NUTRITIONAL PROPERTIES OF PALM OIL

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The nutritional properties of palm oil should be considered in relation to its chemical composition. Typical values are given below (from Berger 1983).

Table 1 Composition of Palm Oil

1. The main fatty acids

	%
C14:0	1.0
C16:0	43.7
C18:0	4.4
C18:1	39.9
C18:2	10.3
Others	0.7

2. The main glycerides

	%	Major components
Trisaturated	8.5	(PPP)
Mono unsaturated	37.7	(POP, PPO)
Di-unsaturated	3.50	(POO, PLP)
More unsaturated	11.7	(OOO, PLO)

3. The non-glyceride components

Crude palm oil	ppm	Main component
Carotenoids	640	β-carotene, α-carotene
Tocopherols	850	γ-tocotrienol, α-tocotrienol α-tocopherol
Sterols	300	β-sitosterol, campesterol
Triterpene alcohols	800	

The major fatty acids are the commonest components in vegetable oils. The saturated acids comprise about 50% and according to the Keys Anderson hypothesis would be expected to raise blood cholesterol levels. This question will be discussed in detail. The unsaturated acids present are mainly oleic, while linolenic acid is absent. In consequence palm oil has a high stability to oxidation. Palm oil is readily absorbed, and shows a digestibility of 97% or greater, similar to other common edible oils.

As in other vegetable oils, the middle 2-position is mainly occupied by unsaturated fatty acids. This is a difference from animal fats, where the 2-position is usually occupied by a saturated fatty acid.

During digestion triglycerides are split to fatty acids and 2-monoglycerides before absorption. A question that has not been investigated, as far as I know, is whether the unsaturated monoglycerides behave differently from the saturated after absorption. In food emulsion systems using monoglycerides, the stability of the emulsion is very different depending on saturation.

Unrefined or "virgin" palm oil is one of the richest natural sources of carotenoids. Regrettably these are deliberately removed during the industrial refining process, so that their nutritional benefits are lost, except to populations who traditionally use palm oil in the unrefined state.

Carotenoids have a number of interesting nutritional properties:

a) They are precusors of Vit A.
b) They act as antioxidants, especially as singlet oxygen quenchers.
c) They appear to have anti-cancer activity. This aspect is the subject of a major long term trial in the USA at present.

The current interest in free radicals in relation to cancer suggests that functions b) and c) may be linked.

The tocopherol content is one of the most interesting features in palm oil, since it consists mainly of the tocotrienols, with an unsaturated side chain. These are not found in the other common vegetable oils.

Table 2 Tocopherol Content of Typical Refined Palm Oil*

@-tocopherol	180 ppm
@-tocotrienol	149 -
γ-tocotrienol	239 -
δ-tocotrienol	62 -

* From A. Gapor (1983).

Analytical work at PORIM has shown that an average 50-60% of the tocopherol content remains after refining though the extent of removal depends on the refining conditions used.

The tocopherols are important natural antioxidants, although their antioxidant activity is somewhat lower than the synthetic phenolic antioxidants permitted in foods, they are less volatile and therefore more persistent in high temperature conditions such as deep fat frying. The tocopherol content is a major factor in stabilising palm oil against oxidation.

The nutritional benefits of tocopherols in a number of disease conditions in which free radicals or oxidation is implicated are a very active field of research which will be discussed in greater detail. To-date little has been done on tocotrienols as such.

The sterols present are common in vegetable oils and the other minor components are not of interest nutritionally.

According to the original Keys Andersen hypothesis palm oil, with its content of 50% saturated acids should increase blood cholesterol levels. Keys however did not use palm oil in his experimental studies and in fact palm oil has appeared rather infrequently in nutritional studies in the past, presumably because it is not a major component of the Western diet.

Where palm oil has been compared with a highly poly-unsaturated diet under experimental conditions, the PUFA diet usually produced lower blood cholesterol levels.

Often these PUFA diets are extreme and would not form a feasible basis for normal day to day eating.

Where data is given which enables the blood cholesterol level to be compared with that on the normal free living diet, it is found that palm oil feeding lowers the blood cholesterol level as indicated in the following chart (see Fig. 1).

