedemann and Klemmedson (1973) found that soils were more fertile under mesquite trees than in the open interspaces. Certain plants including Arizona cottontop (Digitaria californica), bristlegrass (Setaria texana), and bush muhly (Muhlenbergia porteri) were found to adapt to shaded conditions beneath mesquite canopies, while plants such as black grama (Bouteloua eriopoda) were shade intolerant (Tiedemann et al. 1971). Brock et al. (1978) determined that cool-season forage species found mainly in the canopy zone decrease following mesquite control in northcentral Texas. Cable (1977) defined zones of moisture use around mesquite plants with moisture depletion occurring rapidly near tree bases, decreasing with depth and distance from the tree. Thomas and Sosebee (1978) found that mesquite in western Texas relies on a system of shallow lateral roots when moisture is available in the upper soil profile and utilizes a deep tap root system during drought.

The objectives of this study were to determine relative efficiencies of registered and experimental herbicides for mesquite control and to estimate plant responses of associated forage species in sprayed and nonsprayed plots.

Study Area and Methods

Studies were conducted on rangeland 6 km northwest of Crane in western Texas. Climate is semiarid with an average of 33 cm annual rainfall occurring mainly in late spring and summer. Soils in the study area are sands and sandy loams in the Penwell (Ustic Torripalust) series. Malam and Poyte (Ustic Haplargids) series (Watson 1976). Soils are mainly sandy loams in the southern end of the area becoming more sandy to the north. Native vegetation on the area is dominated by shrubs including honey mesquite, catclaw acacia (Acacia greggii), and fourwing saltbush (Arizona crotalaria). Grasses dominate the understory and include Wright thewremark (Aristida wrightii), sand dropseed (Sporobolus cryptandrus), mesa dropseed (Sporobolus flexuosus), bristlegrass, Arizona cottontop, black grama, bush muhly, and hooved windmillgrass (Chloris caycata). Major forbs are leatherweed hoon (Croton poistis) and broom sawkwed (Xanthocephalum sarothrae).

The study area was subdivided into 30 plots (102 x 402 m each) to accommodate a randomized complete block design comprised of nine treated plots and an untreated check plot in each of three blocks. The area was blocked to account for soil variation. Blocks were delineated by four parallel access paths bulldozed 402 m apart. The experimental design was modified by randomizing the order of treatment application but using the same order of treatment installation in each block. Treatments were offset in each block to insure that similar treatments were not together in adjacent blocks. Herbicides were aerially applied in late May 1977. Each treatment consisted of six parallel spray swaths each measuring 12 by 402 m. Untreated buffer zones 30 m wide were maintained between plots to minimize cross-treatment herbicide movement and to facilitate field evaluations. All herbicide treatments were applied at a 0.56 kg/ha (a.e.) rate in 9.4 L/ha volume of 1.7 (v:v) diesel oil and water emulsion. Herbicides were mixed for each treatment in an open vat with constant recirculating agitation. Measured amounts of herbicide and diesel oil were poured simultaneously from separate containers into a premesured amount of recirculating water to form the emulsion. The aircraft was calibrated prior to treatment, loaded through the hopper, and following treatment, drained of residual spray solution which was measured to substantiate proper treatment volume. Aircraft systems were washed and purged between each treatment to prevent herbicide contamination among treatments. Herbicides included in the experiment were: 2,4,5-T alone and in combination (1:1) 2,4,5-T as the propylene glycol butyl ether ester.

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Manuscript received June 18, 1981. Technical article TA-16917 from the Texas Agr. Exp. Sta. Study was a cooperative investigation of Texas Agr. Exp. Sta. and University of Texas Lands.

The authors express their appreciation to J.R. Bell, Garth Grizzle, J.B. Averitt, and Tomas Dominguez with the Soil Conservation Service, U.S. Dep. Agric., for their assistance in collecting the forage production data. We also wish to thank Bill Carr, Manager, Surface Leasing, University Lands for suggesting and supporting this study. Funds for this research were provided by the University of Texas Lands-Surface Leasing, Midland Texas. Herbicides were provided by Dow Chemical Co., U.S.A., and Velocil Chemical Co. Application of herbicides was by H & W Flying Service, Midland, Texas.
with picloram, dicamba, and 3,6-DPA: ester and amine formulations of triclopyr, and triclopyr ester with picloram (1:1); 3,6-DPA; and an equal part combination of dicamba and picloram.

