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The World Supply of Fats

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I shall first make brief reference to the pre-war production and export of oils and fats; I shall then consider in broad terms the reason why existing production is, as will be shown, some 4 million tons short of present-day needs; in conclusion, the steps which are being or might be taken to make good the existing deficiency will be discussed. In this paper I have drawn liberally on data and information presented by Sir Geoffrey Heyworth in a comprehensive discussion of this subject given at the recent Annual General Meeting of Lever Brothers and Unilever Limited and reported fully in the Press.

The pre-war position

The estimated yearly pre-war production of visible oils and fats throughout the world was, according to the U.S. Office of Foreign Agricultural Relations, about 20 million tons. The countries which were the most important contributors are listed in Table 1. While the greater part of these oils and fats was used in the producing

Table 1. *Yearly pre-war production of visible oils and fats*

Region	Quantity (tons × 10^6)
Europe	4·0
U.S.A.	3·7
China	3·6
India	2·5
Africa	1·6
South America	1·1
Manchuria and Korea	0·8
Netherlands East Indies	0·7
Philippines	0·4

countries, a total of some 5·75 million tons remained for export, and of this amount some 60% found its way to Europe, exclusive of Russia. All except two of the countries which were the main contributors to this export total were in the Far East; the most important were Manchuria and China, India, the Netherlands East Indies, the Philippines and British Malaya; the exceptions were Africa and South America.

Causes of post-war shortage

The first reason for the existing shortage, which is shown in Table 2, is the effect of the war and subsequent events on the Far East countries which were the main pre-war exporters. The 1947 estimated export figures for these different countries are broadly what might be expected from consideration of their war and post-war history. Thus, in Manchuria, China and the Netherlands East Indies (now Indonesia) the close of the war with Japan did not mean the cessation of fighting. As a result, the rate of recovery

Table 2. *Exports of oils and fats, as oil*

Region	Average 1934–8 (tons × 10^3)	Estimated 1947 (tons × 10^3)
Argentine	540	370
China	228	110
India	473	100
Malaya (export balance)	109	48
Manchuria	516	—
Netherlands East Indies (Indonesia)	530	97
Philippines	338	633

of exports from these three countries has been disappointingly slow. In pre-war days Manchuria, for instance, exported 516,000 tons of oils, or their equivalent, made up of 402,000 tons of soya-bean oil, 36,000 tons of ground-nut oil and 78,000 tons of perilla and other oils. As a result of the civil war, only a negligible fraction of this is now available for export from the north China ports. In the Netherlands East Indies the close of the Japanese war was followed by serious civil disturbances, which have so retarded the restoration of the pre-war production that the 1947 estimated export surplus, 97,000 tons, is less than 20% of the pre-war figure. The position in China is somewhat similar, although in contrast to the Netherlands East Indies and to Manchuria, which both exported the bulk of their production, China's pre-war exports amounted to no more than 6% of her total production. Nevertheless, this represented an export of nearly 250,000 tons which has fallen to 110,000 tons, most of it tung oil. As for India, the population increase referred to in the next paragraph, together with the tendency towards improved standards of living and a decline in animal-ghee production, has resulted in the reduction in the export of fats from the pre-war total of some 470,000 tons to about 100,000 tons in 1947, and a return to the pre-war figure is unlikely for a long time. Table 2 shows also that exports from Malaya, which is making a steady recovery from the effects of the war, were about 50% of the pre-war figure, while in the Philippines the export of copra or coconut oil was in 1947 nearly twice as great as the pre-war average. The Philippines show an outstanding recovery, although these particular figures are somewhat misleading in that they apparently include a considerable carry-over from the 1946 crop; exports this year are likely to be well below those for 1947.

The second reason for existing shortages is the increase in world population. Taking the 1938 figure as 2145 millions and the yearly rate of increase as nearly 1%, world

population will have increased by at least 180 millions by the end of 1948; in this estimate, account has been taken of war casualties, which have been assessed at 35 millions. At the pre-war average supply of fats for all purposes of 21·4 lb./head this corresponds to an increased requirement of 1·72 million tons. According to the 1941 census the population of India was 389 millions, and it has been estimated that the 1947–8 population was 425 millions, an increase of 36 millions in about 6 years. The increase of population in India has had profound effects on her export capacity.

