EXTRACTION OF EDIBLE PLANT OILS IN NEW ZEALAND

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NZ Plant and Food Research

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OUTLINE

- Current edible plant oil production in NZ
- Seed oils
- Olive oil
- Avocado oil

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EDIBLE PLANT OIL PRODUCERS IN NZ

- Aim to produce high quality oil
- Competition with imported oils

We need to understand factors in NZ that impact on oil quality.

- Unique oils
- Variations in composition and flavour – cultivars, climate and growing conditions

We need data on NZ oil composition to ensure we can claim authentic oils

- **Importance of research and data collection.**

RETAIL SALES OF EDIBLE OILS IN NZ

- Volume edible oil retail sales NZ 83,000 metric tonnes 2024, value $NZ 147M (Euromonitor, 2025)
- Not including restaurant and hospitality

	% of total edible oil sales 2024
Olive oil	53
Rapeseed oil (including Canola)	5
Soy oil	1
Sunflower oil	3
Other edible oils (avocado, grape seed, rice bran, flaxseed etc)	39

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EXTRACTION OF EDIBLE OILS IN NZ

	Volume extracted 2024 (metric tonnes)	Source
Olive oil	~ 184	Olives NZ
Avocado oil	~ 600	Olivado and Grove
Rape seed and Sunflower oil	10,000	Pure Oil
Other edible oil (soy, corn, hemp, flaxseed)	~700	Midland Seeds, Pure Oil

SEED OILS

- Two main producers in the South Island
- Pure Oil, Rolleston, Christchurch
- Midland Seeds, Ashburton

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Mobil Synthetic Petrol - Motunui

Marsden Point Oil Refinery – Whangarei

Clyde Dam

Solid Energy
- **Biodeisel NZ**

- **Biodeisel from waste vegetable oil**

2012

Pure Oil NEW ZEALAND LTD

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PURE OIL

- Rape seed, high oleic sunflower seed, soybean and corn
- Grow own seed or contract growers ($^2/_3$ NZ and $^1/_3$ Australia)
- Control harvesting and seed storage
- Cold-pressed process
  - 8 screw press extractors – processing 70 tonne seed/day $\Rightarrow$ 30 tonne oil/day
- The Good Oil
  - No. 1 independent oil brand in NZ, 700,000L sold in 2024.
  - sold in supermarkets and B2B direct to hospitality in e.g. bag n box.

Pure Oil NEW ZEALAND LTD

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MIDLAND SEEDS

- Specialty oil seed oils
- Cold-pressed extraction →2,000 tonne of seed/year
- Main oil - flax seed oil (linseed) – nutraceutical, skin care, culinary
- Others oils – hemp, blackcurrant, evening primrose, grape seed, borage, chia, almond etc

MIDLANDS

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CHARACTERISATION OF NZ SEED OILS

Composition and quality

Stability - shelf life

Sensory profile

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NZ OLIVE OIL

NZ olive oils win gold in world competition

21 May, 2004 12:17 P

Nelson olive grower wins gold at international award

Tim Newman

May 17, 2020 · 5:00pm

NZ Olive Oil Scoops Medals at International Competitions

May 5, 2017 | Competitions, NZ, Olive business

Winners in two prestigious international Olive Oil competitions have just been announced and New Zeal
both. At the New York International Olive Oil Competition (NYIOOC) Akaroa producers Robinsons Bay a
Road both won Gold for their EVOOs – backing up their respective Best in Show and Reserve Best in
2016 New Zealand Extra Virgin Olive Oil Awards.

At the Olive Japan Olive Oil Competition Telegraph Hill from Hawke's Bay won three Gold and a
olive oils, while The D'Arc Grove from Wairarapa won Silver for their EVOO.

Six virgins grab top awards at New York International Olive Oil Competition

by Editor | May 30, 2022 | News

Once again, New Zealand olive oil makers have won recognition against top international competition

From Wairarapa, Loopline Olives have won two Gold Medals at the 2022 New York International Olive Oil Competition. Blue Earth has won one Gold medal and Dali Olives has won a Silver. From Kapiti, Totara Tunnel has won a Gold and Kapiti Olives has won a Silver.