The following comments should be made:

1. The two subjects studied by Ahrens (1957) had very high blood cholesterol levels.

2. Anderson (1976) used a palm oil : coconut oil blend 2:1.

3. Baudet used a somewhat unsaturated liquid fraction from palm oil, with a reduced palmitic acid content.

The experiments were however not designed specifically to study the effects of palm oil. Two recent trials carried out in Malaysia and Pakistan were reported at a conference last year. They were focussed on palm oil.

In both instances a diet containing high levels of palm oil was compared with fats traditionally used.

In the first study (Lim et al. 1988) 83 students were divided into 3 groups, matched for sex, race, serum cholesterol level and other relevant characteristics. They were submitted to the following dietary sequence.

> Coconut oil - test oil - coconut oil, with 5 weeks on each oil. The test oil was corn oil, palm olein and coconut oil respectively in the 3 groups. 32% of the calories were fat and 3/4 of the fat intake consisted of the experimental oil.

With reference to the serum cholesterol level on the habitual pre-trial diet, coconut oil raised the cholesterol level by 12%, the corn oil period lowered it by 29%, and the palm olein period lowered it by 9%.

It should be mentioned that prior to the growth in palm oil production, coconut oil was the major oil of domestic consumption in Malaysia.

In the Pakistan trial (Khan et al. 1988) butterfat ghee was compared with vanaspati ghee (a blend of hydrogenated soyabean oil 65 and palm oil 35), 100% palmoil and hydrogenated cottonseed oil.* Each fat was fed for 60 days. The subjects were healthy men aged 18 to 35 and groups varied in size between 27 and 50.

Each fat was tested for 2 periods except for hydrogenated cottonseed oil (only once).

The experimental diets induced the following changes from the serum cholesterol level on the normal diet:

Butter fat ghee	+ 3% + 6%
Vanaspati	no change - 6%
Palm oil	-12% -17%
Hydrogenated cottonseed oil	no change

Both these recent trials therefore confirm the effects previously found, that palm oil effects a modest, but significant reduction in blood cholesterol level. Furthermore the effect is not only obtained with the high fat levels of the Western diet.

* Butter fat or vanaspati are the main customary cooking fats of the country.

The obvious question that needs to be answered is why does palm oil not follow the Keys Anderson hypothesis. First of all it would not be the first exception.

Cocoa butter has been found to be neutral in its effect on blood cholesterol and so has beef tallow.

It has been argued that this is because the saturation is mainly in stearic acid, which is "neutral". However, both fats also contain about 25% palmatic acid and very low levels of poly unsaturates. The argument that 25% palmitic acid + 30-35% stearic acid in the presence of low levels of poly unsaturates is neutral, but 45% palmitic acid in the presence of 50% unsaturates (including 10% linoleic acid) is cholesteraemic would require a great deal of direct evidence to be convincing. Actually as we have already seen the direct evidence shows an effect in the opposite direction. It may be mentioned that recent demonstrations that mono unsaturates lower blood cholesterol levels to a similar extent to poly unsaturates have been readily accepted. This also contradicts the Keys Anderson hypothesis.

The effect of palm oil on blood cholesterol may therefore be at least partly explained by its content of 50% of hypo cholesterolaemic unsaturates.

To obtain further evidence we have to look to animal experiments, as yet not extended to humans.

Recent studies by K. C. Hayes (1988a) have been directed to identifying the role of specific fatty acids.

Various blends of coconut oil, palm oil, soya and high oleic sunflower oils were prepared so that total saturated, mono unsaturated and PUFA contents were kept constant, but the specific saturated fatty acids C12, C14, C16 were varied (see Table 3).

The results (see Fig. 2) on Cebus Monkeys show clearly a positive correlation of the saturated acids C14 and below with blood cholesterol level, and a negative correlation with total unsaturates. Palmitic acid also shows a negative correlation. Other species of monkeys, though less responsive to saturated fat, showed similar trends.

In another series of experiments (Hayes 1988b) with hamsters, palm oil (P/S ratio of 0.25) was not hyper cholesterolaemic compared to an American type fat blend (P/S ratio 0.55) or beef tallow (P/S ratio of 0.09).

Hepatic messenger RNA abundance for various apolipoproteins and for LDL receptor were measured. Palm oil alone increased LDLr messenger RNA significantly.

This means that it facilitates clearance of cholesterol.

