

USING SOIL MOISTURE AND MIDDAY STEM WATER POTENTIAL MONITORING DATA TO MANAGE A WATER TABLE IMPACTED 'CHANDLER' ORCHARD

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ABSTRACT

Improved water management based on monitoring of ground water table, soil moisture and midday stem water potential has resulted in improved growth and reversal of tree decline in this Chandler orchard. In general, the better growing areas in the orchard had a lower water table during the growing season compared to the poor growing areas.

INTRODUCTION

In September 2003, an approximately ten year old Chandler orchard on Paradox rootstock was showing interveinal browning on lower leaves and a general yellowing and lack of vigor in some areas of the orchard. The orchard was flood irrigated approximately three to four times each season. Symptoms first occurred after an irrigation event. Augering in September 2003 showed a water table present at approximately four to five feet below the surface.

PROCEDURES

In 2004, seven holes were established to monitor water table depth across the orchard in areas ranging from those with good growth, to intermediate and poor growth areas. Depth to the water table was monitored in these holes in 2004, 2005 and 2006. In the spring of 2004, Watermark soil moisture sensors attached to a datalogger (with data logged every hour) were installed at depths of 8.5, 58.5, 108.5 and 158.5 cm adjacent to a tree in an intermediate area of the orchard. In 2005, the original soil moisture datalogger was replaced with one having 7 Watermark soil moisture sensors at depths of 8.5, 38.5, 68.5, 98.5, 128.8, 158.5 and 188.5 cm. Midday stem water potential and depth to the water table were monitored approximately every 1-2 weeks throughout the growing season.

RESULTS AND DISCUSSION

During early March of 2006, the orchard was flooded above the soil surface as indicated by the spike in water table depth (Fig. 2). This condition did not result in detrimental effects to the orchard since the water table was monitored and irrigation was not started until the water table depth and midday stem water potential suggested it was time to irrigate. Depth to the water table varied from about 35 to 60 inches during the growing season (Fig. 1, 2)). The water table was generally lowest in the good area and highest in the bad area (Fig. 1, 2). This is likely due to physical characteristics in the soil since when the orchard was flooded in March of 2006, the water was above the surface in the intermediate and poor areas of the orchard but remained below the surface in the good area of the orchard (Fig. 2). Average midday stem water potential varied from about -4.5 to -10 bars over the season and generally tracked the water table with higher (less negative) midday stem water potentials when the water table was higher (closer to surface) and lower midday stem water potentials when the water table was lower. Soil moisture readings showed the soil stayed near saturation at the 98.5 to 158.5 cm depths lower depths

throughout the season (Fig. 1, 2). Depth to the water table was generally greater in the good growing area of the orchard, intermediate in the intermediate growing area and shallowest in the poor growing area (Fig. 1,2). This suggests that the shallower water table was impeding tree growth. Since this study was initiated, the water table has been kept at a deeper and more constant level than was the case previously and this has resulted in improved growth and a halting of tree loss in the poor and intermediate areas in the orchard.

