

Avocado Postharvest Quality

Continuing Project; Year 4 of 5

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Benefit to the Industry

This project will help to maintain and enhance the California avocado industry by continuing a project evaluating the potential of snap harvesting and initiating postharvest evaluation on patented and unreleased varieties. Each of these project objectives will assist the California avocado industry in shipping fruit of high quality to the consumer. This in turn will assist the grower to maximize their profit potential and further build a market identity for California avocados as fruit of the highest quality. This is critical as the California industry faces increased competition in the domestic market and elsewhere.

Objectives

- A. To continue a postharvest evaluation program on the unreleased plant material from the breeding program.
- B. To continue collaboration with Dr. Smilanick and D. Margosan examining factors involved with postharvest decay of avocado.
- C. To develop a research program aimed at quantifying ripening of the 'Hass' avocado and development of a non-destructive ripening measure at point of sale.

Summary

A. To initiate a postharvest evaluation program on the unreleased plant material from the breeding.

We continued our postharvest evaluation of fruit from the UC South Coast Research and Extension Center (UC SCREC) from the breeding blocks in 2001. We harvested fruit from 'Hass', 'Lamb Hass', 'Harvest', 'GEM', 'Marvel' (BL516), and 'Nobel' (BL667) trees in Field 46 on July 9, 2001. The fruit were held at 41F overnight at UC, Riverside and then taken to the UC Kearney Agricultural Center for subsequent storage and evaluation. We selected by size and relative absence of defects. We evaluated the tolerance to storage (0, 3, 6 weeks 41 F) by examining the days to ripeness, susceptibility to chilling injury and postharvest decay. One half of the fruit were treated for 24 hours with approximately 40 ppm ethylene to stimulate ripening. We also conducted limited sensory evaluation on these varieties using the same methodology employed in the 'Lamb Hass' maturity project. The data from these studies has been collected and is currently being entered for statistical analysis. The results presented below are averages of the data but without any statistical analysis. All decayed fruit were given to Dr. Smilanick and D. Margosan for pathogen isolation and identification.

Harvest dry weight and the overall percentage of germinated seeds. Table 1 presents the average dry weight (5 fruit sample, composite determination) at the time of harvest and the percentage of the fruit when ripened and evaluated which had germinated seeds (seeds were evaluated as "germinated" if the seed was cracked). There was less seed germination in 2001 as compared to the same evaluation period in 2000 except for the 'Nobel' which had a

relatively high percentage of its seeds germinated. Note, however, that this variety also had the highest composite dry weight. Dry weights at harvest were in the same range as 2000. In both years the 'Lamb Hass' and 'Harvest' had the lowest dry weights.

The influence of ethylene ripening on fruit quality. Table 2 presents the data following harvest and immediate ripening at 68F for the 6 varieties. Except for the 'Lamb Hass' and 'Harvest' a 24-hour exposure to 40 ppm ethylene stimulated ripening; reducing the average time to ripe by 50% or more. The slight effect of ethylene for these two varieties is most likely indicative of the fact that these varieties are "less mature" than the remaining varieties. We also rated on a 1 to 6 scale the initial fruit color and the ripe fruit color. Most fruit were either fully dark green or showed only a slight amount of coloration on the fruit surface. Following ripening, there are apparent differences between the varieties in terms of coloration. All these varieties are purported to turn "black" when ripe; however note that the 'Nobel' in particular, was primarily "green" in color with only slight coloration. Most of the fruit were mostly "black" when ripe, averaging about 60 to 80% of the surface colored. There were also apparent differences between the varieties in the amount of adhesion of flesh tissue to the seed when ripe. The 'GEM' had the highest values although these ratings indicate only "slight" adhesion. The 'Lamb Hass' was judged to have the majority of its fruit as "stringy" when ripe although all varieties had some proportion of the fruit showing stringlike vascular bundles. Finally, using a method originally developed by Cliff Ranney to judge "maturity" we rated essentially the uniformity of ripening within the fruit. The 'Hass' and 'GEM' tended to be the most uniform. The 'Marvel' had a tendency to have a firmer neck in most of the ripened fruit. These types of evaluations need to be carried out over a number of fruit seasons in order to make any conclusions.

Sensory evaluation following ripening and associated with dry weight. Figure 1 shows the relationship between dry weight and sensory evaluation of the fruit by panelists at UC-KAC. The fruit are judged on a 9 point hedonic scale where 1 is equal to extremely dislike; 5 is equal to neither like or dislike; and 9 is equal to extremely like. This is a very limited sample and does not include the data from the 3-week evaluation. It does illustrate that there were, however, some differences between the varieties. The 'Harvest' was rated as the "least liked" of the varieties and the "Hass" was rated as the "most liked". This ranking of the 'Harvest' is again indicative of the fruit probably not quite "mature" and ready for harvest. Table 3 shows the numerical averages for the sensory tests.

