Determination of Root Distribution and Physiological Parameters of Nitrogen Uptake in Almonds to Optimize Fertigation Practices

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PROJECT SUMMARY

Objectives:

For the current year:

- Determination and characterization of patterns and biological dynamics (K_m, V_{max}, $C_{min/max}$) of tree nutrient uptake and the relationship to soil nutrient concentration, tree demand and time.
- Determination of almond root phenology and characterization of root distribution and uptake activity as influenced by irrigation source, irrigation management and plant characteristics.
- Determine the explicit nitrogen uptake and demand dynamics for almond. Integrate this information into the model (in collaboration with ongoing Brown project, 13-PREC2).

Background and Discussion:

To optimize nutrient use efficiency in fertigated almond orchards it is essential that fertilizers injected into irrigation system are provided at the optimal concentration, time, and place to ensure that deposition patterns coincide with maximal root nutrient uptake. Optimizing fertigation practices in almond orchards requires information on the spatiotemporal distribution and activity of nutrients and roots in the soil profile, and knowledge of seasonal crop nutrient demand patterns. The overall goal is to combine information derived from this project (root phenology and root uptake), with information from associated projects (tree demand and N movement in soils) to improve the design of fertigation systems and to optimize the application (volume, distribution pattern, rate, timing etc.) of fertilizers.

Preliminary results show that the uptake of nitrate (NO_3) by roots is strongly influenced by the prior nitrogen status of the tree. Thus trees grown under low N conditions exhibited a higher NO_3 uptake capacity than those grown under high N treatments when exposed to low or moderate concentrations of NO_3 in the root media. This result suggests that N starved trees up-regulate N uptake and can access N from lower NO_3 concentrations than trees with sufficient N content. Results from 2013 samples are still in progress since the amount of sampling was doubled, and the concentration range was increased to more realistic conditions (i.e. actual NO_3 soil solution concentration).These findings have relevance for the timing and distribution of the application of nitrogen during fertigation events.

Minirhizoton access tubes were installed to track root phenology (root flushes, root lifespan, growth, etc.) under four fertilization regimes and thus define the right place to allocate the fertilizers. Preliminary results shows that most of the roots observed were in the upper 40 cm soil profile, with almost 75% and 60% for the continuous and the standard practice fertigation respectively. More quantitative analyses have yet to be performed in order to determine the right timing for nutrient application and plant response to fertigation events.

Project Cooperators and Personnel: Andres Olivos, UC Davis; Blake Sanden, UCCE-Kern County; Paramount Farming Company

For More Details, Visit

- Poster location 50, Exhibit Hall A and B during conference; or on the web (after January 2014) at www.almondboard.com/researchreports
- 2012.2013 Annual Report CD (12-PREC5-Brown); or on the web (after January 2014) at www.almondboard.com/researchreports
- Related Projects: 13-PREC2-Brown; 13-HORT11A-Sanden; 13-HORT13-Lampinen; 13-AIR2-Smart