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5. Author(s)
1. Eric L. Hyman
2.
3.

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Prospects for the Palm Oil Industry in Cameroon

by

Eric L. Hyman, Ph.D.[1]

[1]Evaluation Economist
Appropriate Technology International
1331 H St., N.W.
Washington, DC 20005 USA

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ABSTRACT

This paper discusses the ecological, agronomic, and industrial factors affecting the economics of palm oil production. It begins with a description of the uses of palm oil on the world market and domestic market and the cultivation and harvesting of oil palm. The current and projected supply and demand for palm oil are assessed, along with the implications for international trade, domestic consumption, and prices. It also examines the prospects for the industry in the Cameroon, including large-scale firms, minimills, and artisanal producers.

Characteristics of Palm and Palm Kernel Oil

Palm oil comes from the pulp (mesocarp) of the fruit of *Elaeis guineensis*. This palm has a higher oil yield per unit area than any other oil crop. As much as 5.0-8.5 tonnes (t) of palm oil can be obtained per hectare (ha) under favorable conditions with intensive management, compared to 2 t/ha from soybeans, 3 t/ha from rapeseed or olive oil, and 4 t/ha from sunflowerseeds or coconuts (Wood and Beattie 1981). A different kind of oil, palm kernel oil, is obtained from the nut inside the fruit.

Palm oil contains no cholesterol although it is relatively high in saturated fats. However, an excess of saturated fats is not a common problem for the bulk of the population in most LDCs. In fact, FAO/WHO estimated that 70% of malnourished children in LDCs just suffer from a shortage of calories, not protein. As a concentrated source of calories, increased consumption of oils could help solve this problem (Otto 1987). Recent research at the Palm Oil Research Institute of Malaysia may indicate that palm oil lowers blood cholesterol levels despite the high saturated fat content ("Malaysia Sees Palm Oil Sector" 1987). In addition, crude (unrefined) palm oil, the form consumed most

often in West and Central Africa, is high in carotenes. As a result, vitamin A deficiencies that are common in other parts of the Third World and can lead to xeropthalmia and other maladies are rare in this region.

Palm oil is low foaming due to the low concentration of lauric acid, which makes it good for frying. Other major uses are in margarine, compound cooking fats, and shortening, particularly for baked goods. As a shortening, it is no more saturated than its substitutes such as coconut oil, animal fat, or other vegetable oils that have been chemically hydrogenated. The food industry's choice among these fats largely depends on relative prices. With further processing, palm oil can be used for other food products. In addition, the high proportion of palmitic acid in palm oil makes it good for soaps (Asiedu 1986). Other nonfood uses are as an oleochemical feedstock, substitute for tallow, and as a source of glycerol (Schwitzer 1980). Palm kernel oil is mainly used for high-value, non-edible purposes. Its properties are similar to those of coconut oil because both have a high lauric acid content.

The Geography of Cameroon and the Ecological Niche of Oil Palm

In mid-1985, Cameroon had a population of 10.2 million; this is projected to increase 3.4% per year through the year 2000 (IBRD 1987). About 66% of the population is rural (FAO Investment Centre/IBRD 1986). A sizable area of uncultivated, arable land remains in the central, southern, and eastern portions (FAO Investment Centre/IBRD 1986).

Oil palm is indigenous to Cameroon. In fact, the amount of

wild oil palm has increased during regrowth after slash and burn cultivation because it cannot compete with established, broad-leaved trees (MacFarlane, Swetman, and Coursey 1984). Areas with wild palm are not necessarily good sites for intensive management of high-yielding palm varieties (Richards 1984). Optimal conditions for oil palm include

*Sun: minimum of 2,000 h/y and an average of 165 h/mo
*Rain: minimum of 1,800 mm/y and an average of 150 mm/mo,
*Humidity: minimum of 75%
*Temperature: 26°C annual average, minimum monthly average 18°C
*Soil pH: neutral is preferable, but at least 4.5
*Soil moisture: no prolonged waterlogging, but temporary flooding with rapid drainage is acceptable;
*Soil fertility: high minerals content is less important than soil texture (French Ministry of External Relations 1984)

A high soil water-holding capacity is also important if there is a pronounced dry season. Total rainfall and the evenness of its distribution is the most critical factor (Moll 1987).

Parts of southern and western Cameroon have sufficient precipitation for oil palm. At altitudes below 500 m, the temperatures are suitable. Good growing conditions for oil palm are found in a 50-100 km wide stretch along the coast as well as the area around Mamfe in the west, except for the slopes of Mt. Cameroon and the Rumpi fields. Suitable land is available south of Douala for expansion of plantations, but high labor turnover and high transportation costs for the perishable fruits limit production.

Government policy encourages oil palm production in the forest zone. The competing crops in this area are cacao, rubber, coconuts, bananas, cassava, yams, and cocoyams (Moll 1987). The

forest zone includes parts of the East, Center-South, Littoral, and Southwest provinces.

Varieties of Oil Palm

Oil palm comes in several varieties; Dura, mixed wild, and Tenera are important in Cameroon. These varieties differ substantially in proportions of pulp and kernel in the fruits, oil content of the pulp, and fruit yields per hectare. Much of the semiwild palm harvested in Cameroon is Dura, which spread naturally from old plantations. The oil content of stripped Dura fruit is 15-23% by weight. Equivalently, the oil content is 8.0-12.5% of the fresh fruit bunches (ffb) containing the stalks and fruit since stripped fruit constitutes 55% of the bunch weight. Dura fruit has a large kernel, comprising 40-75% of the weight. Palm kernel oil constitutes 5.0-12.5% of the weight of the kernel (Spaenhoven 1986). Not all of the wild palm in Cameroon is Dura, but ordinary wild palm has a similar oil content (Hadley and Hadley 1986).

