JAOCS News Feature

Malaysian palm oil[1]

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Palm oil is growing rapidly in importance as an export oil. The Malaysian palm oil development is described, and predictions are that it will supply 1,400,000 tons of oil by 1975 and 1,750,000 tons by 1980. Production in 1971 was ca. 580,000 tons.

Introduction

Palm oil is from the fruit of the oil palm, *Elaeis guiniensis.* This palm, as the name implies, is regarded as indigenous to Africa and was not introduced to Southeast Asia until the second half of the 19th century. In fact the first recorded oil palm to be established in the Malayan region was received, via Ceylon, from Kew Gardens in 1870 and planted in the Singapore Botanical Gardens. The purpose of the first palms was purely ornamental, and it was not until 1917 that the first commercial estate planting was undertaken at Tennamaram Estate in Kuala Selangor; the rubber slump in 1920 provoked interest in this new potential crop, and from that date onward planting of oil palms as an estate crop has expanded until now the palm oil industry is the fourth largest in Malaysia, ranking immediately behind rubber, tin and timber.

[1]Presented at the 49th Annual Congress of the International Association of Seed Crushers, Kyoto, Japan, May 1972.

In the last decade, the area under oil palms has increased almost six-fold, and production of palm oil has grown at an average annual rate of over 16.5%.

The oil palm and its fruit

In appearance the oil palm is rather like a date palm, with a large head of pinnate feathery fronds growing from a sturdy trunk; under natural conditions it will grow to a height of well over 50 ft and has a lifetime of 60 years or more. Thus it has every appearance of being a good-sized tree. However, botanically speaking, the oil palm is a grass having no tap root and only a single growing point; for this reason it cannot be propagated vegetatively, and all palms must be grown from seed.

The palm has another somewhat unusual characteristic, in that each palm bears either male or female inflorescences, though usually only one or the other at any one time. Since only the female inflorescences will develop into fruit, it is obviously highly desirable that these should be in the majority, but no way has yet been found to scientifically control the cycle and ensure that male inflorescences are restricted to the numbers needed for fertilization.

The fruit itself forms as a bunch in the upper leaf axils, firmly wedged between the trunk and the leaf base. The bunch, always referred to in the industry as FFB (fresh fruit bunch), varies in size with the age of the palm but in a mature specimen weighs 40-50 lb. and is made up of 400-1500 individual fruits (cases have been recorded of individual bunches weighing over 100 lb. with over 2000 fruits); since the whole bunch is a tight mass, protected by spiny projections, it is not an easy matter either to harvest or transport.

Individual fruits differ depending on the variety of palm, of which there are three in current commercial use, distinguished mainly by the proportions of pulp, shell and kernel in the fruits. However the general form is that of a drupe, about twice the size of a large date, with an outer pulp (the mesocarp), a shell and inside the shell a kernel containing the embryo. The mesocarp is the source of palm oil; the shell provides a useful source of fuel for the pressing machinery, and the kernel provides palm kernel oil and palm kernel meal.

TABLE I

Usual Specifications of Purified Palm Oil

Characteristic	Ordinary	Special prime bleachable
Free fatty acids (as palmitic acid), %	3-5	1-2
Moisture, %	0.1	<0.1
Dirt, %	0.01	<0.005
Copper, ppm	0.2	<0.02
Iron, ppm	10	<10
Iodine value	45-56	53 ± 1.5
Carotene, ppm	500-700	500
Tocopherol, ppm	400-600	800
Bleachability (Lovibond scale)	3.5R 35 Y	2.0R 20 Y

Processing

Palm oil is extracted from the fruit by pressure and palm kernel oil either by pressing or solvent extraction. In the first instance, the whole bunch is sterilized by live steam; then the fruit are stripped from the bunch, "digested" and processed mechanically—nowadays mostly in screw presses. The resultant crude oil is then purified, and excess moisture is removed, while the nuts are separated from the press residue, cracked and the kernels extracted. The kernels are then dried to ca. 6% moisture content, for delivery to the seed mill or extractor or for shipment overseas; crushing of the kernels will yield ca. 49% palm kernel oil and 51% cake.

Apart from facilitating pressing, it is most important that the fresh fruit be sterilized at the earliest possible moment after harvesting. This is because of the somewhat unusual process followed as the fruit ripens. In the early stages of fruit development, the mesocarp contains a large proportion of carbohydrates; and as ripening progresses, the carbohydrate content decreases and the fat content increases correspondingly; when the fruit is harvested this process ceases, and no more oil is formed. However harvesting does not stop the working of fat-splitting enzymes which are present in the fruit and break down the fats into free fatty acids (FFA) and glycerol. This reaction continues until the process is stopped by heating. At the moment of harvesting the oil in the mesocarp is practically neutral—only ca. 0.5% of free fatty acids; but within hours the amount of acid can rise to a significant figure, especially if the fruit has been bruised or damaged.

