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# Seasonal Use of Soil Moisture by Mature Velvet Mesquite

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1971 PROGRESS REPORT

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## ABSTRACT

Soil moisture measurements were taken with a neutron probe on 30 dates between July 10 and December 31, 1971, to determine the pattern of soil moisture use by 4 mature velvet mesquite trees (*Prospis juliflora* var. *velutina*) both in time and within a soil mass 6 m deep and 20 m extending laterally from the tree trunk. The data have been submitted to the Biome data bank, but no summaries have been prepared.

# INTRODUCTION

The research conducted on this project in 1971 consisted mostly in the installation of 36 20-foot aluminum tubes for measuring soil moisture by the neutron probe method, and the measurement of soil moisture on 30 dates between July 10 and December 31. In addition, a short trench was dug to 6 meters depth and soil samples were collected from which measurements of several attributes were obtained: saturation, 1/3-atm and 15-atm moisture percentages; mechanical analysis; pH.

# OBJECTIVES

The objective of the research conducted in 1971 was to determine the relative amounts of soil moisture removed from various soil depths and at various distances from the trunk of individual mesquite trees.

# METHODS

Volume % moisture (DSCODE A3UCA01) measured by Troxler soil moisture probe, Model 104A, with 100 MC AM:BE source; Troxler Ratemeter, Model G-200.

# FINDINGS

The last half of 1971 and the first part of 1972 were unusual in that: (1) the summer rains were late in starting and were about 25% below the long-term average, (2) the fall was unusually wet, and (3) no measurable precipitation fell from December 26 to this date March 15.

Figure 1 shows soil moisture content at the 25- and 100-cm depths, averaged for: (1) the 3 holes under the live mesquite canopies, (2) the 3 holes beyond the live mesquite canopies (5, 10, and 15 m from edge of the canopies), and (3) the 3 holes at dead trees (no live vegetation). The Figure also shows daily precipitation for the period July 1, 1971, to March 15, 1972. The soils at the study site are sandy loams and loamy sands (particle size < 2.0 mm) with from 22 to 54% gravel.

# DISCUSSION

Differences in soil moisture use and retention are apparent on the study site. In general, these differences can be summarized as follows.

1. The 3 holes under the mesquite canopies (near trunk, mid-way between trunk and edge of canopy, and at edge of canopy) tended to react alike, indicating that mesquite roots were about equally active in using moisture within the soil mass extending out from the tap root to the edge of the tree crown. Moisture content at the 25-cm depth under the canopies varied generally between 5 and 10% by volume between July and November, 1971, but went up to about 13% following the December storms.

2. The 3 holes beyond the mesquite canopy (5, 10, and 15 m beyond the edge of the canopy) tended to react alike, but showed several percentage points higher moisture content than under the canopies, indicating reduced use of soil water by mesquite in openings beyond the crowns. Moisture content at the 25-cm depth varied generally between 8 and 12% between July and November, 1971, and went to a little over 13% following the December storms.