Tenera, a hybrid developed in the late 1950s, is cultivated intensively on new plantations. The fruits are larger than Dura and the kernel amounts to just 4% of the fruit (Petitpierre 1984). The yield of palm oil from Tenera averages 22.5% of the ffb weight (Spaenhoven 1986).

In West Africa, Dura typically yields 3.0 t of ffb per ha, compared to 9.0 t of ffb per ha for Tenera (Hadcock 1984) and 1.0-1.5 t of ffb per ha for mixed semiwild stands (APICA/GATE 1983; Moll 1987). At these yields, the quantity of oil obtained

per ha is 0.4 t from selected Dura, 2.02 t from Tenera, and 0.05-0.19 t from semiwild trees. In practice, actual yields are considerably lower due to limitations of the extraction technology.

Oil palm yields vary with the climatic conditions, density of trees, cultivation techniques, and age of the trees. In 1982, average yields for producing Tenera plantations in t of ffb per ha were 17.8 in Malaysia, 17.5 in Indonesia, 15.4 in Colombia, 8.9 in Cameroon, and 8.4 in the Ivory Coast. Average ffb yields for smallholders in Cameroon range from 6.4-10.2 t/ha (FAO/Investment Centre/IBRD 1986), while mature industrial plantations achieve 9-15 t/ha (Younoussi 1985). Additional sites with potential yields exceeding 13 t/ha are largely unavailable in Cameroon (FAO Investment Centre/IBRD 1986). Yields are relatively low in Cameroon because of the seasonality of rainfall and the low intensity of management. For example, plantations use an average of 125 kg of fertilizer per ha in Cameroon, compared to 760 kg/ha in Malaysia (Moll 1987).

Even though the kernels are much smaller for Tenera than Dura, Tenera produces so much more fruit that it can yield double the weight of kernels (Onochie 1982). At Tenera plantations in 1982, the average yield of kernels in t per ha was 0.9 in Malaysia, 0.6 in Indonesia, 0.7 in Colombia, 0.3 in Cameroon, and 0.4 in the Ivory Coast (Moll 1987).

The variety of palm used affects the choice of pressing technology in two ways. First, it affects the profitability of oil extraction, which can determine the capital costs that an

entrepreneur is willing to invest. Second, the relative extraction efficiency of different types of presses varies with the proportion of pulp and kernel in the fruit pressed, which is low for Dura and high for Tenera.

Establishment and Growth of Oil Palm

Semiwild oil palm is a crop that provides supplementary income without taking up much time. Little or no cultivation is done except for clearing of brush around the trees. Some farmers water the trees in the dry season. Most of the labor is in harvesting and processing of the palm fruits. The trees are long-lived and propagate naturally. Semiwild stands usually contain 50-75 trees/ha (Moll 1987; Moutsi 1987). By contrast, Tenera plantations require considerable effort in establishment and maintenance. In West Africa, the spacing for plantation Tenera is 140-145 trees/ha (Moutsi 1987).

Dura may take 7 years to bear (Onochie 1982). Tenera begins bearing after 4-5 years, but 10 years are required to reach maximum production (Moll 1987). As Tenera plantations age, the number of bearing trees per ha may fall and the number of bunches per palm declines. Also, the average weight of a bunch and its oil content increase with age for the first 10 years and then level off. The combined effect leads to a rapid increase in yields from years 4 to 10 followed by a gradual decline to 60-80% of the peak by year 25 (Moll 1987). At age 4, a good smallholder plantation of Tenera in Cameroon yields 2 t of ffb per ha. The yield rises to 4 t/ha at age 6, and around 10 t/ha after 8-10

years (Egli 1987). The economic life of a plantation is 25-30 years (Tjeng and Olie 1978).

Harvesting and Storage of Palm Fruits

Palm yields are less seasonal than many other crops (FAO 1982). The peak harvests in Ndian, Cameroon are March to May and October to November (Langley 1982). During the peak month, 15% of annual production may be harvested. Individual fruits on the same bunch may vary in maturity by 15 days. Detached fruits acidify rapidly, but there is also a tradeoff between acidity and oil content as the rest of the fruits mature. Thus, the best time to harvest a bunch is when 5-10 fruits have spontaneously fallen off (French Ministry of External Relations 1984).

Harvesting difficulties are another important motivation for switching to a hybrid variety. Dura and semiwild varieties are tall and can only be harvested by climbing, which can be dangerous (Puga and Ngankam 1983). Tenera is a dwarf tree that can be harvested by using a sickle hook attached to a pole (LeMerre 1971).

Rapid processing of the fruits is important because their quality can deteriorate rapidly. Yet, the traditional process is slow and industrial-scale mills may face delays in transport of fruits before processing. Also, transportation costs are high because palm fruits are a bulky raw material. Consequently, artisanal production near the harvest site using a press that combines depulping and pressing for rapid processing has advantages for domestic markets.

Current Supply of Palm and Palm Kernel Oil

World Production

Between 1961-63 and 1981-83, world production of palm oil increased over 350% and palm kernel oil production went up 100% (table 1). Most of the increase took place in Malaysia and Indonesia due to research and intensive management; African countries showed only a modest increase. As a result, Asia now accounts for nearly three-quarters of world production of oil palm products, about the same share that Africa had in 1965 (IBRD 1986). Until 1960, Zaire was the major commercial producer of oil palm products, but the industry declined due to political conditions and lack of replanting (Commodities and Trade Division 1984).

