Project No. 80-Q1 (New)

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Project: Tree and Crop Research
Nitrogen Application

Objectives: To determine which nitrogen application period results in the greatest availability of fertilizer nitrogen to the bloom and developing nuts of the Nonpareil variety under field conditions.

Progress: The time of year at which nitrogenous fertilizers are most efficiently applied to deciduous fruit trees remains a subject of debate, and fertilizers have been applied without apparent knowledge of the tree's capacity for nitrogen uptake or its subsequent utilization. Certain application periods may correspond with reduced nitrogen uptake (due presumably to soil losses, tree inactivity, etc.) or enhanced vegetative growth (at the expense of cropping). Economic and efficient tree utilization of nitrogen fertilizer in almond orchards requires determination of (1) seasonal patterns of nitrogen uptake and (2) the differential distribution and utilization of the fertilizer associated with different application periods.

This project represents the first work with labeled nitrogen in deciduous fruit trees conducted under actual field conditions. Studies previously completed employed small potted trees (non-bearing prune and dwarfed apricot trees). Almond conceivably differs from other stone fruits in the depth and duration of its dormant period and, consequently, in its uptake and distribution of nitrogen during late fall and winter.

Plans: A cooperator has been found in Merced County. The plot selected is a 'Nonpareil' orchard on a light to medium-textured soil. Fifty trees (5 treatments, 10 trees per treatment) will be given the equivalent of 2½ pounds of N/tree supplied during 1980 as $^{15}N$-depleted ammonium sulfate. Between January and harvest 1981, blossoms, fruit, nuts, and vegetative tissue will be sampled to compare the utilization efficiency of fertilizer N as affected by application period.

| Treatment | Application Date of N Tracer in 1980* |
|---|---|
| 1 | March 15, 1980 (end of bloom) |
| 2 | June 1, 1980 |
| 3** | August (before last preharvest irrigation) |
| 4 | Split application: March 15, 1980 (1 above)<br>August 1980 (3 above) |
| 5** | December 1, 1980 |

* Use of $^{15}N$-depleted ammonium sulfate tracer is anticipated.
** Treatments will be duplicated in an orchard on a medium to heavy textured soil.

Almond Industry Participation $7,750

ANNUAL REPORT

1980

# EFFECT OF APPLICATION PERIOD ON THE AVAILABILITY OF FERTILIZER N TO ALMOND BLOSSOMS AND DEVELOPING NUTS

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## General Summary

The time of year at which nitrogenous fertilizers can most efficiently be applied to almond trees has been a subject of considerable concern. Fertilizers have been applied without apparent knowledge of the trees' capacity for nitrogen uptake or its subsequent utilization. Certain application periods may correspond with reduced uptake (due presumably to soil losses or tree inactivity, etc.) or enhance vegetative growth (at the possible expense of cropping). Economic and efficient tree utilization of nitrogen fertilizer in almond orchards requires the determination of (1) seasonal patterns of nitrogen uptake by the tree and (2) the differential distribution and utilization (by vegetative growth, buds, blossoms, nuts, etc.) of the fertilizer associated with different application periods.

In this project, a special formulation of nitrogen in ammonium sulfate which can be analytically differentiated from normal nitrogen sources was used. Plants apparently cannot differentiate between these two types of nitrogen. Therefore, the uptake and utilization of this particular fertilizer nitrogen can be traced and measured. Two orchards were utilized for this test -- one in Merced County on a sandy soil and another in Solano County on a medium-textured soil. Both orchards were approximately 17 years old and were yielding similarly. Nonpareil was used as the test variety in both orchards. On the sandy soil, applications were made in mid-March, early June, mid-August, and a split application of mid-March and mid-August. The fifth application period will be December, 1980. In the other orchard, only three application timings were used, mainly to determine any differences caused by soil type. In this orchard, applications were made in mid-March and a split of mid-March and mid-August. The third application will be made in December. Nuts and leaves have been sampled from treated plots throughout 1980 and all plots will be sampled throughout 1981 until harvest.

