ANNUAL REPORT TO THE ALMOND BOARD OF CALIFORNIA

December 31, 1995

Potassium Fertilization Regimes and Foliar N, P, K, B Studies on Almonds
(Project No. 95-RM1)

by

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Objectives:

Potassium fertilization regimes study: (1) To evaluate the effects of different placement, source and rate of applied potassium on growth, nutrient concentrations in leaves and nut yields of almonds. (2) To assess the extent of potassium movement in soil under different placement, source and rate of application treatments.

Foliar application study: (1) To evaluate the effect of foliar applications of several nitrogen, phosphorus, potassium and boron treatments on growth, nutrient concentrations in leaves and nut yields. (2) To evaluate the effect of several timings of foliar treatments on yields and leaf nutrient levels.

Problem and its Significance:

Potassium fertilization regimes study: High yielding almond orchards with declining leaf potassium levels on the West side of the Sacramento Valley and other areas of the state have given growers cause for concern regarding how best to apply potassium. The irrigation of almonds is accomplished with a number of different systems that may apply the necessary water to a very limited soil volume or wetted area up to flooding the entire soil surface and wetting all of the soil. Fertilizers may be applied to the soil surface in a band or broadcast before irrigation or winter rains, or through the irrigation system to help move the materials into the soil. If added through a low volume or smaller wetted area system, even potassium fertilizers which are not easily moved in soils have been taken up readily by trees. Some fertilizers are not dissolved easily or water quality characteristics prohibit trouble free injection and growers choose to use application on the soil surface as an alternative. The availability of several new formulations of potassium sulfate, phosphate and thiosulfate make it easier to inject into irrigation systems. Given the different types of application now being utilized, it seems prudent to evaluate the relative efficiency of potassium uptake from several sources and methods of placement.

Foliar application study: Recent research with foliar application of nutrients on citrus, avocado, peach and almond has shown some potential for increasing yields and improved efficiency of fertilizer use, particularly nitrogen. The primary benefits seem to point to improved set and strength of newly developing fruit/nuts. It is also uncertain what, if any, additional benefit may accrue from phosphorus, potassium, and boron applications along with the nitrogen. The availability of a new material, mono potassium phosphate, along with good nitrogen sources-urea and potassium nitrate provide additional motivation for a more in depth investigation and reevaluation of this topic.

Interpretive Summary:

Potassium fertilization regimes study: The Butte and NonPareil rows of the irrigation system comparison trial on the Marine Avenue location of Nickels Soil Laboratory are being used for this study. The orchard was planted in the spring of 1990 to 4 varieties: Butte (B), NonPareil (N), Carmel (C), and Monterey (M) in a B-N-C-B-N-M sequence. Tree spacing is a "diamond" 16' x 22' (145 trees/A) with individual plots having 5 trees each. Tree circumference measurements were recorded for each tree and the five tree plot totals were used to establish the three blocks or replications. Treatments were then randomly assigned to the four blocks (replications) of the drip irrigation system, two blocks of the micro irrigation system and two blocks of the double drip irrigation system. There are a total of 72-5 tree plots. The potassium sources potassium sulfate, mono-potassium phosphate and potassium thiosulfate are being compared at several rates injected through three irrigation systems (drip, micro and double drip) versus higher rates applied on the soil surface as bands 3 feet from the tree on both sides of the tree row. The band applications were made in the fall which is the normal grower practice. Injection treatments will begin in the spring and continue throughout the growing season. Leaf samples will be taken to evaluate nutrient uptake and yield data will be collected to determine treatment effects. Soil samples will be taken at the end of the season to evaluate potassium and phosphorus movement.

Foliar application study: The experiment was established on a March 1989 planting of Butte variety with a 15 feet by 20 feet "diamond" arrangement. Tree circumference measurements were recorded for each tree and the five tree plot totals were used to establish the three blocks or replications. Treatments were then randomly assigned to the three blocks. The foliar nutrient treatments listed below (2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12) were applied beginning with the prebloom (A timing) application on February 3 and 4, 1995. The second (B timing-30 days after prebloom) foliar nutrient treatments (4, 5,

