# ASSESSING IRRIGATION-RELATED PROBLEMS IN HILLSIDE ORCHARDS IN LAKE COUNTY

Bruce Lampinen, Rachel Elkins, Steve D'Agostini, and Sam Metcalf

## ABSTRACT

Monitoring of soil moisture and plant water status were carried out on a 50-year-old Hartley orchard on a hillside site in Lake County. Large portions of the orchard were showing stunted trees with low production and little new growth for many years. Monitoring suggests that trees in the good growing part of the orchard are mining water from deep in soil profile as season progresses. Trees in poor growing part of orchard experienced overly wet conditions during much of the season and this is the likely cause of poor growth and production. These differences are likely due to soil differences. A change in irrigation practices such that the moveable sprinkler line is moved twice across the orchard on every other row during a 21-day period (rather than once across on every row) appears to have resulted in improved performance of trees in the poor growing part of the orchard.

## INTRODUCTION

This study site is an approximately 50-year-old Hartley on Northern California Black rootstock orchard in Lake County near Kelseyville. Large areas of the orchard showed symptoms of stunted trees with little growth while other areas in the orchard were growing vigorously. Monitoring of midday stem water potential and soil moisture were started in July 2005.

The irrigation system consists of two movable sprinkler lines which are moved across the 42 rows of the orchard over a 21-day period and then the process is restarted. In this way, it is approximately three weeks between irrigation events for any given row. This also means that irrigation commences three weeks earlier in the season in some rows and commences three weeks later in the season than in other rows. After observing the irrigation system for a month or so, the authors suggested that the grower move the sprinkler lines two rows across the orchard irrigating each odd numbered row which resulted in moving across the orchard in approximately 11 days. Then the line was moved back across on the even numbered rows for the next 11-day period.

Sites were set up in a good growing part of the orchard and in the poor growing part of the orchard. A datalogger equipped to monitor soil moisture was installed in both the good and bad areas. Watermark soil moisture sensors were installed at depths of 0.5, 1.5, 2.5, 3.5, 4.5, 5.5 and 6.5 feet at each site and attached to dataloggers. Data was logged at one hour intervals. Midday stem water potential was measured approximately weekly on nine trees surrounding the good area datalogger and nine trees surrounding the bad area datalogger.

## RESULTS AND DISCUSSION

As the season progressed, the soil moisture dried down at the good logger site with the most dramatic drying taking place at the shallowest and deepest depths initially (Fig. 1). The irrigation event in late July was the only irrigation in which each side of the tree was irrigated on simultaneous days before the alternate row system described above was started. This irrigation only reached to the 2.5 foot depth (Fig. 1). There were two later irrigations (one on each side of the logger at 11 day intervals) and these smaller irrigations only reached the 0.5 foot depth (Fig. 1). Below that depth, the soil dried continuously through the season until by mid-October, all sensors at the good area logger site were registering at their minimum readings, which is -200 centibars (Fig. 1). Midday stem water potential readings at the good area logger site ran from the -5 to -8 bar range through the season (mildly to moderately stressed). Some trees in this area showed visual symptoms of water stress by late summer. The fact that the lowest water potentials reached in these trees only averaged about -8 bars while moisture sensors to 6.5 feet were very dry suggests that roots were accessing moisture below the 6.5 foot depth of moisture sensors.

In the poor growth area, soil moisture results were quite different. At the beginning of the monitoring period in July, moisture sensors at all depths were registering as very wet (Fig. 1). After each irrigation event, moisture sensors at all levels returned to near zero levels. This is generally not a healthy situation but the trees in this area tolerated this fairly well with few visual symptoms of damage by season end. The likely reason for this tolerance of these conditions is that previously, these trees had been subjected to twice as much water at each irrigation event so they were likely very shallow rooted and adapted to deal with the situation. When irrigation was ceased in preparation for harvest, the shallower depth dried down quickly while lower depths remained wet (Fig. 1). Midday stem water potentials tended to run in the -5 to -7 bar ranged which is more stressed than you would expect based on wet soil moisture conditions. This suggests either than many roots were active above the shallowest 0.5 foot sensor and/or that root function was compromised by the overly wet conditions.

Water potential transects were done twice during the season spanning across the orchard between the good and poor growing areas. Generally, the poor growth area was slightly more stressed early in the season and less stressed later in the season compared to the good growth area (Fig. 2). The relatively high midday stem water potential in the poor growth area late in the season followed by a rapid drop as shallower soil depths dried down (Fig. 1d) suggests that the trees were shallow rooted.

The plan in 2006 is to continue data collection at this site, More work will be done looking into soil and rooting differences across the orchard as well.