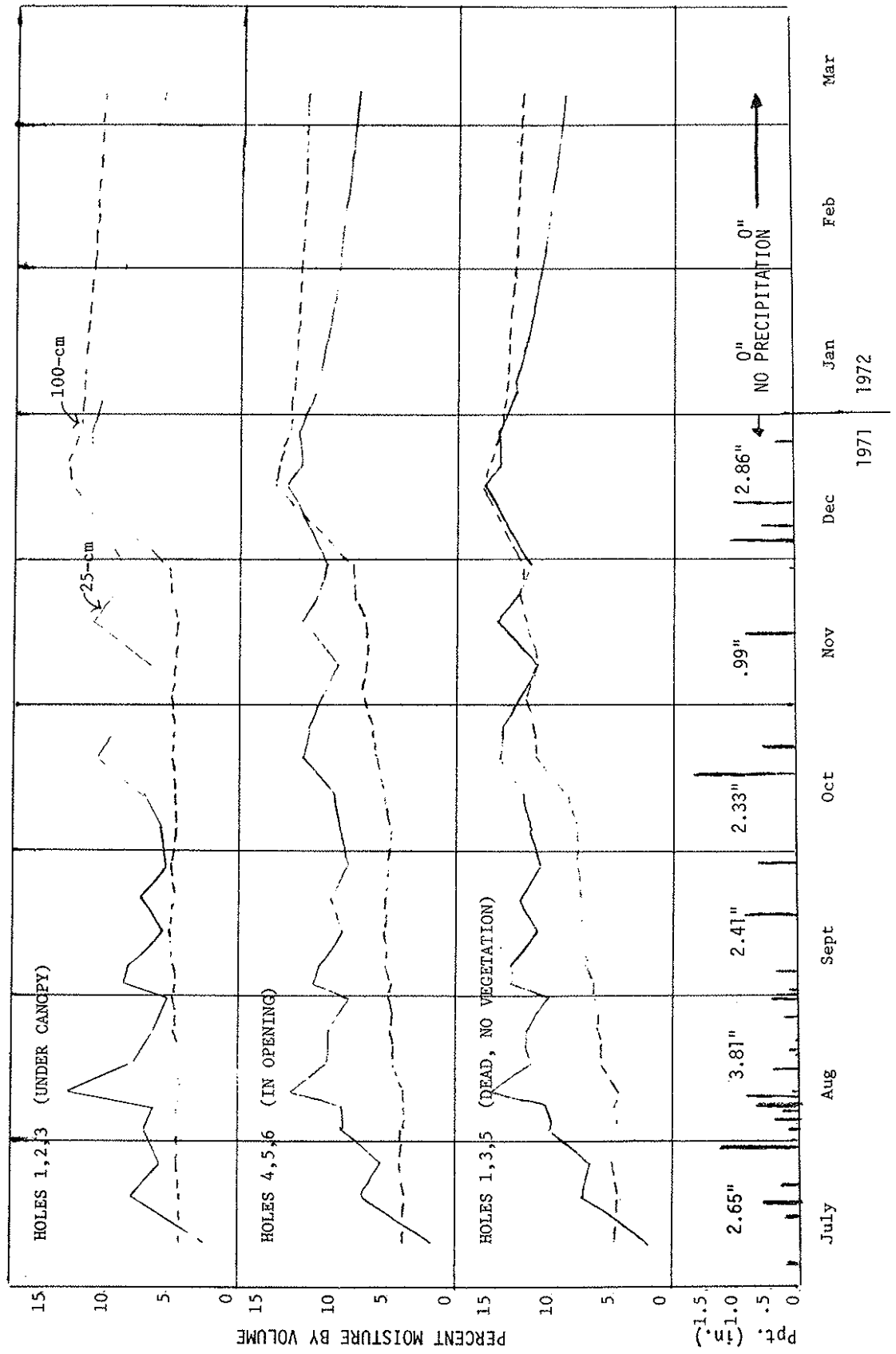


Figure 1. Percent moisture by volume at 25 cm and 100 cm depths under mesquite, in openings, and with no vegetation (means of twelve tubes).

3. The 3 holes near dead trees ( no live roots near soil tubes) tended to react alike, as would be expected, and showed still higher moisture contents. Moisture content at 25 cm varied generally between 10 and 15% between July and November, 1971, and went to 15% following the December storms.

4. Moisture content at 25 cm increased quickly following rainfall events, and decreased quickly due to evaporation loss during subsequent dry periods at all locations. Moisture content at 100 cm increased slowly in response to precipitation.

5. Evaporation loss from the 25-cm depth was substantial, with almost identical patterns shown in the openings and with no vegetation. The more rapid withdrawal of moisture under the canopies (a combination of higher use by mesquite roots plus evaporation loss) is evident in the increased steepness of the recession portions of the curves.

6. At 100 cm, use of soil water by the mesquite roots under the canopies was so rapid that moisture did not reach this depth until the December storms, after most mesquite foliage had fallen. In contrast, in the openings a few tubes showed moisture in August at 100 cm, and starting in early October moisture began reaching the 100-cm depth at all locations. The December storms pushed moisture content at 14% at 100 cm in the openings. With no vegetation, moisture began reaching the 100-cm depth by mid-August, and moisture content increased more or less uniformly to 15% by mid-December.

7. Evaporation loss from the 100-cm depth was not particularly evident until after the end of the December storms, during the subsequent period with no precipitation. During this 3-month dry period rates of water loss for the 3 locations were roughly similar, but total loss averaged a little over twice as much at 25 cm as at 100 cm (net loss of 7.3, 5.9, and 6.5% respectively at 26 cm: 3.0, 2.7, and 3.5% respectively at 100 cm). Because of the similarity in rate of loss at the 3 situations, the actual % moisture by volume showed a spread of several percentage points on March 7, 1972 (5.4, 7.4, and 8.6% respectively under the canopies, in the openings, and with no vegetation at 15 cm; 10.2, 11.5, and 11.8% at 100 cm).

8. There was no available soil moisture at the 200-cm depth during the summer period. Moisture began reaching the 200-cm depth on November 23 with no vegetation, and on December 20 under and near live mesquite.

On the basis of these data, it appears that moisture use by mesquite is highest under the tree crowns, but extends to at least 15 m beyond the crowns within the top 100 cm of soil. Net loss in % moisture by volume during the winter dry period has been averaging about 2% per month at 25 cm and slightly less than 1% at 100 cm.

## EXPECTATIONS

Although this project was not funded for 1972, sufficient funds were left over from 1971 to permit collecting soil moisture through at least the summer of 1972, which would provide data for two summers and one winter. Requests have been made and the necessary steps are being taken to extend the ending date for this project to December 31, 1972 so that unexpended 1971 funds can be used to collect soil moisture (DSCODE A3UCA01) in 1972.