TECHNICAL NOTES

The Influence of Ammonium Nitrate on the Control of Mesquite Resprouts with 2,4,5-T Ester

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Highlight: The influence of ammonium nitrate on the phytotoxicity of 2,4,5-T ester, nitrogen concentration, and niacin concentration of honey mesquite was studied. Fertilizer was applied to individual 3-year-old resprouts in the fall of 1973 and 2,4,5-T ester was applied to the individual 3-year-old resprouts on 3 dates in 1974. There was no conclusive evidence that N fertilizer affected the percentage of root-kill of mesquite when sprayed with 2,4,5-T ester. Ammonium nitrate had no effect on the nitrogen or the niacin levels in honey mesquite.

Herbicidal control of honey mesquite (*Prosopis glandulosa* Torr. var. *glandulosa*) is often unsatisfactory due to erratic root-kill and the subsequent resprouting from basal stem buds. Much recent research has been an attempt to define the physiological processes in mesquite to understand better why erratic root-kills occur, and to predict a control level for a given set of conditions more accurately.

Bonner and Bonner (1948) reported that niacin was necessary for root growth in a variety of legumes and nonleguminous plants. Sosebee et al. (1972) indicated that niacin (1.6 ppm) partially overcame the influence of low soil temperature and increased the effectiveness of aerial-applied 2,4,5-T on honey mesquite.

Improved 2,4,5-T kills of tall larkspur (*Delphinium berbeyi* Huth.), in mixtures with ammonium sulfate applied to the soil at the base of the plant or foliage-applied urea, have been reported by Binns et al. (1971). The absorption of 2,4,5-T isooctyl ester by the leaves of sweetgum (*Liquidambar styraciflua* L.), post oak (*Quercus stellata* Wengen.), red maple (*Acer rubrum* L.), and loblolly pine (*Pinus taeda* L.) seedlings was increased by the addition of 0.1% ammonium nitrate fertilizer solution (Brady 1970).

This study was undertaken to determine if (1) increased availability of nitrogen might stimulate niacin production and (2) the synergistic effect of 2,4,5-T fertilizer treatment would improve the phytotoxicity of the herbicide to honey mesquite.

Experimental Procedures

Treatments were applied to plots of 3-year-old resprouts of shredded trees located on the Post-Montgomery Estate Ranch 21 km east and 16 km south of Tahoka, Texas. The resprouts were growing on a deep hardland range site of Amarillo loam. The surface soil varies from loam to sandy clay loam and is from 12.7 and 25.4 cm in depth. The subsoil absorbs water at moderate to moderately-slow rates and is hard

when dry. The topography ranges from 0 to 3% slope. The vegetation was predominantly honey mesquite and tobosagrass (*Hilaria mutica*).

The treatments consisted of all combinations of five levels of nitrogen fertilizer, three herbicide application dates, and two application rates of herbicide. Each treatment was applied to a group of ten trees and replicated four times. All data were analyzed by a standard analysis of variance and the means were separated by Duncan's multiple range test. Statistical differences were denoted at the 95% confidence level.

Fertilizer treatments consisted of ammonium nitrate (33.5-0-0) applied at 0, 135, and 270 kg N/ha. A circular treatment area of 1.54 m² for each tree was used in calculation of fertilizer application rates. The fertilizer was placed at 30 to 40-cm depths in each of six evenly spaced holes on the perimeter of the treatment area. Fertilizer was applied in the period October 19 through November 1, 1973.

Herbicide treatments consisted of no herbicide and 2,4,5-T ester (1.81 kg/3.78 l) applied to individual trees with a garden-type, compressed air sprayer applied until foliage was uniformly wet. The herbicide mixture consisted of 106 ml of 2,4,5-T ester dissolved in 106 ml of diesel oil with water added to a volume of 3.78 l. Herbicide was applied on May 7, May 22, and August 3, 1974. May 7 was selected to insure that the first application would be prior to the optimum time of application relative to soil temperature and phenological development of the trees. The second date of application occurred when soil temperature was 27°C at a depth of 45 cm and phenological development was at the stage of mature leaves, fully extended spikes, and white flowers. These were near optimum conditions for herbicide application (Dahl et al. 1971). The third application date was chosen so that the plants were past the optimum stage of phenological development for herbicide application.

Tree mortality was recorded on October 27, 1975. Those trees exhibiting any resprouting were considered live trees.

To determine the nitrogen content of honey mesquite, samples were collected from the new growth, including leaves and twigs. The niacin concentration of honey mesquite was determined from samples of bark, including the cambium, peeled from the basal 15 to 20 cm of the stems. Samples were collected on May 7, May 22, August 3, October 4, 1974, and May 28, 1975, from trees that had been fertilized. In addition, samples were collected at biweekly intervals in 1975 from untreated areas. After drying (60°C until there was no weight loss) all samples were ground to pass through a 40-mesh screen. A 300-mg sample was analyzed by a micro-Kjeldahl procedure to determine the nitrogen content. A 1-g sample was analyzed for niacin by the cyanogen bromide-sulfanilic acid method (Sweeney 1951; Horwitz 1970; Brumley 1974; Arnold 1976).

