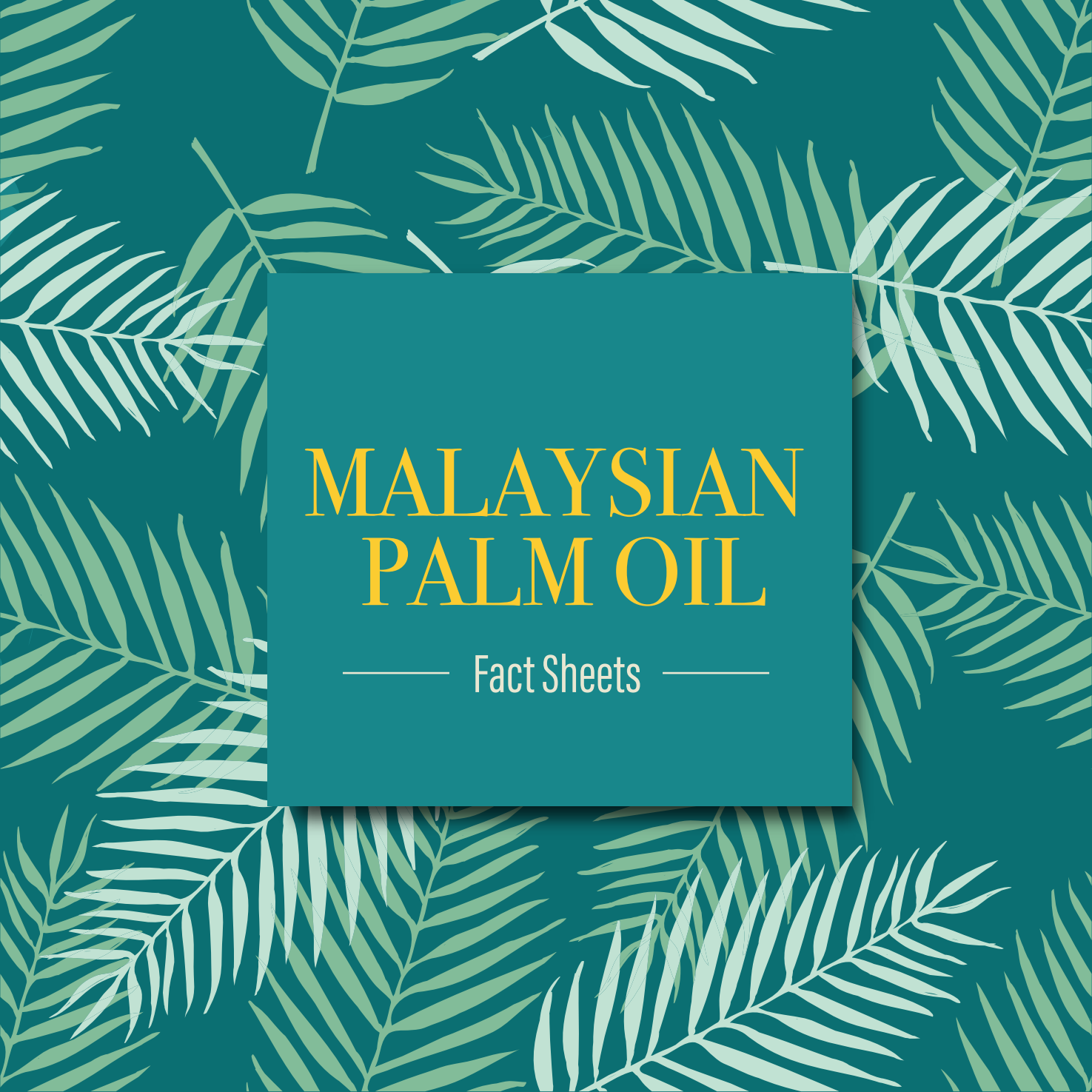




MALAYSIAN PALM OIL

———— Fact Sheets ————

FACT SHEETS MALAYSIAN PALM OIL

Fact Sheets Malaysian Palm Oil

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FOREWORD

Palm oil is one of the 10 major vegetable oils traded in the global oils & fats market. It has been consumed as food from as long as 5,000 years ago and today is found in one of every ten food products sold on the shelves worldwide. Its sibling oil, palm kernel oil, which is also edible, is extensively used in the oleochemical industry that produces chemical feedstock for non-edible products such as cosmetics, toiletries, industrial cleaning agents, and candles.

As one of the world's largest producers and exporters of palm oil, the Malaysian oil palm industry is the pride of the country. Over the past 50 years, the industry has grown by leaps and bounds to provide socio-economic prosperity and political stability to the nation while feeding billions of people worldwide through exports of its palm oil and downstream products. Today, the industry has not only improved the living standards of small farmers, but also provided employment to close to three million people through various palm oil-linked economic activities.

Yet, this is not sufficiently appreciated in some quarters, which consistently fail to give palm oil & the Malaysian palm oil industry their due. To rectify this, the Malaysian Palm Oil Council (MPOC) and Malaysian Palm Oil Board (MPOB) present facts at a glance in this easy-to-read booklet. We hope this comprehensive information will put to rest any lingering doubts about palm oil and its various benefits.





Part I: **THE OIL PALM**

Source: Malaysian Palm Oil Council

History

Fact 1: The oil palm [*Elaeis guineensis*] originates from West Africa in a belt from Angola to Senegal.

Source: Malaysian Palm Oil Council (2005)

Fact 2: Archaeological evidence found in an ancient tomb in Abydos, Egypt in the late 1800s implied that palm oil had been traded and consumed during the time of the Pharaohs, which is about 5,000 years ago.

Source: Friedel (1897)



One of the four original oil palms from which Fauconnier obtained his seedlings to plant at Tennamaram Estate



Source: MPOB



The 5 original steps used to extract palm oil

Fact 3: The oil palm was introduced to Malaya, now Peninsular Malaysia, as an ornamental plant in the 1870s by the British.

Source: *Malaysian Palm Oil Council (2005a)*

Fact 4: In 1917, Henri Fauconnier became the first person to commercialise palm oil in Malaysia when he planted the oil palm for its oil at his Tennamaram Estate; laying the foundation for the development of the Malaysian palm oil industry.

Source: *Malaysian Palm Oil Council (2005a)*

Fact 5: The oil palm's economic potential was realised in the 1960s when the Malaysian Government embarked on a poverty eradication programme through agricultural diversification by planting the crop to complement rubber.

The establishment of land schemes by the Federal Land Development Authority (FELDA) and the Federal Land Consolidation and Rehabilitation Authority (FELCRA) since 1956 and 1966, respectively; has resettled landless farmers on holdings by mainly growing the oil palm. Today, close to 190,000 farmers have benefitted from these two schemes, which have grown a total of 908,550 hectares¹ of the oil palm. These schemes are equipped with basic amenities such as piped water, electricity, communications, roads, schools, worship places and healthcare facilities while providing greater employment opportunities for the people.

Source: ¹*Malaysian Palm Oil Board (2020)*

Currently, the Malaysian palm oil industry as a whole including the downstream sectors employs about 3 million people, both directly and indirectly.

*A Small Farmer's House at a
FELDA's Oil Palm Estate*

*Step 1: Cooking the oil palm
bunches*

*Step 2: Removing fruitlets from
the bunches*

Step 3: Macerating the fruitlets

*Step 4: Pressing out the oil from
the fruitlets*

Step 5: Collecting the oil



Source: *Malaysian Palm Oil Board*

Background

Fact 6: The oil palm planted by Henri Fauconnier at his Tennamaran Estate in Batang Berjuntai (now Bestari Jaya), Selangor, was of *Dura* species, which has a thick shell. There are two other fruit types of the oil palm namely; *Pisifera* with no shell and *Tenera* with a thinner shell. Obviously, the thicker the shell, the less would be the oil-bearing mesocarp and the less the oil yield. Ideally, *Pisifera* should be planted, but it is largely female sterile and produces very few bunches. In practice, *Tenera* is planted as a compromise. At that time, the genetics of shell type was not known but it was later discovered that *Tenera* is just a hybrid between *Dura* and *Pisifera* (i.e. $Dura \times Pisifera = Tenera$).

The Oil Palm (*Tenera*): Basic Facts

Origin	West Africa
Average height increment (present palms)	~ 60 cm/year
Trunk diameter	~ 60 cm
No. of fronds produced per year	~ 24
Average length of frond	3 - 4 m
Leaf colour	Green
Colour of ripe fruit	Usually yellowish red (there are also other colors)
Nursery period	12 - 18 months
First harvesting	~ 30 months after field planting
Harvesting cycle	2 - 3 weeks
No. of bunches produced per tree	10 - 15 per year
Average weight of fruit bunch	10 - 20 kg
No. of fruits per bunch	1,000 - 3,000 fruitlets
Shape of bunch	Round or oval
Fruit size (l x b)	5 cm x 2 cm
Fruit weight	~ 10 g
Kernel content	3% - 8% per fruitlet
Oil extraction rate	20%
Palm oil yield	~ 4 tonnes/ha/year
Planting density	136 - 160 palms/ha
Economic lifespan	20 - 30 years

Source: Malaysian Palm Oil Council (1995)

Biology and Agronomy

Fact 7: Malaysia's humid tropical climate with temperature ranging from 24 – 32°C throughout the year, ample sunshine, and an evenly distributed annual rainfall of almost 2,000 mm, is ideal for the cultivation of the oil palm.

Fact 8: The oil palm is the only oil-bearing crop that produces two different oils from the same fruit namely; palm oil from the mesocarp and palm kernel oil from the kernel.

Anatomy of Oil Palm's Fruitlet



Mesocarp: Palm Oil

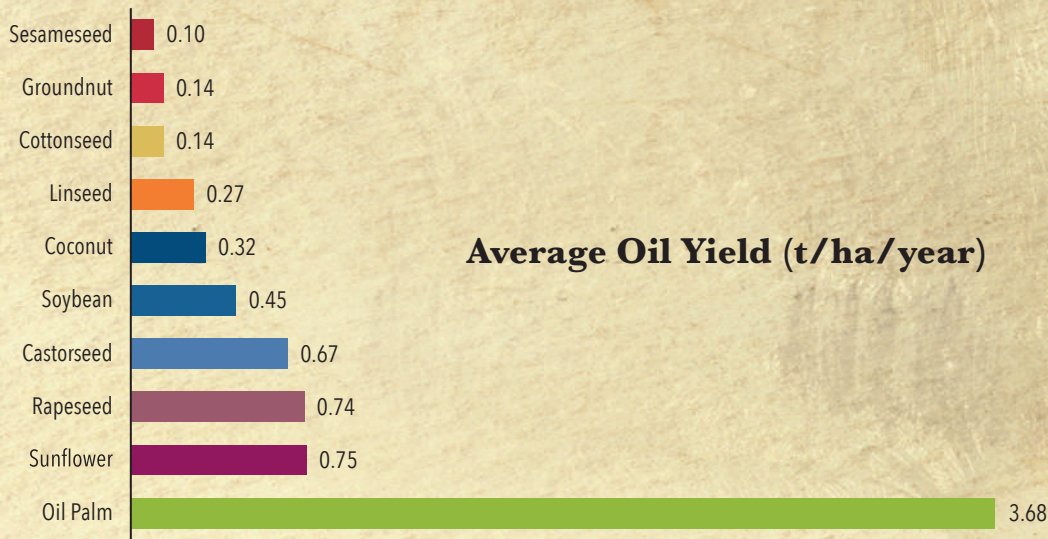
Kernel: Palm Kernel Oil

Source: Malaysian Palm Oil Council

Fact 9: The oil palm usually bears fruits after 30 months of field planting. Once fruiting, it continues producing all year round until it reaches the end of its economic lifespan of 20 - 30 years. This long productive lifespan ensures a consistent and uninterrupted supply of palm oil and palm kernel oil for global consumption.

Fact 10: The oil palm is the most productive oil-bearing crop in the world.

The figures below show that of the world's 10 major oilseeds, the oil palm produces the highest tonnage of vegetable oil per hectare per year.



Average Oil Yield of World's 10 Major Oilseeds

Oil Crop	Oil Production (mil tonnes)	Harvested Area (mil ha)	Average Oil Yield (t/ha/year)
Sesameseed	0.88	8.85	0.10
Groundnut	3.67	25.76	0.14
Cottonseed	4.59	33.03	0.14
Linseed	0.86	3.13	0.27
Coconut	2.91	9.17	0.32
Soybean	56.88	126.07	0.45
Castorseed	0.74	1.10	0.67
Rapeseed	24.96	33.59	0.74
Sunflower	20.51	27.22	0.75
Oil Palm	83.88 ^a	22.82	3.68
TOTAL	199.88	290.74	

Note: ^a combined tonnage of palm oil and palm kernel oil
Source: Oil World (2020)



Part II: Palm Oil & Palm Kernel Oil

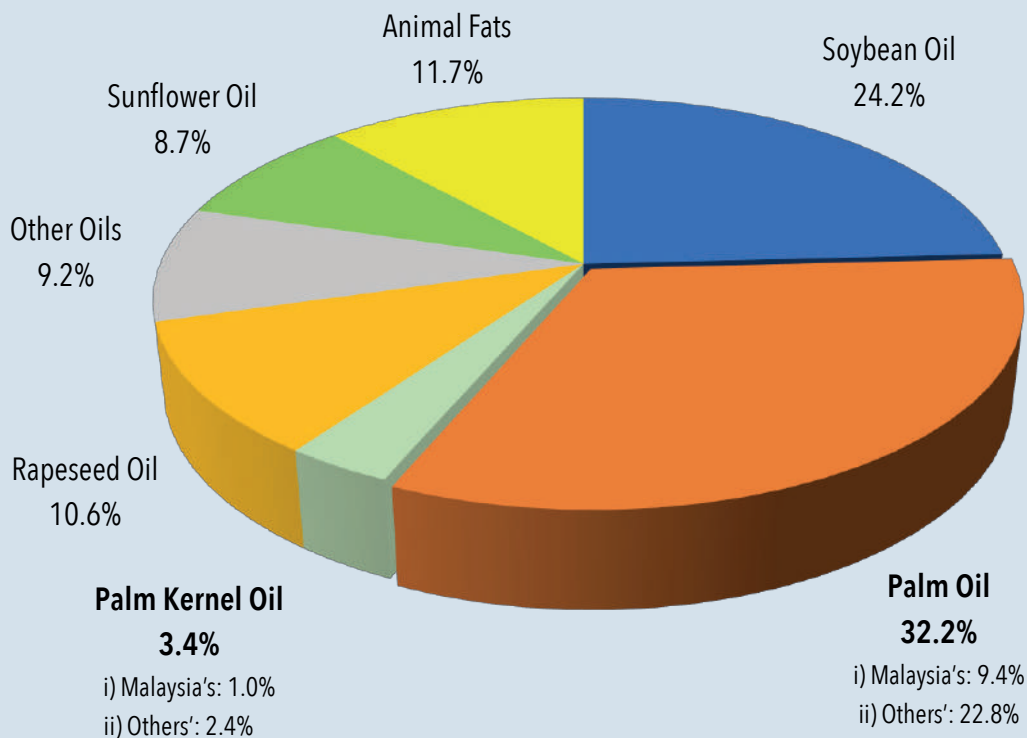
Source: Malaysian Palm Oil Council

OILS & FATS TRADE

Fact 11: Palm oil and palm kernel oil are important constituents of the 17 oils & fats traded in the global market today.

i) Palm oil and palm kernel oil contributed 35.6% of the global production of oils & fats in 2019.