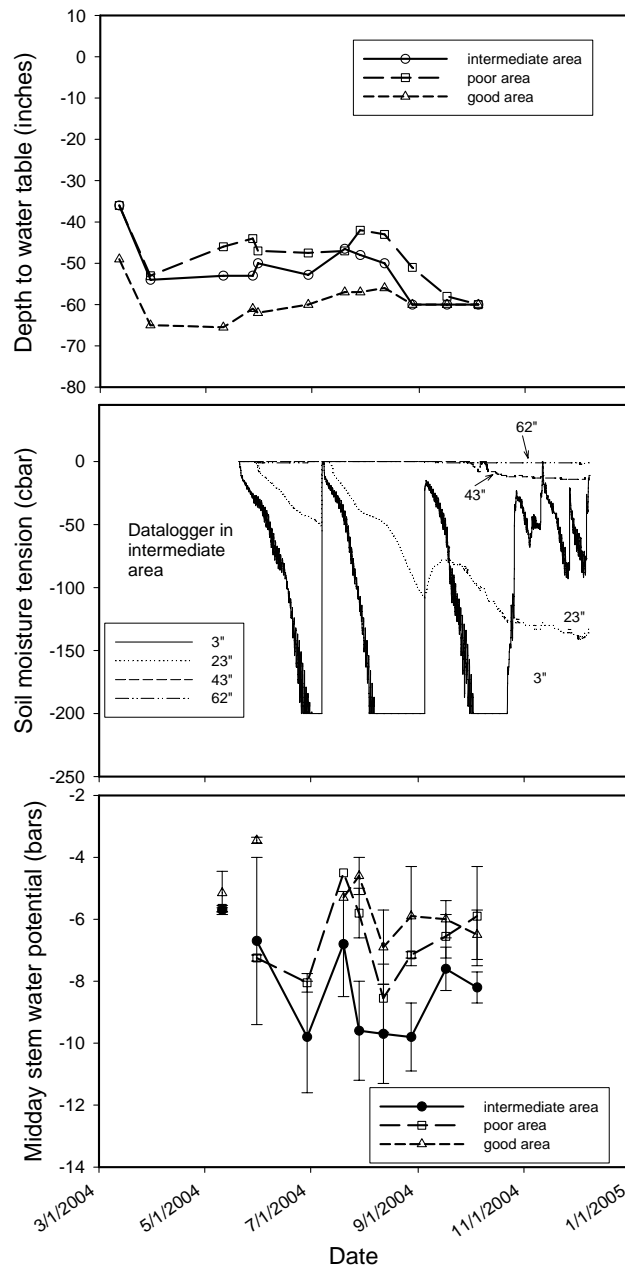


Figure 1. (a) Depth to water table over season in good, intermediate and poor area of orchard, (b) soil moisture tension at four depths in intermediate area, and (c) midday stem water potential for the 2004 season in good, intermediate and poor area of orchard.

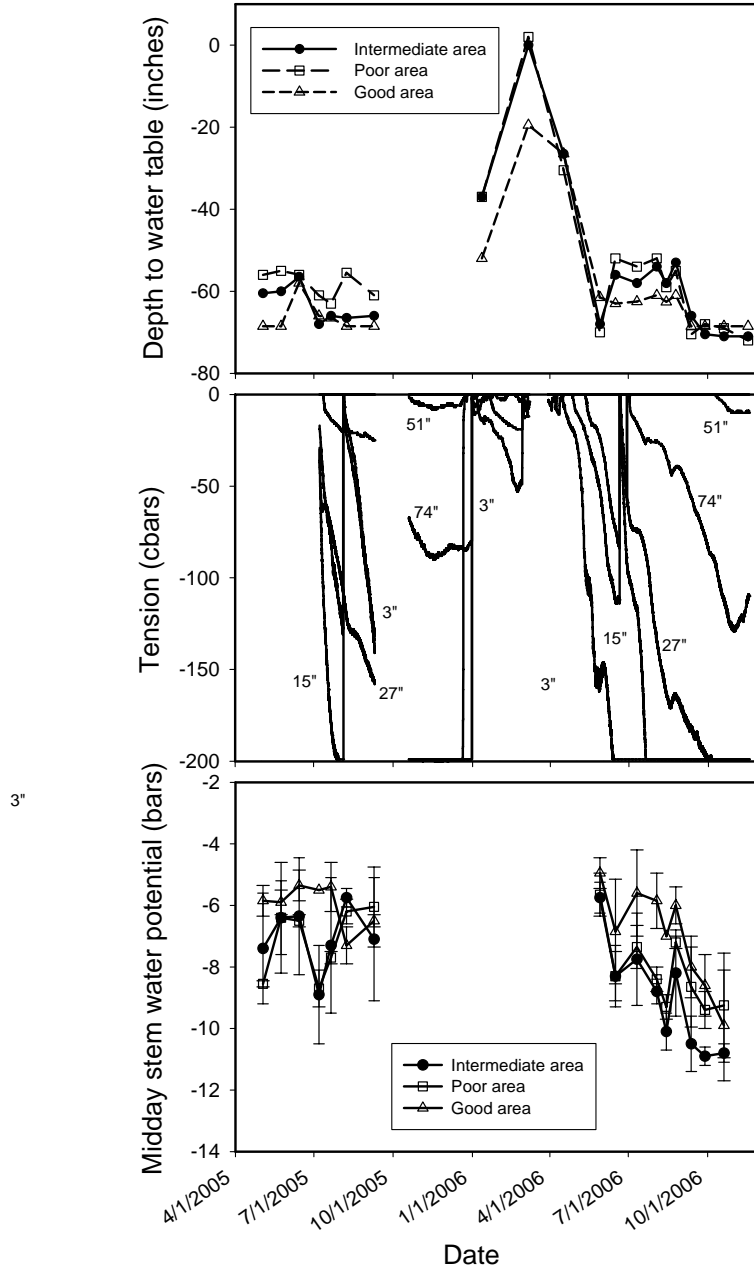


Figure 2. (a) Depth to water table over season in good, intermediate and poor area of orchard, (b) soil moisture tension at seven depths in intermediate area, and (c) midday stem water potential for the 2005 and 2006 seasons in good, intermediate and poor area of orchard.