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INTERNATIONAL TRENDS IN FRESH AVOCADO AND AVOCADO OIL PRODUCTION AND SEASONAL VARIATION OF FATTY ACIDS IN NEW ZEALAND-GROWN cv. HASS

A thesis presented in partial fulfilment of the requirements for the degree of Master in Applied Science in Agribusiness at Massey University
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ABSTRACT

Intensive cultivation of avocados for commercial purposes began in California and Florida and later in Israel, South Africa and Chile. Although a range of avocado cultivars are grown, Hass is the world's most widely-grown and exported cultivar. Avocado fruit has shown good commercial perspectives and planted areas show a tendency to increase. World production of avocado has grown on average 4.3% (over 760,000 MT) between 1988 and 1998. The main producers of avocado are Mexico (34%), USA (8%), Dominican Republic (7%), Indonesia (6%) Brazil (4%) and Israel (4%), Chile (2.4%), Spain (3%) and South Africa (2%) which during 1997 contributed together to 70% of the world production.

Avocado world trade has increased greatly from 57,576 tonnes in 1980 to 238,306 tonnes in 1997. In 1997, the main players in the export market were Israel, Mexico, South Africa, USA and Chile. The main importers of this fruit were in Europe: Belgium, France, The Netherlands, Sweden, Switzerland, the United Kingdom, Germany, Spain, and in America: the USA and Canada and in Asia: Japan has emerged as a strong market since 1995. Average prices paid per metric ton have decreased over the years as higher volumes of fruit are traded and new exporters enter into the business. Avocado producer countries will face major challenges because of increasing production and low prices over the short and medium term. With the exception of Mexico, Israel and the U.S. the rest of the studied country producers are fairly new in the industry, thus, they possess great potential for growing.

In New Zealand avocados are mainly cultivated in the North Island specifically in the Bay of Plenty and Northland areas. The New Zealand avocado Industry is based on the Hass cultivar. Avocado trees in New Zealand continue to be widely planted and with the entrance of new growers, in the future, the orchard area will continue to increase. The avocado industry in New Zealand is export driven. New Zealand's main export markets are Australia and recently the United States. Actual Australian market dominance by New Zealand would be reduced in the following 5 years due to a constant increase in Australian domestic avocado production. Since 1996, the U.S. has become an important market of destination for New Zealand avocados. Traditional supplier of the U.S. market has been Chile and it represents New Zealand's main competitor.

In avocado export leader countries usually the local market is supplied with fruit that does not meet export (usually strict) quality requirements. Great increases in production and export volumes are expected, therefore, it is forecast that large volumes of low price rated avocados would exist and would force the industry to look for alternative uses for avocados. Those avocados rejected during classification for export markets mainly due to defects in cosmetic appearance might be used for avocado oil extraction. The oil industry generally considered a by- product of the fresh fruit industry. For the multiplicity of applications and high prices that it achieves, avocado oil represents an interesting industry that should be further research.
Lipids are an important part of the composition of avocado fruit for a range of reasons. They contribute significantly to the taste of the fruit, and are used indirectly as a means of defining maturity since they correlate highly with dry matter. Although there has been some work carried out in New Zealand examining lipid changes and maturity, there has been no examination of the fatty acid makeup of the lipids, how they vary between regions, and what the lipid content is later in a commercial season. Such information is important from a fruit quality, health and marketing points of view.

On seven occasions between September 1998 and April 1999, fruit from two orchards located in Te Puke and the Far North were harvested and analysed for dry matter, lipid content and fatty acid composition. Dry matter assessments were carried out using the commercial method and, the lipid fraction was extracted using a modification of the Bligh and Dyer technique. Later, the fatty acid analysis of the lipids was carried out by gas chromatography.