Presently, little information is available because all treatments have not yet been made. The analysis of the 1981 samples will need to be made before valid conclusions can be drawn from this study. However, just two weeks after the mid-March 1980 applications were made, nitrogen from these treatments was detected in the tree (leaves and small nuts). Also, from the limited data analyzed so far, it appeared that the percentage of nitrogen in the tree that was derived from the March-applied fertilizer increased during the year even though the total nitrogen from all sources in the tree followed a typical nitrogen curve of decreasing percent nitrogen as the season progressed.

## Background

The time of year at which nitrogenous fertilizers are most efficiently applied to deciduous fruit trees remains a subject of debate, and fertilizers have been applied without apparent knowledge of the trees' capacity for nitrogen uptake or its subsequent utilization. Certain application periods may correspond with reduced nitrogen uptake (due presumably to soil losses, tree inactivity, etc.) or enhance vegetative growth (at the expense of cropping). Economic and efficient tree utilization of nitrogen fertilizer in almond orchards requires determination of (1) seasonal patterns of nitrogen uptake and (2) the differential distribution and utilization of the fertilizer associated with different application periods.

The isotopic composition ($^{14}N/^{15}N$ ratios) of nitrogenous fertilizers may be altered so that nutrient uptake from the fertilizer applied can be traced and measured.

This project represents the first work with 'tagged' nitrogen in deciduous fruit trees conducted under actual field conditions. Studies previously completed employed small, potted trees (non-bearing prune and dwarfed apricot trees). Almond conceivably differs from other stone fruits in the depth and duration of its dormant period and, consequently, in its uptake and distribution of nitrogen during late fall and winter.

## Procedures

The following applications of $^{15}N$-depleted ammonium sulfate (3-1/3 pounds N per tree) have been applied this year:

| Treatment | Application Date of N Tracer in 1980* |
|---|---|
| 1** | March 15, 1980 (end of bloom) |
| 2 | June 1, 1980 |
| 3 | August (before last preharvest irrigation) |
| 4** | Split application: March 15, 1980 (1 above)<br>August, 1980 (3 above) |
| 5** | December 15, 1980 |

*$^{15}N$-depleted ammonium sulfate applied as 'tracer'.
**Treatments applied in an orchard on a medium- to heavy-textured soil; all 5 treatments were applied in an orchard on a light-textured soil.

Tagged N applications were made to 17-year-old 'Nonpareil' trees on two orchards differing in soil texture: a sandy soil (Mr. Y. Asai, Turlock) and a loam (Mr. G. Crum, Winters). The fertilizer (in solution) was poured into trenches dug around each tree. The trenches were immediately refilled with soil and irrigated shortly thereafter to minimize the likelihood of volatilization. Nut and leaf samples were collected once or twice a month in 1980 and will be collected in 1981 according to the following schedule:

Tissue (Buds, Leaves, Blossoms, Fruit, Nuts)
Sampling Periods in 1981

1) Bud swell
2) Mid full bloom
3) Petal fall
4) April 1
5) May 1
6) June 1
7) July 1
8) August 1
9) Harvest
10) December 15 (dormant wood)

At harvest, the shell, kernel, and hull will each be analyzed separately.

Samples are being processed for mass-spectrometric analyses to determine the rate and magnitude of fertilizer N movement to leaves and nuts. At harvest, tree yields are taken, and nut samples are separated into hull, shell and kernel. We will then be able to determine (1) how much of the nitrogen in the crop is derived from the fertilizer and (2) whether nitrogen is better utilized by the crop following specific N application periods.

Results -- 1980

The nitrogen derived from the 'tagged' fertilizer (applied in mid-March) was detected in the young leaves and immature nuts of both orchards within two weeks of application. The level of tagged N in the nuts corresponding to that application increased throughout the season and represented 22% of N in the kernels at harvest. Insufficient time has elapsed between the June or preharvest applications to permit comparisons of N timing this year. The effectiveness of treatments 2 through 5 will be determined during the next crop year.

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The assistance of Farm Advisors Lonnie Hendricks and Dave Holmberg, Staff Research Associate Ron Snyder and growers Yoshio Asai and George Crum is greatly appreciated.

# EFFECT OF APPLICATION PERIOD ON THE AVAILABILITY OF FERTILIZER NITROGEN

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December, 1980

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