Table 2 shows projected world palm oil production in 1990 and the year 2000. An increase of nearly 75% in world production between 1985-87 and the year 2000 is expected, largely from Asia. Continued growth of Malaysian production through the year 2000 is projected, but at a slower rate. Malaysia still has land available for expansion and further yield increases from cloned varieties are anticipated (Ender 1985). The growth rate in Africa is difficult to predict because of uncertainty about artisanal production.

Cameroon

Cameroon is the fourth largest producer of palm oil in Africa, after Nigeria, Ivory Coast, and Zaire. However, Cameroon's share of world production is very small, 1.6% in 1986.

TABLE 1
Average World Production of Palm Oil and Palm Kernels (1000 t)

Region	1961-63[a]	1971-73[a]	1981-83[a]	1985-87[b]
Palm Oil				
Africa	1,011	1,278	1,372	-
Asia	255	1,035	4,184	-
Central and South America	28	91	229	-
World	1,294	2,407	5,874	8,000
Palm Kernels				
Africa	778	861	739	-
Asia	62	220	984	-
Central and South America	194	262	320	-
World	1,034	1,343	2,074	2,520

Sources: a) Moll 1987; b) Foreign Agricultural Service 1987.

TABLE 2
Projected World Palm Oil Production

Region	1990	2000	% Annual Change 1985-2000
Africa	1,465	1,565	0.5
Asia	7,650	11,405	4.7
Central and South America	450	780	5.5
World	9,565	13,975	4.2

Source: IBRD 1986.

Nevertheless, palm oil comprises over four-fifths of crude edible oil production in the country (Mimba 1987).

In 1986, Cameroon had 59,384 ha of productive Tenera plantations. Of this amount, 62% was owned by parastatals, 27% by private firms, and over 10% by smallholders (FAO Investment Centre/IBRD 1986). Semiwild oil palm may occupy as much as 385,000 ha of land (Country Report: Cameroon 1984), but only about 100,000 ha of this is now harvested (Moll 1987).

In 1986, industrial production of crude palm oil amounted to 95,000 t (Mfoula 1987; Mimba 1987). Between 1982 and 1986, industrial production of palm oil rose 30%. Artisanal production has been estimated at 28,000-32,000 t (FAO Investment Centre/IBRD 1986; Moll 1987). The total volume of palm kernels marketed in 1982 was 46,000 t and nearly three-quarters of this was crushed domestically (Moll 1987).

A. Industrial-Scale Production

Industrial-scale production of palm oil began in Cameroon at the end of the 19th century. The first plantation was started in 1928 at Ndian. The two largest producers, SOCAPALM and CDC, are parastatals and the rest are private companies. In 1986, crude palm oil production was 48,784 t at SOCAPALM (Mfoula 1987), and 28,210 t at CDC (Mimba 1987). In 1984-85, palm oil production amounted to 15,330 t at PAMOL, 4,350 t at SAFACAM, 3,650 t at various medium-scale enterprises, and 2,275 t at SPFS (Hornus, Kamga, and Chaillard 1987). Thus, the three largest firms account for 90% of production. The top two producers of palm

kernels in 1986 were SOCAPALM at 6,100 t (Mfoula 1987) and CDC at 5,216 t (Mimba 1987). In 1984-85, PAMOL produced 3,650 t of kernels, SAFACAM 890 t, Mukete 730 t, and SPFS 450 t (Hornus, Kamga, and Chaillard 1987).

In 1986, the area of company-owned plantations was 21,438 ha at SOCAPALM, 15,520 ha at CDC, 9,785 ha at PAMOL, 3,202 ha at SAFACAM, 2,500 ha at SPFS, and 720 ha at Mukete (Hornus, Kamga, and Chaillard 1987). The three largest companies controlled 88% of the land area of industrial plantations. In addition, they contracted with smallholders for 6,219 ha of oil palm (FAO Investment Centre/IBRD 1986). Yields are expected to increase at the SOCAPALM plantations because many are still young (Mfoula 1987). The CDC plantations have stable yields, but the company is reducing their area (Mimba 1987).

Three-fifths of the SOCAPALM plantations are in the Littoral Province, over one-quarter are in the Southern Province, and the rest in the Center Province. CDC and PAMOL plantations are located in the Southwest Province, and the SAFACAM and SPFS plantations in the Littoral Province (Younoussi 1985). The plantations have had trouble keeping their labor force (Moll 1987). The large-scale mills are located in palm-growing areas along the coast for proximity to ports or near urban centers of demand.

In 1984-85, 1,400 smallholders with 3,603 ha of oil palm were under contract with SOCAPALM. CDC had 160 contract growers with 467 ha and PAMOL had contracts for 2,149 hectares. The average participant in SOCAPALM's smallholder program had 2.5 ha

of Tenera, although the program objective was 4 ha per participant (Moll 1987). CDC's supervised contract scheme is limited to smallholders within a 20-km radius of the mill, unlike some of the other programs, but the company also buys as much Tenera as more distant smallholders offer. PAMOL's contract smallholder plantations established around 1960 are now reaching the end of their productive lives (FAO Investment Centre/IBRD 1986).

SOCAPALM's supervised contract growers receive a subsidy covering 40% of the wage costs for the labor required up to the 5th year. They are also eligible for a loan for the costs of the non-labor inputs. The long-term credit from a government bank, FONADER, carries an interest rate of 11.25% per year and repayments begin in year 6 and continue through year 12 (Younoussi 1985). SOCAPALM deducts the loan repayments from the farmer's revenues. When production begins, the farmers can obtain short-term credit for 6 months or medium-term credit for 5 years at an interest rate of 9.25%. PAMOL did not provide services to smallholders other than provision of seedlings (FAO Investment Centre/IBRD 1986).