Average dry matter increased over the period of study (September to April). Dry matter for Te Puke fruit increased from 24.6% to 36.4%, while dry matter from the Far North fruit increased from 24.1% to 32.3% over the same period of time. Total lipid content increased from 17.2% to 31.3% in Te Puke and from 16.4% to 26.7% in the Far North from September to April. The results imply that fruit from Te Puke could be preferred from the point of view of oil extraction because higher yields can be obtained than from fruit from the Far North.

It was found a high and positive relationship existent between total lipids and dry matter content in avocados. During the study period, fruit from Te Puke showed consistently higher lipid content (and dry matter content) than fruit from the Far North. At both sites, the beneficial monounsaturated oleic acid was the major fatty acid synthesised, however, fruit from Te Puke showed higher levels of oleic acid than fruit from the Far North. From the nutrition point of view the ratio of monounsaturated (oleic and palmitoleic acid) to saturated fatty acids (palmitic acid) and the ratio of polyunsaturated (linoleic and linolenic acid) to saturated fatty acids found for the Far North and Te Puke regions compare favourably with those of the recommended olive oil.

Due to similarities in lipid composition between olive oil and avocado oil, it can be implied that the high concentration of monounsaturated fatty acids in avocado will be beneficial to lower blood lipids as olive oil does. The food industry makes use of avocado oil to prepare concentrated foods, while the cosmetics industry prepares lotions and soaps for hair and skin treatments. Lastly, prestigious laboratories are also analysing the property of the flesh and oil for medical purposes.

The information compiled here confirms that avocado oil compares to olive oil and can be regarded as a high-value product from the nutritional and the commercial point of view.

On current production trends in New Zealand, the likelihood of an oil-extraction plant is not remote. An oil industry in New Zealand would benefit the growers because it will absorb the surplus of avocados in the local market that otherwise would compete with their first grade fruit.

IV
New Zealand avocado production has increased from just under 1000 tones in 1987 to 3250 tones in 1997. Approximately 16% of the 1,221 ha is planted with trees less than five years of age which leaves considerable potential for further increases in production.

Avocados are getting an important place in the world fruit trade. However as the fruit is becoming as a typical commodity it could experience surpluses which would be reflected in lower prices affecting the economy of country producers. One way of maintaining a differentiated place in the world market is by means of effective produce marketing. Efficient and effective marketing strategy is only possible by increasing the knowledge of the features of the product to be sold.

As in the avocado leader producer countries marketing planning is supported by intensive research. The success of traditional avocado producers and exporters such as California is regarded to the acquisition of continuous knowledge of their fruit that allows confident in the planning of marketing activities.

In general New Zealand agricultural produce enjoys a unique image in the international market. This is also true for avocados. Over 50% of New Zealand avocados produced are destined to export markets which makes the actual avocado export industry worth around $ 20 million.

The relative success of the New Zealand Avocado export industry is based on the quality of the produce it trades. Nevertheless there is a little research about New Zealand- grown avocados and its main feature which is its oil content. Better knowledge in the variations in oil level and composition in the fruit is necessary for the determination of a maturity index for avocados in New Zealand that could give support to locally and internationally marketing efforts, with highest confidence.
**Hypotheses**

1. There is considerable increase in world demand for fresh avocado fruit therefore New Zealand avocado industry needs further understanding of its fruit and its main components such as oil and its variation in content and composition during the commercial season.

2. The volume of underage fruit in New Zealand is increasing due to large increases in production and exports volumes. In the future, these fruit could represent the raw material for oil extraction and other processed products.

**Objectives**

1. To undertake a preliminary analysis of the avocado world market to analyse the potential and actual situation of New Zealand avocado industry.

2. To develop a rapid extraction technique for the quantitative analysis of oil from avocado fruit.

3. To obtain further knowledge of New Zealand avocado fruit with reference to the oil component by determining the influence of harvest time and growing region on dry matter, total oil concentration and oil composition.

4. To undertake a preliminary analysis of the potential of using New Zealand avocado fruit that does not meet export quality standards for oil extraction.
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