A collaborative study to examine avocado oil in California varieties

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The present study on dry matter and oil composition is part of an ongoing postharvest project on the quality of existing avocado cultivars (e.g. 'Hass' and 'Lamb Hass') and new selections arising from the University of California breeding program. This is part of a collaborative effort between HortResearch in New Zealand and the University of California, Riverside and builds upon the research efforts of the HortResearch team on understanding the factors contributing to the quality of 'Hass' avocado oil (Figure 1) funded, in part, by the California Avocado Commission.

Oil from avocados is known to have health attributes comparable to those in olive oil. The compositional information on the oil will provide further knowledge on these new cultivars that could be coupled with the postharvest and sensory qualities of the fruit to indicate best industry uses. During the 2004 season, samples from 'Gem', Harvest', 'Hass' and 'Lamb Hass', were collected from two variety evaluation trials in California. The two sites were located in Ventura County, one near Pt. Mugu (a coastal environment) and the other just east of Santa Paula (an warm inland site). The first part of this study is focused on the cultivars 'Harvest', 'Lamb Hass', and 'Gem' in comparison to the main commercial cultivar 'Hass'. At the University of California Kearney Agricultural Center, fruit tissue samples were taken to determine dry matter content (as an indicator of maturity) during the season. A second sample of tissue was freeze dried for shipment to HortResearch in New Zealand for further composition analysis of the oil.

In summary, dry matter, oil content and composition differed among cultivars, harvest date and between orchard locations. The main findings of this research are:

❖ Dry matter and oil accumulation were favoured in the Santa Paula block for the 'Harvest' cultivar while these attributes were favoured in the Pt. Mugu block for 'Hass' (Figures 2a, b; 3a, b).

❖ Oil extracted from 'Gem and 'Hass' fruit from the Pt. Mugu block exhibited similar fatty acid make up in May; approximately 74% monounsaturated, 11% polyunsaturated and 13% saturated fatty acids. 'Lamb Hass' had the highest level of polyunsaturated fatty acids (Figure 2c, d). While a high level of polyunsaturated fatty acids is desirable, it also makes the oil more unstable and prone to rancidity. In the Santa Paula block, each cultivar had comparable fatty acid composition. In August the "Harvest' had the highest level of saturated fatty acids at the Pt. Mugu site (Figure 3c).

❖ Growing conditions in the Santa Paula block produced the highest α- tocopherol content in 'Hass' (14 mg/ 100g). Overall the oil from 'Harvest' exhibited the highest level of α- tocopherol in the Pt. Mugu block (10 mg/100g) while 'Gem' exhibited the lowest levels of α- tocopherol of all the cultivars in both breeding blocks (4.5 mg/100g) (Figures 2e; 3d).

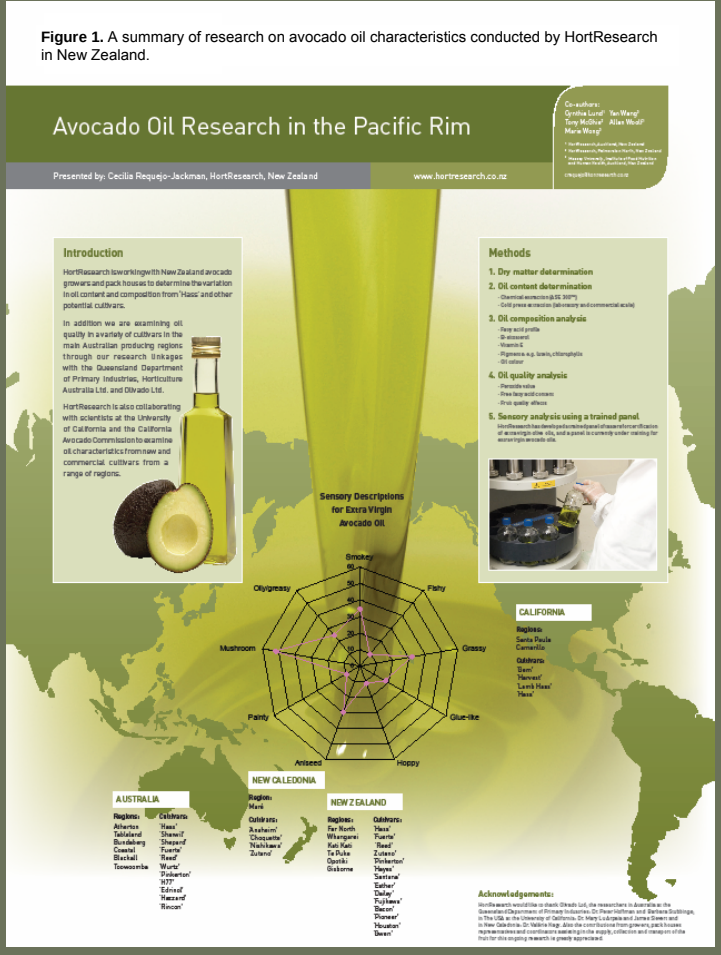
❖ Concentrations of β- sitosterol in the oil from 'Harvest' increased with fruit maturity in the Pt. Mugu location exhibiting the highest level at 6 mg/g. In the Santa Paula block, all four cultivars showed the same amount of β- sitosterol in the oil at approximately 5 mg/g. (Figures 2f; 3d)

