

Avocado Fruit Quality as Influenced by Preharvest Cultural Practices

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The major postharvest limitation of the avocado fruit has been related to the fruit's sensitivity to chilling injury at temperatures below 45 °F (7°C). Symptoms of chilling injury in avocados varies, ranging from external discoloration to internal browning of both flesh and vascular tissue. Storage at temperatures above 45 °F, however, may result in excessive fruit softening and increased difficulty in fruit handling.

The influences of preharvest cultural practices on increasing or decreasing sensitivity to chilling injury has not been described for California avocados. Under South African conditions, Bower (S. A. Avocado Growers Association, 1986) reported that fruit from water stressed trees were more prone to internal browning. The establishment and continuation of a long term irrigation-fertilization study has proved an opportunity to study the possible impact of preharvest cultural practices on postharvest fruit, performance. We initiated a study to evaluate the impact of water stress on fruit quality in 1988-89.

The primary objective of the project was to evaluate in a systematic manner the potential impact of preharvest cultural practices on the postharvest quality of the 'Hass' avocado. I was able to obtain only one fruit harvest from the experimental site at Corona Foothill Properties in 1989, as compared to the planned four harvests. The single harvest was made on May 22, 1989, from the three irrigation treatments (80%, 100%, 120% ET) described elsewhere.

All fruit were size picked (65-75 mm diameter at blossom end) from each irrigation treatment. There are four blocks of trees at the experimental site in Corona. We utilized each block as an in-field replication for the storage evaluations. At the time of harvest, per cent dry matter was determined as outlined by the Ranney Report (1988). Other measurements taken at the time of harvest included external skin color, individual fruit weight, and flesh firmness. Fruit were stored at 41 °F (5°C) for 0, 3, or 6 weeks. Following storage, fruit were held in an ethylene-free atmosphere at 68 °F (20 °C) for five days. The holding period after low temperature storage allows for evaluation of relative shelf life following prolonged holding. Flesh firmness was monitored after storage and subsequent holding at 68 °F flesh firmness declined to 1.5 lbf or lower, internal fruit quality was evaluated for the presence or absence of vascular discoloration (1-4 rating scale) and flesh discoloration (1-6 rating scale). The percentage of fruit exhibiting either moderate/severe vascular or flesh discoloration was subsequently calculated.

Table 1 presents the average fruit size and per cent dry weight at the time of harvest. There were no significant differences in per cent dry weight at the time of harvest due to irrigation treatment. No differences in skin color at the time of harvest were detected.

Table 2 presents the data for softening in storage as related to irrigation treatment. At the time of harvest, the fruit from the 120% ET irrigation treatment were slightly firmer than those from the 80% ET treatment. After three weeks in storage, some softening had occurred at 41 °F, but there were no differences due to irrigation treatment. Following an additional three weeks of storage, substantial softening had occurred (note decline from average firmness of 28.5 lbf to 4.7 lbf). At this time, differences related to irrigation treatment were noted. The fruit from the 120% ET treatment were significantly softer than fruit from the 80% ET treatment, although this difference was slight. Flesh firmness following five days at 68°F did not vary between the irrigation treatments. After five days at 68 °F without 41°F storage, the average flesh firmness was 14.1 lbf. After three weeks of storage, fruit softened much more rapidly (0.9 lbf after five days).

Table 1. The effect of irrigation on harvest fruit measurements.

Irrigation Treatment (%ET)	Fruit Weight (g)	Dry Weight (%)
80	255.9	30.4
100	260.6	30.6
120	241.9	30.9
Significance	NS	NS

NS = Not significant

Table 2. The effect of irrigation on flesh firmness (lbf) after storage.

Irrigation Treatment (%ET)	Weeks at 41°F		
	0	3	6
80	29.7 b	28.3	5.5 a
100	31.1 ab	28.4	4.7 ab
120	31.8 a	28.8	4.0 b
Significance	**	NS	**

** = Significant at P = 0.05. Mean separation using Duncan's Multiple Range Test.

NS = Not significant.

Table 3 presents the data collected which pertained to internal fruit quality following ripening. A slight amount of vascular discoloration was observed after six weeks of storage, but there were no detectable differences between the irrigation treatments. No flesh discoloration was observed in ripe fruit until after six weeks of storage. Again, no differences due to irrigation treatment were detected. Fruit discoloration was prevalent following ripening after six weeks storage, with approximately 20% of the fruit exhibiting moderate/severe discoloration from all irrigation treatments.

Table 3. The effect of irrigation on internal fruit quality after ripening.

	%ET	Vascular Discoloration (1-4)	Flesh Discoloration (1-6)	Moderate/Severe Discoloration (%)
Weeks at 41 °F 0	80	1.2	1.0	0.0
	100	1.2	1.0	0.0
	120	1.1	1.0	0.0
Significance		NS	NS	NS
3	80	1.1	1.0	0.0
	100	1.1	1.0	0.0
	120	1.1	1.1	1.7
Significance		NS	NS	NS
6	80	2.0	2.4	21.7
	100	1.9	2.2	18.3
	120	1.8	2.5	22.1
Significance		NS	NS	NS

NS = Not significant.

Vascular Discoloration: 1 = none, 2 = slight, 3 = moderate, 4 = severe.

Flesh Discoloration: 1 = none, 2 = 1-20%, 3 = 21-40%, 4 = 41-60%, 5 = 61-80%, 6 = 81-100% of flesh discolored.

% Moderate/Severe Discoloration: Individual fruit were placed in this category if vascular discoloration was ≥ 3 or flesh discoloration was ≥ 4 .

Practical Application and Summary

The fruit evaluated in this study were obtained from the second season of a long term irrigation-fertilization project where the trees are differently irrigated. It is important not only to evaluate the impact of irrigation management on total yield, but also to evaluate any detrimental impact on overall fruit quality. The results from 1988-89 may indicate that a 20% reduction in applied water may not impact fruit quality, but further evaluation in subsequent years is needed to verify this initial observation in storage as related to irrigation treatment.