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

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• BACKGROUND

Optimal fertilization practice can only be developed if knowledge of the 4 R's (right source, right rate, right place, and right time) are explicitly developed for the almond production context. To optimize nutrient use efficiency in fertigated almond it is essential that fertilizers injected into irrigation system are provided at the optimal concentration and time to ensure that deposition patterns coincide with maximal root nutrient uptake.

• OBJECTIVES

- Determination of almond root phenology and characterization of root distribution.
- Determine nitrogen uptake and demand dynamics for almond.
- Determine the best fertigation practice for almonds orchards.
- Reduce the contamination of groundwater with pollutants (NO_3) without reducing crop performance.

• METHODOLOGY

The orchard is a high producing 13 year old Nonpareil/Monterey planting located south of Lost Hills in Kern County. The effect of fertigation technique (pulsed, continuous, drip, microjet) have been examined. Twenty minirhizotron access tubes were installed to follow root phenology (root flushes, root lifespan, growth, etc.) under 8 fertilization regimes (Table 1). In addition, 80 soil solution access tubes (SSAT, AKA "suction lysimeters") have been installed in each treatment at 2 depths (150 and 250 cm) in order to measure nitrate (NO_3) concentration and transport through the soil profile.

Individual trees have been analyzed for leaf nutrient analysis, yield, nut size and crackout percentage and contrasted among treatments (see results section).

Root images have been taken during the 2012 and 2013 season in 2 week basis and images will be analyzed at the end of each season.

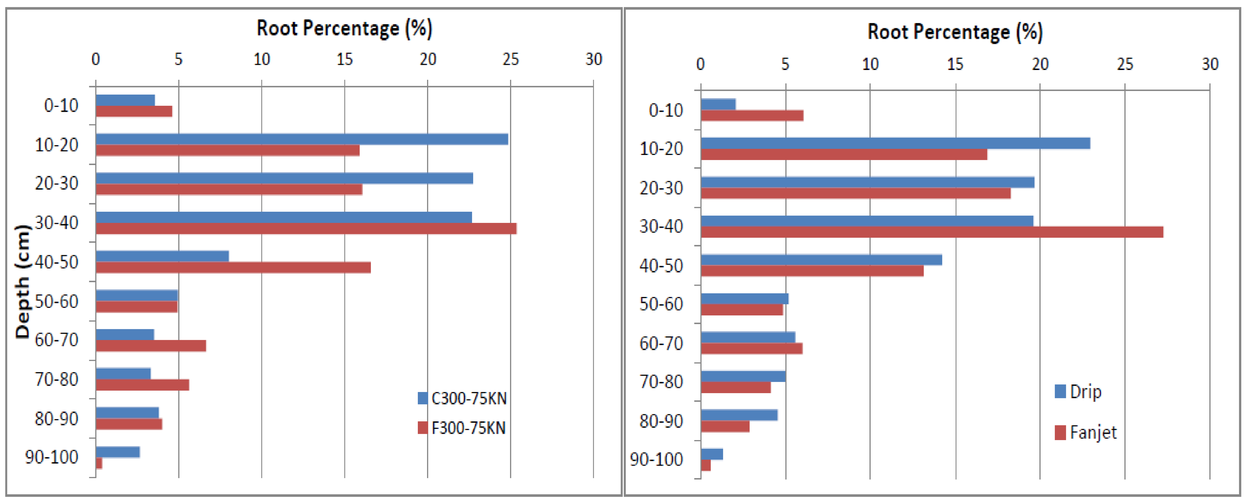
Table 1 Treatments Description

Main Plot Treatments	K Source (%)				N Source (%)	
	SOP	KNO3	KCl	KTS	KNO3	UAN
[1]F300-0	0	0	0	0	0	100
F300-75KTS-125 SOP	62.5	0	0	37.5	0	100
F300-75KN-125 SOP	62.5	37.5	0	0	9	91
[2]C300-200SOP	100	0	0	0	0	100
C300-75KN	32.5	37.5	0	0	9	91
C300-200KN	0	100	0	0	36	64
C300-300KN	0	100	0	0	57	43
C300-150 KCl-150 KNO3	0	50	50	0	17	83