Large-scale palm oil mills conventionally operate on double or triple shifts. At a realistic capacity use rate, a 6 t/h plant would serve 1,000-1,500 ha of plantations. Since village mills are usually operated on single shifts for around 2,000 hours/year, one with a capacity of 0.75 t/hour would process the output from 100-150 ha of Tenera (Moll 1987).

Currently, 11 large-scale mills with a total capacity of 250

t/hour are operating, along with 4 village-scale mills (table 3). Assuming operation for 300 days per year on triple shifts with an oil extraction rate of 21% of the ffb weight, the 4 largest producers have a total capacity of 408,000 t of oil per year. However, the capacity use rate for the large-scale industry is only 24% due to low world market prices, domestic transportation and sales problems, and high production costs for palm fruit and oil. Most of the output of large-scale firms in Cameroon is consumed in crude form.

B. Artisanal-Scale Production

Artisanal production from semiwild stands provides around one-fourth of the country's supply of palm oil. Significant areas of semiwild palm are found in the Northwest, Centre-South and Littoral Provinces (ECA 1983). In addition, there are 2,000-3,000 ha of Tenera smallholdings that are not tied by contract to large-scale industry, often because of their distance from the mills. A majority of these independent smallholder plantations have a legal land title (GRET 1986). Most are less than 2 ha in size because the work is difficult with traditional tools (FAO Investment Centre/IBRD 1986).

Artisanal producers mainly sell oil for the rural market. In 1981-82, 38% of artisanal production was sold directly by the producers, 34% was consumed by relatives of the farmers or workers, and 29% was distributed by the commercial sector or cooperatives (GRET 1986). Some of this oil is produced by the traditional process of stomping by foot, but in Cameroon, most

TABLE 3
Major Oil Mills in Cameroon[a]

	Site	Production Capacity (t of ffb/hr)	Date of Establishment	Press Manufacturer
SOCAPALM				
	Dibombari	40	1948	de Wecker
	Kiribi	20[b]	1949, 1974	Stork
	Mbongo	40	1974	Speichim
	Eseka	12	1975	de Wecker
	Kienke	20	--	de Wecker
CDC				
	Mondoni	48	1972	de Wecker
	Idenau	20	1955, 1984	de Wecker
PAMOL				
	N'dian	18	1935	de Wecker
	Lobe	12	1967	de Wecker/ Colin
SAFACAM				
	Dizangue	20	1981	Speichim

[a]Data were unavailable for the SPFS industrial mill. In addition, there are village-scale mills with an approximate capacity of 1 t of ffb/hour each at Bongungo (Mbonge, Southwest Province), Illuani (Mbonge, Southwest Province), Nchang (Mamfe, Southwest Province), and Teze (Northwest Province).

[b] Can expand to 40.

Sources: Country Report 1984; Mfoula 1987; Mimba 1987; Moutsi 1987.

commercial producers have access to an old Colin press (a small-scale expeller imported from France). Since most of these expellers are over 30 years old, they are nearing the end of their useful lifetimes, and the manufacturer does not regularly produce them anymore.

Small farmers who do not have their own oil presses have the option of purchasing pressing services. In Cameroon, the usual arrangement is for the press owner to receive one-fifth of the oil pressed. The farmer also provides the labor for hand pressing or pays the fuel cost for a motorized press. The value of this in-kind payment for pressing services is much higher than the cash cost of pressing services in the Ivory Coast (ECA 1983).

The artisanal sector offers important advantages in meeting the rural demand. First, rural consumers prefer the sharp taste of palm oil with a high free fatty acids (FFA) content over oil from the large-scale mills. Second, the artisans have low production costs because of their relatively inexpensive source of palm fruits and moderate equipment costs even though oil yields per bunch are low. Unskilled labor, often from within the household, is the main input. Third, artisanal production has been more stable than industrial-scale production from year to year. Fourth and most importantly, the industrial product often does not reach remote rural areas. When available, the industrial product sells at a higher retail price in rural areas than in urban areas because of transportation costs and a lower volume of purchases.

Current and Future Demand for Palm and Palm Kernel Oils

World

Between 1961-63 and 1981-83, world consumption of palm oil increased 8.4% per year, twice as much as the 4.2% annual growth for vegetable oils as a whole (Moll 1987). In volume terms, palm oil consumption overtook cottonseed, groundnut, rapeseed, and sunflowerseed oils in the 1970s, and tallow and butter consumption in 1982 (Commodities and Trade Division 1984). Palm oil's share of total vegetable oil consumption was 12% in 1984 and is projected at 15% in the year 2000 (IBRD 1987).

World consumption of palm oil may increase 86% between 1985 and the year 2000. At present, over 82% of palm oil production is consumed in developing countries; this proportion is expected to increase slightly by the year 2000. Nigeria, Indonesia, India, and Malaysia consume the most palm oil and, except for India, are also important producers (table 4).

The factors affecting the demand for palm oil are population growth and increasing per capita consumption. Per capita consumption of fats and oils depends on the current diet, income elasticity of demand, and income growth over time. Because of the substitutability of various vegetable oils, the share of palm oil in total vegetable oil consumption depends on relative prices. Over the medium term, the supply is more variable for annual crop oilseeds than for palm oil, which is a perennial with long juvenile and bearing periods.