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NZ OLIVE OIL

- NZ olive oil industry established in the late 1980s
- Volume of production – boutique
- With varieties grown and the climatic conditions resulting oils have desirable organoleptic qualities
- Challenges for NZ olive growers - climate, weather, land, small orchards
- Growers are focused on orchard management and climatic factors – drought, frosts, rain, pests and diseases

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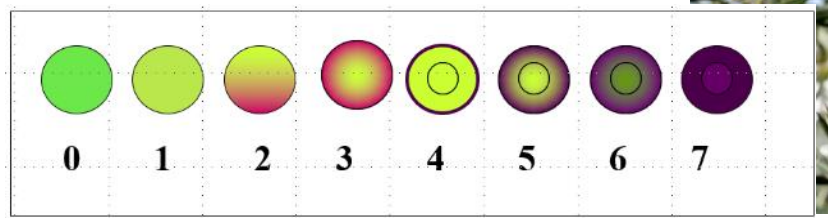
NZ OLIVE OIL RESEARCH

Maturity Indices

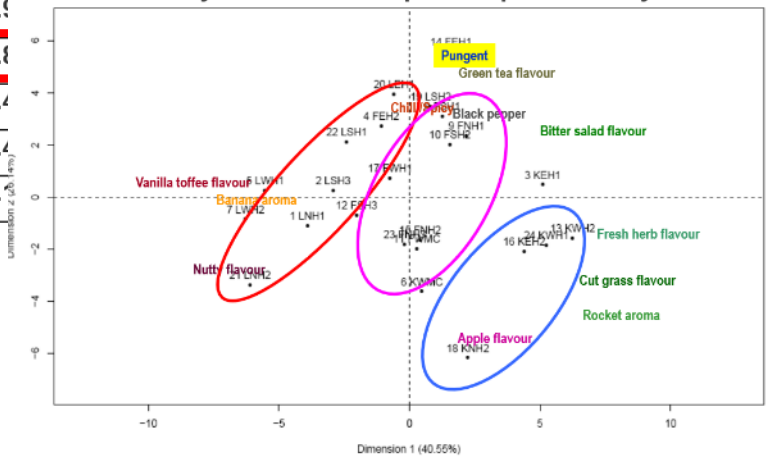


Composition

- Authenticity –fatty acids, sterols
- Phenolic profiles

		% fatty acids (as methyl esters)			
		'Frantoio'	'Koroneiki'	'Leccino'	IOC limits
Palmitic acid	C16:0	8.19 – 12.00	8.34 – 9.07	9.50 – 12.37	7.5 – 20.0
Palmitoleic acid	C16:1	0.54 – 1.29	0.65 – 0.78	0.76 – 1.48	0.3 – 3.5
Heptadecanoic acid	C17:0	0.04 – 0.06	0.04 – 0.05	0.03 – 0.06	≤ 0.3
cis-10Heptadecenoic acid	C17:1	0.08 – 0.12	0.07 – 0.09	0.09 – 0.13	≤ 0.3
Stearic acid	C18:0	1.23 – 2.08	1.69 – 2.25	1.17 – 1.37	0.5 – 5.0
Oleic acid	C18:1	75.81 – 82.94	81.32 – 82.94	76.91 – 82.37	55.0 – 83.0
Linoleic acid	C18:2	4.35 – 7.9			
α-Linolenic acid	C18:3	0.47 – 0.8			
Arachidic acid	C20:0	0.29 – 0.4			
Gadoleic acid	C20:1	0.23 – 0.4			
Behenic acid	C22:0	0.07 – 0.1			

Sensory Results – Principle Component Analysis



EXTRA VIRGIN/VIRGIN AVOCADO OIL

- “Cold pressed” extraction process – mechanical extraction with centrifugation

- First known commercial plant in New Zealand, late 1990s
- Originally two companies
  - The Grove, Bay of Plenty
  - Olivado, Northland (2025 - Seeka)

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AVOCADO FRUIT AND OIL – DATA FOR 2024 (Fresh Facts, Plant and Food Research, 2024)

