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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
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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.

Justification

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 undergrade 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.

Table of Contents

ACKNOWLEDGEMENTS.....	II
ABSTRACT.....	III
Justification.....	V
Hypotheses.....	VI
Objectives.....	VI
CHAPTER 1 THE AVOCADO	1
1. BOTANICAL DESCRIPTION OF THE AVOCADO	1
1.1. The Avocado Tree	1
1.2. The Avocado Fruit	2
1.2.1. <i>Fuerte and Hass cultivars</i>	4
1.2.1. <i>Chemical Composition of the Avocado Fruit</i>	6
1.3. Lipid Content of Avocado Fruit	7
1.3.1. <i>Localisation of Lipids in Avocado Fruit</i>	9
1.3.2. <i>Fatty Acid Composition of Lipids in Avocado Fruit</i>	10
1.3.2.1. Saturated and Unsaturated Fatty Acids	11
1.3.2.2. Lipids and Health	12
1.3.3. <i>Lipid and Moisture Content</i>	15
1.3.4. <i>Factors Influencing Lipid Content and Composition in Avocado Fruit</i>	18
1.3.4.1 Race and Cultivar	18
1.3.4.2 Within Fruit Variation	19
1.3.4.3 Fruit Size	20
1.3.4.4 Fruit Position on Tree	21
1.3.4.5 Time in the Season	21
1.3.4.6 Temperature/Growing Region	24
1.3.4.7 Lipid Changes during Storage and Ripening	28
1.3.5. <i>Maturity Indices and Lipid Content of Avocados</i>	29
1.3.5.1 Determination of Percent Dry Matter using a Microwave Oven (California Avocado Commission (1999)).....	34
1.3.5.1.1 Materials Needed	34
1.3.5.1.2 Sampling	35
1.3.5.1.3 Procedure	35
1.3.5.1.4 Calculating the Percent Dry Matter	36
1.3.6. <i>Determination of Lipid Content in Avocados</i>	36
PRELIMINARY OBSERVATIONS	38

CHAPTER 2 COMMERCIAL AVOCADO OIL	39
2. FAT, LIPIDS AND OIL TERMS	39
2.1. Growing Avocados for Commercial Oil Extraction	39
2.2. Commercial Extraction of Avocado Oil	40
2.3. Chemical and Physical Properties of Avocado Oil	44
2.4. Uses of Avocado Oil	47
2.4.1. <i>Avocado Oil in the Food Industry</i>	47
2.4.1.1. Nutritional Value of the Avocado Oil	47
2.4.1.2. Vitamin E (Tocopherol)	50
2.4.1.3. Bitter Compound	50
2.4.2. <i>Avocado Oil in the Pharmaceutics and Cosmetic Industry</i>	51
2.4.1.4. Unsaponifiable Matter	52
CHAPTER 3 CHARACTERISATION OF LIPIDS IN NEW ZEALAND AVOCADOS ...54	
3. INTRODUCTION	54
3.1. Materials and Methods	59
3.1.1. <i>Sample Collection</i>	59
3.1.1.1. Orchards Location	59
3.1.1.2. Avocado Tree Characteristics	59
3.1.1.3. Fruit Collection	59
3.1.2. <i>Fruit Assessments</i>	60
3.1.2.1. Dry Matter	60
3.1.2.1.1. Commercial Dry Matter	60
3.1.2.1.2. Plug Dry Matter	60
3.1.2.2. Sample Preparation for Total Lipid Extraction	61
3.1.2.3. Firmness and Weight Loss	61
3.1.2.3.1. Weight Loss	61
3.1.2.3.2. Firmness Assessments	61
3.1.2.4. Quantitative Determination of Total Lipids	61
3.1.2.5. Fatty Acid Analysis of Lipids	63
3.1.2.5.1. Conversion of Triglycerides to Fatty Acid Methyl Ester (FAME)	63
3.1.2.5.2. Gas Chromatography Analysis	63
3.2. Results.....	65
3.2.1. <i>Lipid Extraction Technique</i>	65
3.2.2. <i>Fruit Firmness and Weight Loss</i>	65
3.2.3. <i>Dry Matter and Lipids</i>	67
3.2.4. <i>Air Temperature</i>	75
3.3. Discussion	77