As mentioned before, the tocotrienol content of palm oil is unique among the common vegetable oils.

FIG. 2. EFFECT OF DIFFERENT FATTY ACIDS ON SERUM CHOLESTEROL - CEBUS MONKEYS (FROM HAYES 1988A)

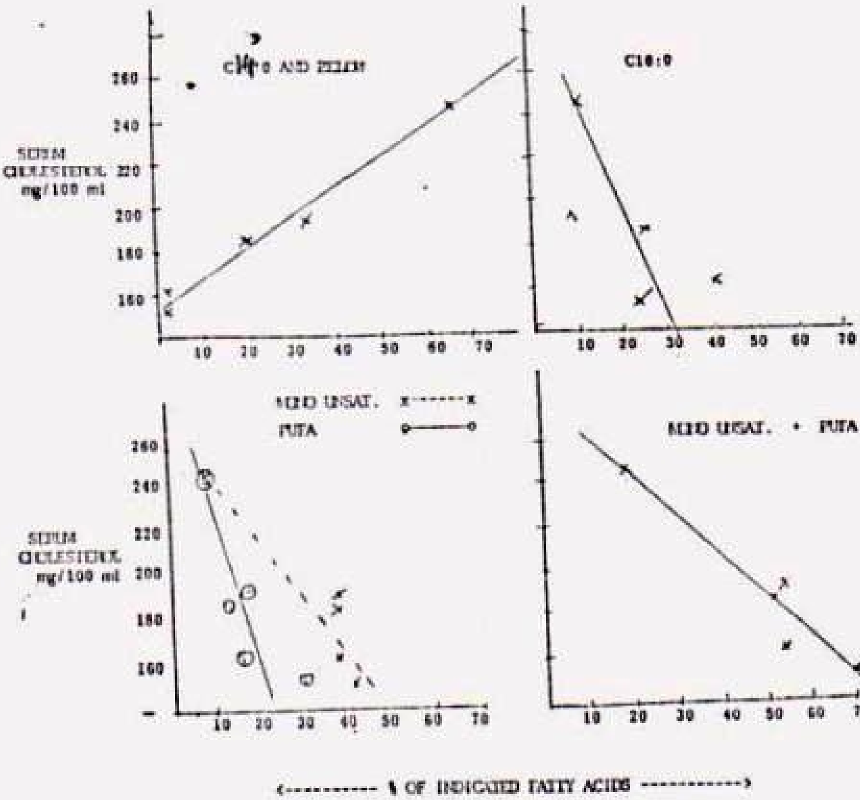

Fig. 2 Effect of Different Fatty Acids on Serum Cholesterol - Cebus Monkeys (from Hayes 1988a)

Qureshi and colleagues (1986) found that an extract from barley inhibited the synthesis of cholesterol in the liver of chicks. The active material was @-tocotrienol. Extension of their study to other tocotrienols gave the following results.

Table 4 Effect of Tocotrienols on Serum Cholesterol Level in Chicks

	Cholesterol-Concentration in Serum mg/100 ml	
	Total	LDL
Control diet	218.8 (a)	70.4 (e)
- - + 0.5% cholesterol	237.8	88.6
- - + 20 ppm α-tocopherol	179.9 (b,c)	64.8 (e)
- - + 20 ppm α-tocotrienol	144.6 (b,c)	54.5 (f)
- - + 20 ppm γ-tocotrienol	140.8 (b,d)	58.2 (f)
- - + 20 ppm δ-tocotrienol	133.4 (d)	56.7 (f)
- - + 20 ppm TRF	155.7 (b,c)	60.4 (f)

Values not sharing same subscript are different at $P<0.01$
TRF = tocopherol rich fraction from palm oil
The tocotrienols inhibit HMG coenzyme A reductase.

Next I would like to discuss aspects of blood clotting or thrombosis. Hornstra (1988) has used an aorta loop technique to study thrombus formation in rats after feeding diets high in a range of fats of varying saturation. In general the obstruction time, the time at which blood flow stops in a tube inserted in the aorta, was inversely related to saturation, but palm oil was an exception. Investigation of a number of palm oils indicated a good correlation of obstruction time with total tocopherol content (see Fig. 3). Palm oil feeding also induced an increase in the prostaglandin to thromboxane ratio, i.e. a change in an antithrombotic direction.

