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Fruit Set and Yield of 'Hass' Avocado Can Be Increased by Shifting the Time of Bloom or by Proper Timing of Nitrogen Fertilization

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Introduction

Flowering and fruit set of the 'Hass' avocado occur 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 roots are still inactive, so the competition for water and mineral nutrients becomes more intense. Singularly and in combination, these factors reduce fruit set.

The main objective of this project is to improve fruit set and yield of the '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. The second is by shifting the time of bloom using GA_3 applied in September, November, December, and January, before the beginning of bloom, to delay bloom sufficiently (4 to 8 weeks) so that it will not coincide with root growth but will occur later at the time when roots are active and the spring flush is mature and serving as a source by exporting photosynthate. We will also attempt to delay bloom by using GA sprays to enhance the summer flush of shoots. These shoots flower later in the spring than shoots produced in the fall.

The results of this research will increase our knowledge of the physiology of flowering and fruit set and will provide basic information from which we can develop practical, field-applicable approaches for improving fruit set and yield.

Procedures

1.) To determine the optimal time for nitrogen fertilization, all trees and the control treatment receive 150 Ibs. N as ammonium nitrate applied to the soil at a rate of 25 Ibs. N per acre in late October-early November 1994, late January-early February 1995, mid-April, mid-June, mid-July, and late August-early September; but in addition, some trees receive an additional 25 Ibs. N as ammonium nitrate per acre in (i) November 1994, (ii) early January 1995, *(iii)* February, *(iv)* mid-April, or (v) mid-June, 1995. There are 20 individual tree replicates per treatment (6 treatments) to insure that any differences in yield observed can be evaluated as statistically significant at the 5% level.

Forty spring flush leaves from non-fruiting terminals will be collected at chest height around each data tree in September for nutrient analysis. The leaves will be immediately stored on ice, taken to UCR, washed thoroughly, oven-dried, ground, and sent to Albion Laboratories for analysis of total nitrogen and all other essential mineral nutrient elements.

Harvest data will include total Ibs. of fruit/tree and the weight of 100 randomly selected individual fruit/tree, which will be used to calculate packout/tree, an evaluation of internal fruit quality, and a cost-benefit analysis of each treatment.

2.) To delay bloom, we will use GA foliar sprays to increase the amount of summer flush, which will also likely reduce the amount of fall flush. The results of our preliminary field trial using branches on individual trees provided evidence that the summer flush, in contrast to what might be expected, flowers later in the spring than the fall flush, and also flowers more intensely. Several concentrations of GA and several application times will be tested. We are attempting to delay bloom by making monthly applications of GA_3 in September, October, November, December, or January In addition, there is one treatment in which the trees receive GA_3 each month. There are 16 individual tree replicates/treatment. The experimental trees were donated by Foothill Properties, Corona, California. Time of flowering will be monitored for each treatment, and the effect of delaying bloom on yield will be determined.

Harvest data will include total Ibs of fruit/tree and the weight of 100 randomly selected individual fruit/tree, which will be used to calculate packout/tree, an evaluation of internal fruit quality, and a cost-benefit analysis of each treatment.

Results

1.) We have two years of yield data for the field experiment designed to determine the optimal time to apply nitrogen to a 'Hass' avocado orchard. The results support the hypothesis that in a given year, some application dates are better than others for maximizing yield. However, the dates were not the same for the two years.

2.) The results of the preliminary field experiment using individual branches to screen several application times (November, December, and January) prior to the bloom and three concentrations of GA_3 were very interesting. GA enhanced the growth of all shoots. Thus, if the shoot was already committed to being a floral shoot, flowers developed in advance of floral shoots not treated with GA. The January application date gave mixed results. The research revealed that during the spring bloom period, shoots produced during the fall flowered earlier than the older shoots produced in the summer. The shoots produced in the summer also flowered more intensely.

This year we initiated the full-scale field trial described above in the procedures to determine the efficacy of applying GA sprays to shift the time of bloom on the yield of the 'Hass' avocado. The time of flowering will be monitored in each treatment and the effect of delaying bloom on yield assessed. The first harvest for this experiment will in April 1996.

To determine which flowers contribute more fruit to set and yield, we tagged inflorescences that open early in the bloom period and a second cohort that open late in the bloom, and quantified fruit set after June drop and again at harvest. In conjunction with our project on determinate *vs.* indeterminate inflorescences, we quantified the number of fruit set by each type of inflorescences in the early and late blooming cohorts of inflorescences. We are currently collecting these data for the second year.