CHAPTER 4 WORLD AVOCADO MARKET OVERVIEW	84
4. WORLD PRODUCTION OF AVOCADOS	84
4.1.1. <i>Dominican Republic</i>	87
4.1.2. <i>Indonesia</i>	88
4.1.3. <i>Brazil</i>	88
4.2. World Avocado Trade	90
4.2.1. <i>The European Market of Avocados</i>	92
4.2.1.1. Marketing Channels	94
4.2.2. <i>The Asian Market for Avocados</i>	94
4.2.2.1. Japan	94
4.2.2.1.1. Marketing Channels	97
4.2.2.1.2. Future Trends	97
4.3. The New Zealand Avocado Industry	98
4.3.1. <i>New Zealand Avocado Industry Structure</i>	101
4.3.2. <i>Local and Export Markets</i>	103
4.3.2.1. Marketing Channels	109
4.3.3. <i>Market Prices</i>	109
4.3.4. <i>Future Trends</i>	110
4.3.4.1. Industry Vision and Key Success Factors	113
4.3.4.1.1. Key Success Factors	113
4.3.4.1.2. Industry Threats	113
4.3.4.1.3. Opportunities	113
4.4. The Mexican Avocado Industry	115
4.4.1. <i>Mexican Avocado Industry Structure</i>	118
4.4.2. <i>Local and Export Markets</i>	118
4.4.2.1. Marketing Channels	119
4.4.2.2. The U. S. Avocado Ban Over Mexican Produce	122
4.4.3. <i>Market Prices</i>	123
4.4.4. <i>Future Trends</i>	126
4.5. The South African Avocado Industry	128
4.5.1. <i>South African Avocado Industry Structure</i>	131
4.5.2. <i>Local and Export Markets</i>	132
4.5.2.1. Marketing Channels	136
4.5.3. <i>Market Prices</i>	136
4.5.4. <i>Future Trends</i>	137

4.6.	The Israeli Avocado Industry	139
4.6.1	<i>Israeli Avocado Industry Structure</i>	141
4.6.2.	<i>Local and Export Markets</i>	141
4.6.3.	<i>Market Prices</i>	143
4.6.4.	<i>Future Trends</i>	144
4.7.	The United States Avocado Industry	146
4.7.1	<i>US. Avocado Industry Structure</i>	149
4.7.2	<i>Local Market, Exports and Imports of Avocados</i>	150
4.7.2.1.	The Avocado Industry in Chile	155
4.7.2.1.1.	Future Trends	148
4.7.2.2.	Marketing Channels	150
4.7.3.	<i>Market Prices</i>	151
4.7.4.	<i>Future Trends</i>	152
	OBSERVATIONS IN THIS CHAPTER	154

**CHAPTER 5 AVOCADO OIL MARKET OVERVIEW AND PRODUCTION FORECAST IN
SELECTED COUNTRIES.....165**

5.	INTRODUCTION.....165	
5.1.	Estimation of the Avocado Oil Production in New Zealand	169
5.1.1.	<i>Analysis and Discussion of the Potential for Oil Production in New Zealand.....</i>	170
5.2.	Estimation of Avocado Oil Production in Mexico	174
5.2.1.	<i>Analysis and Discussion of the Estimation of Oil Production in Mexico.....</i>	175
5.3.	Estimation of Avocado Oil Production in South Africa	178
5.3.1.	<i>Analysis and Discussion of Avocado Oil Production in South Africa</i>	178
5.4.	Estimation of Avocado Oil Production in the United States	181
5.4.1.	<i>Analysis and Discussion of Avocado Oil Production in the United States.....</i>	182
	OBSERVATIONS IN THIS CHAPTER	185