Treatments were evaluated 6 months post-treatment by visually estimating percentage defoliation in each plot. Subsequent evaluations were made 18 and 30 months post-treatment using belt transects in which 100 or more individual mesquite plants were evaluated visually in each plot to estimate plant defoliation and mortality.

In November 1979, 30 months post-treatment, obvious differences in forage production between treated and untreated plots warranted estimates of forage production to be measured by clipping standing grass and forb biomass. Forage production estimates were made between untreated plots and plots treated with 3,6-DPA due to the close proximity of the two plots in each block and the effective control of mesquite by 3,6-DPA.

Within each block ten trees of equivalent size were selected in each of the treated and untreated plots. Trees in the check plots were unaffected by spray while those in the 3,6-DPA plots were dead. Quadrats 0.25 m² in size were placed 1, 3, and 5 m from the tree base on the east side of each plant. Within each quadrat, individual plant species were clipped, bagged separately, and subsequently oven-dried to a constant weight. All data were subject to analyses of variance and mean separation.

### Results and Discussion

Estimation of canopy reduction made in November 1977, 6 months post-treatment, revealed more than 90% defoliation in all herbicide treatment except 2,4,5-T, triclopyr amine and dicamba + 2,4,5-T which were slightly lower. Buffers between plots were largely unaffected, validating lack of herbicide drift across plots. Associated shrubs such as fourwing saltbush were slightly defoliated initially by herbicide combinations containing picloram but these effects were not evident 30 months following treatment.

Evaluations of mesquite defoliation and mortality made in November 1978 and 1979, 18 and 30 months post-treatment, respectively, revealed major differences in herbicide efficacies (Table 1). Herbicide 3,6-DPA was significantly more effective than the other herbicides, whether applied alone or in equal part combination with 2,4,5-T. Triclopyr, provided similar control to 2,4,5-T and 2,4,5-T + dicamba (1:1), while herbicides containing picloram gave higher mortality of mesquite than triclopyr. No significant differences occurred among blocks.

### Table 1. Mean plant defoliation (%) and mortality (%) of honey mesquite treated in May 1977 and evaluated 18 and 30 months following treatment near Crane, Texas.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>18 months post treatment</th>
<th>30 months post treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Defoliation</td>
<td>Mortality</td>
</tr>
<tr>
<td>3,6-DPA + 2,4,5-T</td>
<td>91</td>
<td>78a</td>
</tr>
<tr>
<td>3,6-DPA</td>
<td>82</td>
<td>70a</td>
</tr>
<tr>
<td>picloram + dicamba</td>
<td>79</td>
<td>42b</td>
</tr>
<tr>
<td>picloram + 2,4,5-T</td>
<td>79</td>
<td>36b</td>
</tr>
<tr>
<td>picloram + triclopyr ester</td>
<td>91</td>
<td>30bc</td>
</tr>
<tr>
<td>dicamba + 2,4,5-T</td>
<td>64</td>
<td>19d</td>
</tr>
<tr>
<td>2,4,5-T</td>
<td>51</td>
<td>12cd</td>
</tr>
<tr>
<td>triclopyr ester</td>
<td>61</td>
<td>9d</td>
</tr>
<tr>
<td>triclopyr amine</td>
<td>33</td>
<td>9d</td>
</tr>
</tbody>
</table>

*Means within a column followed by the same letter are not significantly different at the 5% level.

### Table 2. Mean standing crop of grasses and forbs (kg/ha) estimated 30 months post-treatment at 1, 3, and 5 m distances from sprayed and non-sprayed mesquite trees near Crane, Texas.

<table>
<thead>
<tr>
<th>Distance from tree base (m)</th>
<th>Treated Grasses</th>
<th>Treated Forbs</th>
<th>Untreated Grasses</th>
<th>Untreated Forbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg/ha</td>
<td></td>
<td>kg/ha</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1165.4a</td>
<td>373.6c</td>
<td>457.4c</td>
<td>333.8c</td>
</tr>
<tr>
<td>3</td>
<td>715.7b</td>
<td>130.0d</td>
<td>454.5c</td>
<td>196.6d</td>
</tr>
<tr>
<td>5</td>
<td>834.8b</td>
<td>140.2d</td>
<td>336.1c</td>
<td>91.1d</td>
</tr>
</tbody>
</table>

*Values followed by the same letter are not significantly different at the 5% level.