World Production of Oils & Fats 2019 (Million Tonnes)

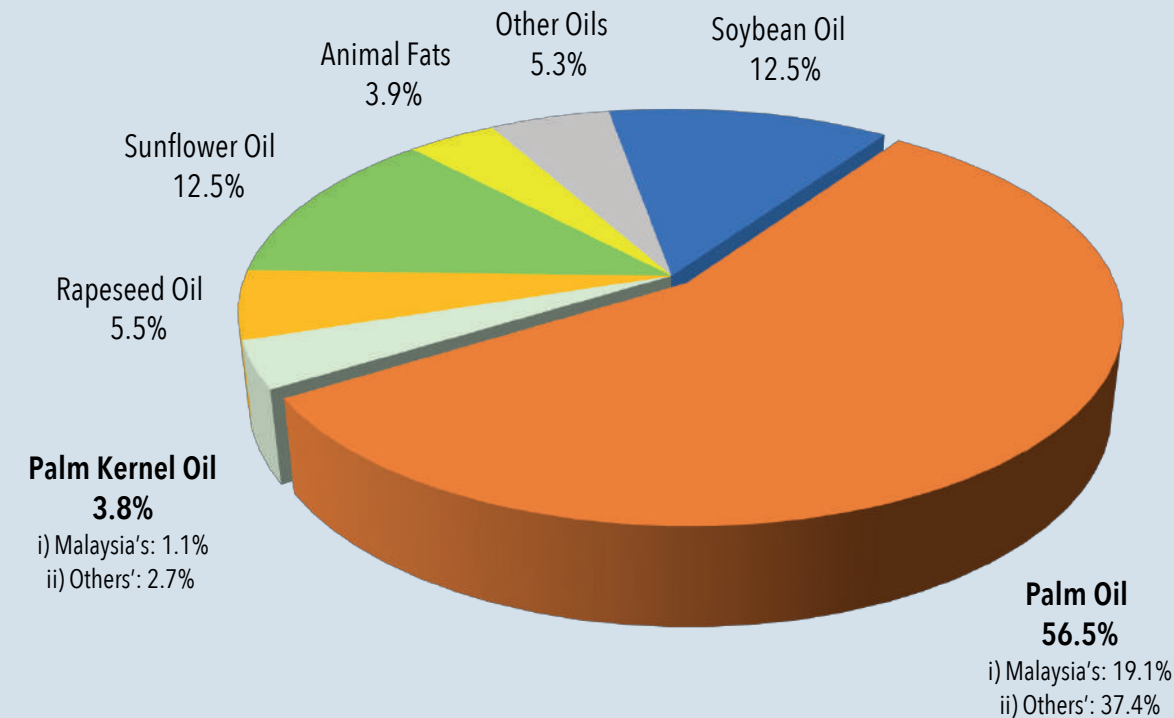


Total: 235.21 mil tonnes

Source: Oil World (2020)

ii) Palm oil and palm kernel oil contributed 60.3% of all oils & fats exports in 2019 with palm oil being the most exported commodity.

World Exports of Oils & Fats 2019 (Million Tonnes)

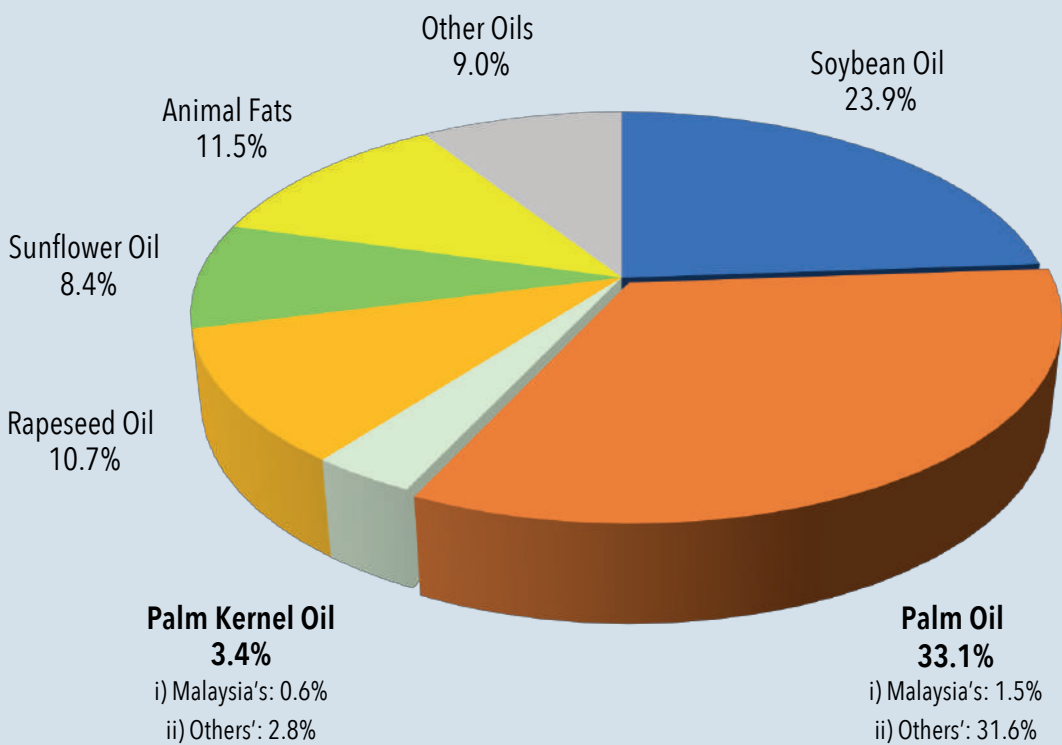


Total: 96.52 mil tonnes

Source: Oil World (2020)

iii) Of 237.56 million tonnes of oils & fats consumed in 2019, palm oil and palm kernel oil constituted 36.5% of the total.

World Consumption of Oils & Fats 2019 (Million Tonnes)

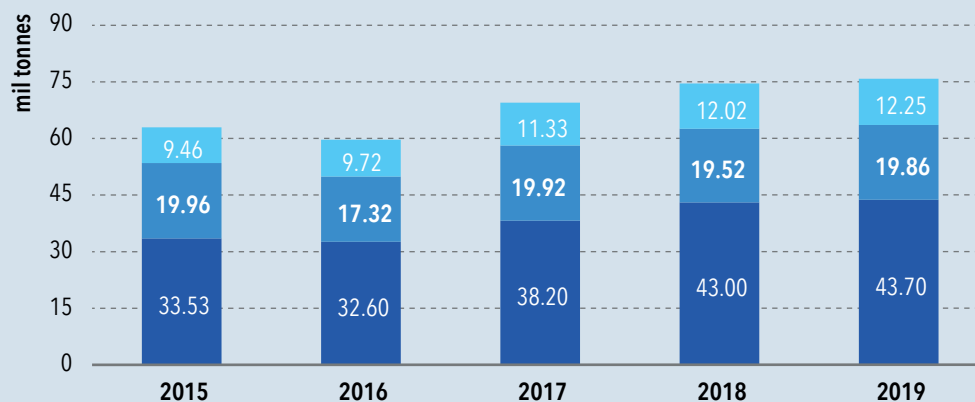


Total: 237.56 mil tonnes
Source: Oil World (2020)

Fact 12: Malaysia is one of the largest producers and exporters of palm oil and palm kernel oil in the world.

In 2019, Malaysia produced about 19.86 million tonnes and 2.32 million tonnes of palm oil and palm kernel oil; respectively. The production and export of these commodities from Malaysia are expected to increase in the future through improved planting materials, better plantation management, and higher market demand.

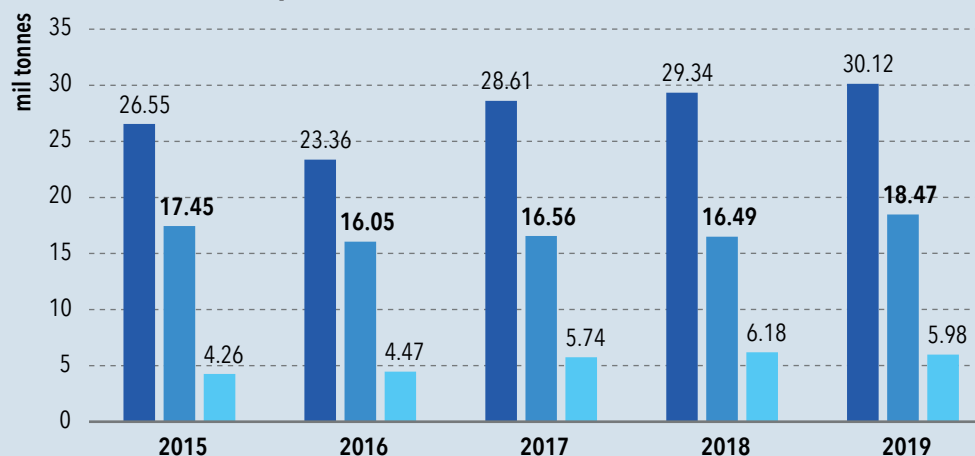
World Production of Palm Oil 2015 – 2019 (Million Tonnes)



Source: Oil World (2018, 2020)

■ Indonesia ■ Malaysia ■ Other Countries

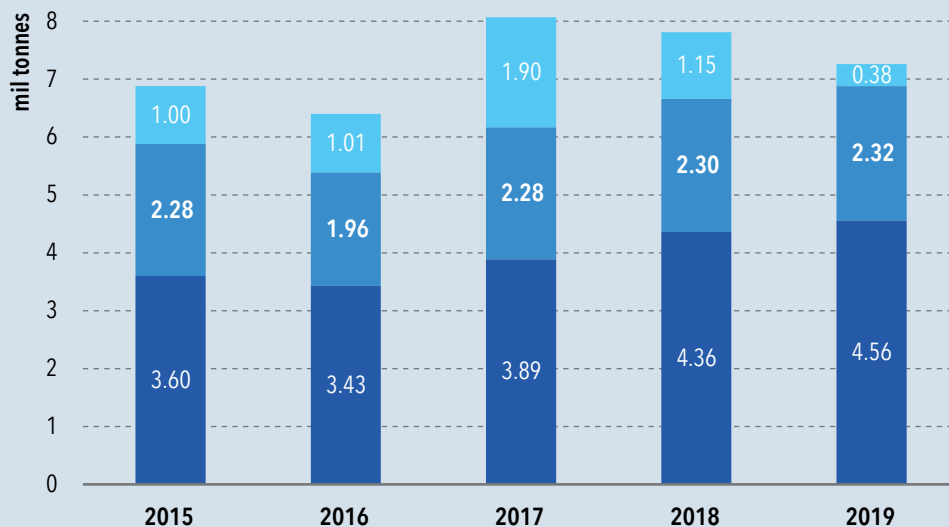
World Exports of Palm Oil 2015 – 2019 (Million Tonnes)



Source: Oil World (2018, 2020)

■ Indonesia ■ Malaysia ■ Other Countries

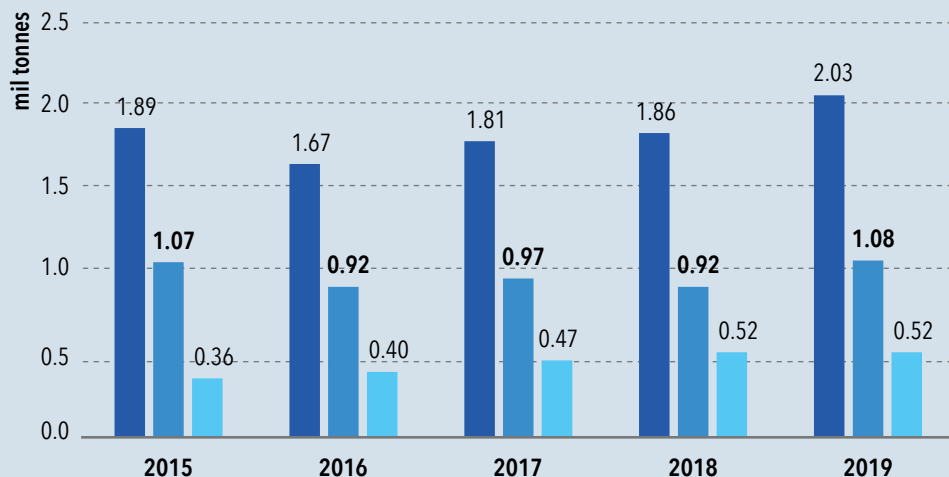
World Production of Palm Kernel Oil 2015 - 2019 (Million Tonnes)



Source: Oil World (2018, 2020)

Indonesia Malaysia Other Countries

World Export of Palm Kernel Oil 2015 - 2019 (Million Tonnes)



Source: Oil World (2018, 2020)

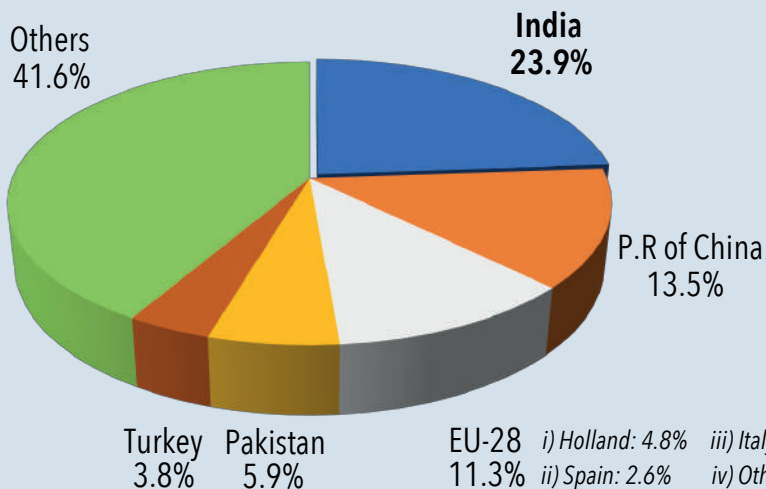
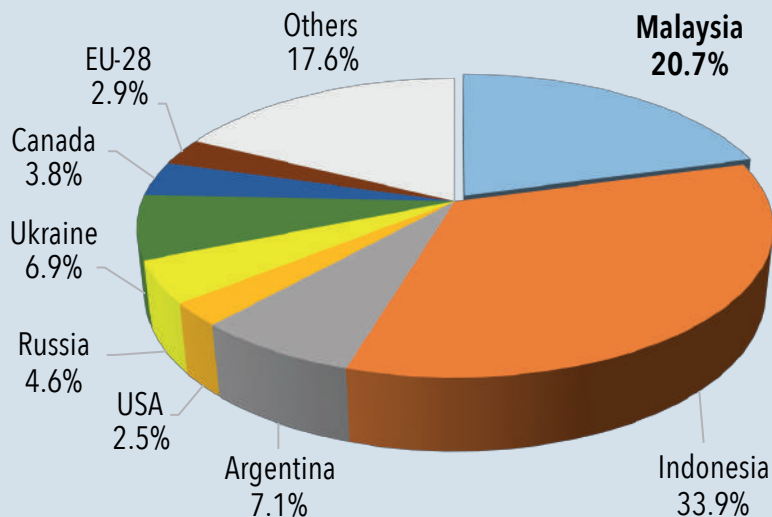
Indonesia Malaysia Other Countries

Fact 13: Since its domestic consumption of vegetable oils is relatively low, Malaysia exports excess of its palm oil and palm kernel oil to the global markets. In 2019, Malaysia had the second biggest share in the global exports of oils & fats with India and the EU-28 emerging as the largest importer of its palm oil and palm kernel oil, respectively.

