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Avocado Fruit Quality As Influenced by Preharvest Cultural Practices

M. L. Arpaia and I. Eaks
Extension subtropical horticulturist and Department of Biochemistry, respectively, University of California, Riverside.

Progress Report

Our efforts during 1989-90 have been divided into three major areas: evaluation of fruit quality as related to irrigation/nitrogen management (Corona Foothill Properties), nitrogen management (Cashin Creek Ranch), and the possible impact of postharvest cooling delays prior to storage. We have completed all fruit evaluations from Corona Foothill Properties and the Cashin Creek Ranch, and are in the final stages of data analysis. Preliminary results are presented below. We currently have underway studies to evaluate the impact of delayed cooling on fruit quality.

A. The influence of irrigation/nitrogen management on postharvest fruit quality.

Fruit was obtained twice (February 7, 1990; May 15, 1990) from Corona Foothill Properties. At this site, there is an irrigation/fertilization study underway (see report: "Irrigation and Fertilization Management"; Meyer, *et al.,* this Yearbook). Fruit were harvested by size (6.5-7.5 ounces) from the three irrigation treatments (80, 100, 120% ETc) and nitrogen treatments (0, 1.5, 3.0 lbs. N/tree). The experimental design is a randomized complete block design for irrigation, with nitrogen a split plot on irrigation. The results for the nitrogen treatments are reported in Tables and Figures as the % N from the leaf analysis collected in Fall 1989, rather than the pounds of nitrogen applied per tree (see above).

The average percent dry weight for each harvest is reported in Table 1. There were no differences in percent dry weight at the time of harvest due to irrigation treatment. There was a slight but significant difference, however, in percent dry weight due to nitrogen treatments at both harvests. At the time of harvest, we also analyzed the fruit pulp for various mineral elements, oil (%), and fatty acid composition. The results from the first harvest are presented in Table 2. There were no significant differences detected in the pulp for % N, NH_4-N (ppm), % K, % Ca, or % Mg due to irrigation treatment. The same held true for fatty acid analysis (data not presented). There were significant differences, however, due to nitrogen treatment. Not surprisingly, fruit coming from the trees with higher % N based on leaf analysis had higher total nitrogen and higher NH_4-N levels. The fruit from the same two treatments also had higher Mg levels in the fruit. There were slight but significant differences in certain fatty acids (%) also noted (data not presented). We expect to complete the analysis of fruit from the second harvest, and will compare these results with what is reported in Table 2. Fruit from the February 7, 1990 harvest were stored at 5°C (41°F) for 0, 3, or 6 weeks. Fruit from the second

harvest (May 15, 1990) were stored at 5°C for 0, 2, 4, or 6 weeks. At each point in time, ten fruit were utilized to evaluate flesh firmness (UC Pressure Tester) after storage. An additional 15 fruit were treated with 10-20 ppm ethylene for 24 hours at 20°C (68°F).These fruit were evaluated for flesh firmness, external appearance, and internal quality after an additional four days at 20°C. The percentage of the fruit showing moderate or severe internal breakdown is reported.

Table 1. Average Percent Dry Weight at Harvest for Fruit Used in Storage Evaluations, 1990.

Experimental Site	Harvest Date	Nitrogen Treatment (%N leaf analysis)	% Dry Weight	Irrigation Treatment (% ET_c)	% Dry Weight
Corona Foothill Properties	2/7/90	1.92	31.3 a	80	30.3
		2.10	30.1 b	100	30.0
		2.19	30.2 ab	120	31.3
Significance level[z]			0.05		NS
Corona Foothill Properties	5/15/90	1.92	30.2 a	80	28.9
		2.10	29.3 ab	100	29.5
		2.19	28.4 b	120	29.5
Significance level			0.10		NS
Cashin Creek Ranch	5/22/90	1.58	30.1		
		2.09	31.3		
		2.26	31.1		
Significance level			NS		

[z] Mean separation using Duncan's Multiple Range Test. NS = not significant.

Table 2. Pulp Analysis of Fruit from Corona Foothill Properties Irrigation/Fertilization Study. February 1990 Harvest[Z].

Main Effects		N (%)	NH_4-N (ppm)	K (%)	Ca (%)	Mg (%)
Irrigation (% ET_c)	80	1.55	207	2.21	0.062	0.10
	100	1.60	208	2.16	0.060	0.10
	120	1.48	195	2.04	0.056	0.10
Significance level[y]		NS	NS	NS	NS	NS
Nitrogen (% leaf analysis)	1.92	1.25 b	150 b	2.11	0.064	0.09 b
	2.10	1.64 a	215 a	2.14	0.060	0.10 a
	2.19	1.75 a	245 a	2.16	0.053	0.10 a
Significance level		0.01	0.01	NS	NS	0.10

[z] Samples for pulp analysis were taken at the time of harvest.