A further important factor operating in the same direction is the improved standard of living resulting from the war. This arises in two ways. First, in any widespread conflict certain countries become relatively affluent as a result of possessing an important raw material or from the ability to supply services to the combatants. Secondly, the training and use of native troops outside their own territories inevitably accustoms these soldiers to a higher standard of living, in particular to better food. On their return to their homes they do not willingly give up these newly acquired standards, and with the resulting increased domestic consumption there is a corresponding fall in the amount available for export.

Yet another reason for the dearth of oils and fats is that increased demand for home-grown cereals has led in certain countries, such as Egypt, to the growing of wheat and maize instead of oil-bearing seeds, such as cotton. In Europe, the shortage of animal protein for human food and of animal feeding-stuffs led to a decrease in the number of cattle and pigs, and hence to a decrease in the production of animal fats, such as butter, lard and tallow.

Lastly, it must be remembered that the shortage of consumer goods, which affects incentive in countries like our own, has a similar effect on native peoples occupied in the production of oil-bearing seeds.

Having considered the general reasons for the existing shortage, we may now study some specific cases by reference to the figures in Table 3.

In the group which it has been customary to describe as edible oils, the considerable fall in the export of cotton-seed oil is due to the replacement of cotton by cereals in Egypt, and to increased local consumption of cotton-seed oil. The very small export of olive oil in 1947 was due mainly to the poor crop, and the reduction in the export of sesame oil to 20–25% of the pre-war figure results from decreased exports from China and Manchuria. The doubling of the export of sunflower-seed oil, which alone shows an increase, is due almost entirely to the increased cultivation of sunflowers in the Argentine.

That the export of palm-kernel oil is as high as 266,000 tons, over 80% of the pre-war figure, is due to the fact that west and equatorial Africa, the main sources of supply, were not devastated by war. In contrast, the estimated 1948 export of the other major nut oil, namely, coconut oil, at 800,000 tons represents no more than 70% of the pre-war total, owing mainly to the decrease in the oil available from Indonesia and Malaya. Palm oil shows a similar fall; even in 1948 the export is expected to reach only 70% of the pre-war figure. This is mainly due to the fact that conditions in Sumatra are still far from normal.

In the animal- and fish-oil groups a considerable decrease in butterfat and tallow is

accounted for, as was mentioned earlier, by the decrease in the farm animal population caused by slaughter of animals for food and the shortage of animal feeding-stuffs. As for fish oils, the decrease in exports to about 40% of the pre-war total has been caused by the falling away of the Japanese and Canadian fish-oil supplies.

Table 3. *World exports of oils and fats, as oil*

Type of oil or fat	Average 1935–9 (tons × 10^3)	Estimate† 1947 (tons × 10^3)	Estimate† 1948 (tons × 10^3)	Present countries of supply in decreasing order of importance
Edible oils				
Cotton-seed	170	47	46	Sudan, U.S.A., South America
Ground-nut	760	440	454	West and equatorial Africa, India, U.S.A.
Olive	155	22	97	Mediterranean regions
Sesame	58	11	15	West Africa, China
Soya-bean	393	67	64	U.S.A., China
Sunflower	29	60	65	Argentine, U.S.A.
Palm oils				
Babassu	18	8	13	Brazil
Coconut	1151	865	800	Philippines, Indonesia, Ceylon
Palm-kernel	313	255	264	West and equatorial Africa
Palm	487	273	360	West Africa, Malaya
Animal and fish oils				
Butterfat	410	237	250	New Zealand, Denmark, Australia
Slaughter fats	344	301	250	U.S.A., Argentine, New Zealand, Denmark
Whale	522	320	320	Antarctic
Fish	134	54	54	Iceland, Norway
Industrial oils				
Castor	90	84	90	Brazil, India
Linseed	638	261	204	South America, India
Oiticica	4	9	10	Brazil
Perilla	35	—	—	—
Rape-seed	40	7	15	Argentine, China
Tung	79	73	80	China

U.S. official estimate. † Unilever estimate.

