

INTRODUCTION.

The coconut palm, Cocos nucifera, L., occupies a unique position in economic botany. As a subsistence crop par excellence it is able to provide most of man's food, his fuel, weapons, utensils, building materials, and if necessary, his water supply. Equally as a cash crop it is amenable to estate cultivation, where under suitable conditions, and with good management, it is capable of yielding high returns, both in terms of land and capital investment. In circumstances intermediate between these extremes, it provides the peasant with an important supplementary source of food and raw materials. While any production surplus to his requirements has often a ready sale, and thus allows the development of a cash economy, even in some of the more remote areas.

Many writers have used glowing terms to emphasize the importance of the coconut palm, several of which are quoted by Aten, Manni and Cooke (1958). Massal and Barrau (1956) state that its absence would virtually preclude human life on the atolls of the South Pacific region. This opinion being shared by Pieris (1954) who confirms the non-existence of a suitable alternative plant. Pieris (1936), Peters (1954), Cooke (1951) and many others have composed impressive lists of the uses of the coconut palm in domestic economy, covering a range of articles from ships to fish-hooks, condiments to charcoal, and arrow-heads to alcohol.

However, it is with the commercial products of the palm that this dissertation is primarily concerned. These consist of copra, the dried endosperm of the nut, and of the by-products of its manufacture and utilization. World production of copra in 1956 reached the record level of three and a third million tons, and is expected by Anon (a) (1959), that this total will be exceeded in 1959.

Approximately two-thirds of recorded production enters world trade, either as copra or its derivatives. The distribution of world production is shown in Table 1, while figures derived from Anon (b), (1958) indicate that 82.5 per cent is produced in the Far East. Exports from the principal primary producing countries are shown in Table 2. Copra is valued for its high content of coconut oil, which is used extensively in the manufacture of edible and industrial products. The residue after oil extraction is copra-cake, or poonac, which is used principally as a stock feed, but is now finding increased industrial application. The relative value of the export of copra and its products in the economics of certain countries is depicted in Table 3, which demonstrates the importance of the coconut palm to the smaller territories of the Pacific and Indian Oceans.

The patent taken out in Great Britain in 1841 by R.L. Sturtewant for the use of coconut oil in the manufacture of soap marks, according to Child (1946), the beginning of the coconut industry. Previous to that the export of copra had been very small but by this development a considerable demand was created. The present importance of copra and the rapid growth of the coconut industry during the early part of the 20th century stems from the increasing demands of soap manufacturers, and from the use of coconut oil in the production of a butter substitute. In a review of the latter development, Lyon (1903) points out that the first commercial factory was built in 1895 and followed by a second in Mannheim in 1877. Messrs. Rocca, Tassy and de Roux established a factory in Marseilles in 1900 with a capacity of 25 tons of 'dietetic compounds' per month. The output of this plant had risen to 72,000 tons per year by 1902, and consisted of two products sold under the names of 'Vegaline' and 'Cocaline'.

The success of this venture was almost entirely due to certain Dutch and Danish merchants who purchased most of the factory's output at between 18 and 20¢ (U.S.) per kilo and then packed it in tins marked 'Dairy Butter'. In that form the products achieved a world-wide market and were especially acceptable in the tropics, where the higher melting point was an advantage. Barrett (1913) commenting on the rapid increase in vegetable fat production quotes the Financial Times as predicting a happy future for these commodities. This view being based on the absence of animal ingredients making them acceptable to all religious groups, while their freedom from Tuberculosis organisms would appeal to the more material. The large boost that these developments gave to the industry, which was at that time operating under semi-monopolistic conditions, made coconut growing a very favourable field for investment as is clearly indicated by Hamel-Smith and Pape (1912), and Belfont and Hoyer (1914).

From these somewhat fraudulent beginnings has developed the huge edible oil industry of the present; aided by the high population pressure of some industrial countries, and by the depletion of the dairy herds of Europe during two World Wars. In addition to soap and margarine, Lyon (1903) states that coconut oil was used in the manufacture of candles, lamp oil, and cooking oil; and in medicine as an anthelmintic, and a cure for eczema and baldness. Today, mills capable of extracting oil at an approximate rate of 63 per cent of the copra by weight have been established in most industrial countries, and in some of the larger or more advanced producing territories. The majority of the oil is at present converted into several grades of soap, during which process glycerine is recovered. While much of it is used in edible products, which consist typically of one or two grades of table margarine, a large

range of cooking margarines and shortenings, cooking oil, and refined edible oil. These processes are more fully described in Appendix I.