❖ In both locations, the oil from 'Lamb Hass' contained the highest level of lutein (between 15- 17 µg/g), whereas the oil from 'Gem' contained the lowest levels (between 3- 5 µg/g). 'Harvest' showed an important increase in lutein content with increased maturity. (Figures 2g; 3e)

❖ At Pt. Mugu no large differences in the amount of total chlorophyll in oil were found between cultivars following the May harvest. However, concentrations of total chlorophyll in the later harvest decreased in the cultivars except for 'Harvest'. In Santa Paula total chlorophyll concentrations were highest in 'Lamb Hass' oil while the lowest level was found in the oil from 'Gem'. (Figures 2h; 3f)

❖ 'Minor carotenoids' content between harvests almost double in 'Gem' oil in the Pt. Mugu block. In the Santa Paula block, the highest value of 'minor carotenoids' was measured in the oil from 'Lamb Hass' and this value was higher than the one found in the Pt. Mugu block. (Figures 2i; 3g)

Figure 1. A summary of research on avocado oil characteristics conducted by HortResearch in New Zealand.



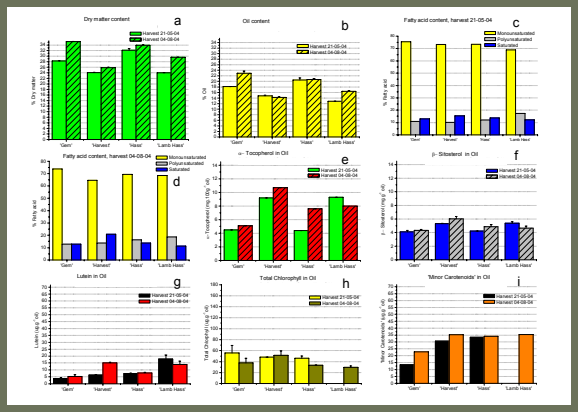


Figure 2. Dry matter and oil content and composition of 'Gem', 'Hass', 'Harvest' and 'Lamb Hass' avocados harvested in May and August during the 2004 production season from the Pt. Mugu research site.

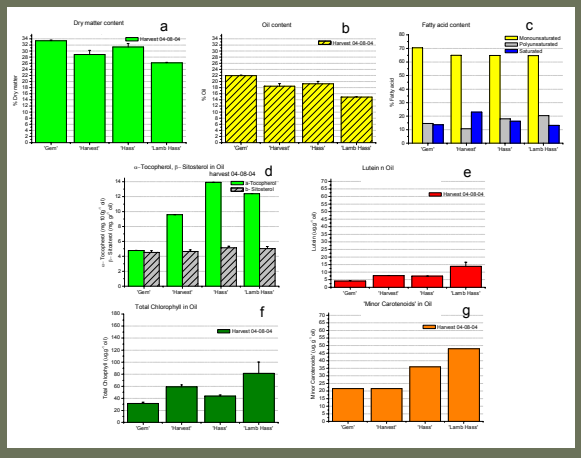


Figure 3. Dry matter and oil content and composition of 'Gem, 'Harvest', 'Hass', and 'Lamb Hass' avocados from one harvest (August) during the 2004 production season from the Santa Paula research site.