The major changes in the industrial-oil group relate to the two drying oils, linseed and perilla. The decrease to about 40% of the pre-war export figure for linseed oil is occasioned by the reduction in the acreage devoted to linseed in the Argentine to about half the pre-war figure and the replacement of linseed by sunflowers; a further point here is that little linseed is now received from India; moreover, the U.S.A. is now self-supporting for this oil. Perilla oil was obtained exclusively from Manchuria, and none is now available. The other oil calling for comment in this group is rape-seed oil, the export figure for which is less than 40% of the pre-war total. This particular decrease is accounted for by lowered exports from south-east Europe, the Balkan countries and India.

It is instructive to bring together the totals for these different categories of oils and fats so that the present overall exports can be compared with those of pre-war days (Table 4).

The world production in 1947 was approximately 2·5 million tons below pre-war. The increase in population would require an additional 1·75 million tons. World supplies last year were therefore 4·25 million tons short of requirements. The situation in Europe is even worse. There was a fall last year in exports from producing areas of

Table 4. *World exports of oils and fats, as oil*

Type of oil	Average* 1935–9 (tons × 10^3)	Estimate† 1947 (tons × 10^3)	Estimate† 1948 (tons × 10^3)
Animal	754	538	500
Edible	1565	647	741
Industrial	886	434	399
Marine	656	374	374
Palm	1969	1401	1437
Total	5830	3394	3451
Percentage of pre-war production		58·2	59·2

* U.S. official estimate. † Unilever estimate.

Table 5. *Total production in the United Kingdom and in Europe of oils and fats, as oil*

	United Kingdom			Europe (excl. U.S.S.R.)		
		Estimate			Estimate	
Type of oil or fat	Average 1934–8 (tons × 10^3)	1947 (tons × 10^3)	1948 (tons × 10^3)	Average 1934–8 (tons × 10^3)	1947 (tons × 10^3)	1948 (tons × 10^3)
Butterfat	41	11	14	1446	838	850
Linseed oil	—	5	30	—	—	—
Marine oils (excl. whale)	6	6	6	42	14	20
Oilseeds	—	—	—	344	260	330
Olive oil	—	—	—	724	706	830
Slaughter fat	112	36	40	1542	705	750
Total	159	58	90	4098	2523	2780
Percentage of pre-war production		36·5	56·6		61·6	67·8

2·5 million tons from pre-war, while production in Europe was still 1·5 million tons below pre-war. Consequently, Europe was short last year of 4 million tons. This shows that the world shortage is being largely borne by Europe, in particular, by Germany.

Table 5 illustrates the effects of the war on the overall production of oils and fats, both in our own country and in Europe. Production of animal fats in our own country in 1947 was little more than one-third of pre-war production. It is, however, hoped to increase the home production of fats significantly by an expansion in the growing of linseed, the expected 1948 yield of which corresponds to 30,000 tons of oil.

Table 6 shows the degree to which a number of European countries were self-supporting in oil and fat production. In pre-war days the United Kingdom produced no more than one-tenth of the fat used; at the other end of the scale Denmark, an agricultural country, produced 40% more fat than was used, though the large animal-

fat production depended on imported oilseed feeding-stuffs. In fact, Europe, less Russia, produced only 54% of the fat used there.

It is instructive to study the yearly fat consumption in different countries of the world, the figures for which in lb./head are recorded in Table 7. It is important to realize that these figures represent not only butter, margarine and other edible fats, but also fats used in the making of soap and for all other technical purposes, such as the manufacture of paint and varnishes, although they exclude the invisible fat consumption in meat, milk, and other foods.

Table 6. *Europe: percentage degree of self-sufficiency in supplies of oils and fats (edible and industrial) before the war**

Country	Percentage	Country	Percentage
Belgium	39	Hungary	116
Denmark	139	Rumania	115
Eire	106	Spain	103
France	44	Switzerland	37
Germany	48	United Kingdom	10

* Unilever estimate.

