16TH ANNUAL ALMOND RESEARCH CONFERENCE, DECEMBER 6, 1988, SACRAMENTO

Project No. 88-Q7 - Nitrogen on Drip Irrigated Almonds

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Objectives: (1) To evaluate the effects of different nitrogen rates applied at two water levels on growth, nutrient concentrations in leaves and twigs, and nut yields of almonds. (2) To assess the extent of soil acidification from nitrogen application under drip emitters. (3) To develop recommendations for nitrogen, irrigation and soil management for use in the establishment of almond orchards. (4) Evaluate changes in nutrient movement in drip zone as a result of acidification, leaching and nutrient uptake.

Interpretive Summary: The 1988 yield results of the nitrogen fertilizer-drip irrigation trial were somewhat lower than the outstanding yields of last year. The weather was less favorable and more erratic in the trial vicinity. The orchard was planted (202 trees per acre) on the Nickels Trust Ranch in the spring of 1981 to three almond varieties--Butte, Carmel and Nonpareil. In the spring of 1982, ten treatments including two water levels-0.6 and 1.0 of evapotranspiration (ET) each with five nitrogen rates-0, 0.5, 1.0, 1.5 and 2.0 oz/tree in 1982; 0, 0.8, 1.7, 3.5 and 7.0 oz/tree in 1983; 0, 2, 4, 8 and 16 oz/tree in 1984; 4, 8, 16, 24 and 32 oz/tree in 1985; 6, 12, 24, 36 and 48 oz/tree in 1986; and 8, 16, 32, 48 and 64 oz/tree in 1987 and 1988. Urea is the nitrogen fertilizer source and it is applied on a monthly basis in six equal increments beginning April 1st. Figure 1 illustrates the almond meat yields as influenced by nitrogen rate and water level. Average yields across the three varieties for the two water levels showed little or no difference. The average yield was about 1400 meat pounds per acre for the 8 oz/tree nitrogen rate and increased to approximately 2400 for the three highest nitrogen rates. Four individual plot yields were greater than 3000 meat pounds per acre with the highest being 3102. As has been the case in the past, the Butte and Carmel varieties recorded the highest yields with the highest water and nitrogen rates whereas the Nonpareil variety showed little difference between water levels and reached its peak yields at the lower nitrogen rates. The seasonal changes in leaf nitrogen, phosphorus and potassium for 1987 are shown in Figures 2 through 4 respectively. Note that the nitrogen concentration for the two lowest nitrogen rates is similar and remains slightly above 2% for the July 2 sample date. Leaf phosphorus and potassium concentrations are much lower for the higher nitrogen rates during the early sample dates with potassium concentrations remaining lower for the entire sampling period. Early season results for 1988 continue to indicate this trend and plans are underway to apply both nutrients. All other nutrient levels are in adequate supply and the higher concentrations of manganese have stabilized in the 300-400 ppm range. Twig nitrogen concentrations have continued to show good correlations with meat yields. Soil samples taken from the nitrogen source trial show considerable acidification has occurred and amelioration treatments are planned in the near future.

Figure 1. Almond meat yields in 1988 as influenced by nitrogen rate and water applied through drip system. Nickels Ranch.

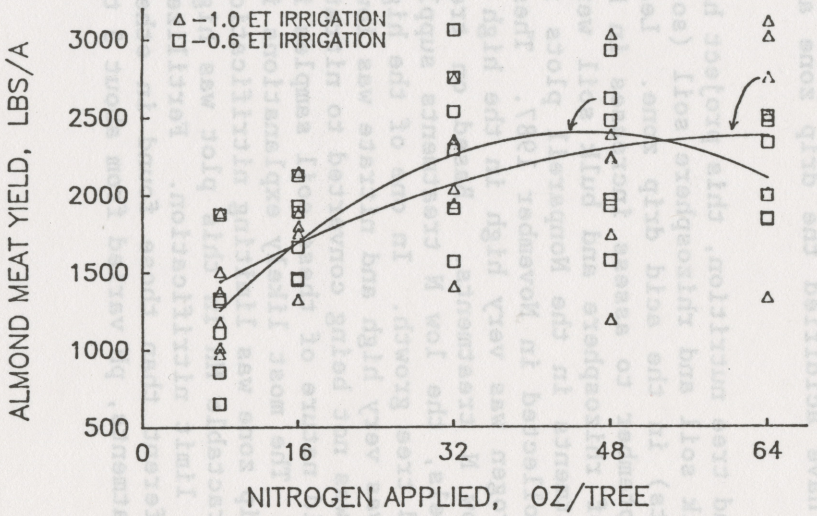


Figure 2. Almond leaf total nitrogen throughout 1987 for five rates of drip irrigation applied nitrogen. Nickels Ranch.

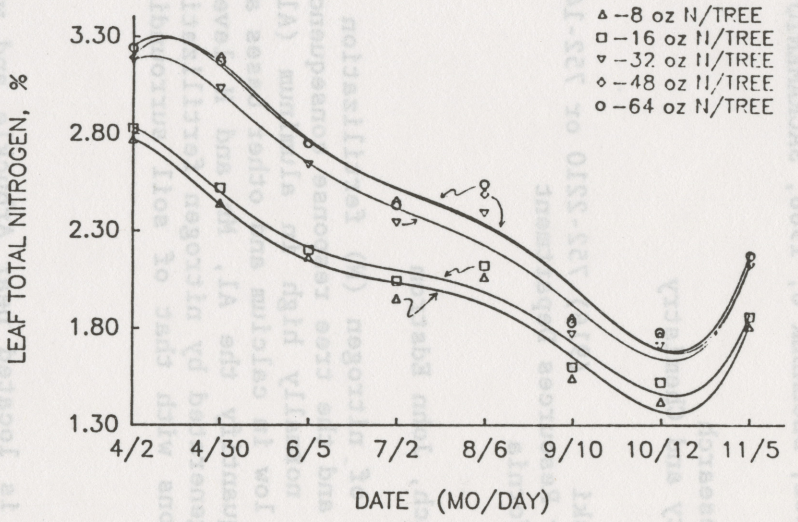


Figure 3. Almond leaf total phosphorus throughout 1987 for five rates of drip irrigation applied nitrogen. Nickels Ranch.