Cameroon

According to FAO Investment Centre/IBRD (1986), per capita

TABLE 4
Historical and Projected Consumption of Palm Oil (thousand tonnes)

Region	1969-71	1979-81	1985	1990	2000
Industrial	653	987	1,022	1,197	1,440
N. America	94	146	184	218	270
United States	80	128	169	200	248
EEC-10	501	636	616	711	841
United Kingdom	175	191	185	211	246
Germany, F.R.	128	145	132	152	176
Netherlands	72	112	97	116	141
Centrally Planned	8	137	297	353	435
Developing	1,383	3,796	6,181	8,015	12,100
Asia	267	2,152	3,979	5,112	7,509
China	114	231	284	398	550
India	0	525	668	840	1,213
Indonesia	35	360	894	1,038	1,408
Iraq	78	134	224	284	458
Malaysia	15	427	416	582	908
Africa	1,012	1,429	1,859	2,445	3,932
Nigeria	575	723	959	1,213	1,966
Zaire	111	162	157	210	334
Central and S. America	83	181	285	380	550
World	2,043	4,920	7,500	9,565	13,975

Source: IBRD 1986.

household consumption of palm oil in Cameroon was 9.94 kg/year in 1985 and is projected to increase to 10.75 kg/year in the year 2000. During the early 1980s, palm oil consumption in Cameroon was increasing 4.4% per year and 20% of the growth was in the two largest cities, Yaounde and Douala (Anonymous 1982). Per capita household consumption of palm kernel oil was nearly zero in 1985, and is projected to be 1.12 kg in the year 2000.

Estimates of demand vary. Total domestic consumption of palm oil was approximately 117,000 t in 1986 (Younoussi 1985). The 6th Five Year Plan covering 1986-91 was based on an estimated domestic demand of 200,000 t in the year 2000. CDC (1983) estimated demand to be 100,000 t in 1983 and and 160,000 t in the year 2000. The sources of the demand may also change from 47% urban, 28% rural, and 25% industrial to 57% urban, 26% rural, and 17% industrial (CDC 1983). GRET (1986) estimated household demand at 119,190 t and industrial demand at 27,300-45,292 t in the year 2000, for a total of 146,500-164,500 tonnes. This was based on an assumed population of 13.7 million in that year.

Another estimate put total domestic consumption at 135,000 t in 1985. The same study assumed a higher population, 15.15 million, for the year 2000, leading to a projected demand of 238,000 tonnes. Over that time period, the household share would increase from 73.6% to 75.6% of total demand, while the share of the food industry would decline from 6.7% to 6.3% and the share of the soapmaking industry would fall from 19.8% to 18.1%. Nearly all of the oil consumed by the restaurant and food industry in 1985 was crude oil, but refined oil may account for

nearly 30% of this consumption by the year 2000 (FAO Investment Centre/IBRD 1986).

Existing plantations could meet the domestic demand through the early 1990s, but new plantings would subsequently be needed under all of the above demand forecasts as the total harvest from existing industrial plantations levels off. Assuming replanting of existing plantations, the total output of palm oil from large mills will only be 1.5% greater in the season 2000-2001 than in 1984-85. In fact, because of the time lags before young stands bear, CDC and SOCAPALM would actually be producing less at the end of that period than at the beginning (table 5). CAMDEV (1983) saw a demand shortfall of 48,400 t in the year 2000, meaning that per capita consumption would either have to decline or be maintained through imports or expansion of artisanal production.

Financing has been arranged for a small amount of additional plantings: 1,130 ha by SAFACAM, 760 ha by PAMOL, 300 ha by SPFS, and 550 ha by Mukete. SOCAPALM and CDC have arranged for about 1,000 ha of new plantations by contract smallholders (FAO Investment Centre/IBRD 1986).

There are six main alternatives for organizing the needed increase in production: (1) establishment of new plantations of contract growers, (2) distribution of seedlings to improve semi-wild stands for artisanal producers, (3) clearing of forest land for larger blocks of small plantations, with or without interplanting of other crops, (4) creation of medium-scale enterprises for intensive management of new plantations, (5)

TABLE 5
Production Forecast for Industrial Palm Oil, for the Season 2000-2001

Company	Fresh Fruit Bunches (t)	Palm Oil (t)	% Change For Oil Over 1984-85	Kernels (t)	% Change For Kernels Over 1984-85
CDC	75,450	15,470	- 35	3,020	- 25
PAMOL	110,250	23,150	+ 51	5,500	+ 50
SOCAPALM	108,120	22,700	- 31	4,325	- 34
SAFACAM	37,350	7,650	+ 76	1,550	+ 74
SPFS	27,500	5,900	+ 159	1,180	+ 162
Other	43,890	8,775	+ 140	1,755	+ 140
Total	402,560	83,645	+ 1.5	17,330	+ 6.0

Source: Hornus, Kamga, and Chaillard 1987.

intensive colonization of forest land through an agro-industrial complex, and (6) intensive colonization combined with food crop production (Ibid.).

The large companies could minimize their capital costs by efficient reliance on contract growers. However, the contract programs are not always beneficial to smallholders. Many potential participants are middle-aged landowners who are not interested in deferring returns for the long term. Often, the plantings are dispersed within a farm and the yields are low due to minimal use of fertilizer and labor and insufficient technical assistance. Because of the low yields, the financial returns to contract growers of oil palm in Cameroon are marginal given the current prices paid for fruit (Ibid.). As a result, there is a high rate of contract farmers dropping out of the programs.