[1] F Treatments: Fertilizer is applied 4 times a year through irrigation (grower standard)
[2] C Treatments: Fertilizer is applied at each irrigation event

Sub Plot Treatments	Description
Fanjet	Two micro sprinklers per tree
Drip	Double drip line

•Fig 1. Vertical distributions of roots in soil depth intervals



• RESULTS

Preliminary results from the minirhizotron access tubes installed in this experiment are shown in **Figures 1 and 3**, showing the root growth distribution by soil depth. 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 respectively. In terms of root phenology, it has been observed two main root growing cycles, in which the production on new roots was highest during the spring (start of the growing season), and a lower one during fall (postharvest). More quantitative analyses has yet to be performed, including root lifespan, root seasonal dynamics (root emergence and persistence) in order to determine the right timing for nutrient application and plant response to fertigation events.

In terms of productive parameters, no significant differences among either (fertigation or irrigation) treatments have been observed during the 3 year period (Figure 2).

Fig 2. Effect of fertigation and irrigation practices on cumulative (3 years) almond yield

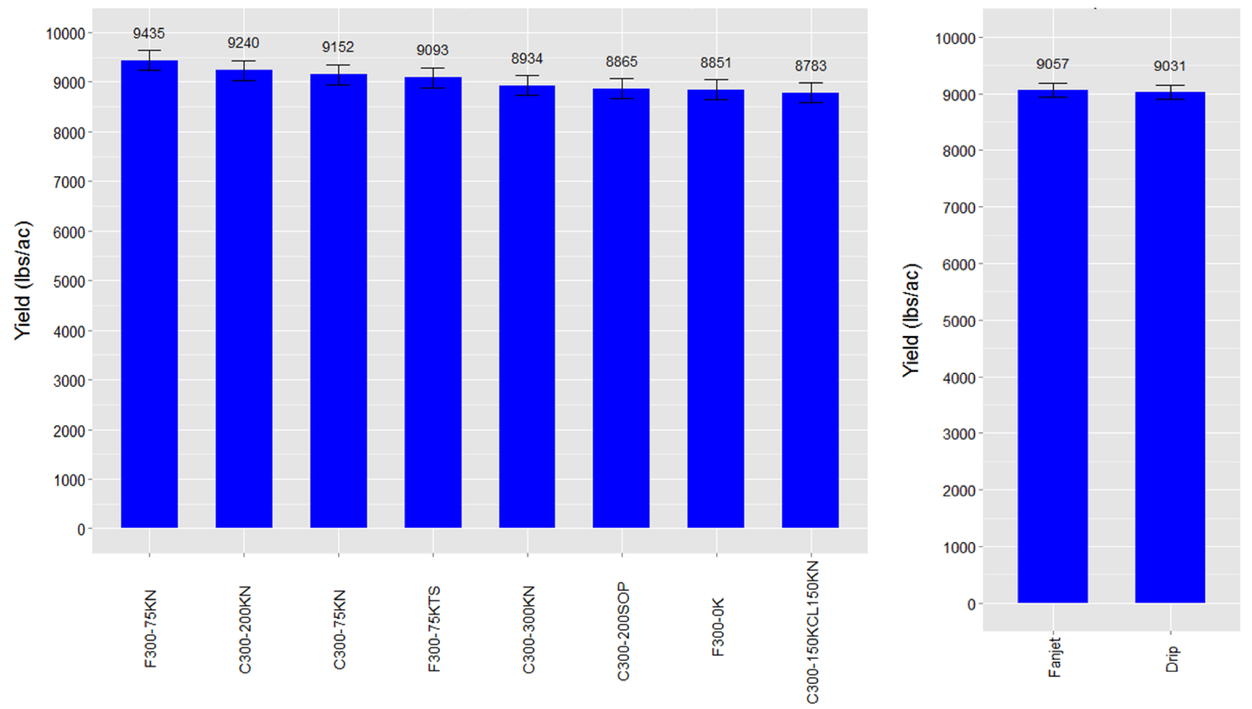


Fig 3. Almond root phenology