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

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PROJECT SUMMARY

To optimize nutrient use efficiency in almond 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. Information on the distribution and activity of nutrients and roots in the soil profile, and knowledge of seasonal crop nutrient demand patterns is required. The overall goal is to use 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.

OBJECTIVES

- Determine almond root growth and phenology and characterize root distribution and activity as influenced by soil and tree nitrogen status.
- Determine almond root growth and phenology at sites representing a range of Californian almond growing conditions.
- Determination of the patterns and biological dynamics (K_m, V_{max}, C_{min}) of root nitrogen uptake and the relationship to tree phenology and demand.

METHODOLOGY

The trees used in this proposed experiment will be selected from among those currently under investigation in related Almond Board Projects. The orchard is a high producing 13 year old Nonpareil/ Monterey planting located south of Lost Hills in Kern County. Experiments provide preliminary individual tree data on yield, soil and plant water (neutron probe and plant based), plant nutrient status (5 in-season leaf samples), tree nutrient demand (sequential crop estimation and determination), leaf area index and photosynthesis and Et_0 .

- **Minirhizotron:** minirhizotron access tubes have been installed and root images have been collected every two weeks. (Fig 1 and 4)
- **Ingrowth core bags:** bags filled with a substrate or a mixture that allow for root colonization and further isolation. This method is suitable for comparing root activity, characterize seasonal variation and determine the effect of treatments within a research project. (Fig 2)
- **Soil Coring:** Soil cores will be collected at each treatment on six dates during the season accordingly to leaf and nut samples. Soil cores will be extracted at 4 horizons (0-15, 15-30, 30-60, 60-90 cm) and washed carefully through sieves.
- **Root Uptake:** isolated roots will be placed in a solution of known concentrations for 30 to 60 minutes of incubation period and the remained solution will be then analyzed. This approach will be used in a field setting as well as in greenhouse conditions. (Fig 3)

Fig 1 Minirhizotron access tubes

Fig 2 Ingrowth core bags

Fig 3 Greenhouse setting

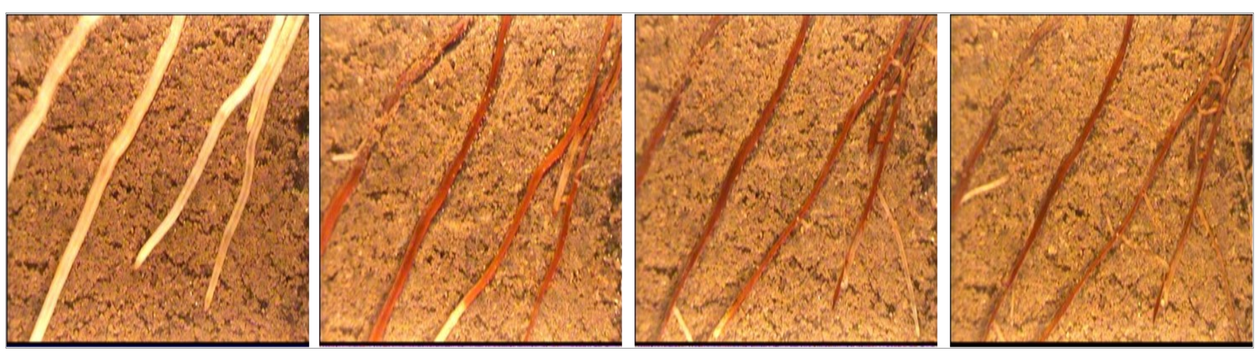

Fig 3 Lifespan of almond roots observed by a minirhizotron technique

PRELIMINARY RESULTS

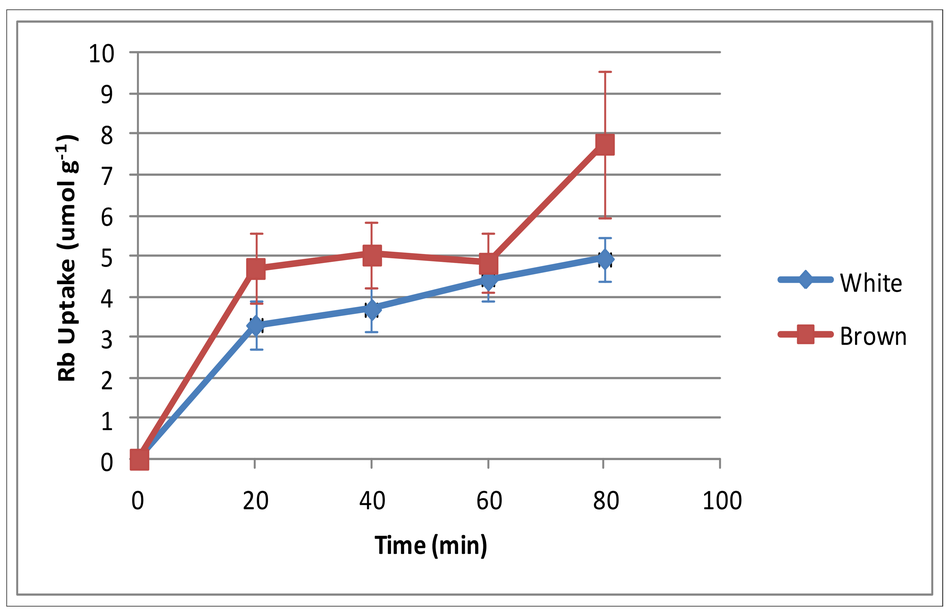

Fig 2 Root Rb^+ (K^+) uptake in almond roots of different ages