Table 7. *Total yearly consumption of visible fats and oils for all purposes*

Country	Pre-war (lb./head)	Present	
		lb./head	As percentage of pre-war consumption
Australia	62·7	52·8	84
China	16	?	?
Denmark	79·6	56·1	70
Finland	37·0	22·0	60
France	46·9	28·6	61
Greece	40·3	30·6	75
Holland	71·3	51·7	72
India	12·3	11·7	95
Italy	33·9	21·6	63
United Kingdom	65·3	50·6	77
United States	70·0	68·0	97

Table 7 shows that there were considerable differences in fat consumption in the different countries of Europe before the war, and that, broadly speaking, these countries are all receiving a similar proportion of their pre-war consumption. Only two other points call for comment. First, the United States is roughly self-supporting in fat, and the consumption per head to-day differs little from the pre-war figure. Secondly, consumption in India, 11·7 lb./head, differs little from the 12·3 lb./head of pre-war days, in spite of the large increase of population and the decline in animal-ghee production. As we have seen, this is due to the curtailment of exports.

Measures to increase fat supplies

The most important single measure to give an immediate return in making greater supplies of fats available would be to restore the Far East countries to normal conditions as rapidly as possible. This will entail not only rehabilitation of estates, but general

re-equipment and the restoration of sadly neglected transport facilities, the importance of which seems insufficiently appreciated. As for Europe, it is obvious that the restoration of animal-fat supplies cannot be effected quickly, for it is necessary to build up the stocks of farm animals, inevitably a slow process. If this is to be done, Europe must receive much larger supplies of animal feeding-stuffs, while adequate supplies of fertilizers are needed for the soil exhausted after the intensive cultivation of the war years. Steps should also be taken to improve the method of extracting oils in countries where modern equipment is not yet in use, in order to avoid the considerable wastage which occurs with inefficient methods. Thus in Nigeria the ordinary native method of fermenting the fruit of the oil palm and removing the oil after boiling with

Table 8. *Effect of method of extraction on yield of Nigerian palm oil*

Method	Actual or potential production of oil (tons)	Percentage extracted
Ordinary native	247,000	55
Hand press	292,000	65
Pioneer mill	382,000	85
Factory	418,000	93

Overall average free fatty acids: Nigeria 17%, Netherlands East Indies 2%.

water yields only 55% of the oil content. A yield of 65% results from fermenting the fruit in barrels equipped with presses, and by the installation of more elaborate, up-to-date equipment as much as 93% of the total oil may be obtained (Table 8). Further, in Nigeria the oil palms grow wild and the collected fruit is often transported over long distances. As a result the oil contains on the average as much as 17% of free fatty acids, compared with 2% in plantation-grown Netherlands East Indies oil before the war. This is of twofold importance. First, it is uneconomical to process oils of high fatty acid content for edible purposes; secondly, these oils are of lower economic value.

As for new sources of fat, a major increase can come only from the growing of oil-bearing seeds. These may be derived either from plants bearing an annual crop, such as the ground-nut, sunflower, soya bean, rape and linseed, or from tree crops, such as the oil palm and the coconut palm. This leads to brief mention of the East African Ground-nut Scheme. Under this scheme some 3000 square miles of east African jungle, often uninhabitable because of the tsetse fly, are to be cleared and planted with the ground-nut, which requires 30–40 in. of rain over the growing period of 3–4 months, followed by 2–3 months' dry weather for the harvesting. When this scheme reaches completion in 6 years' time, the estimated annual yield will correspond to 250,000 tons of oil. With tree crops the return is less immediate, for oil palms do not come into bearing before 7–10 years. They require different climatic conditions, namely, 80–160 in. a year of well-distributed rain. The fact that the conditions required by palms differ so widely from those for ground-nuts and other annual crops means, however, that in schemes for increasing total oil production advantage may be taken of the various types of territory available for development. Our Overseas Food Corpora-

tion is studying the possibility of producing oil-bearing crops of different types in the territories of the British Empire, while the French, Belgian and Dutch Governments are making similar studies in their tropical territories. At the same time, considerably greater acreages of, for example, linseed and rape-seed are being planned for the temperate countries.

Another possible source of greater supplies of oils is the fish-oil industry. The Japanese fish-oil industry should be re-established, and there seems little doubt that further important supplies of fish oils may be made available through the utilization of fish rich in fat, such as the herring. This matter is receiving the attention of the Herring Industry Board in this country.