B. To continue collaboration with Dr. Smilanick and D. Margosan examining factors involved with postharvest decay of avocado.

The results from this collaboration are reported in Dr. Smilanick's report.

C. To develop a research program aimed at quantifying ripening of the 'Hass' avocado and development of a non-destructive ripening measure at point of sale.

Researchers at HortResearch in Auckland, New Zealand are conducting the research for this project objective. They are currently preparing their report for submission.

Table 1. Dry weight and the percentage of germinated seeds for fruit harvested from UC SCREC in July 2001.

| Selection | Dry Weight (%) | Seed Germination (%) |
|-----------|----------------|----------------------|
| Hass | 31.09 | 5.45 |
| Lamb Hass | 26.53 | 10.91 |
| GEM | 34.86 | 5.56 |
| Harvest | 27.34 | 0 |
| Marvel | 30.82 | 5.45 |
| Nobel | 35.75 | 20.00 |

Table 2. Selected fruit characteristics following ripening at 68F with or without a 24 hours 40ppm ethylene treatment.

| Variety | Ethylene (yes/no) | Days to Ripen | Initial Color | Final Color | Flesh Adhesion to the Seed | Prominent Strings in Fruit (%) | Internal Maturity Value |
|-----------|-------------------|---------------|---------------|-------------|----------------------------|--------------------------------|-------------------------|
| Hass | yes | 4.8 | 2.3 | 5.1 | 0.75 | 45.0 | 4.0 |
| | no | 12.5 | 2.1 | 4.4 | 0.55 | 15.0 | 4.1 |
| Lamb Hass | yes | 13.4 | 2.0 | 4.8 | 0.50 | 85.0 | 3.7 |
| | no | 13.7 | 2.1 | 4.9 | 0.50 | 90.0 | 3.7 |
| GEM | yes | 5.6 | 2.4 | 4.4 | 0.90 | 20.0 | 4.0 |
| | no | 14.8 | 2.9 | 4.6 | 1.05 | 5.3 | 4.3 |
| Harvest | yes | 13.5 | 2.0 | 4.3 | 0.65 | 35.0 | 3.6 |
| | no | 16.5 | 2.0 | 4.6 | 0.90 | 50.0 | 3.8 |
| Marvel | yes | 7.0 | 2.2 | 4.2 | 0.90 | 20.0 | 2.8 |
| | no | 10.9 | 2.1 | 4.0 | 0.75 | 25.0 | 3.6 |
| Nobel | yes | 5.3 | 2.0 | 3.2 | 0.90 | 52.6 | 3.7 |
| | no | 11.5 | 2.0 | 2.9 | 0.90 | 65.0 | 3.8 |

Skin Color: 1= Emerald green; 2 = forest green; fruit is not shiny; 2.5 = hint of black; 3 = 20% colored black/purple on green; 3.5 = 40% colored black/purple on green; 4 = 60% colored black/purple on green; 4.5 = 80% colored black/purple on green; just a hint of background color of green left on fruit; 5 = purple over 100% of peel surface; 5.5 = purple/black and 6 = black over 100% of surface area.

Flesh Adhesion to Seed: 0 = none; 1 = slight adhesion; 2 = moderate; 3 = seed completely covered by flesh.

String in Fruit. Vascular bundles appearing in flesh, easily picked out with toothpick.

Internal Maturity Value (judged by probing top and bottom of fruit with a toothpick): 1 = rubbery and hard spots more than 50%; 2 = rubbery and or hard spots more than 25% and less than 50%; 3 = Some firmness or resistance less than 25% and or signs of excessive wateriness; 4 = Generally soft with some evidence of firm and or grainy texture or slight wateriness; 5 = Uniformly soft throughout with creamy smooth texture.

Table 3. Average dry weight and hedonic rating following ripening at 68F and a 24 hr, 40 ppm ethylene treatment.

| | Average dry weight (%) | Average hedonic rating (1 – 9) |
|-----------|---------------------------|--------------------------------------|
| Hass | 31.4 | 7.2 |
| Lamb Hass | 26.5 | 5.6 |
| GEM | 34.7 | 6.9 |
| Harvest | 26.7 | 4.8 |
| Marvel | 29.8 | 6.4 |
| Nobel | 30.7 | 6.9 |

Figure 1. The relationship between harvest dry weight and hedonic rating of 6 varieties. Fruit harvested on July 9, 2001 from the UC South Coast Research and Extension Center in Irvine, CA.