The antithrombotic effect of palm oil was similar to that obtained with sunflower oil. The latter however increased blood platelet aggregability in vitro, while palm oil did not.

A similar favourable PGI2 to Thromboxane A2 ratio was reported by Sugano (1987). Holub (1988) has reported an inhibition of human platelet aggregability by γ-tocotrienol.

Weimann et al. (1988) reported increased synthesis of PGI2 in segments of rat aorta supplied with @-tocotrienol.

Shay et al. (1989) obtained a shift in the prostacyclin/thromboxane ratio towards an antithrombotic state in rats fed diets supplemented with palm oil.

The involvement of free radicals in damage to biological systems and consequently in various human disease states is an active field of current research, as indicated for example by the recent meeting in Paris of the Society for Free Radical Research (Dec 1988). Studies were reported on atherosclerosis, cancer, arthritis, adult respiratory disease syndrome, Alzheimers disease, senile cataract and lupus. In many instances tocopherol and other natural antioxidants ameliorated the patient's condition. None of the reports involved tocotrienols. It is however possible that in some systems the tocotrienols could be more effective than tocopherols. The effectiveness of the antioxidant function will in some cases be dependent on its positioning in cell membranes. Clearly the long unsaturated side chain of tocotrienols will have a significant spatial effect.

In the context of atherosclerosis, it may be that oxidised cholesterol or oxidised LDL cholesterol is more "sticky" and more atherogenic than cholesterol in the normal state. A great deal is yet to be learnt about the function of the natural antioxidants in this system.

To summarise the factual information about palm oil :

- It is natural vegetable oil
- It is not cholesterolaemic in animals or man
- It is highly stable to oxidation
- Its solid fat content gives it useful functionality in a number of food applications
- It has been shown to have beneficial effects on blood clotting behaviour in animal models.

It is a relatively minor contributor to the fat intake or the saturated fat intake of the Western diet.

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Table 3 Fatty Acid Composition % Experimental Diets (K.C. Hayes)

BLEND	1	2	3	4	5
C14 & below	66.6	33.4	19.2	1.2	1.1
C16	10.7	8.6	25.1	40.3	23.4
C18	3.3	3.0	3.6	4.1	3.9
Total Sat.	80.6	45.2	48.1	45.9	28.7
Total Monounsat.	9.4	37.2	37.2	37.0	41.0
Total Polyunsat.	9.4	17.2	14.1	16.4	29.9

Figure 1 Reduction in Serum Cholesterol from Palm Oil Diets in Humans

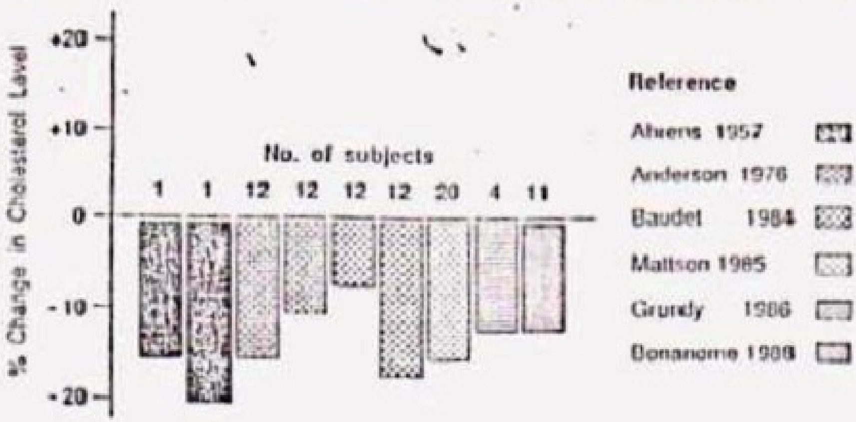
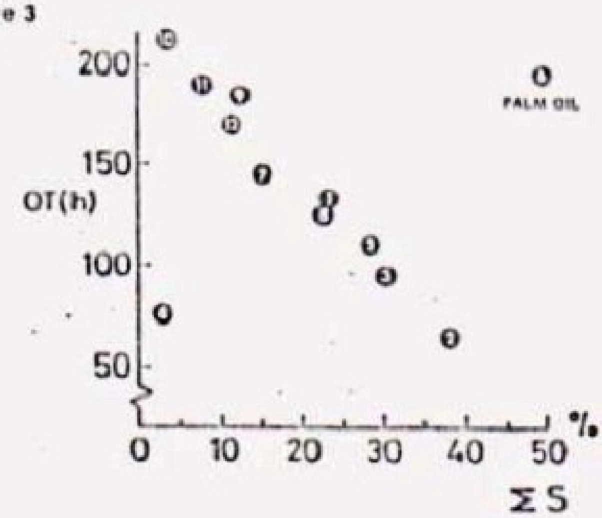