Treatments No.	Fertilizer	Rate of Application, lbs N, P_2O_5, K_2O/A A*	B*	C*	Yield, meat lbs/A
1.	Control	0-0-0	0-0-0	0-0-0	1985
2.	Urea (low biuret)	5-0-0			2259
3.	Urea (low biuret) plus MKP**	5-3-2			1879
4.	Urea (low biuret)	5-0-0	10-0-0		2089
5.	Urea (low biuret) plus MKP**	5-3-2	10-6-4		1813
6.	Urea (low biuret)	5-0-0	10-0-0	10-0-0	1777
7.	Urea (low biuret) plus MKP**	5-3-2	10-6-4	10-6-4	1886
8.	Urea (low biuret) plus MKP**	5-3-2	10-6-4	20-12-8	2063
9.	Urea (low biuret) plus KNO_3	5-0-2			1868
10.	Urea (low biuret) plus KNO_3	5-0-2	10-0-4		2099
11.	Urea (low biuret) plus KNO_3	5-0-2	10-0-4	10-0-4	1887
12.	Boron-Solubor 20% B (3 lbs/A)	0.6 LB B/A			2144

* Timing of treatment applications: (A). Prebloom - 2/3-4/95, (B). 30 days after prebloom application - 3/6/95-trts 4, 5, 6, 7, 8 and 3/30/95-trts 10, 11 and (C). 60 days after prebloom application - 4/4/95-trts 6, 7, 8 and 5/2/95-trt 11.
** MKP=Mono Potassium Phosphate (0-51.5-34).

6, 7, 8) were applied on March 6 and treatments (10 and 11) on March 30, 1995. The third (C timing-60 days after prebloom) foliar nutrient treatments (6,7,8) were applied on April 4 and treatment (11) was applied on May 2, 1995. Rates of applied nutrients were chosen to minimize any possible damage with increasing amounts being applied as the leaf area increased 30 and 60 days after the prebloom application. Almond leaves were observed after each foliar application for any phytotoxicity but none was found Leaf samples were taken on July 6 and October 5, 1995. Almond meat yields were collected on September 28, 1995. Eight to ten pound samples were taken from each plot for moisture and meat shellout percentages. One hundred twenty five nut samples were also collected for meat, shell and hull percentages as well as number of doubles, blanks and average kernel (meat) weights for each plot.

Almond meat yield responses to applied foliar nutrient treatments were not significantly different. The yield from the control (no fertilizer applied), 1985 meat lbs/A, versus other treatments receiving nitrogen alone (2, 4, 6 receiving 1, 2 and 3 applications respectively), with yields of 2259, 2089 and 1777 lbs/A respectively showed a trend for the prebloom only treatment to have a slightly higher yield (274 meat pounds). Meat yields for treatments 3, 5, 7 and 8 which received 1, 2, 3 and 3 applications respectively and contained the nutrients nitrogen, phosphorus and potassium were not significantly different but a trend did exist for the highest rate of 3 foliar applications to give a slightly higher yield (1879, 1813, 1886 and 2063 respectively). Nitrogen and potassium foliar treatments (9, 10 and 11) indicated a trend for the 2 application treatment to give a slightly higher yield but meat yields were not significantly different (1868, 2099 and 1887 respectively). . The boron treatment (12) resulted in one of the higher yields but again it was not significantly different from other treatments. The average meat weight was 1.125 grams with a range from 1.076 to 1.155 grams but there were no significant differences between treatments.

Leaf samples taken on July 6 and October 5, 1995 were analyzed for total nitrogen, phosphorus, potassium, zinc, manganese, copper and boron. The results from both sample dates indicated no significant differences between the foliar treatments applied. The only noteworthy trend observed was that the mono potassium phosphate treatments showed slightly higher potassium leaf concentrations on both sample dates. No trends were observed in leaf potassium leaf concentrations for the potassium nitrate treatments.

Since some of the more recent research with foliar application of nutrients on citrus and peach has involved applying fertilizers in the fall just prior to leaf drop, another small trial was initiated in November 1995 to study the effect on almonds. The objective was to investigate the potential for increasing nutrient storage in the wood if the leaves were sprayed with rather high nutrient concentrations just prior to leaf drop. Treatments included foliar applications of mono-potassium phosphate alone at 1, 2 and 3% solution concentrations and in combination with urea at 20 lbs N/A. These applications were made on November 10, 1995, approximately 3-4 weeks before leaf fall to provide adequate uptake of applied nutrients.

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March 8, 1996

Joe MacIlvaine
Chairman, Production Research Committee
Almond Board of California
1104 12th Street
Modesto, CA 95354

Dear Joe:

Enclosed are two copies of our 1995 annual report on Project No. 95-RM1 "Potassium Fertilization Regimes and Foliar N, P, K, B Studies on Almonds". John, Larry, Wilbur and I want to express our appreciation for the continued support of this project by the Almond Board.

Please feel free to get in touch if you have any questions or comments (Phone 916-752-2531 or FAX 916-752-1552 or email rdmeyer@ucdavis.edu).

Sincerely,

Roland D. Meyer

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Enclosures

cc: John Edstrom
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