- Plantings of avocados in NZ = 4093 hectares
- Volume of crop 5,395,000 trays
- Export - fresh fruit $NZ 20,294,000 (FOB)
- Domestic - fresh fruit $NZ 47,514,000
- Avocado oil export value $9.5M

- Production of oil from second grade fruit is a juggle
  - competing with fresh fruit market
  - transport costs can increase price of fruit

AVOCADO OIL STANDARDS

- Codex standards for Named Vegetable Oils (CXS 210-1999)
- Inclusion of avocado oil – adopted November 2024 (discussions since 2020)
- For quality and purity

- "Avocado oil may be derived from either the mesocarp of avocado fruit (*Persea americana*) or obtained by processing the whole avocado fruit."
- Quality parameters for virgin and crude oils
- Fatty acid composition – lists ranges for individual fatty acids
- Desmethylsterols and tocopherols

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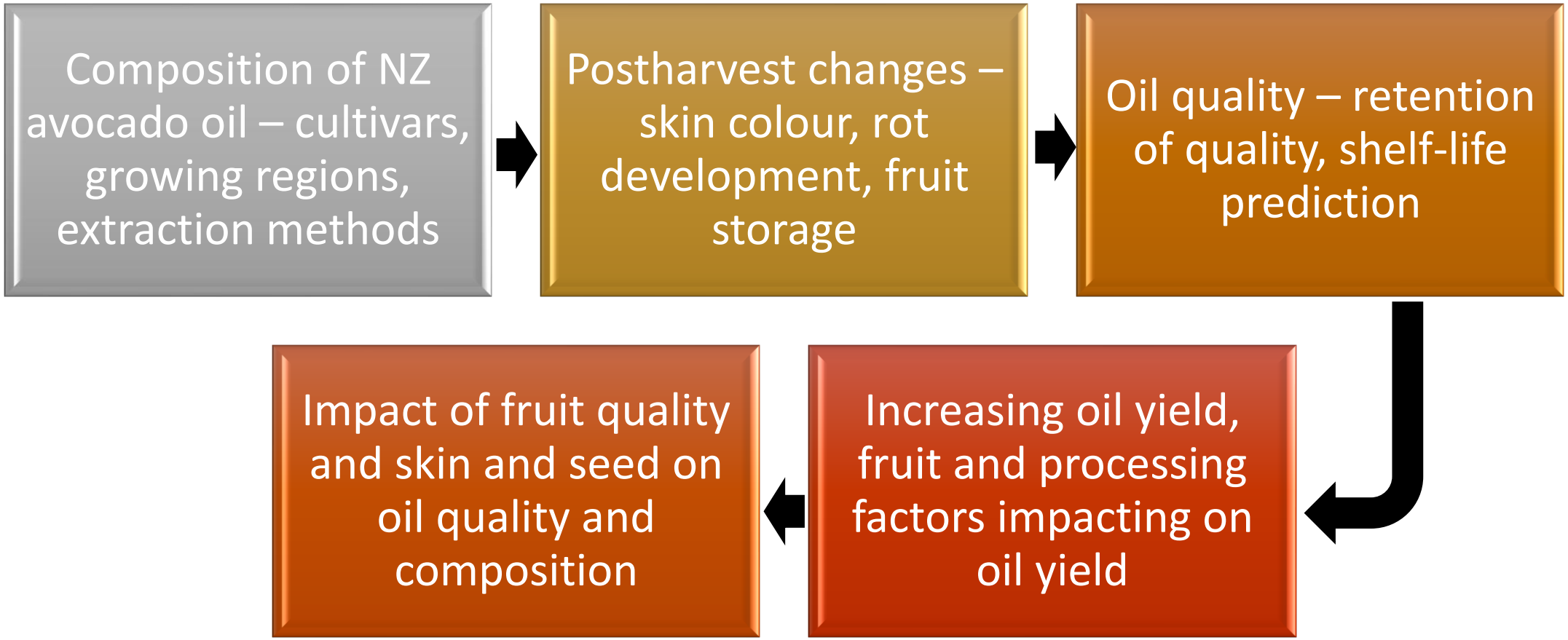
NZ AVOCADO OIL RESEARCH