Figure 3



$$S = \frac{C14{:}0}{2} + C16{:}0 + C18{:}0 + \text{Higher Sat.}$$

Relationship between saturated fatty acid content (S) and thrombogenicity (OT) of dietary fats in rats.

All diets contained 50 en% fat.

1. Coconut oil
2. Triglyceride mixture
3. Hydrogenated coconut oil
4. Medium chain triglycerides
5. Whale oil
6. Palm oil
7. Olive oil
8. Hydrogenated soyabean oil
9. Linseed oil
10. Rapeseed oil, old
11. Rapeseed oil, new
12. Sunflowerseed oil

Nutritional Properties of Palm Oil

Addendum

In September there was an international conference on palm oil in Kuala Lumpur, featuring a major symposium on nutrition. Out of 35 papers, 18 dealt with original research on palm oil in relation to various aspects of coronary heart disease.

Ten of the 18 studies were in human subjects. The two dietary studies in Malaysia and Pakistan have already been discussed. Two additional major human dietary studies are in progress in USA and Holland, in which normal foods are provided but with the maximum possible substitution of palm oil for other dietary fats. The study of Dr Randall Wood in Texas is still in an early stage, without conclusive results. Analyses completed to date in Dr Hornstra's study in Holland, where 70% of total fat intake was palm oil, indicate a significant increase in HDL2 cholesterol; and significant decreases in IDL and LDL triglycerides. These changes are beneficial. There were no other significant changes in blood lipids.

The National University of Malaysia has compared palm olein and soyabean oils used as cooking oils in 110 male students over 5 weeks. The palm oil diet effected no change in plasma lipid profiles, while the soyabean oil diet resulted in an increase (+ 28%) in plasma triglyceride and a decrease (15%) in Apoprotein A1. These changes are unfavourable. It was concluded that soyabean oil is not superior to palm oil in its effect on plasma lipids.

Sook Hoo Yoon in S Korea compared palm olein, soyabean oil and tallow at 15% of energy intake. He found that blood platelet aggregation tendency (epinephrin induced) was lower on soyabean oil and palm oil diets, than on beef tallow. The TXB_2/PGI_2 ratio was decreased on palm olein from 2.2 to 1.7, unchanged on soyabean oil and raised on beef tallow.

I have already mentioned the favourable results on blood platelet aggregation reported by Dr Holub.

The Palm Oil Research Institute has developed a pilot plant for the separation and purification of vitamin E from palm fatty acid distillate - a refinery by-product. The product is being used in 50 mg capsules for nutritional trials. The results of 3 preliminary trials in Malaysia and Finland and a more extensive double blind crossover study in USA are summarised in Table 4 below. The USA study, which was carried out in hyper-cholesteraemic subjects additionally showed lower thromboxane B2 and platelet aggregation.

Table 4

Effect of Palm Tocol Concentrate on
Serum Cholesterol Levels in Humans

Researcher	Number of subjects	Dose (mg)*	Duration (weeks)	Mean Serum cholesterol mg/dl	Mean Reduction %
D. Tan, Malaysia	9	200	4	231	19
D. Tan, Malaysia	22	200	4	258	14
T. Westermark, Finland	6	235	1	234	5
A. Qureshi, USA	11	200	4	293	12

* Composition:
15-20% α tocopherol
12-15% α tocotrienol
35-40% γ tocotrienol
25-30% δ tocotrienol

Eight animal studies were also reported. In Wisconsin Qureshi found that 50 parts per million of the tocotrienol concentrate from palm oil, fed to hypercholesterolaemic pigs, led to a 15-24% decrease in serum cholesterol and a reduction in platelet aggregation tendency.