Country's Share of World Exports of Oils and Fats (%)

Total Exports: 96.52 mil tonnes
Malaysia's Share: 19.99 mil tonnes

Source: Oil World (2020)



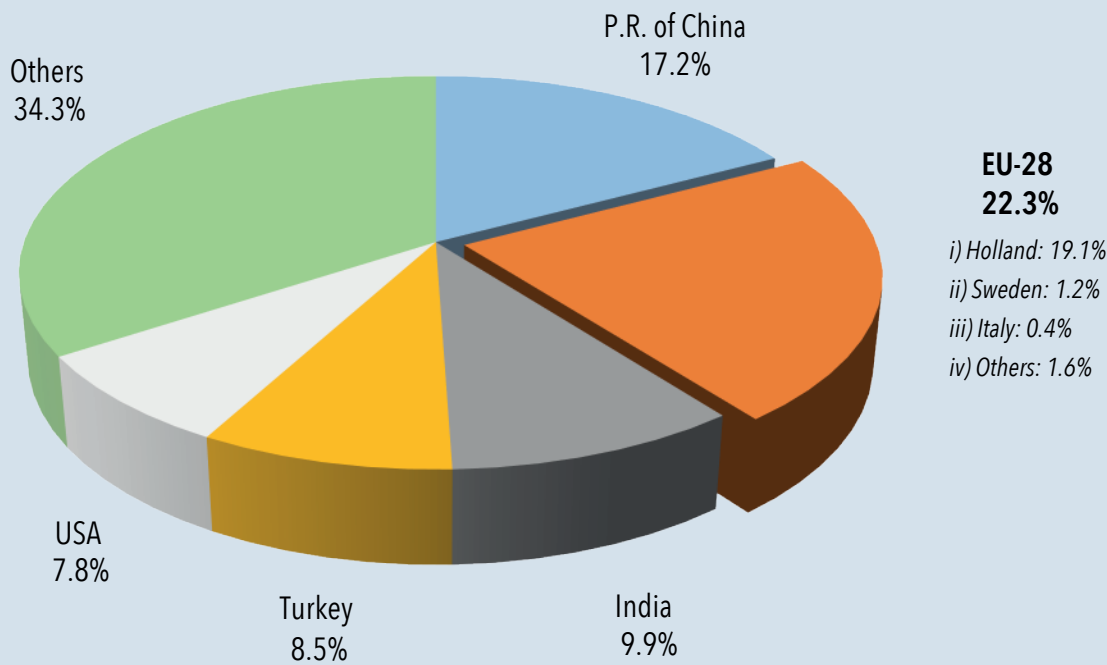
Major Export Destinations for Malaysian Palm Oil 2019 (%)

Total Exports: 18.47 mil tonnes

Source: Malaysian Palm Oil Board (2020a)

i) Holland: 4.8% iii) Italy: 2.6%
 ii) Spain: 2.6% iv) Others: 1.3%

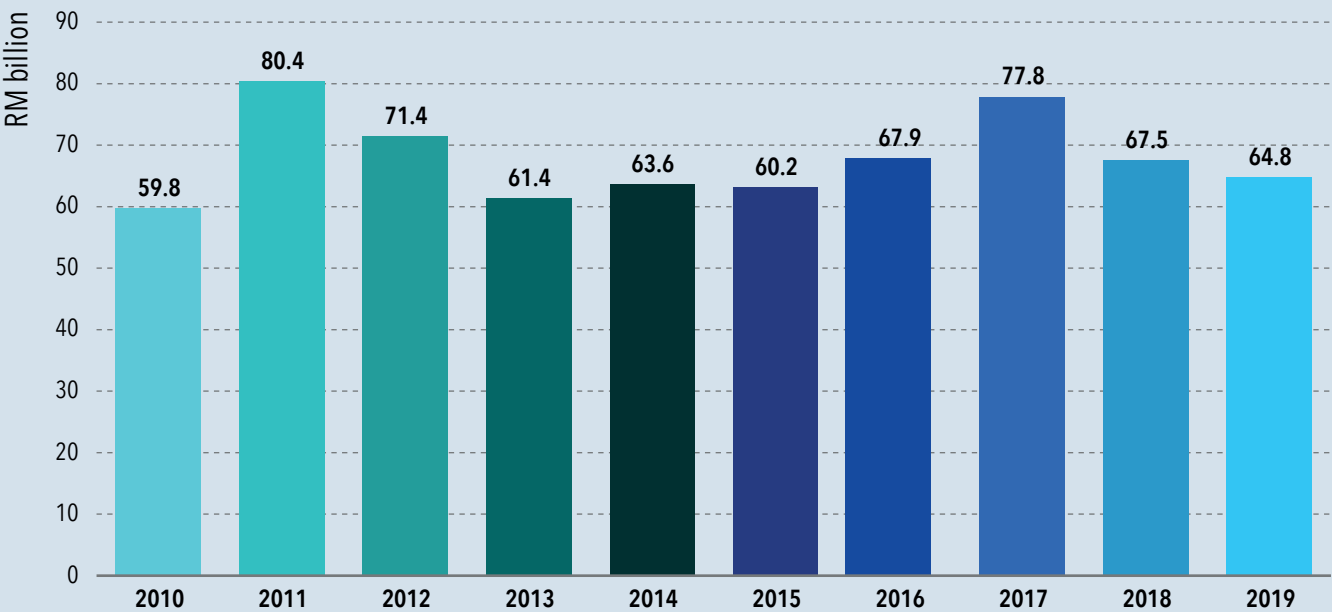
Major Export Destinations for Malaysian Palm Kernel Oil 2019 (%)



Total Exports: 1.08 mil tonnes
Source: Malaysian Palm Oil Board (2020a)

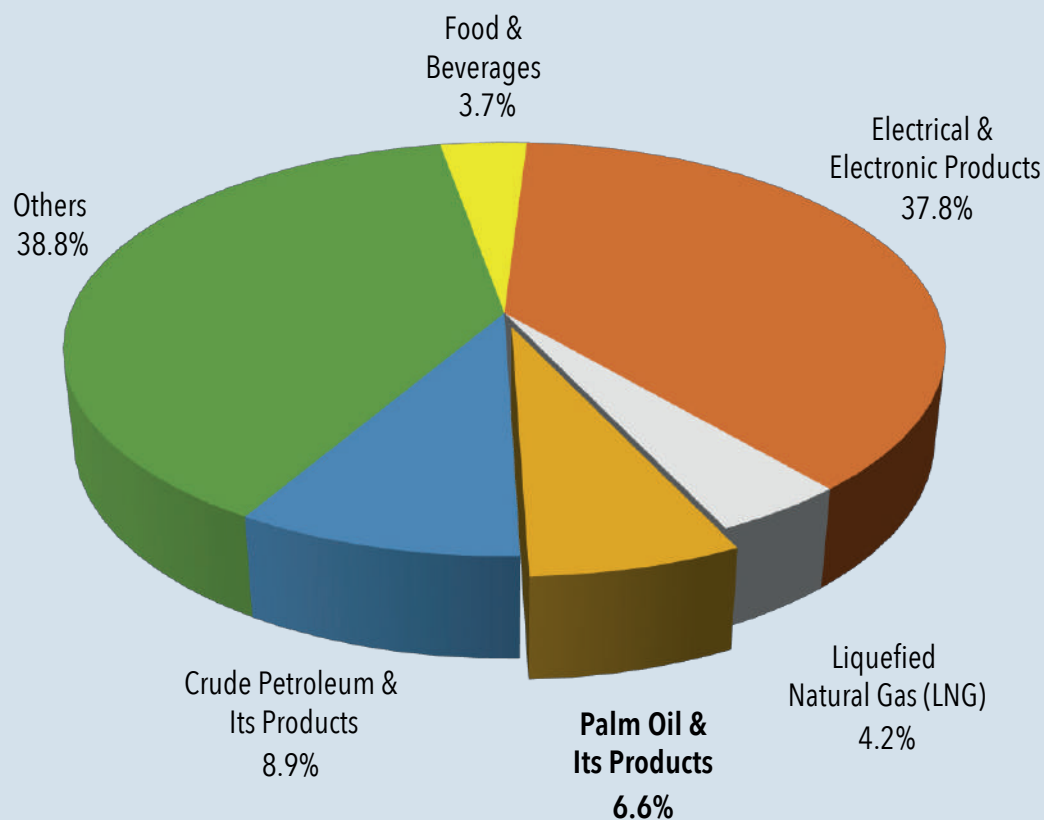
Fact 14: The palm oil industry has been contributing billions of ringgit in annual export revenues to Malaysia. With a total export worth of RM64.8 billion, it was the third-largest contributor to Malaysia's external trade in 2019.

Export Earnings from the Malaysian Palm Oil Industry 2010 – 2019 (RM billion)



Source: Malaysian Palm Oil Board (2012, 2014, 2016, 2018, 2020b)

Malaysia's External Trade 2019 (%)

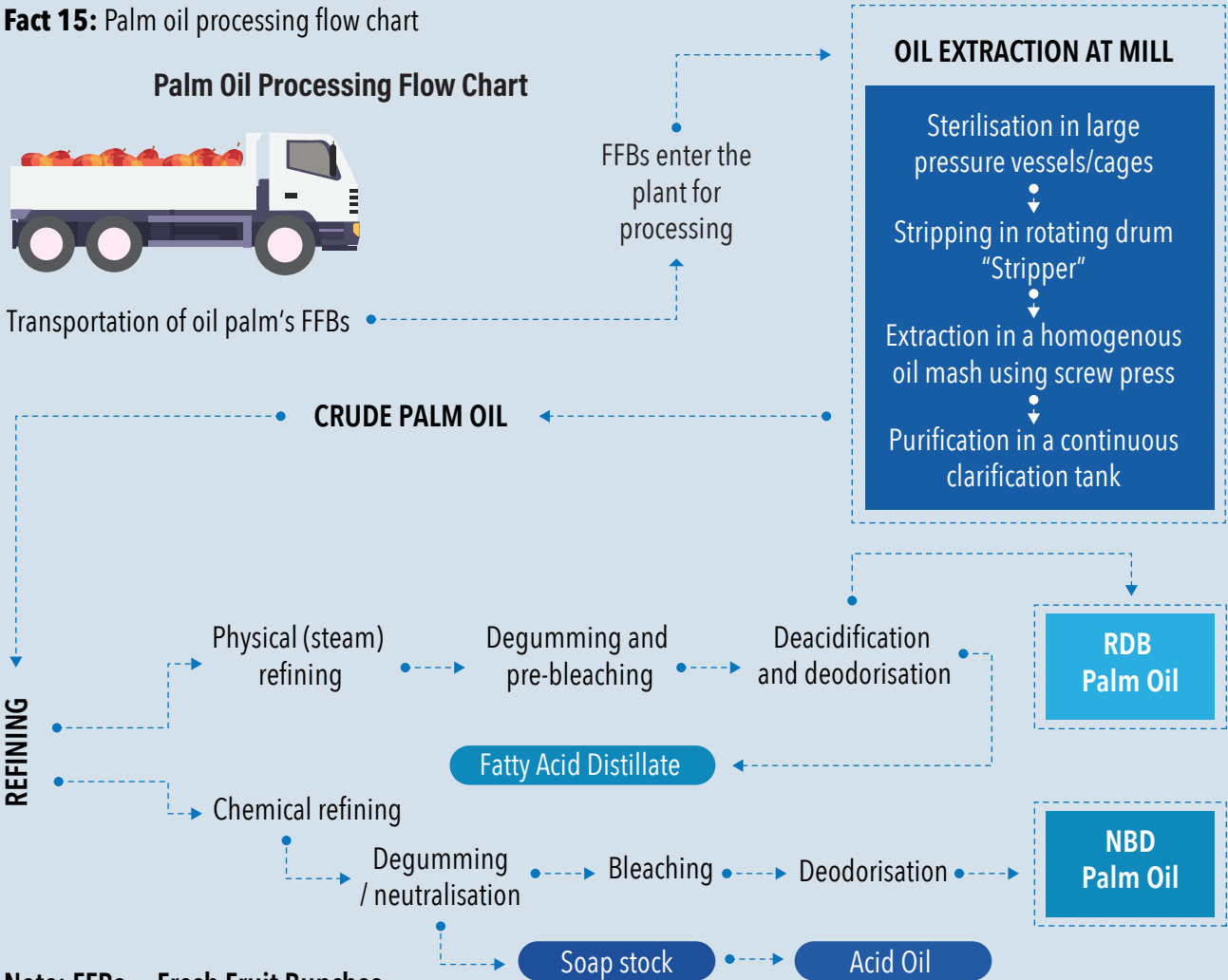


Total Trade: RM 986.40 bil

Source: Department of Statistics Malaysia (2020), Malaysian Palm Oil Board (2020b)