The large mills have also had problems with smallholder programs. The distance between farms and political pressures to expand participation beyond a 25-km radius of the mills made transport costs for the companies high. At present, CDC buys all suitable Tenera offered by smallholders within 30 km of a mill (Mimba 1987). The complementary investments incurred by the companies in equipment, transport, and quality control proved burdensome given the low production rate. Thus, it has been suggested that companies eliminate contracts with smallholders beyond the economic distance for transport of palm fruits (Ibid.).

If contract growing arrangements were cancelled, it could stimulate the demand for small-scale, low-cost pressing

equipment. However, as long as the contracts are available, many farmers will resist giving up the security these arrangements provide, even if there is a potential for a higher income on their own. Many smallholders with Tenera plantations also have access to semiwild palm, which could increase the capacity use rate if they bought a press.

Artisanal production will also be increasingly more important as the gap between industrial-scale production and demand grows (FAO Investment Centre/IBRD 1986; GRET 1986). The large unused area of semiwild trees could support expanded production if harvesting difficulties can be overcome. Improvement of semiwild palm stands is proceeding gradually, mainly through the Plan Palmeraies Villageoises (PPV) program of the Catholic mission at Otele. Tenera is easier to harvest than Dura and this seem to be as important a motivation for enrichment plantings as increasing yields. The financial returns from enrichment plantings of semiwild stands through sale of fruit to the mills would be moderate, but could be higher if farmers extracted the oil themselves (Ibid.). Enrichment planting could easily allow harvesting of an additional 36,630 t of ffb each year (FAO Investment Centre/IBRD 1986). This could be converted into over 6,200 t of palm oil using a manual Colin expeller.

Artisanal production also allows relatively rapid expansion of oil for rural markets without a large capital investment or high foreign exchange costs. With block plantings of 10-20 ha in privately managed, contract farm plots of at least 2 ha, some

economies of scale could be reaped in provision of inputs and services to oil palm growers and transport of the harvest to large-scale mills. However, it may be difficult to find suitable land for these blocks, especially if the beneficiaries come from other villages. Alternatively, if farmer groups could be effectively organized, this would provide an opportunity for a high capacity use rate for small-scale pressing equipment. (Ibid.).

Privately owned, medium-scale plantation enterprises with 50-150 ha of oil palm could achieve higher yields using intensive cultivation techniques, fertilizer, and herbicides. The financial returns from this can be good (Ibid.).

Colonization of the forest zone with establishment of an agro-industrial complex can have good direct financial returns, but the costs of developing the necessary infrastructure and the risks are high for a large, new facility in an undeveloped area (Ibid.). Agricultural research stations in Cameroon have identified two good sites for new plantings of oil palm. The first, 5,500 ha of flat land southwest of Edea, could produce 16-18 t of ffb per ha if drainage were installed. The second site which is 2,000 ha south of the SOCAPALM plantation at M'Bongo has a potential yield of 14-15 t/ha (Hornus, Kamga, and Chaillard 1987).

Exports

World

Table 6 lists recent and projected international trade in palm oil. World exports of palm oil grew at an average annual

TABLE 6
Historical and Projected International Trade in Palm Oil

	Quantity (1000 Tonnes)					Average Annual Growth Rates (%)	
	1969-71	1979-81	1985	1990	2000	1961-84	1985-2000
A. Gross Exports							
Industrial	37	110	118	185	225	11.1	4.4
EEC-10	36	107	116	177	209	11.1	4.0
Developing	965	3,118	4,797	5,620	8,955	10.5	4.3
Asia	773	2,967	4,580	5,405	8,730	14.6	4.4
Malaysia	444	2,102	3,235	4,230	5,717	18.0	3.9
Indonesia	182	357	450	662	1,890	6.2	10.0
Singapore	147	508	890	485	430	14.6	(-4.7)
Africa	186	95	52	40	40	(-6.4)	(-1.7)
World	1,002	3,228	4,915	5,668	9,180	10.6	4.3
B. Gross Imports							
Industrial	689	1,097	1,140	1,382	1,665	5.5	2.6
N. America	94	146	184	218	270	11.5	2.6
United States	80	128	169	200	248	15.2	2.6
EEC-10	538	744	732	888	1050	3.6	2.4
United Kingdom	175	192	185	211	246	2.6	1.9
Germany, F.R.	133	168	158	180	210	3.1	1.9
Netherlands	99	180	180	220	260	5.7	2.5
Japan	41	143	179	216	266	13.6	2.7
Centrally Planned	8	137	297	353	435	23.6	2.6
Developing	299	1,879	3,478	4,070	7,080	16.0	4.9
Asia	249	1,665	2,859	2,945	4,604	16.7	3.2
Singapore	155	534	900	600	450	14.9	(-4.5)
India	0	525	668	870	1,213	24.9	4.1
Iraq	78	134	224	284	408	9.1	4.1
Pakistan	1	215	416	582	858	67.4	4.9
Africa	24	178	461	1,060	2,407	18.1	11.6

Source: IBRD 1986.

rate of 10.6% between 1961 and 1984. Between 1985 and the year 2000, they are projected to grow at a slower rate, 4.3% per year. Most of the increase will be from Malaysia and Indonesia. African exports of palm are expected to decline 1.7% per year because the domestic market is expanding relative to production.

Developing countries imported 71% of the palm oil on the world market in 1985. Singapore was the largest single importer although most of this was re-exported. India and Pakistan are large net importers with growing consumption. Import demand is also increasing in Iraq, Saudi Arabia, and the USSR. The EEC is a much larger importer than North America (IBRD 1986). Although palm oil only accounts for 4% of edible oil consumption in the United States, its share is growing ("Malaysia Sees Palm-Oil Sector" 1987). European countries prefer to import crude palm oil because the refining process can be adapted to correct for quality variations (Willems 1985).