Elson confirmed previous results in chicks, showing that palm oil tocotrienols depress blood cholesterol level in chicks, as compared to α tocopherol at the same level in the diet. The cholesterol content of eggs from the tocotrienol fed chicks was also lower.

Charnock & Abeywardena of CSIRO Adelaide, studied the effect of palm oil on cardiac arrythmia in rats. This is intensified by feeding saturated fats, but not by palm oil. They also observed a reduction in Thromboxane A2 production in heart muscle and aorta, without a change in prostaglandin I2. There was therefore a favourable change in the ratio of these two substances, which control blood clotting. A similar favourable change in this ratio in rats has been reported by Murku in Canada.

Finally, two animal feeding trials were reported from the National Institute of Nutrition in Hyderabad. Both indicated that palm oil was a satisfactory source of dietary fat.

None of the eighteen studies described produced adverse results. On the contrary, palm oil fed at a high level in the diet of human or animals, affects various blood parameters favourably.

It is of particular interest that the human studies were carried out in a variety of populations with different genetic background and different dietary customs. They included the high levels of fat consumption of Europe and USA and the lower levels customary in Asia. Several of the studies were supported by Malaysian funds, while others were not.

It is clear that the adverse publicity given to palm oil in the USA in the last 2-3 years is not based on scientific fact. At best it is an unjustified extra-polation of evidence from other fats, at worst it is a deliberate libel executed for commercial advantage.

K G BERGER
Sept 89

INDIA

Oil Net Imports to Rise to 0.9 Mill.T

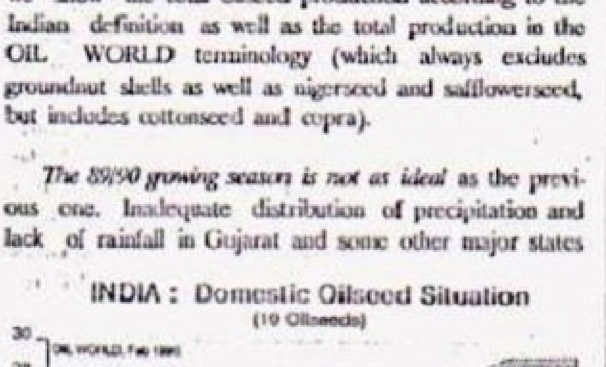
The prospective sharp decline in groundnut and rapeseed production is likely to force the Indian Government to adopt a more liberal import policy for oils and fats. In our new estimate we project the net import requirements for 89/90 at 0.9 mill.T compared with 0.5 million in 88/89. Before we go into detail, let us first summarize the latest information on oilseed production and then analyze the prospective crushings and domestic oil output.

The 88/89 season was an outstanding year with ideal weather conditions plus a Government support policy boosting production of the nine oilseeds soybeans, groundnuts (on a shelled basis), sunseed, rapeseed, sesameseed, linseed, castorseed, cottonseed and copra by an unprecedented 4.6 mill.T to 18.25 million tonnes. We show details of the development of oilseed production on SU 32 - 51. Our table includes the final official crop estimates for all oilseeds except cottonseed and copra. There have been substantial changes from the previous estimates not only for 88/89 but also for 87/88, which gets obvious when comparing the revised table with the previous one published as of December 8, page SU 32 - 39. The 87/88 crop estimates of groundnuts (unshelled basis) and rapeseed, for example, were raised to 5.85 mill.T (vis-a-vis the previous official estimate of 5.67) and 3.45 mill.T (3.37), respectively.

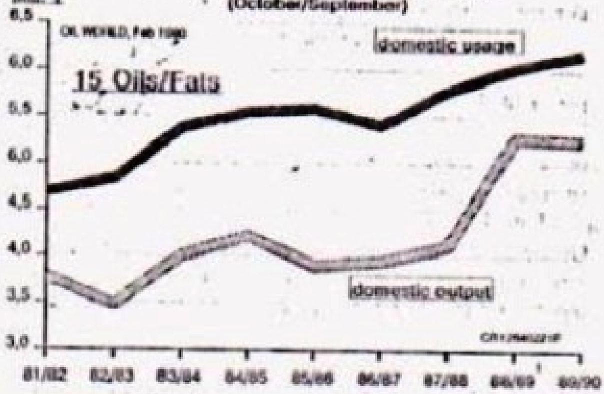
According to the traditional Indian definition of the term 'oilseeds' -- which excludes copra and cottonseed, but includes groundnuts in shell as well as saffiowerseed and nigerseed -- 88/89 production reached 17.89 mill.T vis-a-vis 12.65 million in 87/88 and 11.27 in 86/87. These are the totals which are generally published and circulated over the news wires. In the first table on SU 32 - 51 we show the total oilseed production according to the Indian definition as well as the total production in the OIL WORLD terminology (which always excludes groundnut shells as well as nigerseed and safflowerseed, but includes cottonseed and copra).