PALM OIL & PALM KERNEL OIL PROCESSING FLOW CHART

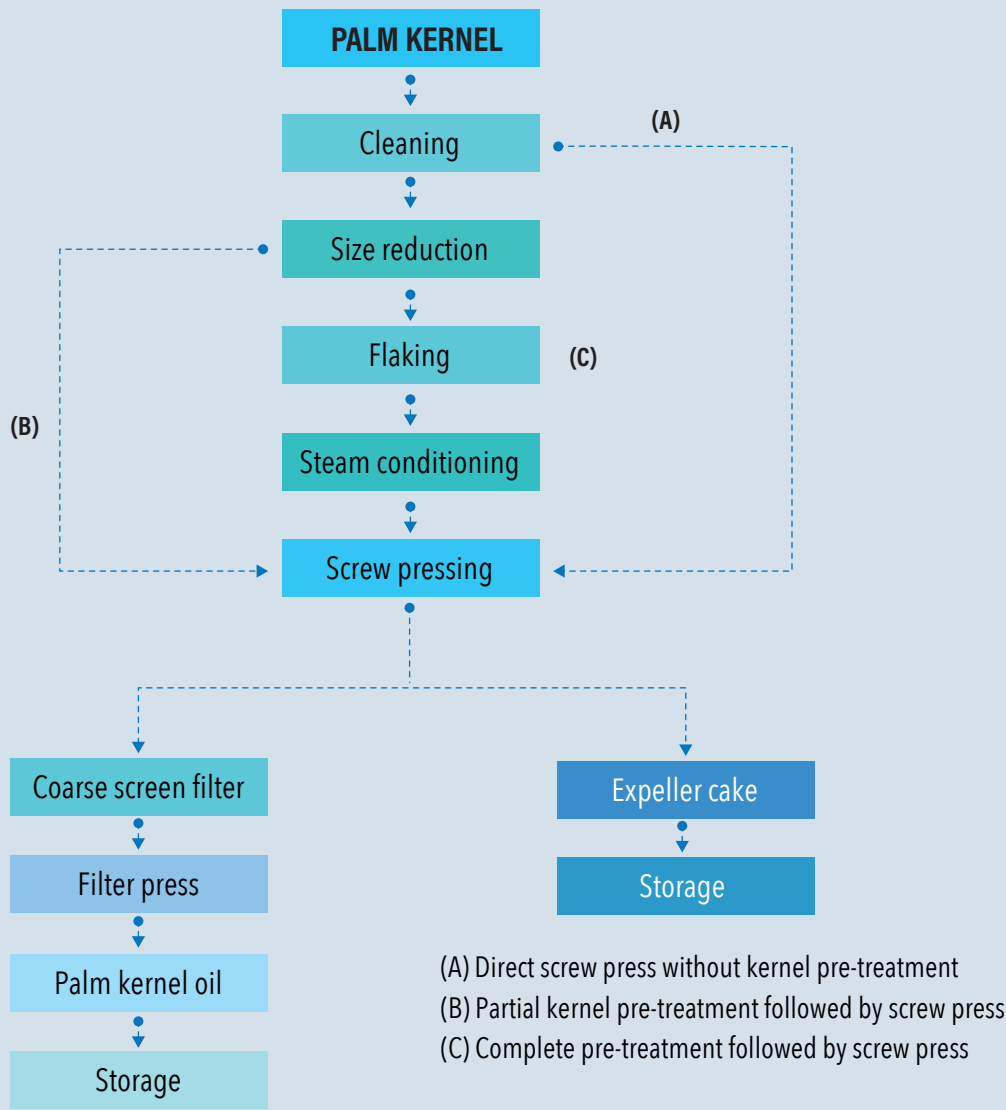
Fact 15: Palm oil processing flow chart



Note: FFBs = Fresh Fruit Bunches
Source: Malaysian Palm Oil Board (1992)

Fact 16: Palm kernel oil processing flow chart

Palm Kernel Oil Processing Flow Chart (Mechanical Extraction)



Source: Source: Malaysian Palm Oil Board (1992)

PHYSICAL CHARACTERISTICS OF PALM OIL AND PALM KERNEL OIL

Fact 17: Physical characteristics of palm oil

Physical Characteristics of Palm Oil

Characteristic	Mean (of 215 samples)	Range*
*Apparent density @50°C (g/ml)	0.889	0.888 - 0.889
*Refractive Index @50°C	1.455	1.455 - 1.456
+Solid fat content		
5°C	60.5	50.7 - 68.0
10°C	49.6	40.0 - 55.2
15°C	34.7	27.2 - 39.7
20°C	22.5	14.7 - 27.9
25°C	13.5	6.5 - 18.5
30°C	9.2	4.5 - 14.1
35°C	6.6	1.8 - 11.7
40°C	4.0	0.0 - 7.5
45°C	0.7	0.0 - 4.5
+Slip melting point [°C]	34.2	31.1 - 37.6

Source: *Chin, et al (1980), +Tan & Oh (1981)

Fact 18: Physical characteristics of palm kernel oil

Physical Characteristics of Palm Kernel Oil

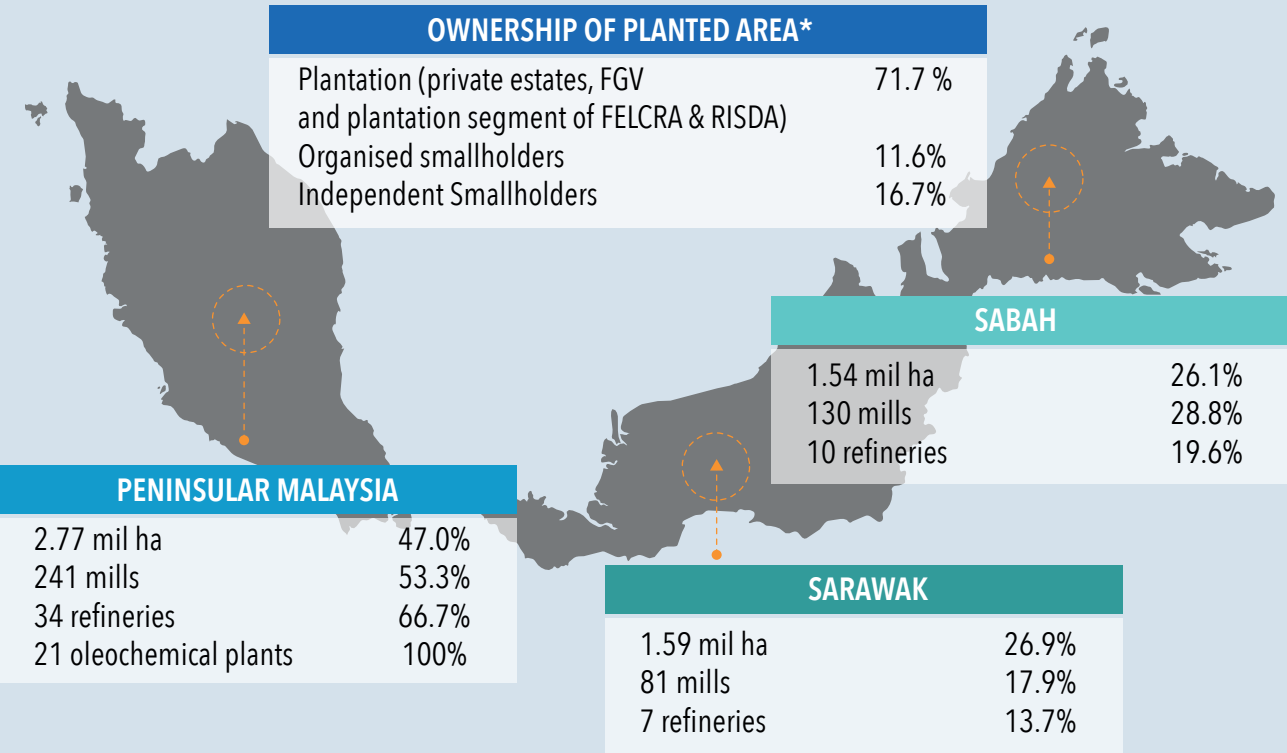
Characteristic	Mean Value
Refractive Index	1.4509
Slip melting point [°C]	27.3
Colour (Lovibond 5 ¼" cell)	5.5R 50Y
Colour (FAC)	-
Carotene content (from absorption at 446 nm)	7.6
Solid fat content by Wideline NMR (%)	
at 5°C	72.8
10°C	67.6
15°C	55.7
20°C	40.1
25°C	17.1
30°C	-

Source: Siew and Berger (1981)

THE INFRASTRUCTURE OF THE MALAYSIAN PALM OIL INDUSTRY

Fact 19: The infrastructure for the Malaysian palm oil industry is rapidly developing to keep pace with the high global demand for palm oil, oleochemicals, and biodiesel.

Distribution of the Malaysian Oil Palm Business and Ownership 2019



Source: Malaysian Palm Oil Board (2020a), *MPOB internal communication

Status of Malaysian Oil Palm Processing (mil tonnes/year)

Sector	2019		2018	
	No. of Plant	Operating Capacity	No. of Plant	Operating Capacity
Milling	452	112.91	451	112.42
Refining	51	26.63	50	26.24
Kernel Crushing	43	7.25	43	7.26
Oleochemical	21	2.68	19	2.67

Source: Malaysian Palm Oil Board (2020c)

Status of Oleochemical Plants & Capacity in Malaysia at End 2019 (tonnes/year)

State	No.	Capacity
Selangor	9	848,358
Johor	7	675,900
Other States	5	1,156,683
Malaysia	21	2,680,941

Source: Malaysian Palm Oil Board (2020a)

Part III:
**TECHNO-ECONOMIC
ADVANTAGES OF PALM OIL**

Source: Malaysian Palm Oil Council

Fact 20: The oil palm ensures a consistent and abundant supply of vegetable oil to meet the ever-increasing demand for oils and fats.

In Malaysia's oil palm estates, one hectare of the oil palm produces an average of 3.47 tonnes of palm oil per annum, with the best fields capable of producing up to 7-8 tonnes of palm oil annually. The long natural economic lifespan of the oil palm tree ensures a consistent supply of palm oil to meet consumer demand.

Example of High-yielding Oil Palms



Source: Malaysian Palm Oil Council

Fact 21: Palm oil is the least expensive vegetable oil to produce.

Production Cost of Selected Vegetable Oils (USD/tonne)

Oil	Cost (USD/tonne)	Country/Region
Palm	228	Malaysia
Soybean	400	USA
Rapeseed	648	Canada
Rapeseed	900	Europe

Note: USD 1 = RM 4.40 (2019)
Source: Malaysian Palm Oil Board (2005)

Processing Costs for Palm, Soybean, and Sunflower Oils (RM)

Chemical	Soybean Oil / Sunflower Oil		RBD Palm Oil	
	Quantity (kg)	Cost (RM)	Quantity (kg)	Cost (RM)
Phosphoric Acid @ RM 2,000/tonne	2	4.00	-	-
Caustic Soda Solid @ RM 1,400/tonne	2.5	3.50	-	-
Bleaching Earth @ RM 800/tonne	30	24.00	10	8.00
Nickel Catalyst @ RM 26/kg	1	26.00	-	-
TOTAL COST		57.50		8.00
Savings for RBD Palm Oil (RM)			49.50 per tonne	

Note: USD 1 = RM 4.40 (2019)
Source: Malaysian Palm Oil Board (2005)

Fact 22: Palm oil is the most versatile vegetable oil as it can be used in various food applications without or with minimal modification, as well as in non-food applications.

- i) Palm oil has many of the required characteristics suitable for food applications. Being semi-solid at room temperature, it can be fractionated to produce multiple downstream products such as olein, stearin, super olein, palm mid fraction, and others, which are used in various food applications.

Food Uses of Palm Oil and Its Downstream Products

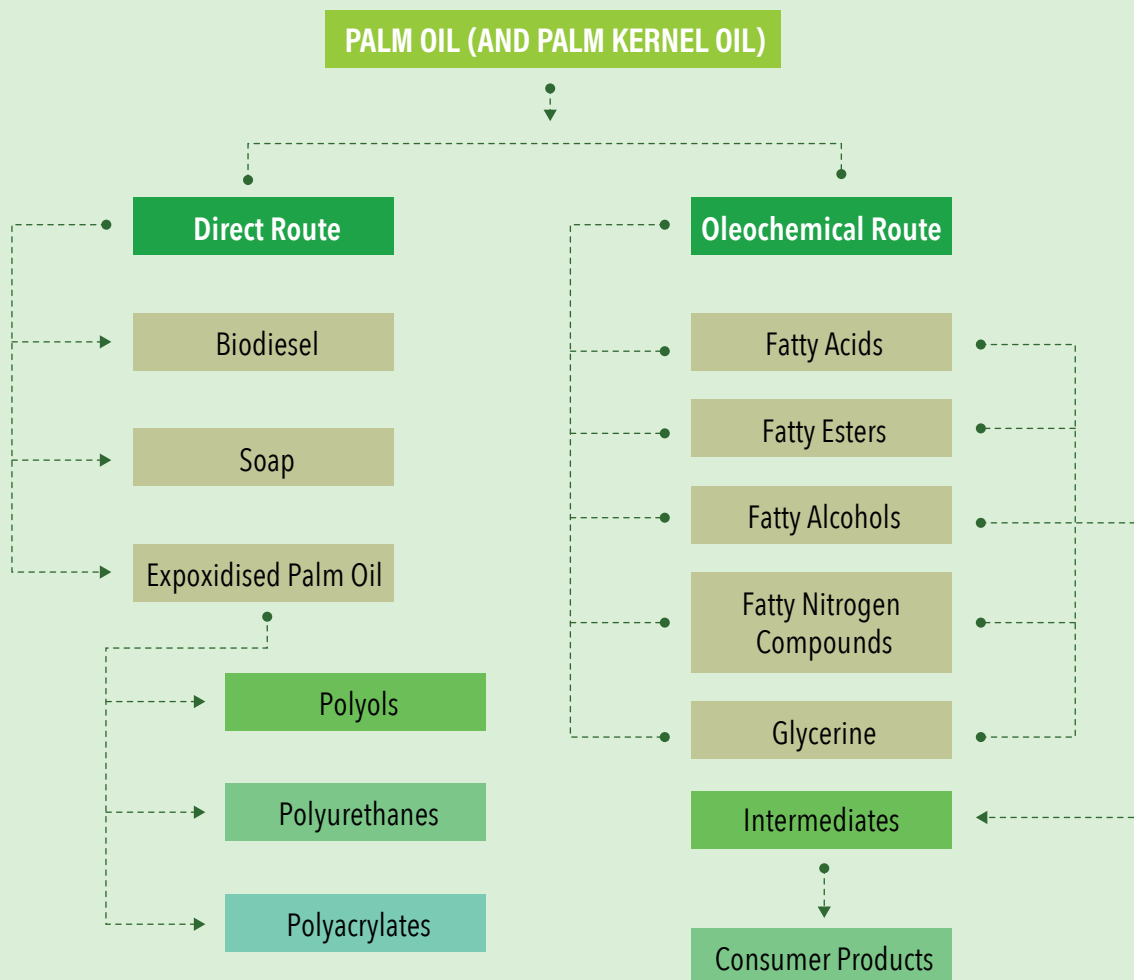
Product	Palm Oil	Palm Olein	Double Fractionated Palm Oil (Super Olein) IV ¹ > 60	Palm Mid Fraction (Soft)	Palm Mid Fraction (Hard)	Palm Stearin (Soft) IV > 30	Palm Stearin (Hard) IV 20 - 30	Premium Stearin (Hard) IV < 20
Cooking Oil	Ø	•	•					
Frying Fats	•	•	•			•	•	•
Shortening/Dough Fats	•	•	•			•	•	•
Vegetable Ghee	•	•	•	Ø	Ø	•	•	•
Margarine	•	•	•	•	•	•	•	•
Specialty Fats for Coatings	Ø			•	•		*	•
Ice cream Fats	Ø			•	•			
Chocolate Fats	Ø			•	•	•	•	•
Milk Fat Replacers	•	•	•	•	•	•	•	•
Butter Oil Substitutes	•	•	•	•	•	•	•	•
Confectionery Fats	•	•	•	•	•	•	•	•
Non-dairy Creamer	•							

• highly suitable Ø suitable * minor application only

Note: ¹ Iodine Value
Source: Malaysian Palm Oil Council (1995a)

ii) In the oleochemical industry, palm oil (and palm kernel oil) is used to produce various chemical feedstock, such as fatty acids, fatty alcohols and fatty esters, which are required in the manufacturing of various non-food products. In addition, palm oil can also be directly used to produce biodiesel, which is renewable & environment-friendly.

