ANNUAL REPORT

Project No. 91-R5 - Root Zone Acidity and Chemistry

Project Leader: Dr. Robert J. Zasoski
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Cooperating Personnel: R. Meyer, J. Edstrom, H. Schulbach, and Nickel's Trust

Objectives: 1) To determine the effects of nitrogen (N) fertilization on soil. 2) To compare the bulk and rhizosphere soil properties. This project quantifies the Al, Mn, Ca and H levels in bulk and rhizosphere soil in relation to fertilization rate. 3) Studies of root distribution in relation to soil properties started in 1989.

During the past year, two lines of investigation were followed at Nickel's Trust. The first examined root growth into acidified root cores placed a different locations in relation to the emitters. Thirty-two cores filled with acidified and control soil were constructed from polyethylene mesh, as described last year, and placed in the field in April. These cores were located 15 and 25 cm below the surface both in the tree row and 1 meter toward the row middle. In November of 1991 the cores and roots which had grown into the cores were extracted from the orchard and frozen. Root weights in the control and acid-treated cores will be determined along with pH, nutrient and salt content. A second line of investigation determined the ability of porous ceramic solution samplers to determine changes in dissolved nitrogen and solution pH following fertilizer additions to the drip basin. Porous ceramic solution samplers were placed at 5, 20, 30, 40 and 60 cm below the surface of the drip basins. Ammonium sulfate was applied monthly during the growing season. Figure 1 shows the changes in dissolved

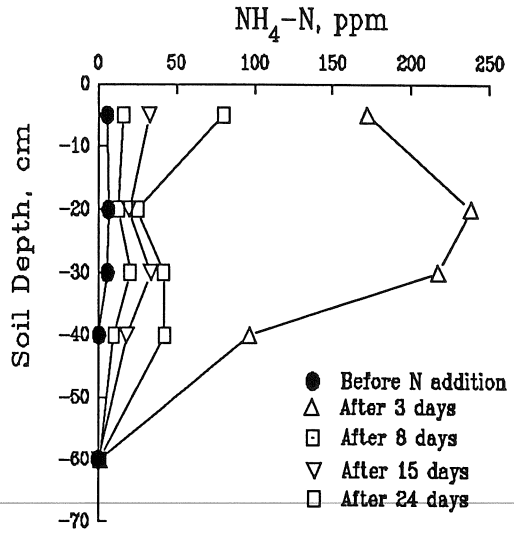

Figure 1. Solution ammonium concentration in soil solutions extracted following addition of granular ammonium sulfate.

ammonium levels following fertilizer addition in late July. At all depths ammonium was low before fertilization. Three days after fertilization dissolved ammonium had increased dramatically except at the 60 cm depth. During the next three weeks, solution ammonium decreased toward the pre-fertilization value. Dissolved nitrate (Figure 2) showed a similar but smaller response to fertilization. Within three days solution nitrate increased at the 5 cm depth, which indicates rapid nitrification.

At the 60 cm depth both ammonium and nitrate were very low and changed very little over the fertilization cycle. Solution pH (Figure 3) exhibited some interesting trends during the fertilization/irrigation cycle. Before fertilization solution pH was 5.6 at the 5 cm depth and varied from 7.85 at 60 cm to 4.35 at 40 cm. After three days, solution acidity increased as pH dropped to values ranging from 4.1 to 4.65 except at the 60 cm depth which remained nearly neutral. During the next three weeks, pH increased at the 5, 20 and 30 cm depths but the increases were small at the 40 and 60 cm depths. In water below the emitters at Nickels Trust, acidity is changing dramatically during a fertilization cycle.

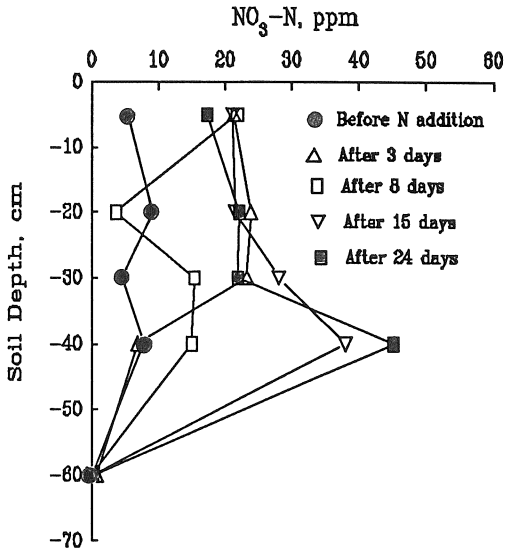

Figure 2. Solution nitrate concentration following addition of granular ammonium sulfate.

Part of the reason for the large difference in the upper soil depths is the alkaline irrigation water. Before ammonium sulfate addition, water in the drip basin had a pH of 8.3. Immediately following ammonium sulfate addition solution pH dropped to 6.8. The alkaline water and the changes in solution pH over a four-week period suggests that the roots are not continuously exposed to the extremely acid conditions which have been measured in earlier studies. This may help to explain the lack of deleterious effects associated with the strongly acid soils in this orchard. During the next year additional studies of solution nitrogen levels will be conducted to further elucidate then changes in dissolved nitrogen which can be expected following fertilization in these drip systems.

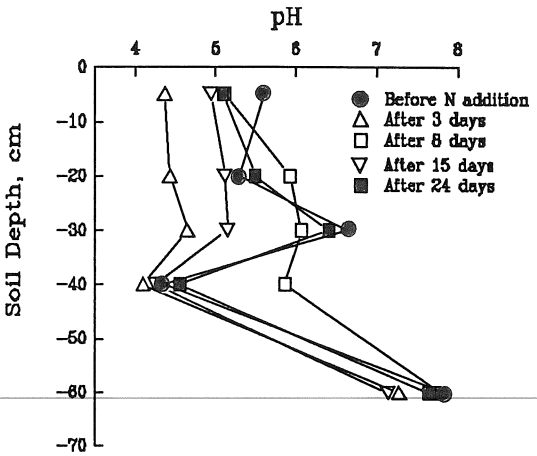

Figure 3. Solution pH in samples collected following addition of granular ammonium sulfate.

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January 11, 1992

Ms. Susan McCloud
Research Director
Almond Board of California
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Sacramento, CA 95852

Dear Ms. McCloud:

Enclosed is a copy of the 1991 final report for Project No. 91-R5 - Root zone acidity and chemistry. We appreciate the support the you and the Almond Board have provided for this project and look forward to another fruitful year. If you have any questions feel free to contact me.

Best wishes for a productive New Year.

Sincerely,

R.J. Zasoski
Associate Professor of Soil Science and Plant Nutrition