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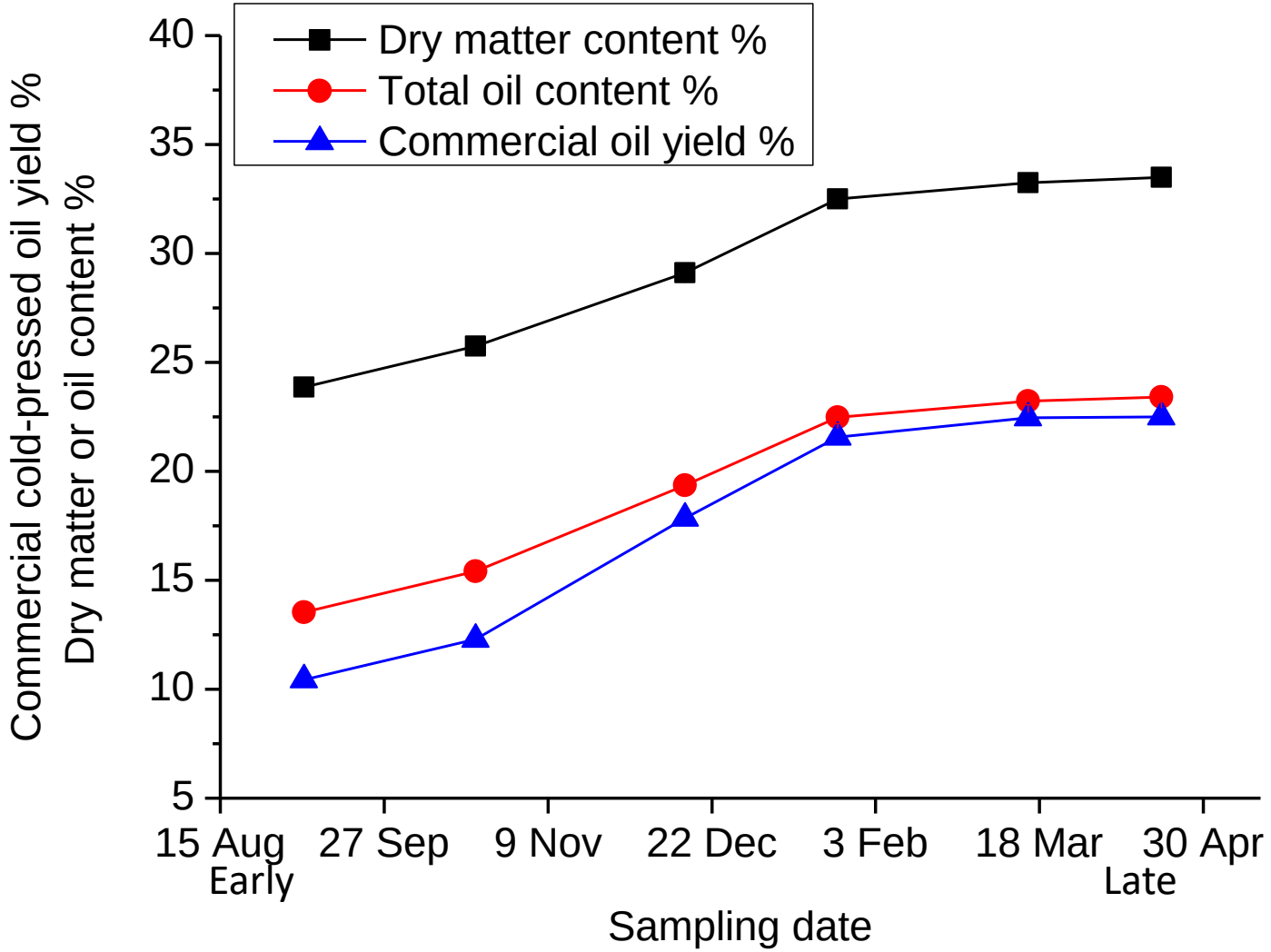
IMPROVING AVOCADO OIL YIELD