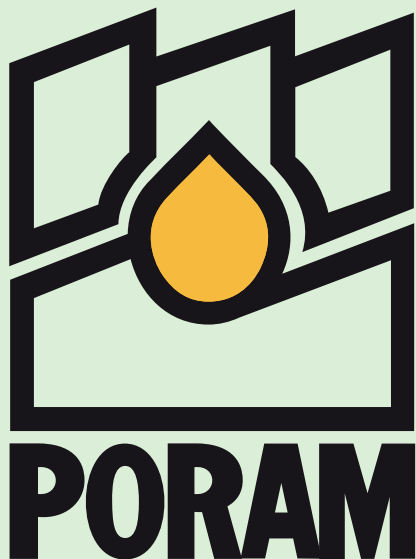
Non-Food Applications of Palm Oil (and Palm Kernel Oil)



Source: Malaysian Palm Oil Board (2005)

Fact 23: Malaysia guarantees the quality of its palm oil to meet customer requirements.

The Malaysian palm oil producers and exporters are keenly aware that the quality of their palm oil is their *sine qua non* for future sales. In Malaysia, strict quality control is observed throughout the supply chain, i.e. from production to processing, refining, and shipping. The industry is also regulated by various quality and food safety standards, such as the PORAM Standard Specifications for Processed Palm Oil and the Ministry of Health's Hazard Analysis & Critical Control Points (HACCP) standards.



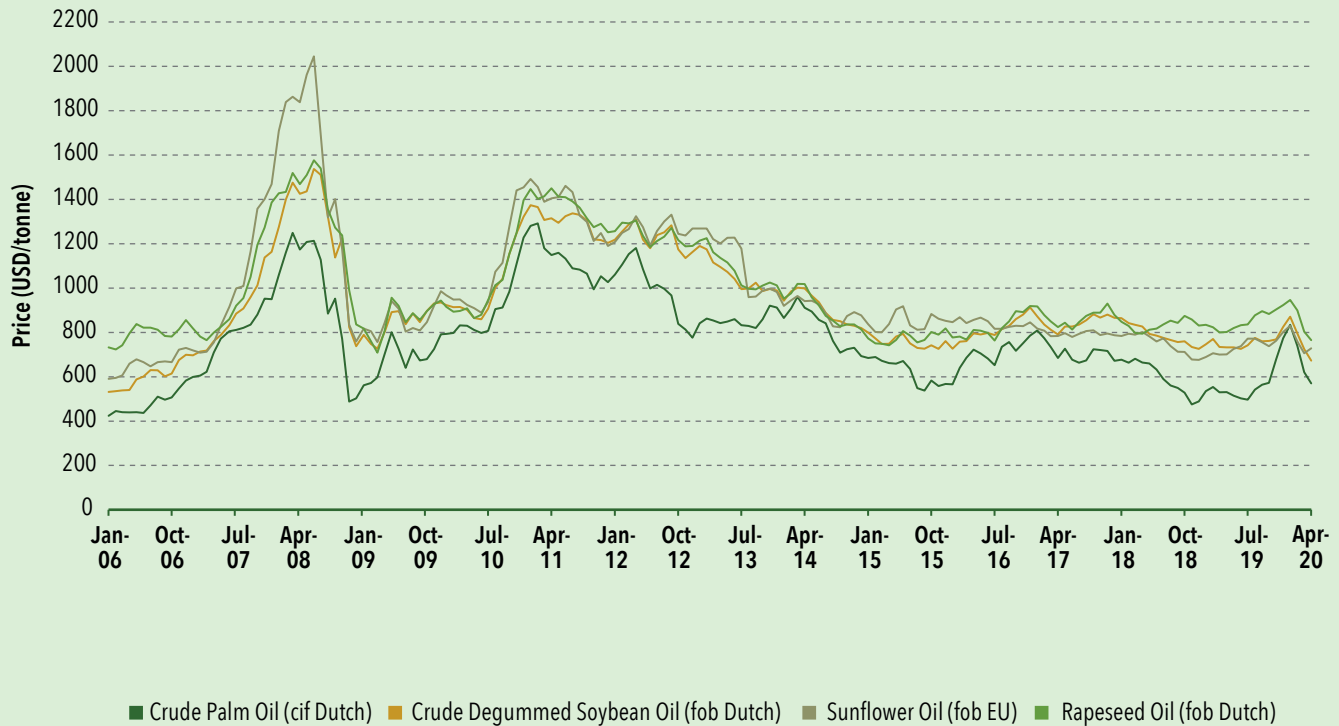
Fact 24: The Malaysian palm oil industry offers a wide range of specifications to meet various requirements.

New technologies allow the Malaysian palm oil industry to diversify its downstream products such as processed palm oil, high-carotene palm oil (red palm oil), palm kernel cake, and oleochemicals to satisfy requirements. Also products that are not 'on the shelf' can be tailor-made for specific uses.

Fact 25: Of the top four vegetable oils, palm oil is the most competitively priced.

Palm oil is competitively priced *vis-a-vis* other top vegetable oils. With its guaranteed and consistent supply, palm oil's price competitiveness is likely to remain.

Price Performance of Top Four Vegetable Oils (USD/tonne)



Source: Oil World (Jan 2006 – May 2020)

Fact 26: The oil palm's biomass can be utilised as value-added products, thus minimising waste.

The oil palm fronds can be fed to cattle while the trunk is sawn into timber or used to make medium-density fibreboard (MDF) and pulp. The empty fruit bunches (EFBs) can be used to make fibre or mulch the young palms (natural fertiliser).

Examples of Palm Biomass Products



Source: Malaysian Palm Oil Council

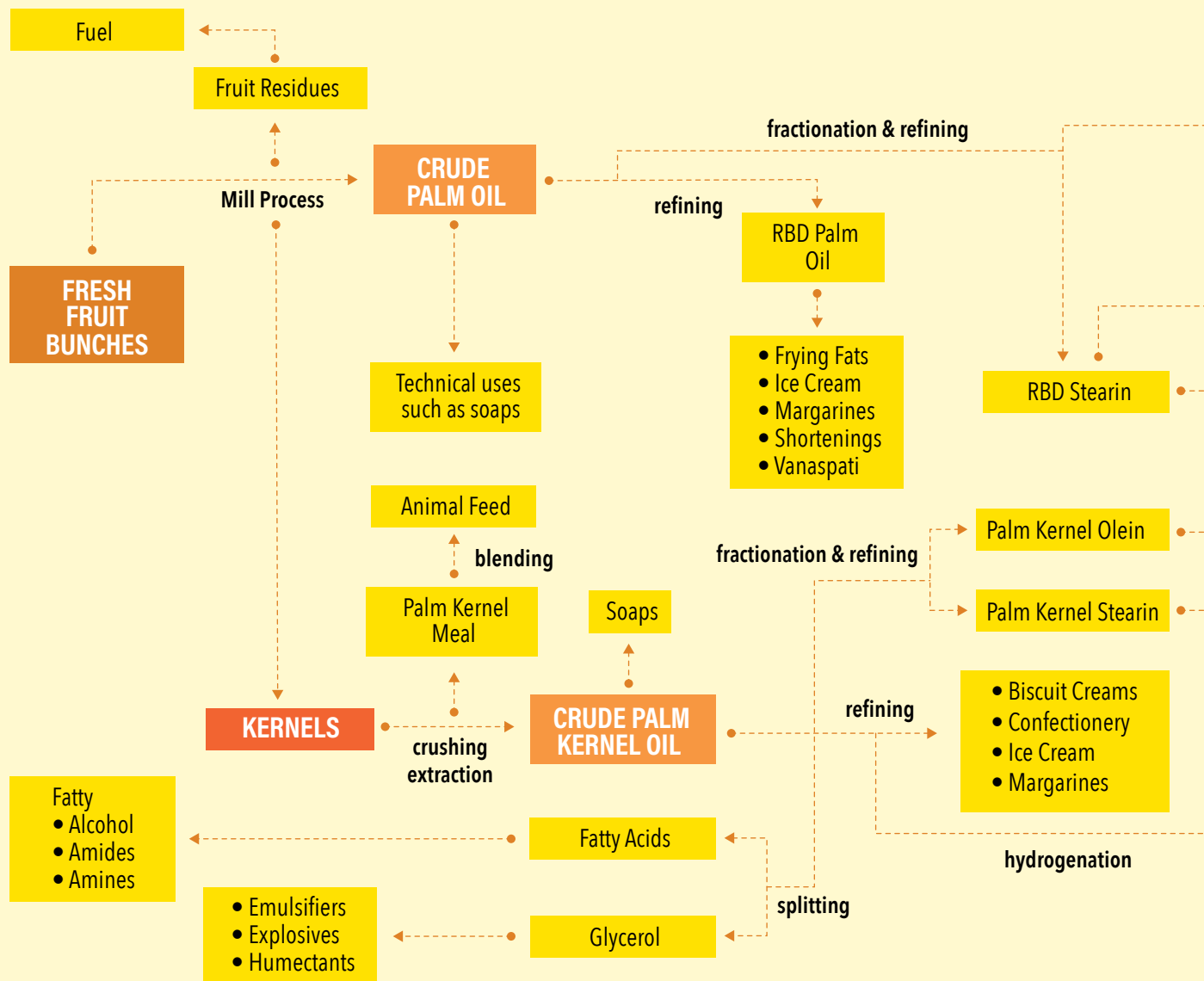


Part IV: PALM OIL & PALM KERNEL OIL APPLICATIONS

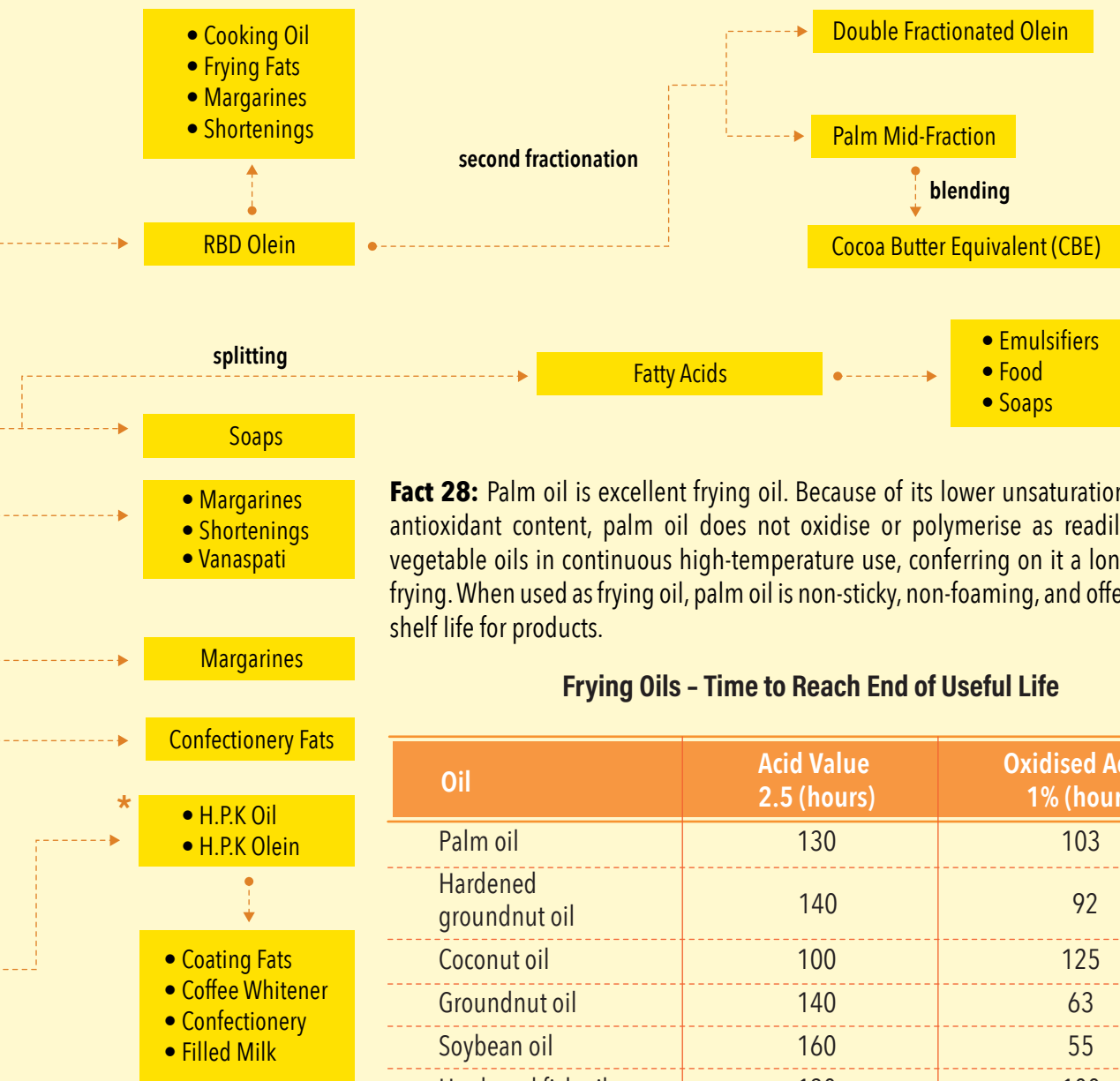
Source: Malaysian Palm Oil Council

Fact 27: A flow chart on the versatility of palm oil and palm kernel oil in food and non-food applications

The Versatility of Palm Oil & Palm Kernel Oil in Food and Non-Food Applications



Source: Pantzaris (2000)



Fact 28: Palm oil is excellent frying oil. Because of its lower unsaturation and high antioxidant content, palm oil does not oxidise or polymerise as readily as other vegetable oils in continuous high-temperature use, conferring on it a longer life for frying. When used as frying oil, palm oil is non-sticky, non-foaming, and offers a longer shelf life for products.

