

## Best Management Practices, Food Safety & Post Harvest

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### Avocado Postharvest Quality

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#### PROJECT OBJECTIVE:

The project was scaled back from the original proposed objectives due to a reduction in funding from the requested amount. In light of this the research emphasis for this year was made following consultation with G. Witney. The aim of this the project for the current funding year is to study the influence of fruit maturity and handling following fruit harvest on the concentration of various phytonutrients of 'Hass' avocado. We are analyzing the edible portion of the fruit for water-soluble components (the carbohydrates mannoheptulose and perseitol, water-soluble vitamins), non-soluble components and fatty acids. See Table 1 for the list of vitamins to be assayed.

Table 1. List of vitamins to be assayed.

Vitamin generic descriptor name	Chemical name(s)	Solubility
Vitamin A	Retinoids (retinol, retinoids and carotenoids)	Fat
Vitamin B <sub>1</sub>	Thiamine	Water
Vitamin B <sub>12</sub>	Cyanocobalamin, hydroxycobalamin, methylcobalamin	Water
Vitamin B <sub>2</sub>	Riboflavin	Water
Vitamin B <sub>3</sub>	Niacin, niacinamide	Water
Vitamin B <sub>5</sub>	Pantothenic acid	Water
Vitamin B <sub>6</sub>	Pyridoxine, pyridoxamine, pyridoxal	Water
Vitamin B <sub>7</sub>	Biotin	Water
Vitamin B <sub>9</sub>	Folic acid, folinic acid	Water
Vitamin C	Ascorbic acid	Water
Vitamin D	Ergocalciferol, cholecalciferol	Fat
Vitamin E	Tocopherols, tocotrienols	Fat
Vitamin K	phylloquinone, menaquinones	Fat

#### PROGRESS:

The project is divided into two parts.

1. *The influence of fruit maturity, stage of ripeness and cold storage on concentrations of phytonutrients in the fruit.*

In order to achieve this we selected 3 groves in Ventura County (Fillmore, Santa Paula and Somis) where we conducted repeat sampling 4 times during the commercial season. Following harvest the fruit were divided into 5 cohorts of 15 fruit each. The first group of fruit is used to determine the maturity of the fruit. Another cohort is ripened at 20C (68F) with no storage. The remaining cohorts are stored at 5C (41F) for 1.5, 3 and 6 weeks, respectively. Following storage the fruit are treated with ethylene (24 – 48 hours) to trigger the ripening process. Before storage, 2 ~1.5 g flesh samples are taken from the equatorial region of each fruit. Following ripening, 2 additional samples are taken, again from the equatorial region. These samples are frozen at -40C until analysis. We are also taking detailed notes on the general condition of the ripe fruit and will not use any fruit which exhibits either physiological or pathological disorders. We are using procedures developed during the 'Lamb Hass' maturity project for fruit sampling. We collected fruit from our cooperators 4 times during the season (February 26, April 9, June 4 and July 30, 2008). Table 2 provides the dry weight content of the freshly harvest fruit.

The complete set of samples from all harvests has been taken to UC Riverside for analysis. Dr. Fayek Negm is overseeing the analysis of the fruit samples for the water-soluble and organic components as well as the fatty acids (using equipment in Dr. David Crowley's laboratory). The fatty acid analysis will be conducted using a Hewlett Packard gas chromatograph equipped with a Agilent capillary column. We have found in the literature an improved method for fatty acid analysis (described for grain crops) and have verified this method for avocados. Ripe and unripe avocado samples will homogenized in a mixture of solvents Methanol:heptane:benzene:2,2-dimethoxypropane:H<sub>2</sub>SO<sub>4</sub> (37:36:20:5:2) and heatd for 2 hrs at 80C. After cooling at room temp., two phases are formed and the upper phase contains the fatty acid methyl esters for GC analysis. In May 2008, we "invested" (using NON-CAC funds) in the purchase of an uplc (ultra performance liquid chromatography) system in the Botany Department. We invested into the machine since it will allow us to conduct the vitamin and sugar analysis in a much more efficient manner. Run times on this machine are 5 to 10 minutes as compared to 45 minutes on the machine currently in use.

## *2. The phytonutrient status of avocado fruit in the southern California retail market.*

Our approach for this portion of the project is to visit 3 retail outlets in the southern California area 4 times during the commercial season. Samples were collected on April 28, June 2, July 1 and August 4. At each sampling time, we purchased 5 "ready to eat" avocado from the store display. These fruit were taken to UC Riverside and 2 ~1.5 g samples will be taken from the equatorial portion of the fruit. These samples were frozen at -40C until analyzed for the same phytonutrients as described above. We are also taking notes on the general condition of the ripe fruit.

### **Overall progress:**

When we made our mid-season report in May 2008 we felt that the project was making good progress. Research methodologies had been identified and the necessary equipment and supplies had been purchased. We had high hopes, based on promises made by department colleagues that the investment in the uplc system would quickly return results. Unfortunately, we continue to be hindered by equipment failures. The uplc system has yet to be made fully operational. Dr. Negm has spent many hours learning the operational procedures of the machine but has not yet been able to inject any of our samples into the system. The equipment in Dr. Crowley's lab has also experienced problems and is currently not operational. It is with extreme frustration that we report this situation. We are committed to completing the project and will report our full findings to CAC upon completion hopefully within 6 months.