The 89/90 growing season is not as ideal as the previous one. Inadequate distribution of precipitation and lack of rainfall in Gujarat and some other major states

INDIA : Domestic Oilseed Situation
(10 Oilseeds)



INDIA : Oil Output and Usage
(October/September)



have caused kharif groundnut production to fall by approximately 30% to 5.2 mill.T (unshelled basis). Some Indian sources even indicate the likelihood of a kharif crop of only 5.0 million. This is a substantial reduction from the 7.3 mill.T produced in 88/89 but still relatively high as compared to the average 4.1 mill.T in the three years ended 87/88.

The contra-seasonal price rally in groundnut oil to Rupees 2470 per 100 kilos on the average of February is a clear confirmation of the tightness in domestic groundnut oil supplies. It represents a sharp increase of 16% from Rupees 2135 registered in Dec 1989 and compares with just Rupees 1820 in February 1989. It is also interesting to see that the price premium vis-a-vis rape oil widened to approximately Rupees 700 per 100 kilos compared with a premium of Rupees 145 in Febr 1989.

Also the 1990 rape/mustardseed crop outlook is not as ideal as a year earlier. The earlier, very ambitious and optimistic forecasts of 4.5-5.0 mill.T for the 1990 crop have recently been trimmed, due to lack of rainfall early in the growing season in some major states. As a result, we are currently working with a range estimate of 3.8-4.0 mill.T -- still the second highest on record and only trailing the 4.4-million-tonne crop of 1989.

Good recoveries are seen in the production of soybeans to 1.8 mill.T as well as of sunseed and castorseed to 0.5 mill.T each. The 1990 cottonseed crop has apparently reached 3.8-3.9 mill.T, a new record and up sharply from the 3.45 million produced last year.

The depletion of the previous crops' stocks of groundnuts and rapeseed can prevent a decline in Indian oilseed crushings in 89/90. We have also taken into consideration that the Indian rapeseed season is February/January, which means that a large share of the bumper 4.4 mill.T produced in early 1989 has been processed in Oct/Jan 89/90, the first four months of the new season. For 9 major oilseeds we currently project crushings at 14.0 mill.T this season compared with 13.6 million in Oct/Sept 88/89 and 10.1 mill.T in 87/88. On SU 32 - 51 we are supplying further details. It is important to realize that the larger share of low-oil yielding soybeans and cottonseed and the declining share of high-oil yielding groundnuts is cutting Indian vegetable oil output this season.

Vegetable oil import requirements are increasing sharply' this season. Domestic demand is strong in view of an average annual increase of the Indian population by 16-17 mill.head and, in addition, due to the higher purchasing power of the Indian consumers and a corresponding rise in caput demand. The sharp contra-seasonal increase in domestic groundnut oil prices is a good barometer that current domestic supplies are insufficient.

But it is an open question whether the new Indian Government will allow imports to rise to 0.9-1.0 mill.T, as we currently conclude from basis the complete Indian supply and demand balance shown on SU 32 - 52.

There will be some major changes in the economic policies of the new Indian Government headed by Mr. V. P. Singh, the new Prime Minister. It will give more support to the agricultural sector. This implies stimulating the Indian farmer to step up production by supplying the required inputs and assuring remmunerative domestic ...ices. The oilseed policy of the new Government still ..s to be announced (expected for this month) but it is ..med to aim at reducing imports of edible oils to the bare minimum and allow domestic prices to rise above the level registered in the previous seasons to give the Indian farmer additional price signals to expand investments and plantings.