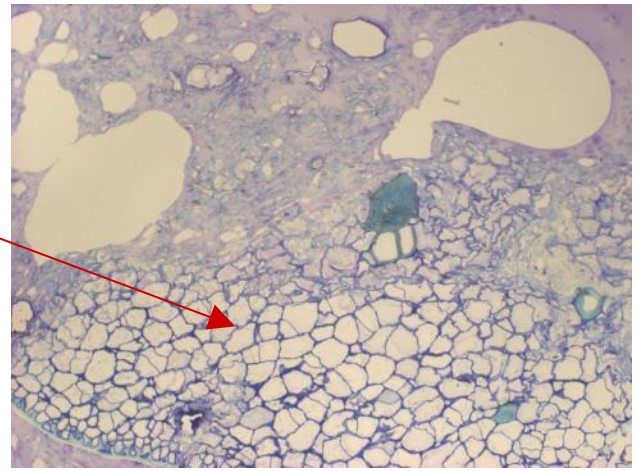
- Dry matter and oil content
- Early season vs Late season

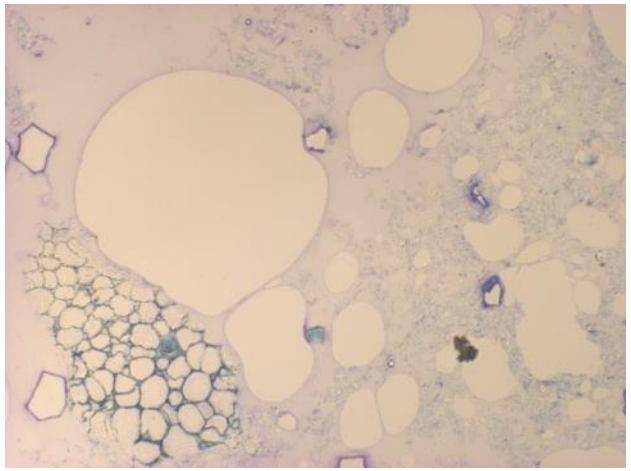
- Early season → cold-pressed oil yield is 2 – 3% less than total oil content -**WHY?**

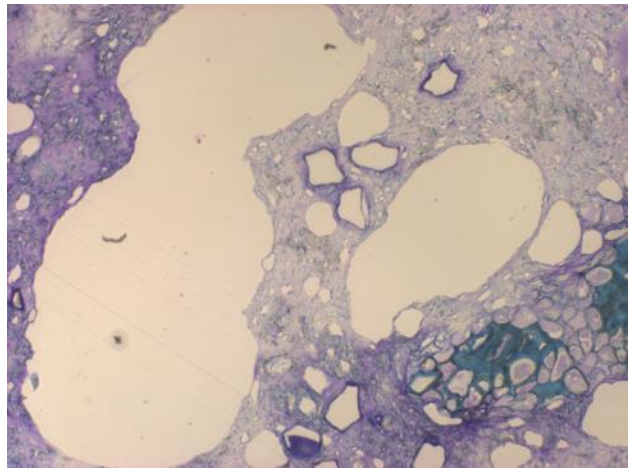


IMPACT OF HARVEST DATE ON CELL STRUCTURE

Unbroken parenchyma cells







September (Early season) **December (Mid season)** **March (Late season)**

- Parenchyma cell walls in late season fruit - more water-soluble polysaccharides
- Late season → easier to disrupt cell walls