Frying Oils - Time to Reach End of Useful Life

Oil	Acid Value 2.5 (hours)	Oxidised Acids 1% (hours)
Palm oil	130	103
Hardened groundnut oil	140	92
Coconut oil	100	125
Groundnut oil	140	63
Soybean oil	160	55
Hardened fish oil	130	100

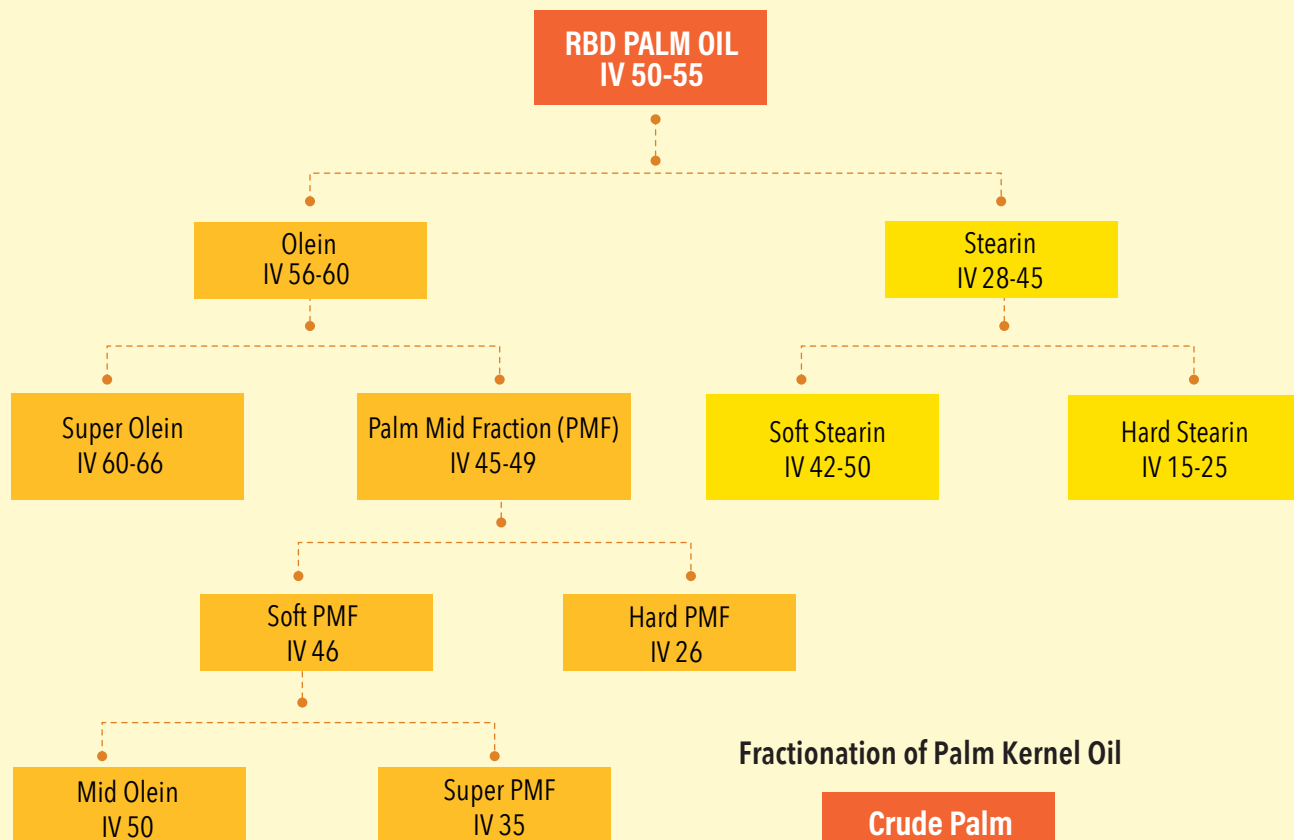
Note: Taking the two criteria together, palm oil has the longest shelf life of 103 hours.

Source: Berger (2005)

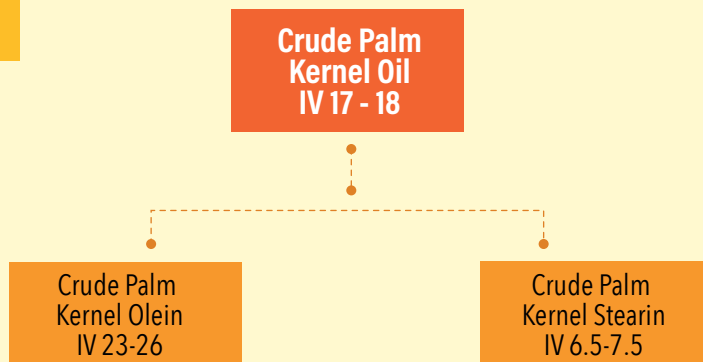
*H.P.K = Hydrogenated Palm Kernel

Fact 29: Palm oil and palm kernel oil can be fractionated into, *inter alia*, olein, stearin, and palm mid fraction (PMF) for different food applications. Interesterification can be introduced to make even more products for other uses.

Fractionation of Palm Oil



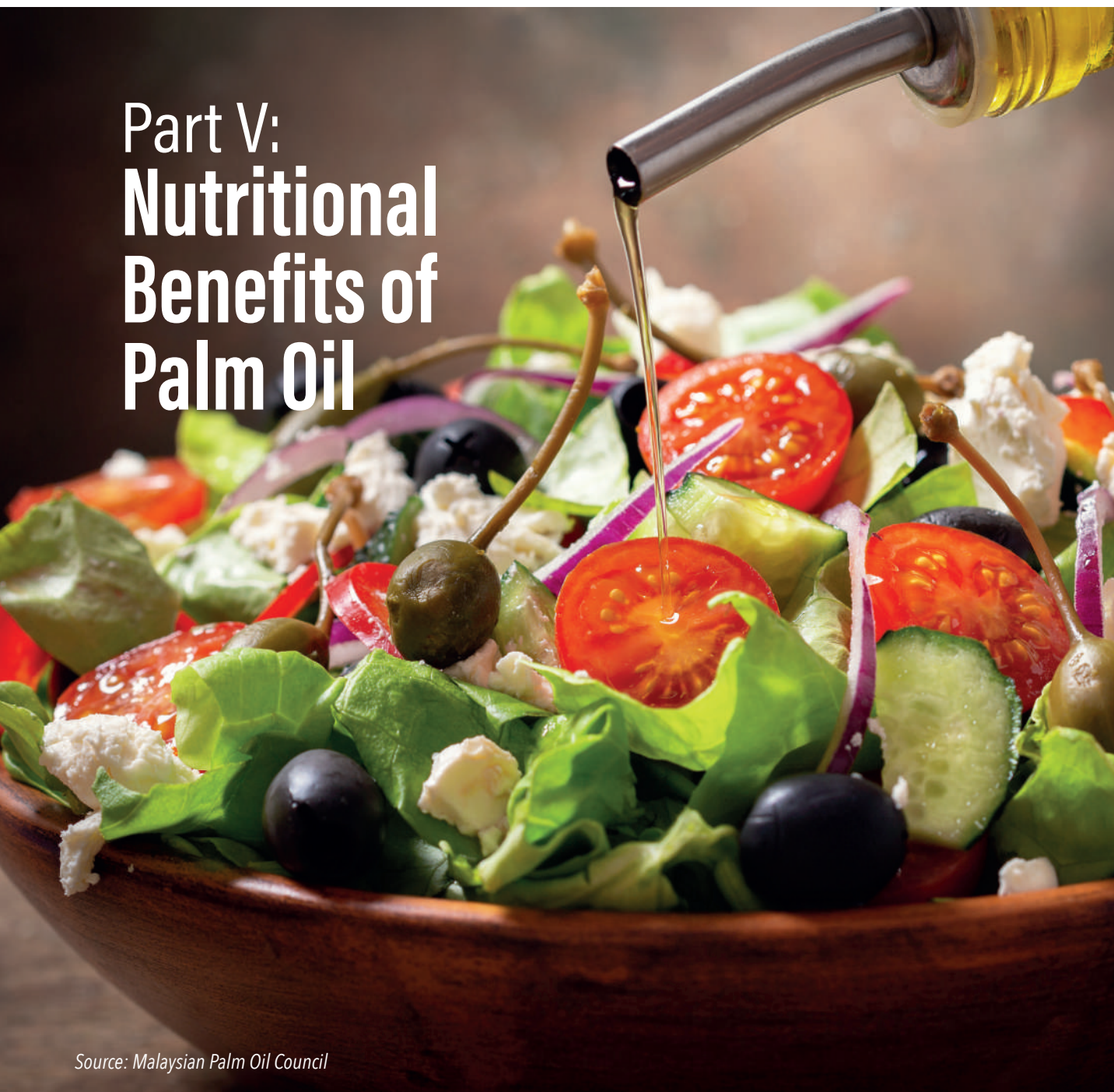
Fractionation of Palm Kernel Oil



Note: IV = Iodine Value

Source: Malaysian Palm Oil Board (1992)

Part V: Nutritional Benefits of Palm Oil



Fact 30: Unlike other oils, palm oil is a balanced oil as it contains an equal amount of unsaturated (mainly oleic) and saturated (mainly palmitic) fatty acids, with the former constituted mostly by the preferred monounsaturates.

Composition of Fatty Acids in Selected Oils

Oil	Monounsaturates (%)	Polyunsaturates (%)	Saturates (%)
Palm	40	10	50
Peanut	39	42	19
Olive	75	10	15
Corn	30	54	16
Soybean	25	60	15
Safflower	13	77	10
Coconut	5	1	94

Source: Malaysian Palm Oil Council (1991)

Fact 31: The main saturated fatty acid in palm oil is palmitic acid, which has a neutral effect and does not raise blood cholesterol levels. Other saturated fatty acids, in particular myristic, are known for their cholesterol-raising effects.

Fatty Acid Composition of Palm Oil and Its Effects on Blood Cholesterol

Fatty Acid	Composition (%)	Effect on Blood Cholesterol
Lauric (12:0)	0.2	Negative or neutral
Myristic (14:0)	1.1	Cholesterol-raising
Palmitic (16:0)	44.3	Neutral
Stearic (18:0)	4.6	Neutral
Oleic (18:1)	39.0	Lowers ^a
Linoleic (18:2)	10.5	Lowers ^a
Others (16:1, 18:3)	0.3	Lowers ^a
Total in palm oil	100.00	Lowers ^a

Note: ^a means cholesterol-reducing
Source: Ong and Goh (2002)

Fact 32: Thanks to its natural semi-solid state at room temperature, palm oil does not require hydrogenation in most food uses, thus obviating the issue of trans-fatty acids and uncommon cis- fatty acids, which have been shown to be detrimental to health, in solid fat products.

Source: Sundram, K., et al (2003)

Fact 33: A collaboration between researchers at the Malaysian Palm Oil Board and Brandeis University, USA, has produced a blend of natural and cholesterol-free fats that readily meets the ideal balance of saturated, monounsaturated, and polyunsaturated fatty acids (1:1:1 ratio). This fatty acid ratio is recommended by the American Heart Association (AHA) in its effort to reduce the incidence of cardiovascular diseases (CVDs).² Today, this blend of fats is commercially available as the Smart Balance products.

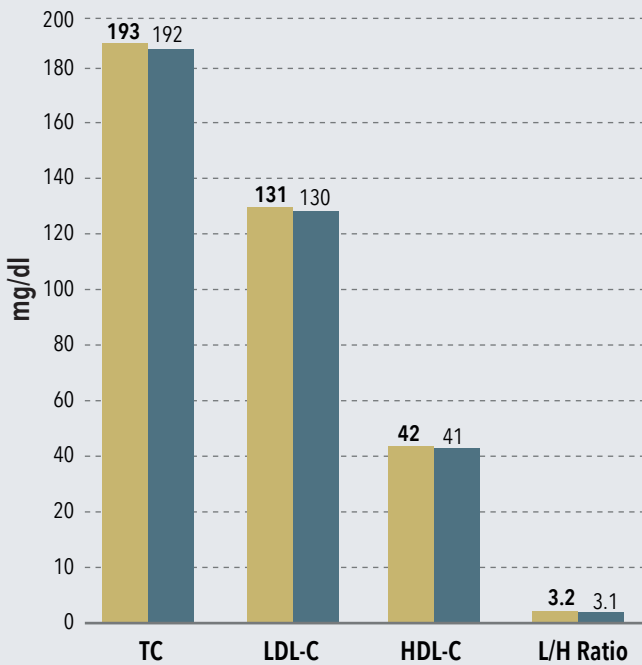
²Source: Sundram, K., et al (1996)



Source: GFA Brands Inc.

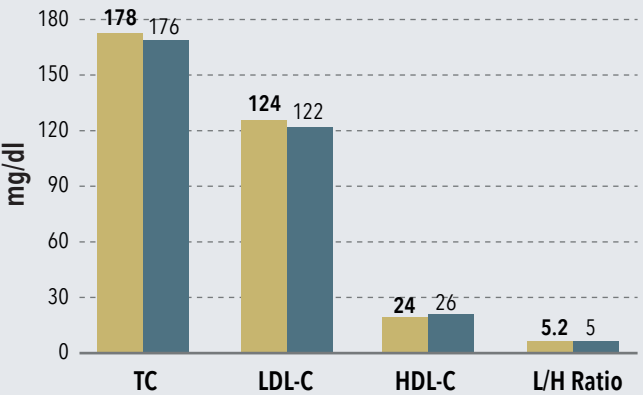
Fact 34: Numerous studies comparing the health effects of palm olein and olive oil (both high in oleic acid) have shown that palm olein and olive oil have similar beneficial cholesterol-modulating effects in protecting humans against CVDs.

A Comparison between Palm Olein and Olive Oil on Their Effects on Cholesterol Modulation



Source: Ng, T.K.W., et al (1992)

■ Palm Olein ■ Olive Oil



Source: Choudhry, N., et al (1995)

Note: Both studies showed that palm olein and olive oil have comparable effects on total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and the ratio of low-density/ high-density cholesterol (L/H).

Fact 35: Palm oil is one of the 17 edible oils, which have been accepted as meeting the FAO/WHO Food Standard requirements under the CODEX Alimentarius Commission Programme.
Source: Food and Agriculture Organisation & World Health Organization (1983)

Fact 36: Like all types of vegetable oil, palm oil is cholesterol-free.