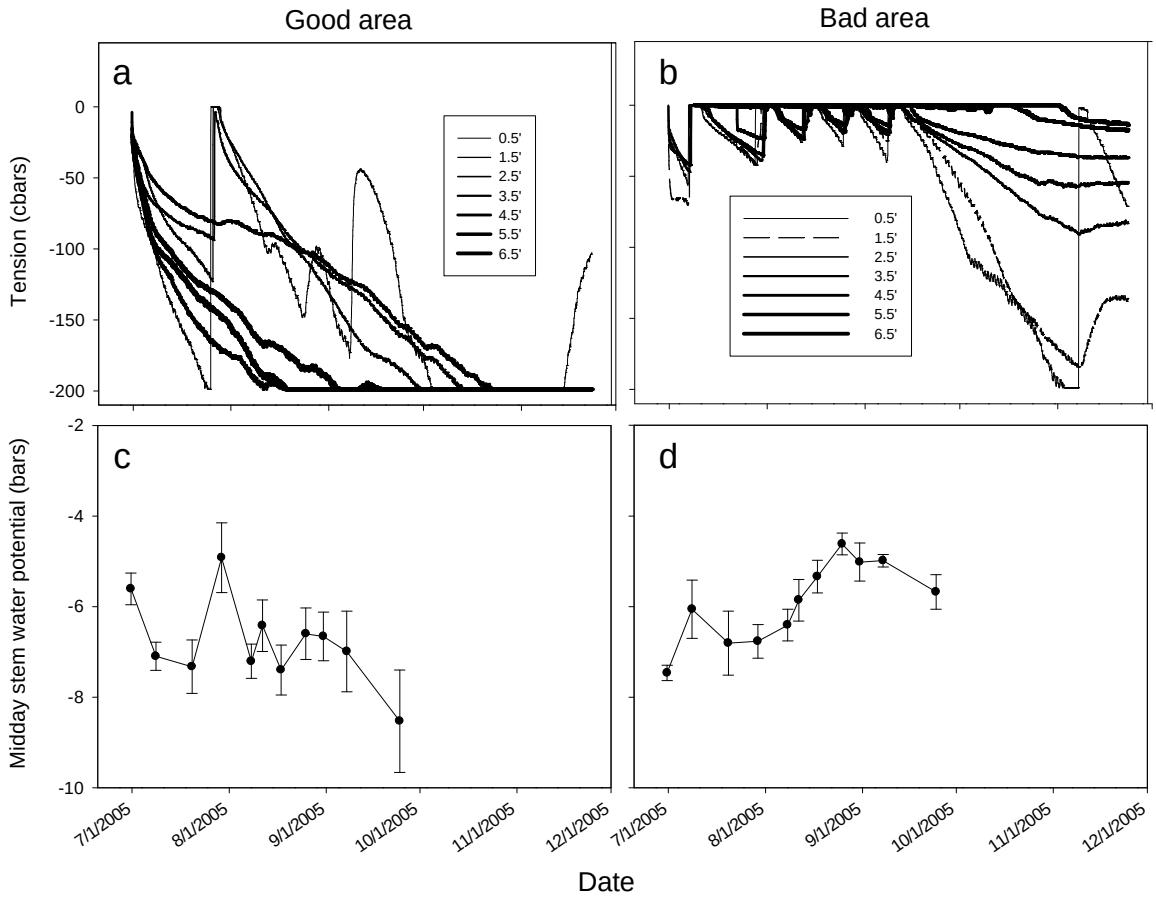


Fig. 1. Soil moisture tension over season by depth for a) good growing area of orchard b) poor growing area of orchard and midday stem water potential over season for c) good growing area and d) poor growing area.

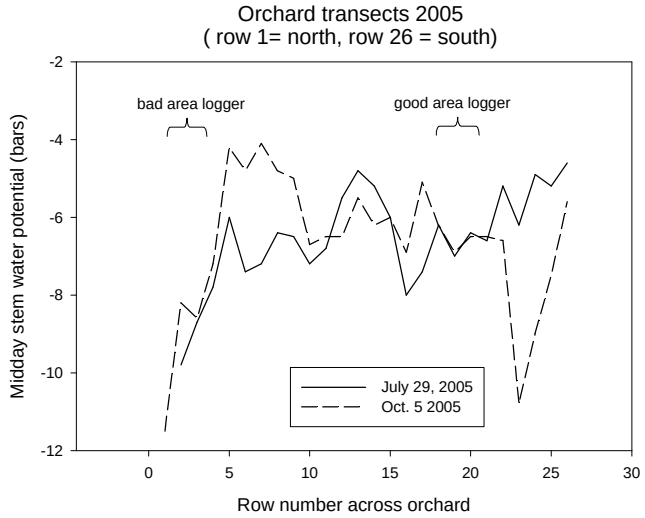


Fig. 2. Water potential transects across orchard on two dates in 2005. On July 29, 2005, irrigation was approximately 6 days past the good area logger and was 2 rows to the north of the bad area logger (soil surface was wet at both logger sites. On October 5, 2005, irrigation had ended for the season and soil surface was dry.