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FRUIT SET AND YIELD IN 'HASS' CAN BE INCREASED BY SHIFTING THE TIME OF BLOOM OR PROPER TIMING OF NITROGEN FERTILIZATION

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The time at which flowering occurs determines when fruit set is going to occur. Currently, fruit set is predominantly at a time of low root activity, reduced transpiration, low photosynthesis, and low temperatures which negatively impact flower opening, pollination, fertilization, and fruit set. As bloom progresses, there is increased competition with new developing vegetative shoots at a time when the roots are still inactive so that competition for water and mineral nutrients, especially nitrogen which is required in larger amounts than other nutrients, becomes more intense. Singularly, and in combination, these factors reduce fruit set and yield.

The objective of this project is to improve fruit set and yield of 'Hass' avocado using two approaches. The first is to determine the optimal timing of nitrogen fertilization with the goal of identifying those application dates which increase flowering and/or fruit set and yield without a reduction in fruit size. (This part of the project is conducted by Lovatt in California.) By determining the optimal time for nitrogen fertilization of citrus, in this case to the foliage, we were able to increase yield of nitrogen-sufficient 'Washington' navel orange trees by approximately one packing carton (35 lbs of fruit) per tree without a reduction in fruit size for each of three consecutive years (Ali and Lovatt, 1993, Citrograph 78:7-9). This increase in yield represents approximately a 10% increase over untreated trees.

The second approach is by shifting the time of bloom by injecting the trees with GA_3, GA_4, and GA_7 three to four weeks before the beginning of bloom to delay bloom sufficiently (4 to 8 weeks) so that it will now coincide with root growth and activity and maturation of the spring flush (the spring flush becomes a carbon exporter after 30 days, according to Wolstenholme and Whiley). (This part of the project is conducted by Cutting and Wolstenholme in South Africa.)

To determine the optimal time for nitrogen fertilization, all trees and the control treatment received 150 lbs N as ammonium nitrate in six applications to the soil at a rate of 25 lbs N per acre in late October early November; late January early February; mid-April; June; mid-July; and late August - early September. In addition, some trees

received an additional 25 lbs N as ammonium nitrate per acre in *(i)* November, *(ii)* early January, *(iii)* February; (iv) mid-April; or (v) June.

Figure 1 illustrates the relationship between key physiological events and the timing of 25 lbs N/acre (N) or 50 lb N/acre (2XN) fertilizer application rates. There are 20 individual tree replicates per treatment (6 treatments) to insure that differences in yield observed are statistically significant at the 5% level. Yield, including lbs of fruit per tree, packout, and fruit quality (pulp quality), will be determined this March for the first year of the experiment, and March 1994 for the second year of the research. Leaf samples for total nitrogen, as well as all other essential nutrients, were collected in September. The leaves are being analyzed by Albion laboratories; the results have not been completed, as of yet.

As part of this project, Dr. Michael Blanke from the Institut fur Obstau und Gemusebau der Universitat Bonn, Germany, was a visiting Postdoctoral Research Plant Physiologist in my laboratory from April through June of 1992. Dr. Blanke investigated the anatomy, transpiration, and photosynthesis of the avocado flower in relation to fruit set by determinate versus indeterminate (vegetative) inflorescences. Two manuscripts resulted from Dr. Blanke's work. The first has been submitted to *Annals of Botany* and is in review. The second manuscript is in preparation. The title and abstract of the first manuscript follow.