It is also expected that the Government will concentrate most of the imports of edible oils in the lean period from June to October and allow the National Dairy Development Board to purchase groundnuts and groundnut oil as well as rapeseed and rapeseed oil (and other commodities) to prevent prices from falling particularly sharply after harvesting. Such a policy will imply some sacrifices by the consumers who must now and in the future face considerably higher domestic prices than in most of the preceding seasons.

India will export rapeseed oil. The Government has ..horized the National Dairy Developing Board to ex..t 25000 T of rape/mustard oil on the condition that the revenue be used to import cheaper palm olein.

The 89/90 supply and demand balance for 15 oils & fats points to a growing domestic vegetable oil gap. Based on our current projections of a) this season's oilseed production, b) oilseed crushings in Oct/Sept 89/90 and c) carryover stocks of vegetable oils as of Oct 1, gross imports *of 1.0 mill.T (or net imports of 0.9) appear necessary* to allow for a marginal rise of caput usage. But it is, of course, an open question whether the Government allows a pick-up of imports, particularly in the second half of this season when most of the kharif oilseed supplies will have been used up.

An analysis of the monthly Indian imports indicates a recovery from November onward and we currently assume a stagnation during Oct/Dec 1989, an increase to 0.25 mill.T in Jan/March and a boost to 0.56 mill.T in April/Sept 1990.

FACTS & FIGURES

ROTTERDAM OIL STOCKS

The reduction of Rotterdam bonded warehouse stocks in the second half of February occurred mainly in coconut and palm oils. At the end of the month, inventories of 10 vegetable oils amounted to 0.23 mill.T, almost unchanged from a month earlier. The current inventories are the lowest February stocks in at least five years and compare with 0.35, 0.27 and 0.36 mill.T at the same time one, two and three years ago.

Palm and coconut oil stocks declined from their end-Jan or mid-Febr peaks of 82000 T and 66000 T, respectively, and amounted to 71000 T and 51000 T at the end of February. While palm and palmkernel oil stocks are sharply above a year earlier, those of all other vegetable oils are relatively small. This refers particularly to groundnut oil with inventories depleted to only 1200 T, but also current stocks of soya and rape oils are steeply below the level registered twelve months ago.

ROTT. BONDED WAREH.: Stocks of Major Oils (1000 T)

Rott b wareh Open'g stocks	Mar 1990	Feb 1990	Jan 1990	Oct 1989	Mar 1989	Oct 1988
Soybean oil	4.9	5.2	5.9	5.4	50.0	43.2
Groundnutoil	1.2	5.5	7.2	7.0	17.1	9.5
Sunfloweroil	31.0	26.8	15.8	26.0	40.7	29.6
Rapeseed oil	31.3	17.1	5.7	8.1	70.8	69.0
Palm oil	70.9	72.1	35.2	27.2	49.4	15.8
Palmkern oil	35.8	34.8	23.5	12.7	15.5	21.9
Coconut oil	51.0	66.4	41.8	47.4	90.3	80.3
Linseed oil	7.0	6.0*	6.0*	2.0*	12.0*	15.9
Castor oil	0.4	0.5	1.1	1.5	1.1	2.9
Tung oil	-	-	-	-	-	0.2
Total	233.5	234.5	145.2	137.2	347.0	288.3

FRANCE

89/90 sunflowerseed production has been revised upward. Arrivals at the Intermediaires Agrees were higher than expected at 1.92 mill.T from Aug 1 through Jan 31 (against 2.09 million at the same time last year), causing an upward revision of the French commercial sunflowerseed production estimate to 1.96 mill.T for 89/90, according to the latest figures of SIDO. This compares with the previous estimate of 1.90 mill.T, last year's 2.33 million and the record 2.51 mill.T produced in 87/88. We have consequently raised our projections on this season's French crushings and exports to 0.95 and 1.0 mill.T, respectively.

The crop estimates for rapeseed and soybeans remained unchanged at 1.73 and 0.31 mill.T (vis-a-vis 2.30 and 0.26 in 88/89), bringing total French production of the three major oilseeds to 4.0 mill.T. This -- although higher than previously thought -- is still 18% below last season and one quarter below the record output of 5.4 mill.T in 87/88.

WEST GERMANY

Oilseed crushings showed a good recovery of 9% to 1.44 mill.T in Oct/Dec 1989. But the rate of increase slowed down in December to just 5%, due to a sizeable