

Quantification of incident light under mature and young citrus trees

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Introduction

Light and temperature strongly influence the probability of weed emergence by breaking or inducing dormancy in many species. Interactions of light and temperature not only stimulate germination and growth of weed species, but also dictate herbicide activity particularly for photosynthetic inhibitor herbicides. Differential growth of weeds around mature and young citrus trees, as influenced by light and temperature variations, may require different rates of herbicide for effective control of several weed species. The information on incident light under mature and young citrus trees is lacking. The present study is aimed in quantifying the amount of incident light under mature and young citrus trees and the influence of shade on soil and ambient air temperature.

Objectives

- > To quantify the incident light around mature and young citrus trees during the year
- > To record soil and air temperature under mature and young citrus trees

Methods & Materials

A citrus grove containing 15-years-old Hamlin trees in Aubumdale, Florida was used for light and temperature study. Trees were planted in Candler fine sand at 12.5 by 25 ft spacing in North-South rows. Canopy width is 17 ft at the bottom (8.5 ft on both sides). Tree size was maintained by hedging and topping. Trees are topped at a height of 16 feet and hedged to provide an open middle of approximately 8 feet. The grove was irrigated with one micro sprinkler per tree.

Four light sensors (Spectrum Technologies, Inc., US) were placed at a distance of 2 and 4 ft from the tree trunk on both sides of mature citrus tree (West-outside, West-inside, East-inside and East-outside). The PAR light sensors were positioned under the tree canopy by mounting sensors on PVC pipes, 30 cm above the ground and attached to Watch-Dog data loggers which were programmed to record data every 5 minutes. Soil temperature was measured at a depth of 2.5 cm and air temperature at 30 cm above the soil surface. A young citrus tree (replant) in the same tree row was used for comparisons. Sensors were placed between two resets (young citrus trees). Data were downloaded three times per month using Speeware Software. The light study was initiated in July 2004 and continued up to August 2005. Soil and air temperatures under mature and young citrus tree were recorded from October 2004 to August 2005.

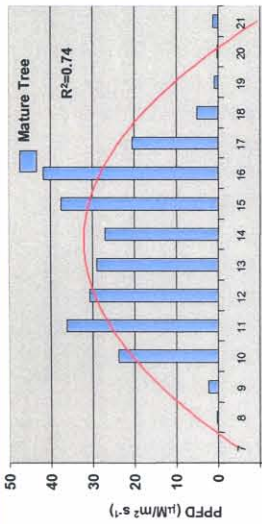


Fig. 1 Mean average light intensity distribution under a mature citrus tree during the day (7 AM to 9 PM). Values averaged over 12 months.

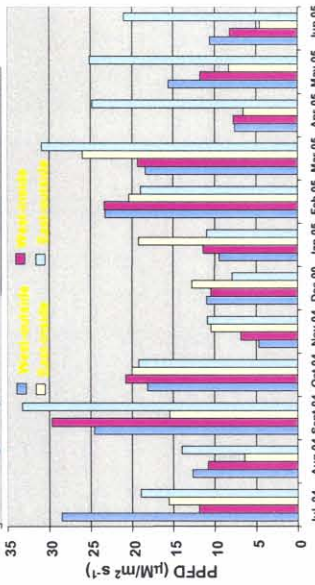


Fig. 3 Average monthly light distribution under a mature citrus tree

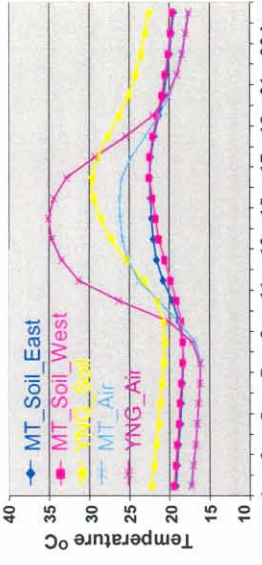


Fig. 5 Soil and air temperature under mature (MT) and young (YNG) citrus tree during the day and night (24 hrs). Values averaged over months and days of month

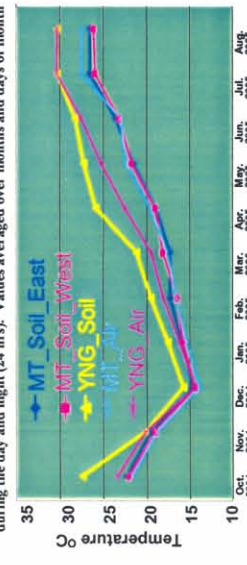


Fig. 6 Soil and air temperature under mature (MT) and young (YNG) citrus tree during the year. Values averaged for month and hours



Plate 1. Showing light and temperature data at young citrus tree site



Plate 2. Data loggers, sensors and probes under mature citrus tree



Plate 3. Low light sensor probe under young citrus tree

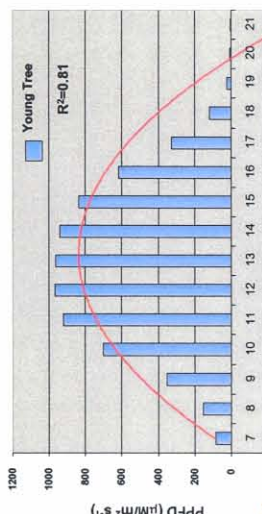


Fig. 2 Mean average light intensity distribution under young citrus tree during the day (7 AM to 9 PM). Y values averaged over 12 months

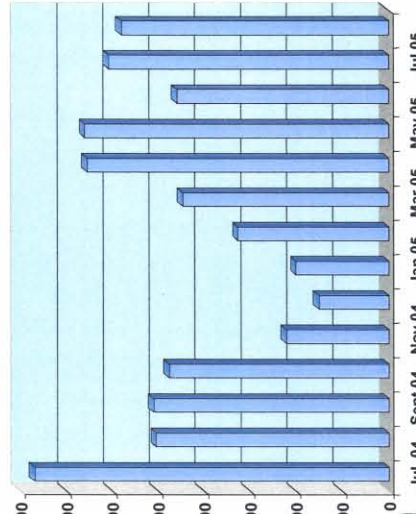


Fig. 4 Average monthly light distribution under the young citrus tree

Summary

- ❖ The incident light falling under the young citrus tree was 30 times greater than that of the mature tree. Under the mature tree, light intensity was higher on Eastern side of a North-South tree row than on West side of the trunk. Light intensity was further reduced in the inner perimeters (2 ft from trunk) than outer perimeter (4 ft from the trunk) on either side.
- ❖ Distribution of light was more uniform under the young tree than the mature tree during the day.
- ❖ Air Temperature around the young citrus trees was higher from 8 AM to 8 PM than mature tree; increase in air temperature correspondingly increased soil temperature which was consistently higher than under mature tree. Soil temperature on East or West of mature tree was similar.
- ❖ Lowest soil and air temperatures around mature and young citrus trees were recorded in December which increased steadily till July. Both air and soil temperatures were higher around young citrus tree compared to mature citrus tree