[y] Mean separation by Duncan's Multiple Range Test. NS = not significant. There were no significant interactions between irrigation and nitrogen detected.

Irrigation management did not appear to significantly impact the rate of flesh softening in storage (Fig. 1). There was, however, a significant difference in the percentage of fruit with moderate or severe internal breakdown after six weeks of storage (Fig. 2). Fruit harvested from the 80% ETc treatment after six weeks of storage had significantly less internal breakdown as compared to either the 100% or 120% ETc treatments (Harvest 1, P=0.01; Harvest 2, P=0.10).

Fig. 1. The effect of irrigation (%ET) on flesh softening during 5°C storage.

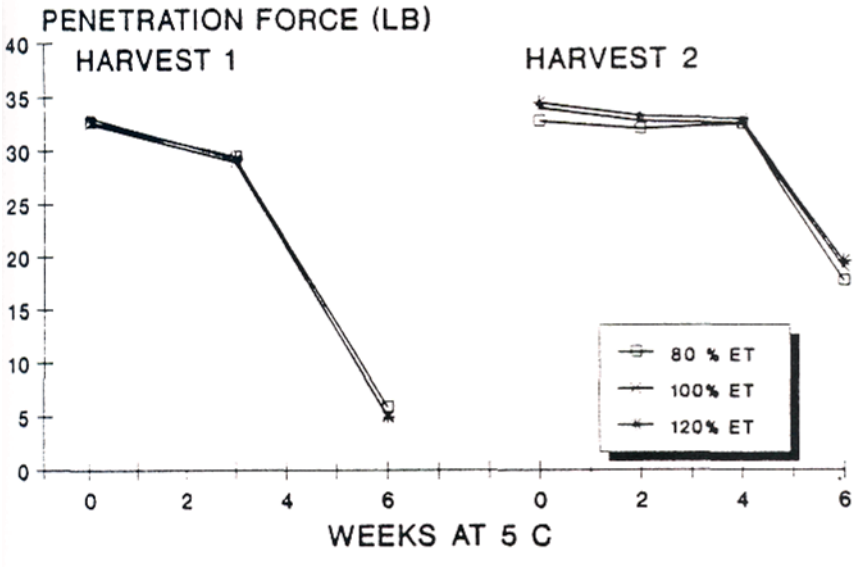
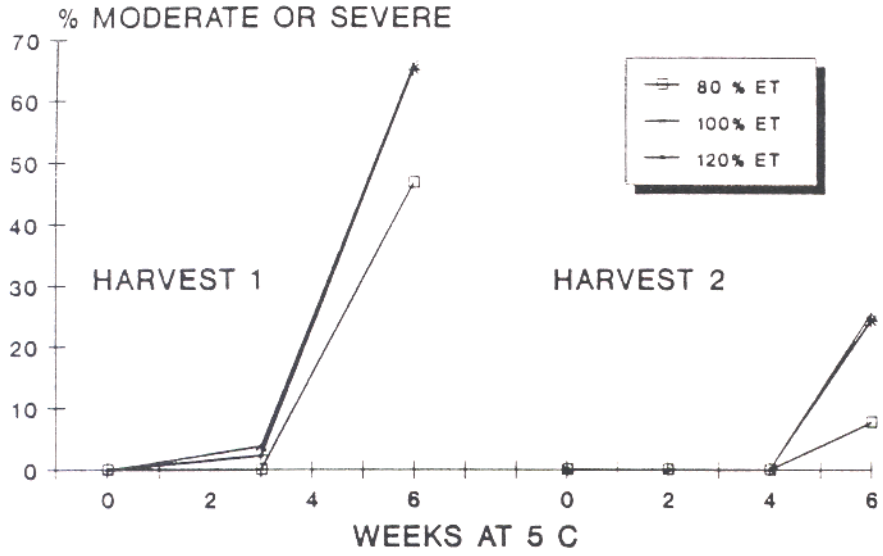


Fig. 2. The effect of irrigation (%ET) on flesh/vascular discoloration.



