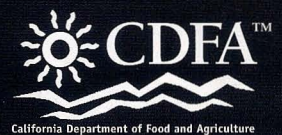


# PROCEEDINGS

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# DEVELOPMENT OF NITROGEN BEST MANAGEMENT PRACTICES FOR THE 'HASS' AVOCADO

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## OBJECTIVES

1. Quantify the nitrate pollution potential of the various N fertilization strategies.
2. Identify the threshold rate of N fertilization above which the pollution potential increases.
3. Evaluate the potential for replacing the April double dose or triple dose of soil N with foliar N.
4. Provide a ratio of enhanced-yield benefit to environmental cost for each N fertilization strategy.
5. Identify BMP's for N fertilization for the 'Hass' avocado in California.

## DESCRIPTION

To reduce potential nitrate pollution of groundwater, avocado growers apply N fertilizer to the soil in several small doses annually. This strategy ignores tree phenology and the possibility that the tree requires more N at certain times of year. In a prior 4-year study, we determined the impact of supplying a double dose of soil N to 'Hass' avocado trees at one of several key times in the phenology of the tree in comparison to supplying a single dose of N six times per year. The results of this study demonstrated that N application

time was more important than the total annual amount of N applied to sustain over multiple years higher yields, to obtain a greater proportion of commercially valuable, and to reduce the degree of alternate bearing of the 'Hass' avocado. November proved to be the best time to apply N to the soil based on both increased yield and fruit size averaged across the four years of the study and increased cumulative yield for both total lb and lb large size fruit per tree. April also proved a good time to apply N based on increased cumulative yield, i.e., both total lb and lb large size fruit per tree, and decreased alternate-bearing index compared to control trees. Applying the double dose of N in January, February, or June had no effect on yield, fruit size, or alternate bearing. The yield increases were economically significant.

In 1997, we initiated a 6-year study funded by the California Avocado Commission (CAC) to replicate our earlier study and to quantify the effects of additional strategies with the overall goal to even out alternate bearing and to increase annual and cumulative yield and fruit size. The danger is that using double or triple doses of soil-applied N to increase yield might increase the potential for nitrate groundwater pollution. We hypothesized that supplying an avocado tree with more N at times when demand is greater should not increase leached nitrate. Since yield is increased, the interpretation is that the tree utilized the extra N. Our CDEA/FREP project is coordinated with and complemented by our CAC project. We are quantifying the amount of nitrate and ammonia leaching past the root zone of 'Hass' avocado trees treated with various N fertilization strategies. The results of this research will identify Best Management Practices (BMPs) for N for the 'Hass' avocado in California. The avocado growers of California are proactive and are seeking this information.

## RESULTS AND CONCLUSIONS

Yield for two harvests, 1997-98 and 1998-99, and cumulative yield is provided in this report (see Table). The yield data for the first year confirmed that time of N application is more important than the amount of N applied. This was not the case for the second harvest. The 1998-99 crop was not a normal crop. Fruit load was dramatically reduced due to the unprecedented devastation caused by the *Persea* mite and avocado thrips and due to the freeze in the winter of 1998/99. As a result there was very little variation in yield among treatments. The 1999-00 crop, which we will harvest this September, will also be lower than normal due to the freeze. The 2000-2001 crop will be a normal to high yield.

Funding for our CDEA/FREP project started in April 1999. Due to the abnormally low yield in 1999-00, we delayed

***Effect of nine nitrogen fertilization strategies on yield of the 'Hass' avocado during an "on" year in 1998 and an "off" year in 1999.***

Treatment	Total lb N/acre	Year		2-year cumulative yield lb fruit/ tree
		1998 lb fruit/ tree	1999 lb fruit/ tree	
2x N in August (all years)	40.0	73.6 az	37.8z	113
Grower fertilization practice <sup>y</sup>	42.5	70.7 a	40.1	110
2x N in November (prior to "on" years) and April ("off" years)	40.0	68.1 a	40.5	106
2x N in November (all years)	40.0	62.3 ab	44.6	107
Control <sup>x</sup>	80.0	58.8 ab	49.4	108
2x N in April and November (no N in February and June) (all years)	80.0	58.8 ab	32.8	96
2x N in April ("off" years) and 3x N ("on" years)	60.0	58.6 ab	48.5	107
2x N in April (all years)	40.0	56.8 ab	42.1	99
2x N in April ("off years) and 3x N ("on" years) applied foliarly	100.0	42.3 b	44.6	87
P-value		0.06	NS	NS

<sup>z</sup>Values in a vertical column followed by different letters are significantly different at the specified P level by Duncan's Multiple Range Test

<sup>y</sup>Grower's fertilization practice is 40 lb N as ammonium nitrate/acre split into two applications made in July and August.

<sup>x</sup>Control trees received 80 lb N as ammonium nitrate/acre, divided into four, 20 lb/acre applications made in mid-April, mid-July, mid-August, and mid-November.

starting the research by approximately six months to start with the 2000-01 crop. With the delay, the CAC and CDFA projects are now synchronized with regard to crop year, which will improve the results and the overall utility of the research. We spent the six-month delay improving the methods for recovering the resin bags and for standardizing

the extraction and recovery of nitrate and ammonia from the resins. We are confident that this extra research will improve the quality of the data that we are now collecting. At the time of submission, the lab had not completed the analysis of samples from the field.