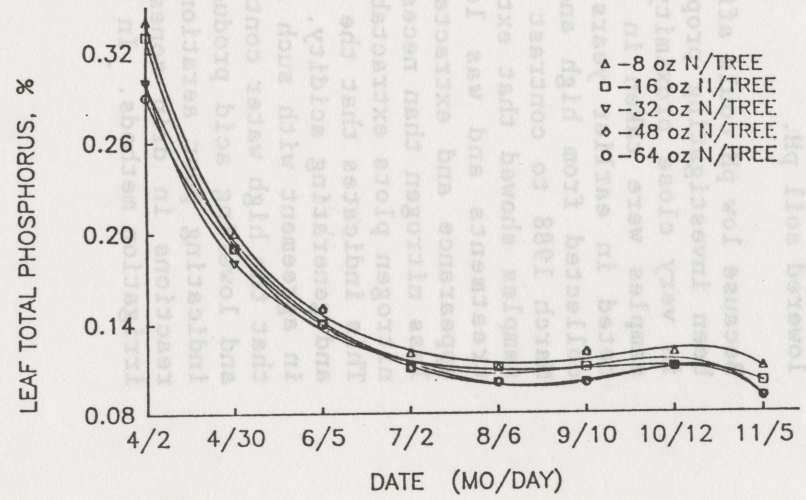
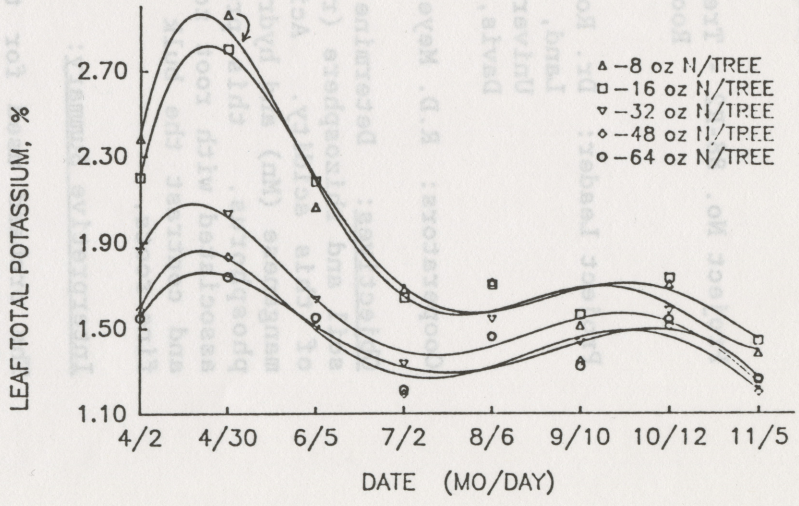


Figure 4. Almond leaf total potassium throughout 1987 for five rates of drip irrigation applied nitrogen. Nickels Ranch.



Project No. 88-R2 - Tree and Crop Research
Root Zone Acidity and Chemistry

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Objectives: Determine the effects of nitrogen (N) fertilization on soil and rhizosphere (root zone) pH and the tree response consequences of this acidity. Acid soils are normally high in aluminum (Al), manganese (Mn) and hydrogen (H) and low in calcium and other bases and phosphorus. this project will quantify the Al, Mn and H levels associated with root zone acidity generated by nitrogen fertilization and contrast the bulk soil conditions with that of soil surrounding fine roots.

Interpretive Summary:

The orchard used for this project is located near Arbuckle and was planted in 1981 and nitrogen fertilization began in 1982. The highest nitrogen application rate was 2, 7, 16, 32, 48, 64 and 64 oz per tree in 1982, 1983, 1984, 1985, 1986, 1987 and 1988 respectively. Low nitrogen levels were 0, 0, 0, 4, 5, 8 and 8 oz. per tree over the same period. Rates of 64 oz. per tree are equivalent to 800 lbs N/per acre. The high urea applications have acidified the drip zone and lowered soil pH.

Because low pH could affect growth and tree nutrition, this project has been investigating properties of bulk soil and rhizosphere soil (soil in very close proximity to the roots) in the acid drip zone. Leaf samples were taken in March and September to assess increases in Mn noted in earlier years. Samples of rhizosphere and bulk soil were collected from high and low N treatments in the Nonpareil plots in March 1988 to contrast with those collected in November 1987. These samples showed that extractable nitrogen was very high in the high N treatments and was low in the low N treatments. Based on tree appearance and extractable soil levels, the low N treatments supply less nitrogen than necessary for good tree growth. In one of the high nitrogen plots extractable ammonium was very high and nitrate was low. This indicates that the applied urea was not being converted to nitrate and generating acidity. The less acid nature of these soil samples is in agreement with such a suggestion. The most likely explanations is that the high water content of the drip zone was limiting nitrification and lowering acid production. Extractable Mn in this plot was high indicating poor aeration which could limit nitrification. Fertilizer reactions in drip zones can be different than those found in other irrigation methods. In the low N treatments, pH varied from about 5 to