World exports of palm kernels are small, 130,000 t in 1986-87, and most of this is from Malaysia. Palm kernel oil exports are rising, predominantly for nonfood uses (Foreign Agricultural Service 1987).

Cameroon

Cameroon exports little palm oil, only 10,000 t in 1985-86 (Bradley 1987), which was 10.5% of the industrial-scale production. Most of the palm kernels and palm kernel oil produced by large-scale industry is exported. Cameroon is a minor exporter of oil palm products because it cannot compete with Southeast Asian exporters and has a large domestic demand. Total

production costs per tonne of product in Cameroon are 86% higher than in Indonesia and 113% more than in Coastal Malaysia mainly due to lower yields (Moll 1987).

Prices of Oil Palm Products

World Market Prices

Palm oil is a medium-valued oil priced similarly to soybean, rapeseed, and sunflowerseed oils. It is generally cheaper than coconut oil. World prices for palm oil vary with the level of industrial and consumer demand, supply of palm oil, price and availability of substitutes, and fluctuations in currency exchange rates. Nominal prices have fallen since mid-1985 due to large stocks of palm oil on the world market and declining imports by India and other countries (IBRD 1986). Figure 1 shows changes in the real price of palm oil between 1948 and 1985, and projections for 1986-2000. In mid-1987, the c.i.f. price from Cameroon was $284/t (Mimba 1987). The 12-month average f.o.b. price in the United States was $346 in mid-1987, 12% below the previous year's level in nominal terms (Foreign Agricultural Service 1987).

Since palm kernel oil has special uses due to its high lauric acid content, it sells for a higher price than palm oil. However, palm kernel oil receives a lower price than its principal substitute, coconut oil, because its higher FFA content makes it slightly more expensive to process. Unprocessed kernels from Cameroon were exported at a price of $178/t in 1983-84 (FAO Investment Centre/IBRD 1986). The domestic price of palm kernels was CFA 191 in 1982 (Moll 1987).

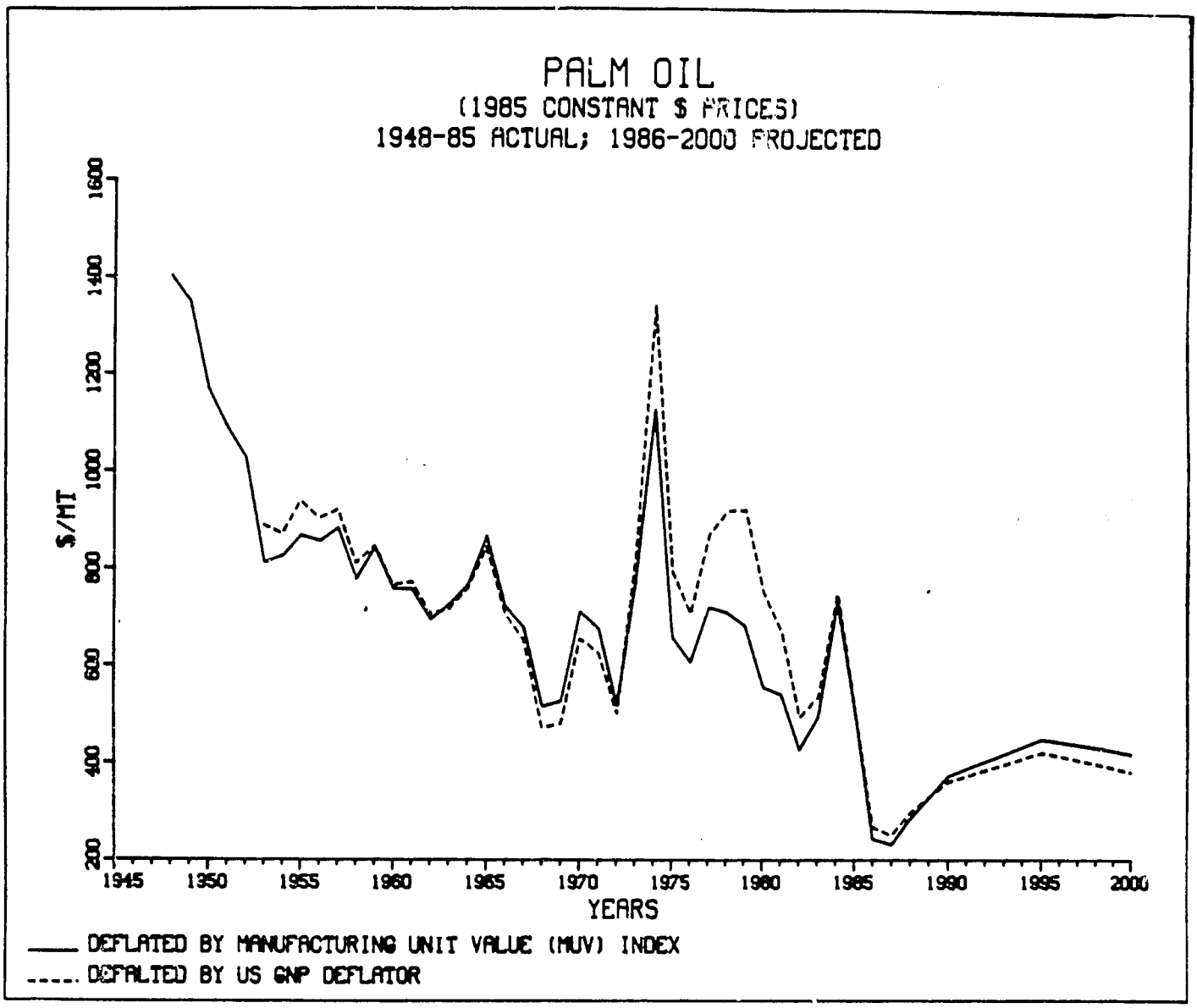

Figure 1. Real Prices of Palm Oil in the World Market

Source: IBRD 1986.