Apart from the production of oils and fats from plants or animals it is worth considering the question of the production of synthetic fats. German scientists showed great ingenuity and persistence during the war in attempting to overcome the fat shortage by the catalytic oxidation of hydrocarbons to produce fatty acids. These fatty acids were fractionated, certain fractions being used for the production of soap while others were esterified with glycerine, and the resultant fat was used for edible products, such as margarine.

A sample of German margarine supplied to us by Sir Jack Drummond was quantitatively analysed in our Research Department. While the fatty acids of naturally occurring fats all have an even number of carbon atoms, this analysis showed that the fatty acids of the fat of German margarine contained both odd and even numbers of carbon atoms. Generally speaking, the amount of any odd-numbered fatty acid was similar to that of the even-numbered fatty acid with one carbon atom less. Further, about 55% of the fatty acids contained less than sixteen carbon atoms. The fact that nearly half this synthetic fat consists of odd-numbered fatty acids may not detract from its nutritive value, although information on this point is as yet inconclusive. Much would need to be done, however, to improve the palatability of the product. As for the use of these fatty acids for soap, the indications are that only about 5–10% of the synthetic fatty acids could be used in the normal fat charge, for although these fatty acids have more or less normal lathering and detergent properties, the use of larger quantities leaves a persistent unpleasant odour on the hands. Economic considerations will obviously determine the future of the production of synthetic fatty acids from petroleum.

The last point to which I wish to refer is the suggestion which has been made recently in the Press that if soapless detergents were used instead of soap, substantial amounts of additional fat would be available for edible purposes. While this suggestion looks superficially attractive and might indeed contribute something to a solution of the problem, it is based on a fundamental misapprehension. In fact, the soap industry uses the free fatty acids which have been removed from fats in their preparation for edible purposes, so much so that at least 30% of the total soap production of Great Britain to-day is derived from the soapstocks or acid oils rejected by the edible-oil refineries. In addition, there are very large supplies of fats which, for a variety of reasons, have always been regarded as inedible. In this category come the west African palm oils of such high free fatty-acid content that it is uneconomic to refine them for

edible purposes; similarly, there are the black tallows and greases used extensively for soap production.

It has also been suggested recently that it would be more economic to manufacture soapless detergents from petroleum than to embark on very expensive schemes for the clearing of territory for the production of oil-bearing crops, such as the East African Ground-nut Scheme. It is not for me to discuss the economic merits of these alternative projects. I do, however, wish to emphasize, particularly before a society concerned with nutrition, that there is also a great world shortage of protein, and that in growing the ground-nut or similar oil-bearing seeds a great increase in protein production can also be achieved. I should not like to predict the future of the oil-bearing seed. It has been suggested, however, that, whereas up to now the seed has been grown for its oil content and the protein residue has been used for animal feeding-stuffs, the time may come when the protein content may be considered just as important as its oil content.

There is, however, a wider consideration to bear in mind. The standard of living of the peoples inhabiting tropical areas is extremely low, and it is obvious that any improvement in this standard can come only from the development of the territories in which they live. These developments must be agricultural, and can be effective only if broadly conceived. It is our duty to make use of the potentially vast productivity of these tropical areas to improve both the standard of living of their inhabitants and also that of the world beyond them.

Marine Animals as a Source of Fat

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By far the most important marine source of fat is the whaling industry, but the contribution made by fish to the world's fat supply, although much smaller, is by no means negligible. The yearly pre-war whale-oil production was somewhat above 500,000 tons, whereas fish-oil production, excluding that of Japan, was about 160,000 tons, most of it in the United States. Whale-oil production in the 1946–7 Antarctic season was 347,000 tons, and the estimated world production of fish oils in 1947 was 104,000 tons. Before the war whale oil was obtained largely by expeditions from the United Kingdom, Norway, Germany and Japan, although the last named was not a signatory of the International Whaling Agreement. At present, whaling operations are carried out mainly by Norwegian and British fleets, with a very limited, controlled Japanese participation. Fish oil is produced on a large scale in the United States, Canada, Norway and Iceland. Before the war much was produced in Japan; this activity has now recommenced, but so far on a smaller scale.

It is not certain how far production of marine animal oils can be expanded, or even whether it can be maintained at present levels. The whaling industry affords a classic example of the dangers of overfishing. In the early days of whaling the Arctic seas provided the catch. With the development of the harpoon gun and faster and more