Cholesterol Content in Selected Oils & Fats

Oil/Fat	Range (ppm or mg/kg)	Mean (ppm or mg/kg)
Palm (mesocarp)	13 - 19	18
Palm (kernel)	9 - 40	17
Sunflower	8 - 44	17
Soybean	20 - 35	28
Rapeseed	25 - 80	53
Cottonseed	28 - 108	44
Coconut	5 - 24	14
Maize	18 - 95	50
Cocoa Butter*	n.a	59
Beef Tallow*	800 - 1400	1100
Butter*	2200 - 4100	3150
Lard*	3000 - 4000	3500

*Note: *Gunstone, F.D., et al (1986)*
Source: Downes, M.J. (1982, 1983, 1984, 1985)

Fact 37: Several controlled human studies in Europe, the USA, and Asia have confirmed that there is no significant rise in serum total cholesterol when palm oil, providing most of the dietary fat, is used as an alternative to other fats in the habitual diet. In these studies, the level of HDL cholesterol, regarded as beneficial, was unaltered or significantly raised.
Source: Sundram, K., et al (1992)

Fact 38: The content of Lipoprotein (a) in blood plasma, a potent risk factor for coronary heart disease, was significantly reduced when palm oil provided most of the dietary fat.
Source: Honstra, G., et al (1991)

Fact 39: Refined palm oil, as used in foods, is a rich source of tocotrienols and tocopherols having Vitamin E activity. Refined palm oil still contains a high amount of Vitamin E, up to 500 ppm.

Tocopherols (T) and Tocotrienols (T3) Determined in Vegetable Oils (mg/kg)

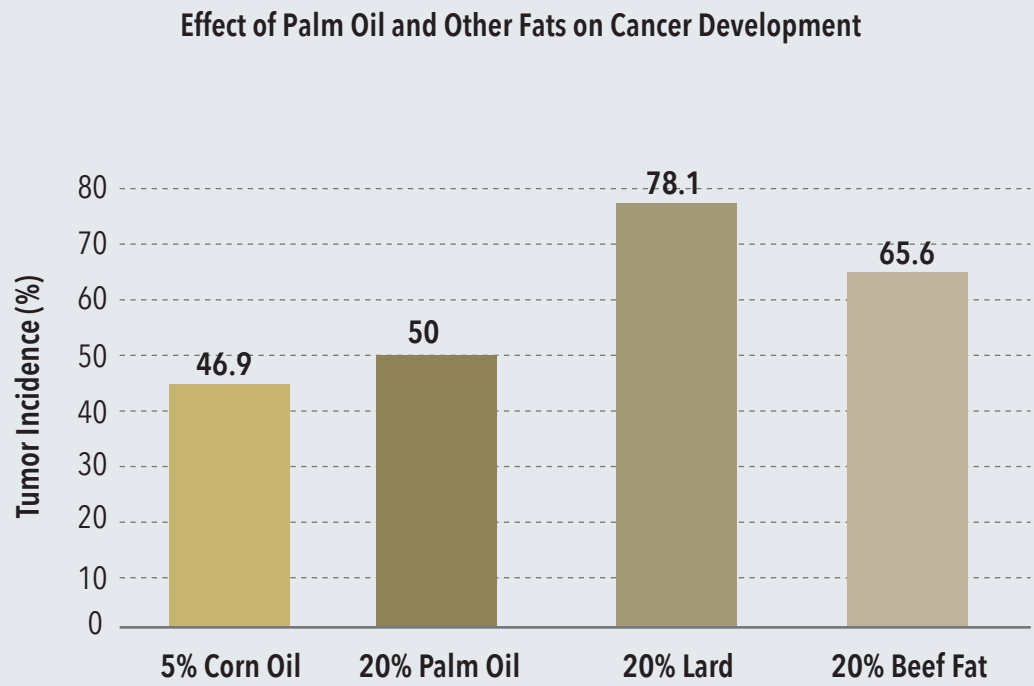
Oil	α-T	β-T	γ-T	δ-T	α-T3	γ-T3	δ-T3
Cocoa butter	11	-	170	17	2	-	-
Coconut*	-	-	-	3	20	-	-
Corn*	134	18	412	39	-	-	-
Cottonseed	573	40	317	10	-	-	-
Groundnut	169	5	144	13	-	-	-
Mustard	75	-	494	31	-	-	-
Olive	93	-	7	-	-	-	-
Palm	150	-	-	-	117	297	80
Palm*	133	-	-	-	130	204	45
Rape*	70	16	178	7	-	-	-
Rice bran*	249	15	47	-	167	141	-
Safflower	477	-	44	10	-	-	-
Soybean*	116	34	737	275	-	-	-
Sunflower*	608	17	11	-	-	-	-

*Note: *Refined oils*
Source: Ong A.S.H. (1993)

Fact 40: Palm tocotrienols have been demonstrated in human and animal studies to reduce the production of cholesterol in the body. A study at the University of Wisconsin, USA, showed that palm tocotrienols inhibit the action of enzymes that are responsible for the production of cholesterol in the body.
Source: Qureshi, A. A., et al (1995)

Fact 41: Palm tocotrienols are also showing much promise in cancer research. Some studies have demonstrated that palm tocotrienols can inhibit the growth of cancer cells.
Source: Nesaretnam, K., et al (2005)

Fact 42: Compared to a number of other edible oils, dietary palm oil reduces the number of chemically-induced tumours in rats.



Note: A 20% palm oil diet was protective and comparable to low fat (5%) corn oil diet than the 20% lard and 20% beef fat diets.
Source: Sylvester, P.W., et al (1986)

Fact 43: Red palm oil (RPO) is the only commercially available refined oil that contains substantial amounts of carotenoids as well as Vitamin E. There is a bouquet of more than 20 carotenes in red palm oil which explains its deep red colour. RPO contains about 50 milligrams of carotenes in every 100 grams of oil (500 ppm), mostly as beta-carotene (55%) and alpha-carotene (35%).

Carotene composition of refined red palm oil and crude palm oil

Carotene	Refined Red Palm Oil (%)	Crude Palm Oil (%)
Phytoene	2.0	1.3
Phytofluene	1.2	0.1
Cis-β-carotene	0.8	0.7
β-carotene	47.4	56.0
α-carotene	37.0	35.1
Cis- α-carotene	6.9	2.5
γ-carotene	1.3	0.7
ζ-carotene	0.5	0.3
δ-carotene	0.6	0.8
Neurosporene	trace	0.3
β-Zeacarotene	0.5	0.7
α-Zeacarotene	0.3	0.2
Lycopene	1.5	1.3
Total (ppm)	545	673

Source: Ooi, C., et al (1994)

Fact 44: Like other edible oils and fats, palm oil is readily digested, absorbed, and utilised as a source of ready energy. Refined palm oil and its processed fractions, palm olein and palm stearin, are in fact 95-97% digestible, which is within the digestibility range of 93-99% for most edible oils and fats.

Source: Ng, et al (1987, 1988)

Part VI:
**THE OIL PALM &
THE ENVIRONMENT**

Source: Malaysian Palm Oil Council

Fact 45: An oil palm plantation is more effective than a rainforest in generating new biomass, which is a potential renewable fuel.

A comparative study by Henson [1999] showed that an oil palm plantation assimilated up to 36.5 tonnes of dry matter/ha/year, which is better than that assimilated by natural rainforest.

Fact 46: Oil palm plantations are as effective as rainforests in acting as a carbon sink to absorb carbon dioxide.

The same study by Henson also showed that the oil palm plantation is capable of accumulating up to 8.3 tonnes of biomass/year, which is higher than that accumulated by the rainforest.

A Comparison of Some Physiological Perimeters of the Oil Palm and Tropical Rainforest

Parameter	Oil Palm (plantation)	Rainforest
Gross assimilation (t CO ₂ /ha/year)	161.0	163.5
Total respiration (t CO ₂ /ha/year)	96.5	121.1
Net assimilation (t CO ₂ /ha/year)	64.5	42.4
Leaf area index	5.6	7.3
Photosynthetic efficiency (%)	3.18	1.73
Radiation conversion efficiency (g/M)	1.68	0.86
Standing biomass (t/ha)	100	431
Biomass increment/year (t)	8.3	5.8
Dry matter productivity/year (t)	36.5	25.7

Source: Henson (1999)

Fact 47: The oil palm is an energy-efficient crop that requires the least energy input to produce a tonne of vegetable oil.

In comparison to other oil crops, the oil palm requires the least inputs of agrochemicals and fossil fuel for cultivation.

Input-Output in Cultivating the Oil Palm and Other Oil Crops

Input & Unit	Input to produce one tonne of vegetable oil by the crop			
	Palm Oil	Soybean Oil	Sunflower Oil	Rapeseed Oil
Seed/fruit for extraction (kg)	4500*	5000	2500	2500
Inputs				
i) Nitrogen (kg N)	47	315	96	99
ii) Phosphate (kg P ₂ O ₅)	8	77	72	42
iii) Pesticides and herbicides (kg)	2	29	28	11
iv) Others (kg)	88	117	150	124
v) Energy (GJ)	0.5	2.9	0.2	0.7
Outputs				
a) Emission to soil and water				
i) Nitrogen	5	32	10	10
ii) Phosphates	2	23	22	13
iii) Pesticides/herbicides	0.4	23	22	9
b) Emission to air (kg)				
- NO _x	0.5	4	0.3	0.8
- SO ₂	0.2	2	0.1	0.2
- CO ₂	32	205	16	50
-Pesticides/herbicides	0.1	6	6	2

Note: *Fruit bunches

Source: Food and Agriculture Organisation (1996)

Input-Output in Processing Oil Palm Fruits and Other Oilseeds to Vegetable Oils and Meals

Item and Unit	Input-Output per tonne of oil			
	Palm Oil	Soybean Oil	Sunflower Oil	Rapeseed Oil
Seed/fruit for extraction (kg)	4500 FFB*	5000	2500	2500
Final Product : oil (kg)	1000	1000	100	1000
: meal	200	1500	1500	4000
Input for extraction				
Solvent (Hexane) (kg)	nil	4.3	4	4
Energy (GJ) ¹	a	2.2	3	3
Emission to air (kg)				
- Solvents	nil	4.3	3.8	3.9
- NO _x	-	0.1	0.3	0.3
- SO ₂	-	0.2	0.7	0.7
- CO ₂	-	56	164	164
Emission to water (kg)				
- COD ²	2	Negligible	Negligible	Negligible

Notes:

* Fruit bunches

^a The fuel for producing all the steam required to process the fruits is the fruit residues, e.g. fibre and shell

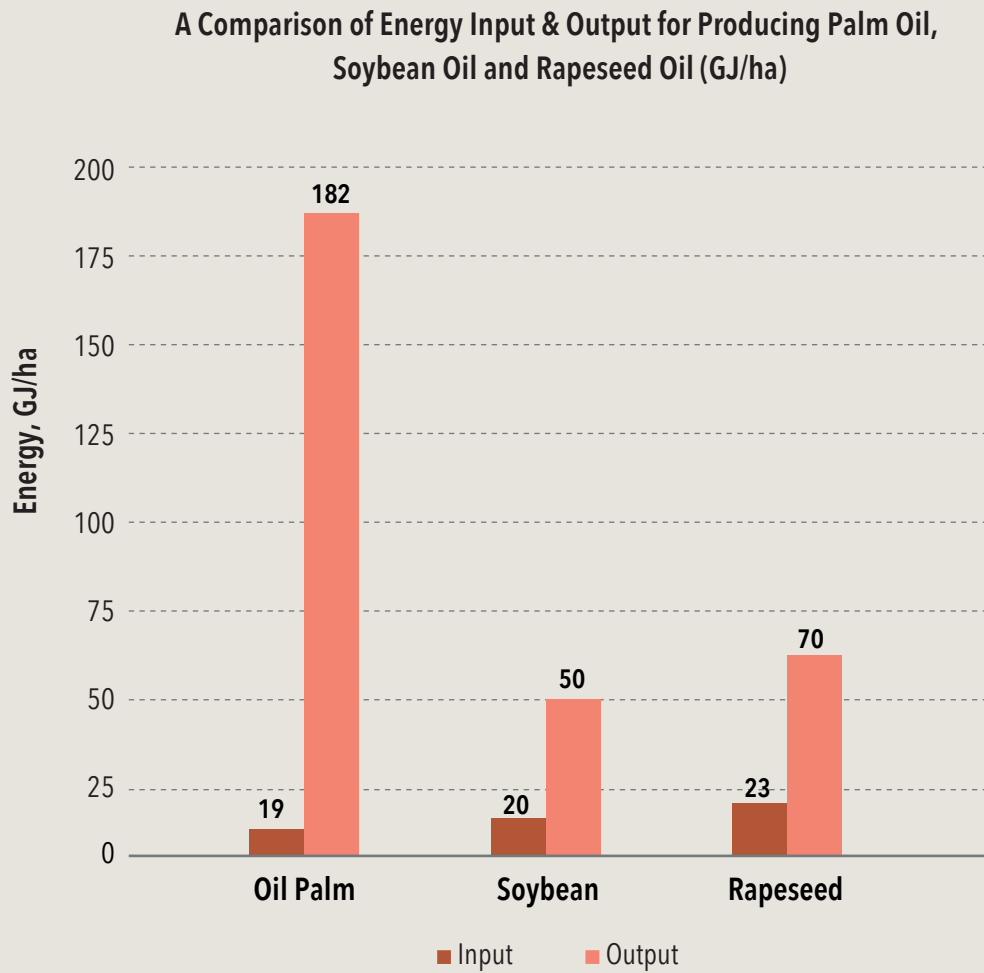
¹ Total is underestimated, as the energy for producing the solvent (hexane) is not included.

² Chemical Oxygen Demand.

Source: Singh (1999)

Fact 48: The oil palm leads other crops in terms of energy balance.

The oil palm is the most efficient crop, producing the highest energy output:input ratio. In absolute terms, the oil palm also requires the lowest inputs of pesticides, fertilisers, and fuel for unit production of vegetable oil.



Source: Wood & Corley (1991)

Fact 49: The Malaysian oil palm industry adheres to sustainable practices that ensure the environment and biodiversity are not harmed by the cultivation of the oil palm. Indeed, the Malaysian oil palm plantations have adopted a set of Good Agricultural Practices (GAPs) to minimise the impact of their activities on the environment.

- i) Integrated Pest Management (IPM) minimises the use of pesticides by relying on biological control to protect the palm trees. Some examples are the barn owl to control rat populations; parasitoids, predatory insects, and entomofungi to prey on leaf-defoliating insects, as well as *Cassia Cobanensis* plant that attracts the bagworm's natural predator. The fewer chemicals used, the less the environment is damaged.

Predatory Insects and Barn Owl in An Oil Palm Field



Source: Malaysian Palm Oil Council

- ii) Biological control is also used in weed control, for example, grazing ruminants under the palms, and by planting a legume cover to fix nitrogen and smother weeds. The leguminous cover also prevents soil erosion and improves soil tilth and rainfall retention.

Goat Rearing to Control Weeds in an Oil Palm Plantation



Source: Malaysian Palm Oil Council

- iii) Zero-burning is practised in clearing the oil palm's stands during replanting where the old trees are mechanically pushed over, shredded, and left to decompose *in situ*. There is, therefore, no air pollution and most importantly, the nutrients in the old crop are recycled into the soil.