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The end product

The character and quality of oil produced after processing depends, of course, upon the method used and the degree of quality control. Oil destined for export to refiners and eventual commercial end users is currently produced to a standard specification of 5% FFA (as palmitic acid), but to meet the buyer's increasing demands for oil of even higher quality (which costs less to refine and bleach) it is now common for Malaysian oil to be produced with a FFA value of 3% or even less. It is indeed possible to meet even more exacting requirements and special prime bleachable (SPB) oil can be offered in limited quantities at additional cost.

When purified and ready for shipment palm oil normally falls within the specifications listed in Table I. It should, however, be emphasized that at present there are no standard international specifications for palm oil.

Storage and shipment

The main problem in connection with storage and shipping of palm oil is that of oxidation, which is accelerated in the presence of heavy metals such as copper and iron. Palm oil, due to its relatively high content of tocopherol, has good natural resistance to oxidation; but once oxidation takes place the carotene in the oil becomes degraded and increasingly difficult (and costly) to remove by bleaching. It is therefore necessary to take stringent precautions both in storing (by avoiding uncoated steel tanks) and in shipping. In particular, care must be taken to ensure that no unnecessary heat is applied at any time, although in order to obtain efficient pumping temperatures of ca. 130 F are needed, and in order to avoid solidifying in transit a minimum temperature of ca. 95 F is required. However qualified carriers are fully aware of the stringent regulations relevant to cleanliness, make-up of tanks and temperature limitation, and it is rare for oil to deteriorate in transit.

End uses

In Africa palm oil was at first used solely for edible consumption; later it was used in such fields as tin plating and certain types of lubrication and, particularly, in soap making. In this technical field, however, synthetic substances can be and have been produced which are equally satisfactory and less costly, with the natural result that detergents are ousting soaps, and palm oil is once again largely restricted to use in the edible field. Here the main uses are for shortenings (particularly in the US and the UK), frying fats, pastry and baking fats, vanaspati and margarine. For all these purposes it is an excellent vegetable oil which does not foam or splatter and is of a consistency which does not require a great deal of hydrogenation for hardening.

Palm oil, like other vegetable fats and oils, is a glyceride made up of a combination of fatty acids and glycerol with a relatively high carotene content (carotene, which has a vitamin value, is responsible for the deep orange color of normally processed palm oil). The main fatty acids combined in palm oil are ca. 40% palmitic acid, 38% oleic acid, 10% linoleic acid and 5% stearic acid; this combination is ca. 50% unsaturated and 50% saturated fatty acids. This question of "saturated" and "unsaturated" fatty acids is of considerable, perhaps exaggerated, importance at the present time in view of the belief held by a number of authorities, particularly in the U.S., that there is a connection between cholesterol (produced by saturated fats) and coronary thrombosis. Whatever may be the merits, medically speaking, of this theory, there is no doubt that the peculiar composition of palm oil renders it otherwise attractive as an edible oil.

TABLE II

1971 Export of Fats and Oils

Fats and oils	Tons	Per cent
Soybean oil	2,953,000	24
Tallow-grease	1,722,000	14
Lauric oils	1,649,000	14
Palm oil	935,000	8
Rapeseed oil	782,000	7
Peanut oil	704,000	6
Sunflowerseed oil	699,000	6
Butter	699,000	6
Fish oil	689,000	6
Others	1,165,000	9
Total	11,997,000	100

TABLE III

Malaysian Palm Oil Production

Year	Acreage, x 1000	Oil production, 1000 tons
1923	1	0.2
1960	136	90
1970	760	422
1971 (E)	910	581
1975 (E)	1380	1400
1980 (E)	1600	1750

World markets

At the level of commodity trade, when fats and oils are merely raw materials still requiring to be made suitable for their end use by conditioning, purifying, refining, bleaching, hydrogenating, blending or saponifying, the ultimate interchangeability of fats and oils is determined by the manufacturer who carries out these operations; and he, other things being equal, will decide upon the basis of comparative prices. For this reason palm oil (like nearly all other oils and fats) cannot be considered by itself alone but must be taken in the context of the world markets for all fats and oils.

According to the latest available figures the total production of fats and oils in 1971 amounted to 41,671,000 tons of which 40,259,000 tons were in the edible-soap fats and oils category; the estimate for 1972 is for production of a total of 42,665,000 tons, with 41,518,000 in the edible-soap group. The great bulk of this production is of course consumed in the countries of origin, but gross exports for 1971 are estimated at 12,684,000 tons with 11,997,000 tons in the edible-soap category and those for 1972 at 13,127,000 tons with 12,430,000 tons in the edible-soap group.

These figures are perhaps seen better in perspective if broken down into main components. For the year 1971 the export figures for the edible-soap group, representing 95% of the total—those figures upon which the market is based, are given in Table II. All these figures are given in terms of the oil equivalent, and they serve to emphasize that with the exception of soybean oil there is no one source of oils and fats holding a preponderant share of the market.

The question of course arises as to what is to happen in the future. Projections prepared by the FAO suggest that by 1980 production of oils and fats will be ca. 54 million tons, with 51 million tons in the edible-soap group. Export availabilities, as distinct from actual exports, may be in the region of 14 million tons, but import

(Continued on page 353A)