### Table 3. Mean standing crop (kg/ha) by species estimated 30 months post-treatment in sprayed and non-sprayed plots at 1, 3, and 5 m from base of trees near Crane, Texas.

<table>
<thead>
<tr>
<th>Species</th>
<th>1m</th>
<th>3m</th>
<th>5m</th>
<th>Untreated 1m</th>
<th>Untreated 3m</th>
<th>Untreated 5m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aristida wrightii</td>
<td>5d</td>
<td>377a</td>
<td>344ah</td>
<td>14d</td>
<td>753bc</td>
<td>196c</td>
</tr>
<tr>
<td>Chloris cucullata</td>
<td>502a</td>
<td>150bc</td>
<td>216b</td>
<td>207b</td>
<td>74c</td>
<td>64c</td>
</tr>
<tr>
<td>Panicum havardii</td>
<td>99a</td>
<td>33bc</td>
<td>74ab</td>
<td>29bc</td>
<td>8c</td>
<td>28bc</td>
</tr>
<tr>
<td>Setaria texana</td>
<td>208a</td>
<td>0b</td>
<td>0h</td>
<td>55b</td>
<td>0h</td>
<td>0h</td>
</tr>
<tr>
<td>Sporobolus cryptandrus</td>
<td>232a</td>
<td>149ab</td>
<td>140ab</td>
<td>130bc</td>
<td>118bc</td>
<td>45e</td>
</tr>
<tr>
<td>Other grasses</td>
<td>70a</td>
<td>128b</td>
<td>60ab</td>
<td>2c</td>
<td>0c</td>
<td>2e</td>
</tr>
<tr>
<td>Croton poirii</td>
<td>361a</td>
<td>152c</td>
<td>122c</td>
<td>326ab</td>
<td>196bc</td>
<td>91c</td>
</tr>
<tr>
<td>Other forbs</td>
<td>13ab</td>
<td>10ab</td>
<td>18a</td>
<td>7bc</td>
<td>0c</td>
<td>0c</td>
</tr>
</tbody>
</table>

*Mean values within a row not followed by the same letter are significantly different at the 5% level (Duncan's multiple range test).
production among the 1, 3, and 5 m distances in the untreated plots was not significantly different while forb production was greatest near the trees. Significant differences in overall grass, forb or forage (grass + forbs) production were not found among blocks, although individual species displayed considerable variation among blocks and distances from trees (Table 3). Forbs, especially annuals, would have probably been higher if sampling had occurred in late spring.

**Reaction of the Various Species**

Wright threeawn was a fairly ubiquitous species but was more productive on the loamy soils of the study area. Treated plots produced significantly ($P<0.05$) more production than untreated plots. Both treated and untreated plots had significantly ($P<0.01$) more production away from the tree (3 and 5 m) than near the tree (1 m). Wright threeawn showed a general affinity for open areas of loamy soils and responded positively to mesquite control.

Hooded windmillgrass was most responsive to mesquite control and contributed greatly to overall forage production in the treated plots. This species produced significantly ($P<0.01$) more forage in treated areas than in untreated areas. Hooded windmillgrass produced significantly ($P<0.01$) more forage near the trees than in open areas and favored the lighter textured soils.

Harvard panicum (Panicum harvardii) was found in significantly ($P<0.01$) greater amounts on the treated area than in the untreated plots. While overall production did not vary greatly among the distances from trees, significant ($P<0.01$) variation occurred among the blocks, with practically all production being measured on loamy soils.

Bristlegrass occurred in the immediate proximity of mesquite trees where production quadrupled following mesquite control. This interspecific relationship suggests the presence of a favorable habitat for bristlegrass, such as physical protection from grazing, allowing valuable plants released by the spraying treatment to produce seed and reestablish on the adjacent range-land. The importance of the canopy area should be recognized when considering mechanical removal of dead trees following treatment.

**Literature Cited**


*Cable, D.R.* 1977. Seasonal use of soil water by native velvet mesquite. J. Range Manage. 30:4-11.