Yang et al. 2020 JOACS

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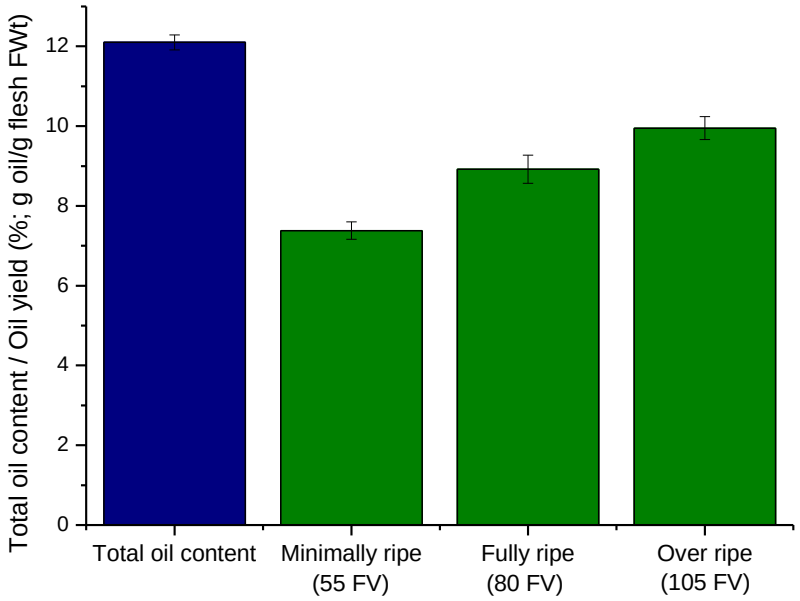
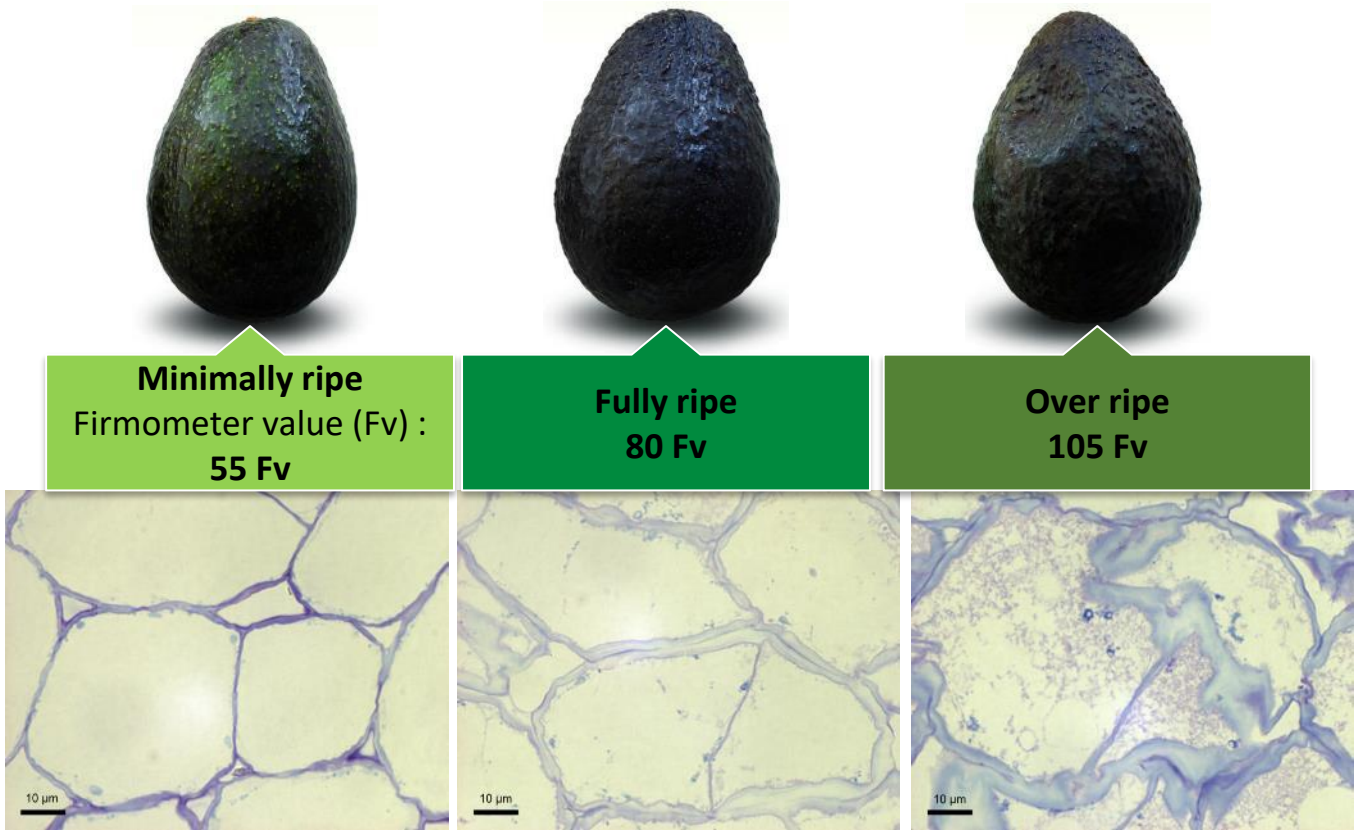
FRUIT MUST BE RIPENED BEFORE OIL EXTRACTION