The softening patterns observed due to nitrogen treatment were similar to those observed due to irrigation treatment (Fig. 3). There were no significant differences observed in internal breakdown due to nitrogen management (Fig. 4). We did not observe any significant effect on fruit storage characteristics due to an irrigation/nitrogen interaction.

B. The Influence of Nitrogen Management.

Fruit were obtained on May 22, 1990, from the Cashin Creek Ranch. We harvested fruit from the "Brown" block, where a nitrogen trial is underway (0, 2, 4 lbs. N/tree). See Meyer *et al.* for experimental details. The experimental design at this site is a randomized complete block design. The % dry weight of the fruit at harvest is reported in Table 1. There were no significant differences in dry weight detected.

The fruit were stored at 5°C for either 0, 2, 4, or 6 weeks. Fruit evaluations were carried out as described below. The results obtained are reported in Figures 5 and 6. We did not observe any significant differences in the pattern of flesh softening or the amount of internal breakdown after storage.

C. The Influence of Postharvest Cooling Delays on Subsequent Storage Quality.

We are conducting a study to evaluate the impact of delayed cooling on fruit quality. Fruit have been obtained in the field within one hour of harvest. After transportation back to Riverside (1 hour), the fruit were placed at either 20°C (68°F), 30°C (86°F), or 40°C (104°F) for either 0, 6, 12, or 24 hours. Fruit were then transferred to 5°C for 0, 2, 4, or 6 weeks. Fruit are being evaluated as described above with the exception that they are not being treated with ethylene to promote ripening, since we are interested in observing any effect on ripening due to temperature and duration.

Fig. 3. The effect of N management on flesh softening during 5°C storage.

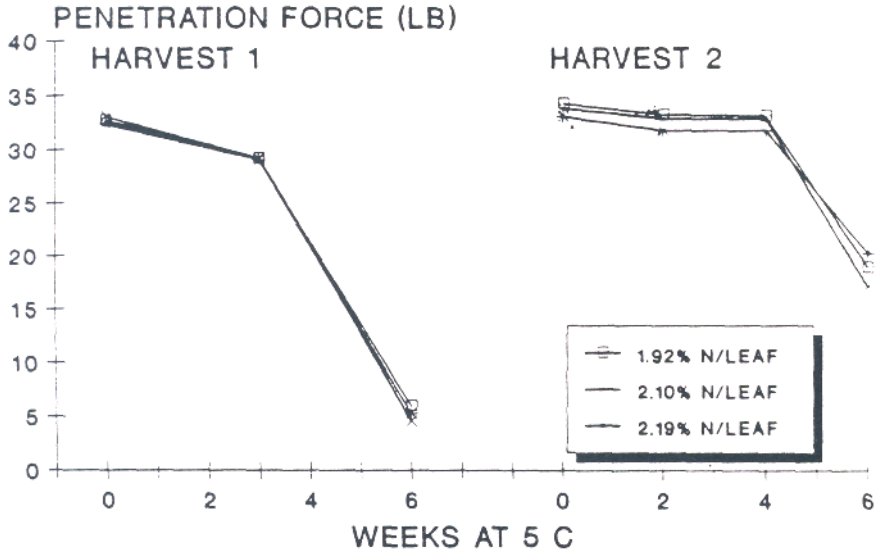


Fig. 4. The effect of N management on flesh/vascular discoloration.

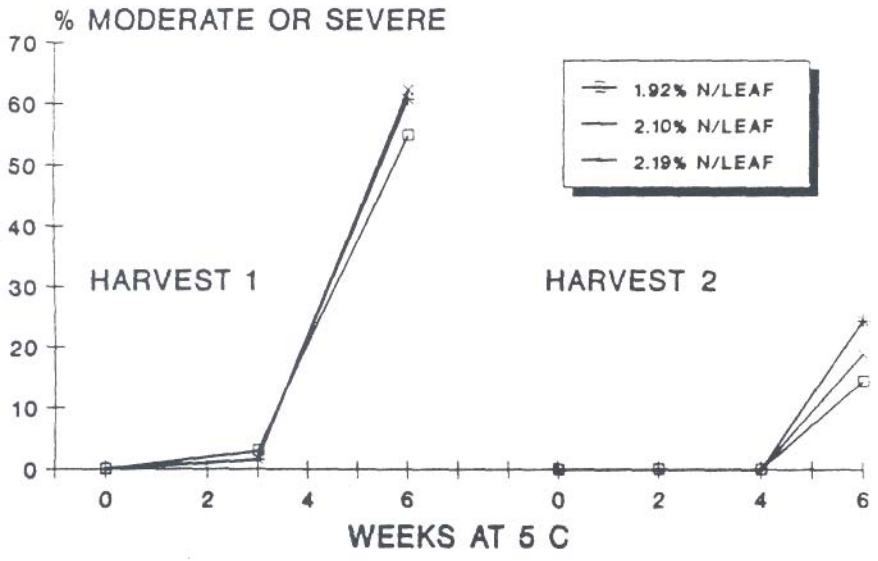


Fig. 5. Cashin Ranch nitrogen studies. Flesh softening during 5°C storage.

