Project Number 75-S1

Title: Nitrogen Fertilization Study

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1. Objectives. To chemically analyze the backlog of tissue samples accumulated up to early summer, 1976, from a long-term nitrogen rate study being conducted in Butte County.

2. Interpretive Summary. Nitrogen analyses of leaves, hulls, shells, kernels and pruning wood were completed for samples taken in 1975 and early 1976. With increasing amounts of nitrogen applied (the nitrogen treatments were: 0, 1, 2, 4 or 8 lbs. of N per tree per year) there was a progressive increase in the level of N found in each type of tissue. In the leaves, the concentration of N was very high in early spring, declined very rapidly, then leveled off around July and declined again in August and September. Any routine leaf sampling should be done in July when the level of leaf N is changing the least. The normal range of leaf N that has been used as a standard for years has been 2.0-2.5%, i.e., leaf N should not fall below 2% for a July sample. It now appears that the 2.0% level is too low and probably should be raised to about 2.2%.

In the almond fruit the concentration of N on a dry weight basis was about 3.3% to 4.0% N in the kernel, 0.3-0.4% in the shell and 0.5-0.7% in the hull. In terms of the total amount of N in the entire almond fruit, approximately 75% of the N was found in the kernel, 5% in the shell and 20% in the hull. This means that a crop of one ton per acre of meats (kernels) could remove 100 lbs. or more of N per acre from the orchard.

The N removed from the orchard in brush from a normal pruning program is small in comparison to that removed in the crop--usually 10 lbs. per acre or less.

3. Experimental Procedure. Leaf samples were taken 11 times during 1975 and five times in 1976. Each sample consisted of 50 leaves taken from the two trees within each replication. The treatments were: 0, 1, 2, 4 and 8 lbs. N per tree per year applied as urea in December. The plots were sprinkle irrigated immediately following the application of the fertilizer. Treatments were replicated six times.

Leaf samples were washed in a weak detergent solution, given a final distilled-water rinse, dried in a circulating oven at 160°F and ground in a Wiley mill to pass a 40-mesh screen.

At harvest, all the nuts on each experimental tree were harvested and weighed. Twenty-five nuts were sampled from each tree, air-dried for several weeks and separated into hull, shell and kernel. The hull and shell were ground in a Wiley mill and the kernel chopped up into small bits prior to analysis.

After pruning was completed at the end of the year, the brush was divided into two categories, shoots less than 3/8-inch in diameter and those greater. Each type of pruning was weighed and sampled for analysis.

In the laboratory nitrogen was determined on all the samples by a macro-Kjehldahl method.

4. Results. Leaf nitrogen for the 1975 season is shown in Figure 1.

The concentrations of N in the kernels, shells and hulls are shown in Table 1:

Table 1. Concentration of N (on a dry wt. basis) in kernels, shells and hulls sampled September 12, 1975.

Nitrogen Treatment (lbs/tree)	% Nitrogen Kernel	Shell	Hull
0	3.34	.35	.49
1	3.53	.37	.52
2	3.78	.38	.60
4	3.93	.43	.64
8	4.03	.44	.69

The nitrogen levels in the pruning brush are shown in Table 2:

Table 2. Concentration of N (on a dry wt. basis) in wood prunings. Small wood = shoot diameter less than 3/8 inch. Large wood = shoot diameter greater than 3/8 inch.

Nitrogen Treatment (lbs/tree)	Large Wood	Small Wood
0	.43	.69
1	.41	.67
2	.43	.76
4	.43	.79
8	.47	.85

5. Discussion. (See Interpretive Summary.)

Fig. 1. Concentration of leaf nitrogen during the 1975 season.