Zero-burning During Replanting



Source: Malaysian Palm Oil Council

Available Nutrients and Fertiliser Equivalent in Oil Palm Biomass at Replanting (per ha basis)

Palm Residue	Dry Matter (tonne/ha)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Mg (kg/ha)
Above-ground	85	577	50	1,255	141
Below-ground	16	65	8	129	15
Total	101	642	58	1,384	156
		A/S	CIRP	MOP	KIES
Fertiliser Equivalent (kg)		3,060	370	2,770	1,000

A/S = Ammonium Sulphate CIRP = Christmas Island Rock Phosphate MOP = Muriate of Potash KIES = Kieserite

Source: Khalid, H., et al (1999, 1999a)

- iv) Hilly land is contoured with back slopes for planting. The terraces are mulched along their length with a line of pruned fronds to minimise soil erosion and water run-off.

Example of Terracing in an Oil Palm Plantation



Source: Malaysian Palm Oil Council

Fact 50: The expansion of oil palm cultivation in Malaysia does not encroach into forest areas.

The increase in oil palm areas in Malaysia is either through the planting of idle land or conversion from other crops. Since 1990, 1.365 mil ha of land, which used to be under other crops, had been converted to the oil palm. Today, the oil palm is planted on 5.90 mil ha, which is about 18% of the total land area of Malaysia. The country also has about 18.28 mil ha or 55.3% of its total land area under permanent forests, which is still more than the commitments it made at the Rio Earth Summit in 1992.

Changes in Area under the Main Tree Crops in Malaysia (mil ha)

Year	Oil Palm	Rubber	Cocoa	Coconut	Total
2014	5.392	1.069	0.016	0.088	6.565
2015	5.643	1.074	0.017	0.082	6.816
2016	5.738	1.078	0.017	0.085	6.918
2017	5.811	1.082	0.017	0.083	6.993
2018	5.849	1.083 ^e	0.015	0.084	7.031 ^e
2019	5.900	1.084 ^e	0.015 ^e	0.082 ^e	7.081 ^e

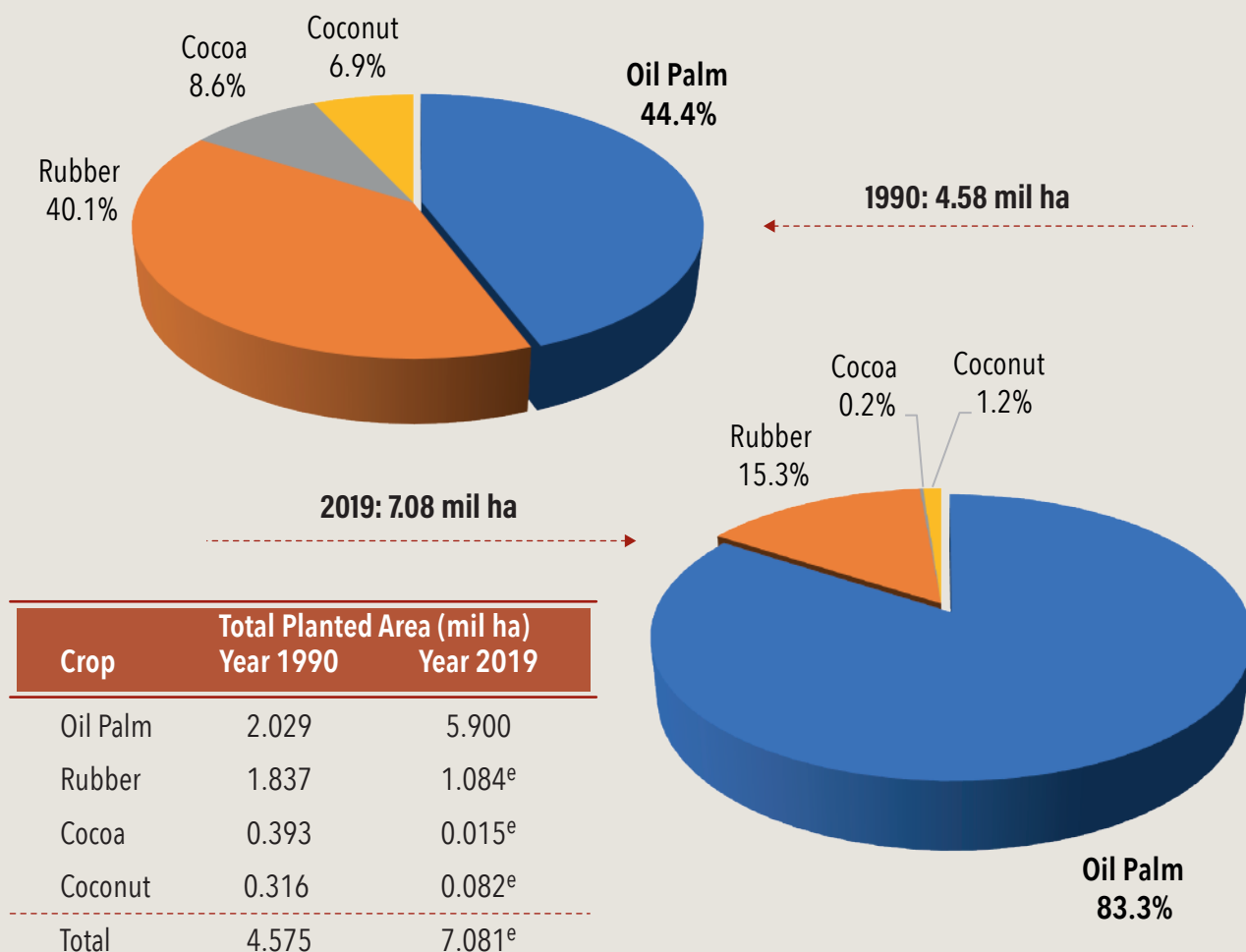
^e estimated figure

Source: Department of Agriculture Peninsular Malaysia (2018, 2020), Malaysian Palm Oil Board (2020a), Malaysian Cocoa Board (2020), Malaysian Rubber Board (2020)



Source: Malaysian Palm Oil Council

Changes in Area under the Main Tree Crops in Malaysia (mil ha)



Note: ^e estimates

Source: Department of Agriculture Peninsular Malaysia (2020), Department of Statistics Malaysia (2015), Malaysian Cocoa Board (2020), Malaysian Palm Oil Board (2020a), Malaysian Rubber Board (2020), Ministry of Primary Industries Malaysia (1993)

Since 1990, rubber, cocoa, and coconut had collectively lost 1.365 mil ha of their planted area, which were mainly converted to oil palm's area.

Fact 51: The Malaysian palm oil industry is committed to implementing the Principles & Criteria (PnC) of the Roundtable on Sustainable Palm Oil (RSPO); widely regarded as the world's most stringent certification scheme available today for sustainable palm oil. Currently, Malaysia produces about 4.48 mil tonnes of RSPO-certified palm oil from 1.235 mil ha of certified oil palm areas. This is expected to rise in the future.

Overview of the Malaysian Palm Oil Industry Performance in the Production of RSPO-Certified Palm Oil (as of May 10th 2020)

Entity	Certified Area (ha)	Certified Palm Oil Mill	*CSPO (tonnes)
Boustead Plantations Berhad	37,236	5	128,684
Carotino/JC Chang Group	32,559	3	106,056
FGV Holdings Bhd	180,342	31	457,673
Genting Plantations Berhad	55,436	8	199,542
Hap Seng Plantations Holdings Bhd	33,485	4	150,153
Harus Abadi Sdn. Bhd	567	1	2,062
IOI Corporation Berhad	184,281	15	790,061
Johor Corporation	62,069	5	259,614
Keck Seng (Malaysia) Berhad	3,412	1	8,685
Keresa Plantations Sdn Bhd	6,023	1	24,780
Kretam Holdings Berhad	19,475	3	70,909
Kuala Lumpur Kepong Berhad	108,958	11	441,192
Lam Soon Cannery Private Ltd	10,105	2	46,518
N.Y. Hiew (Holdings) Sdn. Bhd.	456	1	1,907
Sime Darby Plantation Sdn Bhd	348,296	33	1,282,988
Spark Glory Sdn. Bhd.	127	1	500
TDM Plantation Sdn Bhd	36,625	2	91,511
Tian Siang Holdings Sdn Bhd	-	1	4,750
TSH Resources Berhad	1,773	2	6,635
United Plantations Bhd	37,658	4	193,850
Wilmar International Limited	75,878	8	215,106
TOTAL	1,234,761	142	4,483,176

Fact 52: In 2019, Malaysia produced 22.12 million tonnes of palm oil and palm kernel oil, accounting for 11.1% of global vegetable oil production of 10 major oilseeds (199.9 million tonnes). This was achieved with only 5.24 million hectares of harvested area, which represents about 1.8% of the world's 10 major oilseed harvested areas.

Oil Palm - A Malaysian Sustainable Achievement

2019	Total Harvested Area (mil ha)	Total Vegetable Oil Production (mil tonnes)
Malaysia's Oil Palm	5.24	22.12
World's 10 Major Oilseeds	290.74	199.87

Source: Oil World (2020)

A photograph of an industrial palm oil processing facility. In the foreground, two large, horizontal, cylindrical metal tanks are visible. The tank on the left has a red number '4' and a label that reads 'PM1 89483'. The tank on the right has a red number '2' and a label that reads 'PM1 57166'. Both tanks have their circular doors open, revealing dark interiors. In the background, there are more industrial structures, including pipes, scaffolding, and a large, high-ceilinged building with a corrugated metal roof. The overall scene is dimly lit, with light coming from the background.

Part VII: **THE MALAYSIAN PALM OIL INDUSTRY**

Source: Malaysian Palm Oil Council

OVERVIEW

The palm oil industry has been the backbone of Malaysia's social and economic development. Since more than 88% of its production is exported, the industry is one of the top earners for the country, contributing about RM 64.8 billion in foreign exchange in 2019. It also provides direct employment to close to 0.55 million people.

From its humble beginnings, the Malaysian palm oil industry has expanded and flourished while learning its way about its present state of excellence. Today, the industry is well-developed and at its strongest ever. Currently, the sector is under the Ministry of Plantation Industries and Commodities, under which two agencies are responsible for its progress and promotion - the Malaysian Palm Oil Board (MPOB) and the Malaysian Palm Oil Council (MPOC). These agencies undertake R&D, promotion and marketing, regulatory and enforcement functions, as well as provide economic and technical advisory services. This is done to ensure that the industry will continually achieve higher yields, offer more products as well as increase its share of the global oils and fats market.

The industry can be divided into three levels - plantation, milling, and refining - represented by their respective association(s) to coordinate mutual and separate interests. The Malaysian Palm Oil Association (MPOA) represents the planters or growers and the Federation of Palm Oil Millers' Associations of Malaysia (POMA) speaks for the millers. The refiners are represented by the Palm Oil Refiners' Association of Malaysia (PORAM). The oil palm industry is closely linked to its sister industry - the oleochemical sector - represented by the Malaysian Oleochemicals Manufacturers' Group (MOMG).

To ensure that all the activities do not pose problems, the industry is subject to several laws and regulations, making it one of the most regulated industries in the world. Some of the laws and regulations include the Land Acquisition Act 1960, Protection of Wildlife Act 1972, Environmental Quality (Clean Air) Regulation 1978, Pesticides Act 1974 (Pesticides Registration) Rules 1976, Labour Law, Workers' Minimum Standard of Housing and Amenities Act, Hazard Analysis & Critical Control Points (HACCP), and Occupational Safety and Health Act 1977.

Through its long, colourful, and historic journey, the Malaysian palm oil industry has and will continue to prosper while continuing to assume a significant role in the country. The good demand for the oil, as well as new opportunities in the form of biodiesel as an alternative fuel, will ensure that the journey forward will be equally exciting. The Malaysian palm oil industry is undoubtedly the pride of the nation.



RELATED ORGANISATIONS

Ministry of Plantation Industries & Commodities (MPIC)

No. 15, Aras 6 - 13, Persiaran Perdana
Presint 2
Pusat Pentadbiran Kerajaan Persekutuan
62654 Putrajaya
Tel: +60 (3) 8000 8000
Fax: +60 (3) 8000 3482

Malaysian Palm Oil Association (MPOA)

T3-08-09, UOA Business Park
No. 1, Jalan Pengaturcara U1/51A
40150 Shah Alam, Selangor
Tel: +60 (3) 5021 0730
Fax: +60 (3) 5021 0112

Malaysian Palm Oil Board (MPOB)

No. 6, Persiaran Institusi
Bandar Baru Bangi
43000 Kajang, Selangor
Tel: +60 (3) 8769 4400
Fax: +60 (3) 8925 9446

Malaysian Palm Oil Council (MPOC)

Level 7, Menara Axis
No. 2, Jalan 51A/223, Section 51A
46100 Petaling Jaya, Selangor
Tel: +60 (3) 7806 4097
Fax: +60 (3) 7806 2272

Malaysian Palm Oil Certification Council (MPOCC)

Unit 2-1, Level 2, Tower 2B
UOA Business Park
No. 1, Jalan Pengaturcara U1/51A
40150 Shah Alam, Selangor
Tel: +60 (3) 5569 9676
Fax: +60 (3) 5567 9943

The Malayan Edible Oil Manufacturers' Association (MEOMA)

Level 1, Wisma MEOMA
No. 134, Jalan Tun Sambanthan
50470 Kuala Lumpur
Tel: +6 (03) 2274 7420
Fax: +6 (03) 2273 6698

Malaysian Oleochemical Manufacturers Group (MOMG)

Wisma FMM
No. 3, Persiaran Dagang, PJU 9
Bandar Sri Damansara
52200 Kuala Lumpur
Tel: +60 (3) 6286 7200
Fax: +60 (3) 6277 6714

Malaysian Biodiesel Association (MBA)

Wisma FMM
No. 3, Persiaran Dagang, PJU 9
Bandar Sri Damansara
52200 Kuala Lumpur
Tel: +6 (03) 6286 7200
Fax: +6 (03) 6277 6714

The Palm Oil Refiners Association of Malaysia (PORAM)

801C/802A, Level 8, Block B
Executive Suites, Kelana Business Centre
No. 97, Jalan SS7/2
47301 Kelana Jaya, Selangor
Tel: +60 (3) 7492 0006
Fax: +60 (3) 7492 0128

The Federation of Oil Palm Millers' Associations of Malaysia (POMA)

No. 27, Jalan Soo Ah Yong
Taman Canning
31400 Ipoh, Perak
Tel: +60 (5) 548 2279
Fax: +60 (5) 545 0380

National Association of Small Holders (NASH)

D-1-11, Setiawangsa Business Suites
Jalan Setiawangsa 11
Taman Setiawangsa
54200 Kuala Lumpur
Tel: +60 (3) 4251 0984
Fax: +60 (3) 4266 4444

Sarawak Land Consolidation & Rehabilitation Authority (SALCRA)

Wisma SALCRA
No. 1, Lot 2220, Block 26
MTLD, Jalan Dato Mohd Musa
94300 Kota Samarahan, Sarawak
Tel: +60 (82) 621 881
Fax: +60 (82) 621 918

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