CHAPTER 6 CONCLUSIONS.....187

CHAPTER 7 REFERENCES.....193

List of Tables

Table 1. 1. Comparison of the Three Main Avocado Races	5
Table 1. 2. Composition of the Several Cultivars of Avocado Fruit	7
Table 1. 3. Percentages of the Various Classes of Lipids in the Mesocarp of Mature Fuerte Avocados	10
Table 1. 4. Minimum Maturity Standards for Some California Cultivars.....	18
Table 1. 5. Fatty Acid Composition of Lipids of Mature Fuerte Avocado Fruit.....	21
Table 1. 6. Fatty Acid Composition (percent by weight) of Fuerte Avocado Mesocarp during Fruit Development (grown under Mediterranean Climate)	24
Table 1. 7. Average Fatty Acid Composition of Mature Fuerte Avocado Fruit in Different Countries...27	
Table 1. 8. Percentage of Total Fatty Acids in Avocado from Different Regions.....	27
Table 2. 1. Monthly averages of avocado oil in ripe whole South African Fuerte avocados extracted by centrifugation method.....	41
Table 2. 2. Fatty acid composition of refined and crude industrial avocado oil using two different extraction methods.....	42
Table 2. 3. Fatty Acid Analysis of Crude Avocado Oil	45
Table 2. 4. Properties for California Avocado Oil	45
Table 2. 5. Minimum and Maximum Values for the Properties of Avocado Oil.....	46
Table 2. 6. Fatty Acids Types in Different Oils (approximate average percentages).....	48
Table 2. 7. Ranking of several natural oils in order of their effectiveness as sunscreens.....	53
Table 3. 1. Mean Fresh Weight, Firmness and Dry Matter of "Hass" Avocados from the Far North and Te Puke from September 1998 to April 1999 at Harvest.....	66
Table 3. 2. Fatty acids of New Zealand Hass Avocados from the Far North and Te Puke Regions.....	81
Table 3. 3. Fatty acids of New Zealand Hass Avocados and other Countries.....	83
Table 4. 1. Avocado Production by Main Country Producers (Mt)	89
Table 4. 2. European Imports of Avocados by Main Country of Destination	93
Table 4. 3. Months of Supply and Country Suppliers of Avocados to Europe.....	94
Table 4. 4. Imports of Fresh Avocados into Japan	95
Table 4. 5. Japanese Import Prices (CIF) of Fresh Avocados by Month.....	96
Table 4. 6. Avocado Areas and Tree Plantings	99
Table 4. 7. New Zealand Export by Country of Destination	107
Table 4. 8. Crop Estimates and Projected Industry Growth	112
Table 4. 9. Mexican Avocado Area Planted, Harvested and Yield	116

Table 4. 10. Mexican Share in the World Production of Avocados	117
Table 4. 11. Mexican Production, Internal (Domestic) Consumption and Exports of Avocados	120
Table 4. 12. Mexico's avocado export by country destination	121
Table 4. 13. South African Production Harvested Area and Yield per hectare of Avocados.....	129
Table 4. 14. South African Production, Internal Consumption and Exports of Avocados.....	135
Table 4. 15. Area Planted and Yield per Hectare of Avocados in Israel	139
Table 4. 16. Area Harvested and Yield per Hectare of Avocados by State in the US.....	148
Table 4. 17. US. Production of Avocados by Producing State.....	148
Table 4. 18. Production, Internal Demand and Export Volumes of US- grown Avocados.....	152
Table 4. 19. Avocado Comparison between the U.S and Mexico.....	154
Table 4. 20. Avocado Planted Area and Production in Chile.....	155
Table 4. 21. Production, Exports, Imports and Total Internal Demand for Avocados in the U. S.....	159
Table 5. 1. Estimate of Avocado Production, Exports and Availability of Fruit for Domestic Consumption and for Avocado Oil Production in New Zealand.....	172
Table 5.2. Estimate of Avocado Production, Exports, and Availability of Fruit for Domestic Consumption and Avocado Oil Production in Mexico	175
Table 5.3. Estimate of Avocado Production, Exports and Availability of fruit for Domestic Consumption as fresh and Avocado Oil Production in South Africa.....	180
Table 5.4. Estimate of Avocado Production, Exports, Imports and Availability of Fruit for Domestic Consumption as fresh and Avocado Oil Production in the United States.....	183