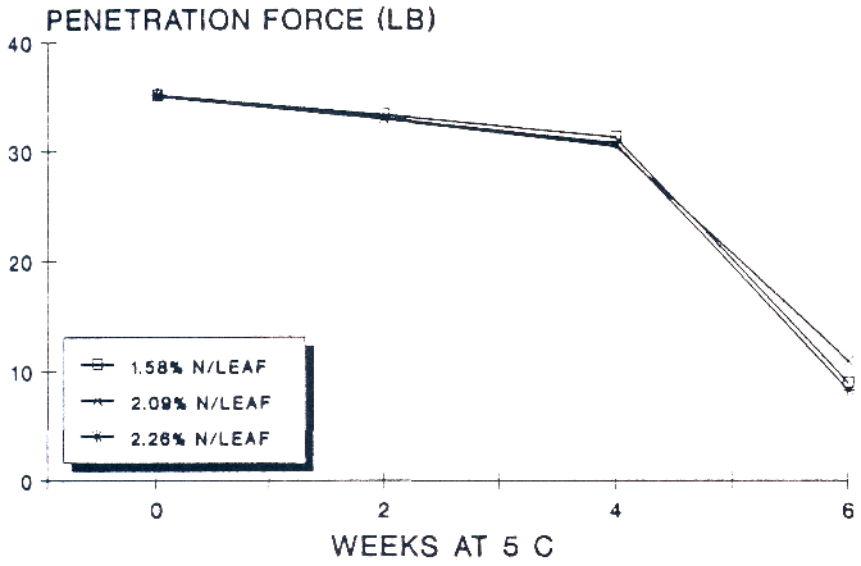
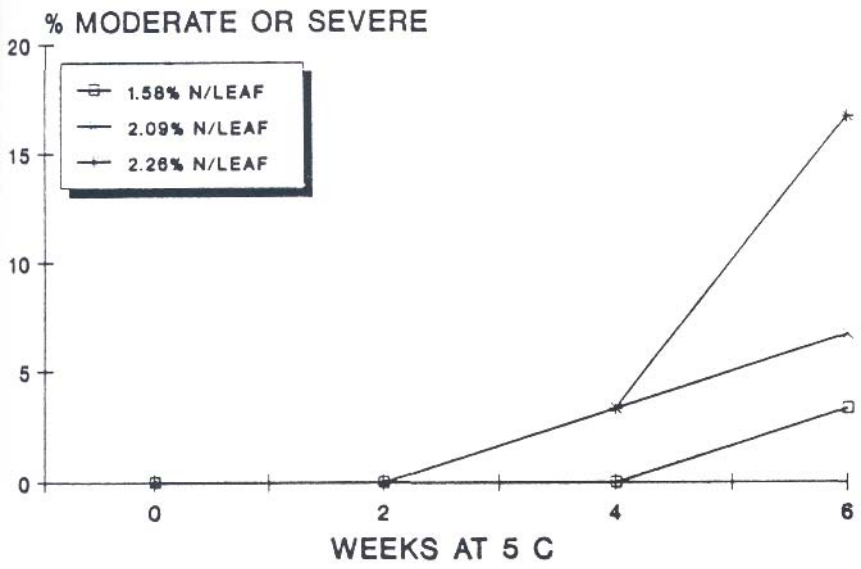


Fig. 6. Cashin Ranch nitrogen studies. Flesh/vascular discoloration.



Practical Applications and Summary

The results from this study will help to provide the avocado industry with guidelines pertaining to postharvest handling. Enhancement of fruit quality through improved

cultural and handling procedures will help to ensure the continued acceptance of California avocados by the consumer and wholesale trade. Preliminary results indicate that nitrogen management may influence both the nutrient and the fatty acid composition of the fruit. These results will need to be verified. We have not seen any significant impact of nitrogen management on storage quality. Irrigation management may influence storage quality in terms of the amount of internal breakdown following long-term storage.