The current import picture for copra and oil is indicated by Table 4, and Table 5 shows the relative proportions of each imported into selected countries. The increase in copra exported has to a certain extent been at the expense of oil, but the increase has been real as indicated by Table 1. The United States, Western Germany, and the United Kingdom are the leading net importers of copra. United States consumption has declined since the boom occasioned by the Korean War due, according to Anon (c), (1958), to a fall in soap production resulting from the huge output of synthetic detergents, and to a processing tax which favours the use of domestic oilseeds and tallows. Western Europe on the other hand is now taking 53 per cent of the world's exports as the increased utilization in margarine has more than off-set the fall in soap production. The same three nations are also the largest importers of oil, the United States leading, despite a tariff which has reduced the post-war level. China made a substantial incursion into the market in 1954, and may become an important consumer. The United Kingdom's import of oil has increased in the post-war years.

Naturally the world price of copra and oil is largely governed by that ruling in the Philippines, which provide nearly 40 per cent of the total copra products exported. Also the price structure is very elastic, being greatly effected by the price of competitive oil sources. This is particularly true of palm kernel oil which has very similar properties to coconut oil and is not excluded from the soap industry by virtue of a low saponification value, as is the case of palm oil. Table 6 shows the relative net exports of these three edible-industrial oils.

By and large manufacturers appear to prefer coconut oil as it is suitable for most purposes and has the added advantage of the poonac, for which there is always a ready market, provided that the copra was of good quality. A slight change in demand has a considerable effect on price, as exemplified by the entry of China as a purchaser in 1954. These considerations are adequately dealt with by Lefort (1956 a) and Anon (c) (1958), recent price trends for copra products are indicated in Table 7.

The present picture appears to be satisfactory, but in such a long term crop it is the future which is of supreme importance. Figures quoted by Gregory, Sills, and Palmer (1958), show the vast increase in synthetic detergent production in the United States and Great Britain. They account for 53 per cent of all washing products in the U.S.A., and have reduced soap consumption from 18 to 8.4 lbs. per head per annum. This has naturally reduced the demand for copra, especially that of poor quality. Lefort (1956) fears that the situation will be aggravated if American surplus tallow and animal fats become available in Europe. Fortunately, the production of toilet soap, shampoos, etc., still depend on natural fats, and particularly those like coconut oil which have a high lauric and myristic acid values, although this situation may not be long maintained. However, Anon (c) (1958), states that it is now possible to use coconut oil in the manufacture of synthetic detergents, though this outlet will almost certainly be limited to good quality oil.

It is clear that the increase in margarine and cooking fat production has created a demand for coconut oil which has more than off-set the decline in the soap market. This is particularly true of Western Europe where 60 per cent of the world's output of 2,900,000 tons

of margarine is produced. There is general agreement that the main hope of the industry must be placed on edible fats as the market is expanding rapidly and has every prospect of doing so in the future. While it is common practice to multiply the world's population, both present and future, by 25 pounds, (the minimum fat intake per head, per year) and to claim that the product represents the future demand for fat; this optimism is strongly criticized by Anon, (d) (1947) as being based on a degree of human goodwill which is entirely unknown. It is better to recognise that steadily improving living standards will create a slowly enlarging demand for edible fats which will be reflected in a larger market for cheap good quality copra. Equally, the premise that this increase in living standards will lead to a heavy demand for bar soap must be qualified by the knowledge that detergents in bar form will soon be available. It is clear that except for some minor, and futuristic outlets, (described under By-Products) the commercial future of the coconut industry depends on its position in the edible fat trade. *to be profitable.*

Pieris, (1955), describes two general grades of coconut oil, the first, suitable for edible use, is clear, of light colour, and low free fatty acid content, and free from rancidity, objectionable odours, and taint precursors. It is the product of clean, sweet-smelling, well dried white copra, free from mould and insect damage, and impurities. The second, lacks these properties and is produced from the deteriorating and dirty copra which results from inadequate drying and poor storage. It is only suitable for soap manufacture and the residual poonac is often unfit for livestock. Clearly the opportunity to dispose of this type of product profitably will decrease with the fall in

independent soap production and with the increased availability of good quality oil sources.

It is certain ~~that the~~ increasing emphasis on edible fats will lead to a strong demand for the high quality product which the industry must be able to meet. While it is unreasonable to expect anyone to make good copra without some incentive, the premium that it will fetch, coupled with the inability to sell rubbish, should provide this. Thus in the final analysis the future of the industry depends on its ability to market a high grade product at competitive prices, while generating sufficient profit to encourage increased investment and good management.

Quality in copra and thus in the oil is dependent on extracting the fresh kernel from the mature nut without contamination, drying it rapidly to a moisture content of not more than 6 per cent, and finally maintaining it dry and free from vermin during storage and shipping. The cost of these operations must be minimized if the enterprise is to be profitable.

It is the purpose of this dissertation to review the present knowledge of these operations, and to attempt to indicate the most suitable methods. The present and future uses of the by-products of these processes are reviewed and considered. Despite the uniformly low quality of the copra produced by the Trinidad industry, it was felt that a study of the local practices would be worthwhile, and the writer's impressions of these appear in Section 2.