Yang et al. 2019 JFoodProcess Eng

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FRUIT RIPENING AND QUALITY

- Controlling avocado ripening is challenging
- Ethylene treatment is recommended - to uniformly ripen fruit
- Rots develop very quickly - within days

Uncontrolled ripening

Ethylene ripened

Fruit	Processing	Oil
 High quality fruit with low defects/ damage	Careful extraction below 50°C after removing most skin and seeds	Extra virgin/virgin oil with no 3-MCPD esters and trans fats
 Good quality fruit with some defects/ damage	Extract to make good quality crude. Light refining required, low losses	High quality RBD oil for end use such as refined avocado oil and cosmetic oils
 Low quality fruits with a lot of rots and damage	High level of refining required, degumming and bleaching, high losses and costs	High quality RBD oil for sale as commodity oil

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- Codex standards for Named Vegetable Oils (CXS 210-1999)

"Avocado oil may be derived from either the mesocarp of avocado fruit (Persea americana) or obtained by processing the whole avocado fruit."

- Industry concerns
  - Limited fruit supply or oversupply
  - With oversupply - too much fruit to handle, fruit will ripen rapidly and lead to more rots
  - More crude oil is produced which needs to be refined

REFINING, BLEACHING AND DEODORIZING

Crude oil

↓

Degumming

↓

Bleaching

↓

Deordorising
220 - 250°C

→

CONCERNS

- Contaminants/degradation products
- 3-MCPD and GE esters
- EU regulations

NZ ROYAL SOCIETY CATALYST SEEDING FUND

“ Improving market access for NZ avocado oil by ensuring high quality and food safety”

Research Questions

What is the effect of including high amounts of rotten fruit or skin and seed on oil quality and composition?

If high amounts of rotten fruit are included → leading to crude oil which must be refined, is there a safety concern?

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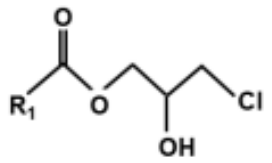
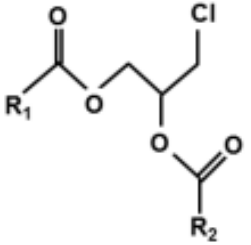
- Volatiles
- Organoleptic properties
- Quality and composition
- Stability

Degradation products

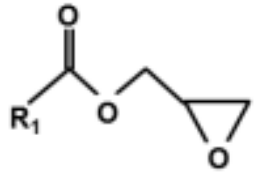
- 3-Monochloropropanediol esters (3-MCPD) (EU limit 1.25 ppm)
- Glycidyl fatty acid esters (GE) (EU limit 1.0 ppm)



3-MCPD-Monoester



3-MCPD-Diester



Glycidyl-Ester

NZ ROYAL SOCIETY CATALYST SEEDING FUND

" Improving market access for NZ avocado oil by ensuring high quality and food safety"

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Does Fruit Rot Proportion Affect the Quality and Composition of Cold-Pressed Avocado Oil?

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Effect of Malaxing Temperature and Rotten Fruit on the Formation of 3-MCPDE and Glycidyl Esters in Avocado Oil

Y Wang[1], J Kuhlmann[2], P Weitkamp[3], C Diako[1], B Matthäus[3], S.C Wang[4], L Eyres[5], P Pidakala[6], A.B Woolf[6], M Wong[1]

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CONCLUSIONS

NZ needs to keep producing good quality oils

Composition data collection is important to identify authenticity

Control your raw material supply → control of oil quality and yield.

- Understand the agronomy or horticultural aspects of your raw material – from growing, harvesting and postharvest storage.

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