Dissolved Organic Carbon, Total Carbon and Nitrogen in Pomegranate under Drip Irrigation Systems

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Introduction

In the past six years, pomegranate (*Punica granatum, L* var. Wonderful) cultivation has become a popular commercial crop in San Joaquin Valley, California. The rising demand for this permanent crop is primarily due to pomegranate juice high nutritional and antioxidants properties. In addition, it has been found pomegranate trees are drought tolerant that can thrives on a wide range of soils. However, the establishment of not well managed permanent crops in California Valley soils can increase the actual deficit of water and reduce water quality by increasing soil salinity. For that reason, a pomegranate research project was initiated by the San Joaquin Valley Agricultural Science Center (SJVASC) in cooperation with the UC KARE Center in Parlier, CA and partially funded by CDFA/FREP to determine pomegranate water requirements under different drip irrigation systems [surface (DI) and subsurface (SDI)] and to minimize leaching losses of nitrogen and carbon.

Objectives

- The overall objective of this project is to optimize water-nitrogen interactions, to improve fertilizer use efficiency of young and maturing pomegranate and to minimize leaching losses of nitrogen.
- The objective of this presentation is to provide initial quantitative and qualitative information of stored Soil Carbon and Nitrogen and Dissolved Organic Carbon (DOC) under DI and SDI systems.

Materials and Methods

Photo 1. Comparison of Pomegranate trees growing under different drip system: DI (left side) and SDI (right side).

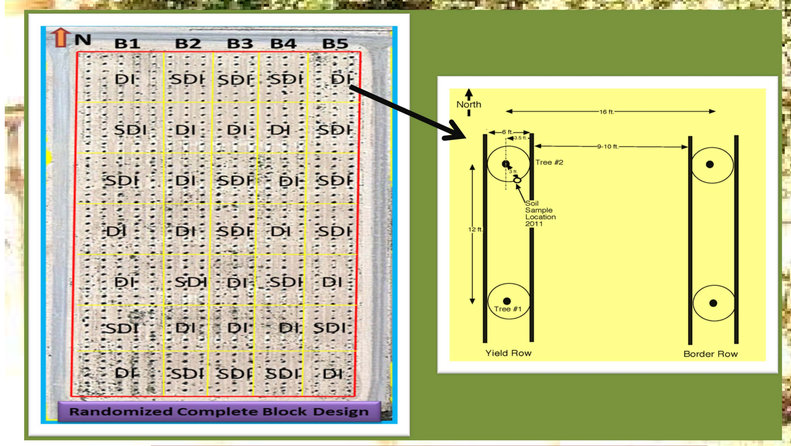

Photo 2.Field design and soil sampling sites

- Irrigation system- Drip in classic with root guard (0.620 in. diameter, 0.53 gph, 0.045-in. wall thickness, 18-in emitter spacing)

  a) DI and SDI Installed 3.5 ft. on each side of the tree row
  b) SDI installed at 20-22- in. depth

- Soil samples from eight soil depths (0-6, 6-12, 12-18, 18-24, 24-30, 30-36, 36-42, 42-48 in) were collected in 2011, one year after planting 799 Pomegranates trees (POM Wonderful variety).

- Total N and C contents were determined by dry combustion with a Flash 2000 N & C Soil Analyzer from Thermo Scientific®.

- DOC was determined after saturating the soil with DI water (1:1 soil: water) for 24 hours, shaking for a one hour on a reciprocal shaker, and filtered through a Whatman, no. 42 filter. Carbon recovered in the water extract was determined by using Fusion Total Organic Carbon Analyzer from Teledyne Tekmar.

Results

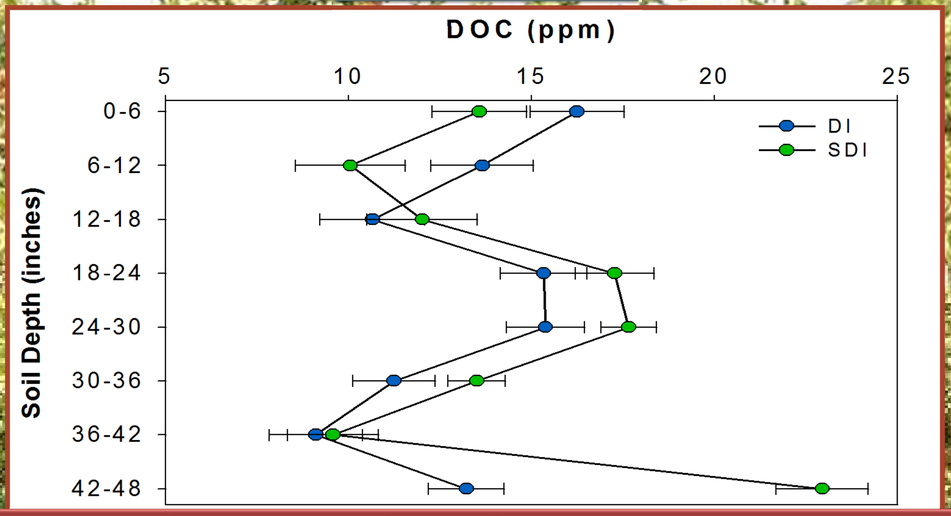

Figure 1. Vertical distribution of soil DOC collected from DI and SDI treatment plots in May, 2012 before nitrogen treatments were applied. Error bars are standard errors of the mean value (n=15).