List of Figures

Figure 1.1 Relationship between Percent Oil and Percent Dry Weight during Development and Maturation of 'Hass' fruit.....	35
Figure 3.1 Lipid content and dry matter of 'Hass' avocado fruit harvested from Te Puke and the Far North from September 1998 to April 1999.....	68
Figure 3.2.(a).Relationship between lipid content and dry matter of 'Hass' avocado fruit harvested from Te Puke, September1998 to April 1999.....	70
Figure 3.2.(b).Relationship between lipid content and dry matter of 'Hass' avocado fruit harvested from Far North, September1998 to April 1999.....	70
Figure 3.3 (a) Te Puke Rate of fatty acid synthesis in 'Hass' avocado fruit harvested from September to April.....	71
Figure 3.3 (b) Far North. Rate of fatty acid synthesis in 'Hass' avocado fruit harvested from September to April.....	71
Figure 3.4 (a) Te Puke Fatty acid concentration in 'Hass' avocado fruit harvested from September1998 to April 1999.....	73
Figure 3.4 (b) Far North. Fatty acid concentration in 'Hass' avocado fruit harvested from September1998 to April 1999.....	73
Figure 3.5 (a)Te Puke Fatty acid content as a percentage of total lipids for 'Hass' avocado fruit harvested from September 1998 to April 1999.....	74
Figure 3.5 (b)Far North. Fatty acid content as a percentage of total lipids for 'Hass' avocado fruit harvested from September 1998 to April 1999.....	74
Figure 3. 6 Average weekly temperatures for Far North and Te Puke orchards from September 1998 to April 1999.....	76
Figure 4. 1. World Avocado Production	86
Figure 4. 2. World Avocado Production by Main Producer Countries in 1997.....	87
Figure 4. 3. World Export Volumes and Value in Dollars per Mt	90
Figure 4. 4. Main Avocado Exporters for 1997	91
Figure 4. 5. Main Avocado Importers for 1997	91
Figure 4. 6. Main Avocado Growing Regions and Production in 1997/98 in New Zealand.....	98
Figure 4. 7. New Zealand Avocado Production	100
Figure 4. 8. New Zealand Avocado Industry Structure	102
Figure 4. 9. Purchase Frequency of Avocados in New Zealand	104
Figure 4. 10. New Zealand Avocado Production, Export Volume and Average value.....	106
Figure 4. 11. Prices of Imported New Zealand Fruit in, USA- San Francisco.....	110

Figure 4. 12. Mexican Avocado Production (Mt).....	117
Figure 4. 13. Production, Internal Consumption and Export Volumes of Avocados in Mexico.....	120
Figure 4. 14. Export Volume and Average Annual Price for Mexican Avocados.....	124
Figure 4. 15. Seasonal Market Price received in USA for Mexican Export Hass Avocados during 1998/99 (for 11 kg. carton).....	125
Figure 4. 16. Percentage of Trees planted in South Africa by Cultivar	130
Figure 4. 17. South African Avocado Production	131
Figure 4. 18. Main consumption markets of avocados in South Africa.....	134
Figure 4. 19. Production, Internal Consumption and Export of Avocados in South Africa.....	134
Figure 4. 20. South African Exports by Country of Destination	136
Figure 4. 21. Volume and Value of Exports of South African Avocados.....	137
Figure 4. 22. Avocado Area by Cultivars in Israel	140
Figure 4. 23. Israeli Avocado Production, Exports and Domestic Consumption Volumes.....	142
Figure 4. 24. Israeli Avocado Exports by Destination during 1997.....	143
Figure 4. 25. Volume and Value of Israeli Avocado Exports	144
Figure 4. 26. U.S. Avocado Production by Areas: California and Florida.....	149
Figure 4. 27. Sales Volumes and Prices per Mt of California Hass in the Local Market during 1997.....	151
Figure 4. 28. Exports Volume and Value in Dollars per Mt of United States Avocados.....	152
Figure 4. 29. Percentage of U.S Exports by Country of Destination during 1996 and 1997.....	153
Figure 4. 30. Prices of Chilean Fruit count 40 (2 layer carton) in Los Angeles.....	157
Figure 4. 31. United States Avocado Imports.....	158
Figure 4. 32. Production, Exports, Imports and Total Internal Demand for Avocados in the United States.....	159
Figure 4. 33. Total Value and Total Volumes of California 'Hass' Traded in the US.....	161
Figure 5. 1. Projected Trend of Avocado Production, Exports and Availability of Fruit for Domestic Consumption (as fresh) in New Zealand... ..	172
Figure 5.2. Projected Trend of Avocado Production, Export and Availability of Fruit for Domestic Consumption (as fresh) in Mexico.....	176
Figure 5.3. Projected Trend of Avocado Production, Export Volumes and Availability of Fruit for Domestic Consumption (as fresh) in South Africa.....	180
Figure 5.4. Projected Trend of Avocado Production, Export and Imports and Availability of Fruit for Domestic Consumption (as fresh) in the United States.....	183