On the days herbicide was applied, measurement was taken of air temperature; relative humidity; soil temperature at depths of 15, 30, 45, and 60 cm. The soil water content was determined from samples

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taken at 0 to 15, 15 to 30, 30 to 45, and 45 to 60 cm. Phenological development of the trees was also determined at the time of herbicide application.

Results and Discussion

The percentage of root-kill was inadequate in all treatments (Table 1). The treatment of 67 kg N/ha and herbicide application on May 22, 1974, and August 3, 1974, resulted in root-kills of 19% and 33%, respectively. However, there was no conclusive evidence that fertilizer affected the percentage of root-kill of mesquite. These results agree with the results of Cronin et al. (1976). They found that nitrogen fertilizer did not affect the phytotoxicity of silvex (2-[2,4,5-trichlorophenoxy] propionic acid) or 2,4,5-T when applied to tall larkspur.

Unsatisfactory root-kill percentages were obtained from the May 2, 1974, 2,4,5-T application date because soil temperature was 20°C at a depth of 45 cm and leaves were one-fourth extended. These conditions did not meet the criteria for herbicide application to honey mesquite as established by Dahl et al. (1971).

Table 1. The percent root-kill of resprouted honey mesquite trees treated with a wetting spray of an emulsion of 2,4,5-T, oil, and water¹ and varying rates of ammonium nitrate at the Post-Montgomery Ranch, Lynn County, Texas.

Fertilizer rate kg N/ha	Herbicide application rate	Root-kill ² %
0	0	0 a ³
0	May 7, 1974	8 ab
0	May 22, 1974	6 ab
0	August 3, 1974	11 ab
67	0	3 a
67	May 7, 1974	0 a
67	May 22, 1974	19 a
67	August 3, 1974	33 c
135	0	0 a
135	May 7, 1974	6 ab
135	May 22, 1974	3 a
135	August 3, 1974	8 ab
200	0	0 a
200	May 7, 1974	3 a
200	May 22, 1974	8 ab
200	August 3, 1974	14 ab
270	0	0 a
270	May 7, 1974	6 ab
270	May 22, 1974	3 a
270	August 3, 1974	11 ab

¹ 106 ml 2,4,5-T with 106 ml diesel fuel made up to a 3.78 l volume with water.

² Data was recorded October 27, 1975. Mean represents 40 observations.

³ Means with the same lower case letters were not significantly different (0.05 level).

The honey mesquite trees that were not killed by herbicide applied May 7, 1974, initiated resprouts after 81 days. Resprouts were evident after 51 days on those plots treated with herbicide on May 22, 1974, if they had been fertilized with 270 kg N/ha. No resprouting was noted on other trees sprayed on that date until a 66-day period had elapsed. The trees that were not root-killed by the August 3, 1974, herbicide application initiated regrowth within 27 days after treatment. In the spring of 1975 all trees had initiated growth by May 2 except those sprayed on August 3, 1974. These trees were delayed in initiation of growth until May 21.

Ammonium nitrate did not affect the nitrogen or the niacin concentration of honey mesquite (Table 2). The nitrogen concentration of honey mesquite decreased as the season progressed in 1974 (Table 3). This is a normal response of N levels in plant tissue with advance in maturity. The niacin concentration in samples collected in 1974 was relatively constant (Table 3). There was a slight trend for niacin concentration to increase with advance in season in 1975 (Table 3). These differing results are believed to be due to a more uniform distribution of moisture during the 1975 growing season. In 1973, only 24.66 cm of precipitation was received from April 1 to November

Table 2. The percentage of nitrogen (reduced-nitrogen) and niacin concentration of resprouted honey mesquite at the Post-Montgomery Ranch, Lynn County, Texas, under varying rates of ammonium nitrate fertilizer applied in the dripline.

Fertilizer treatment kg N/ha	Reduced- nitrogen ¹ %	Niacin concentration μg/ml ¹
0	3 a ²	0.53 a ²
67	3 a	0.50 a
135	3 a	0.59 a
200	3 a	0.52 a
270	3 a	0.48 a

¹ Mean represents 20 observations.

² Means having the same lower case letters were not significantly different (0.05 level).

Table 3. The percentage of nitrogen (reduced-nitrogen) and niacin concentration of resprouted honey mesquite at the Post-Montgomery Ranch, Lynn County, Texas, at different seasons.

Date of sampling	Reduced- nitrogen ¹ %	Niacin concentration μg/ml ¹
		1974
5/7/74	3.8 a ²	0.56 a ²
5/22/74	3.5 b	0.49 a
8/3/74	2.9 c	0.58 a
10/4/74	3.7 c	0.49 a
		1975
5/29/75	3.7 a	0.52 abcd
6/12/75	2.8 b	0.41 a
6/26/75	2.6 cde	0.57 bcd
7/18/77	2.6 cd	0.54 bcd
7/30/75	2.5 cdef	0.60 de
8/13/75	2.7 bc	0.70 e
8/26/75	2.4 f	0.59 cde

¹ Means represents 20 observations.

² Means having the same lower case letters were not significantly different (0.05 level).

1. During the same time period in 1974, 50.42 cm of rain fell, but 17.22 cm of this was received the last two weeks of September. In 1975, 43.48 cm of precipitation was received from April 1 to November 1.

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