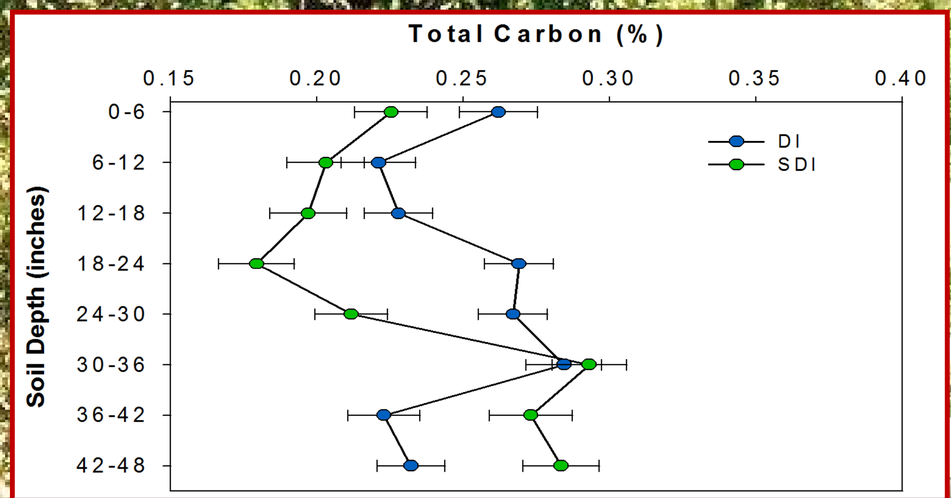

Figure 2. Vertical distribution of soil Total Carbon (%) collected from DI and SDI treatment plots in May, 2012 before nitrogen treatments were applied. Error bars are standard errors of the mean value (n=15).

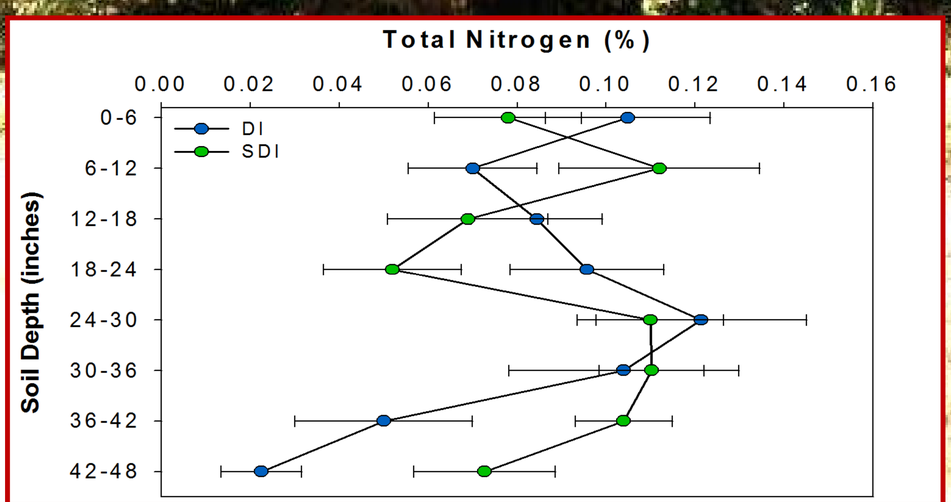

Figure 3. Vertical distribution of soil Total Nitrogen (%) collected from DI and SDI treatment plots in May, 2012 before nitrogen treatments were applied. Error bars are standard errors of the mean value (n=15).

Discussion

Measurements in the following three graphs were obtained in May 2012 were the SDI and DI system was installed and running and after a small amount of N was applied uniformly to all the plot in 2010 after the trees were planted.

Dissolved Organic Carbon

One year preliminary results shows higher DOC in the first 12 inches for DI system. However, at deeper depth (> 18 in.), higher DOC was found under subsurface SDI system.

Total Carbon

While for Total Carbon (TC), higher percentage was found in the first 20 in. under DI system. However, at deeper depth (> 36 in.) was found under SDI system.

Total Nitrogen

No consistent response in the first 36 inches for total Nitrogen (TN) on both irrigation systems. However, higher TN was found deeper depth (> 36 in.) under SDI system.

Conclusion

This research is ongoing and additional data will be collected from 2012 to 2015 to clarify soil TC, TN and DOC in pomegranate cultivation under high frequency DI and SDI and fertigation.

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