A glut or disaster in one major oilseed producing country can affect the entire market for vegetable oils. Although the real price fluctuations over the past decade have been largest for coconut oil, the pattern is similar for palm and soybean oils (Hyman 1987). The price of palm oil shows a strong correlation to the price of the major edible fats and oils, especially soybean, groundnut, cottonseed, rapeseed oils as well as tallow. Palm kernel oil's price is most affected by the price of coconut and palm oils.

Domestic Prices in Cameroon and the Effect of Government Policies

By government policy, domestic prices for palm oil in Cameroon have exceeded world market prices since 1975. However, large-scale producers may not charge a higher price than the fixed level. Together with a ban on palm oil imports, this pricing policy allows continued operation of domestic producers whose production costs exceed the delivered price of oil from Southeast Asia. Some palm oil of Indonesian origin is smuggled in through Nigeria. This oil sells for CFA 275/l in 40 l containers and puts downward pressure on the price of domestically produced oil (Mimba 1987).

At present, the regulated ex factory wholesale price is CFA 295/liter. With the 10.99% sales tax, the ex factory price becomes CFA 327. The costs of containers and transportation may be added to this price. CDC sells palm oil to the soap industry in large volumes at a lower price, CFA 225/kilogram.

Artisanal producers are indirectly affected by the controlled price through competition. In 1987, middlemen bought

oil from a small-scale mission enterprise at Otele at a price ranging from CFA 250/l to CFA 350/l (Egli 1987). In the same area, middlemen paid CFA 175-250/l for lower-quality oil from artisanal-scale producers in smaller volumes, 20-l tins, with the buyers bearing the costs of containers and transport.

Seasonal variations in palm oil prices are significant and mostly reflect changes in supply. Prices are lowest in the dry season from March to June when palm fruit is easiest to harvest, and highest in the rainy season from August to December (GRET 1986). Demand is nearly constant year-round, except for an increase around the Christmas and New Year's holidays (Van Beuningen, Thijsen, and Rijnsburger 1984). Between 1976 and 1982, the average difference between the yearly maximum and minimum monthly prices was 65% (GRET 1986).

Geographic variations in supply are common due to poor distribution systems and infrastructure. There can be a 40% difference in price between Douala where the product of large-scale mills is readily available and areas in the north where palm oil is not produced. In mid-1987, the retail price was around CFA 350 in urban areas (Mfoula 1987). However, it can reach CFA 800/l in remote areas (GRET 1986). Small palm oil producers who have access to vehicles have an opportunity to earn much larger profits by selling palm oil to vendors in remote areas where it is not produced. Retail prices for palm oil are higher in other African countries, e.g. CFA 500-800/l in Equatorial Guinea (Spaenhoven 1986).

In 1987, the large-scale mills sold palm kernels to

domestic, industrial soap factories at CFA 50,000/tonne (Mimba 1987). Cameroon used to have a government marketing board for palm kernels, but that has been abolished (Moll 1987). In 1986, artisanal kernel oil for medicinal purposes sold for CFA 800/l (Spaenhoven 1986).

Government regulation has not been able to control the large retail price increases that take place in times of scarcity. Following a drought, retail prices in Bamenda went from CFA 275/l in mid-1983 to CFA 900 in early 1984 before falling to CFA 350/l later in the year as supplies reached normal levels (Van Beuningen, Thijsen, and Rijnsburger 1984).

Cameroon levies a 35% tax on the profits of large- and medium-scale, formal sector firms. Artisanal-scale, informal sector producers or service pressing enterprises do not pay the corporate income tax. Exporters pay a duty based on the "mercurial value" fixed at CFA 50,000/t of palm oil or kernels. The export duty is 9.5% of the mercurial value for palm oil and 10.8% for palm kernels (Moll 1987).

Import prohibitions, and the government-set price floor boost the price that mills are able to pay oil palm producers above what they would be in an open market, but below the level that would prevail under continued protectionism in the absence of a price ceiling. In mid-1987, CDC and SOCAPALM paid CFA 27/kg for ffb delivered to the factory, and CDC paid only CFA 23/kg if it handled transport. The price does not vary by quality of fruit purchased, but unsuitable batches are rejected. CDC also bought palm kernels at CFA 25/kg (Mimba 1987).

The Oil Palm Oil Processing Industry

Medium- and Large-Scale Firms

A medium-scale mill generally has a capacity of 10-20 t of ffb per hour, compared to 20-60 t per hour or more in a large-scale mill. Medium- and large-scale palm oil mills use sophisticated, capital-intensive equipment. They both use similar technology and have similar oil extraction rates. In Cameroon, medium- and large-scale mills achieve an average extraction rate of 21% of the weight of the bunches for Tenera, with a range of 19-22% (Younoussi 1985).

Table 7 lists the capital costs of the newest large-scale mill in Cameroon, CDC's Idenau mill, which was built in 1984. At an exchange rate of CFA 300 per U.S. dollar, the capital costs then amounted to approximately $9 million, excluding land. In the year ending June 30, 1987, total operating costs were CFA 199,091,000 for production of 9,398 t of palm oil and 2,111 t of kernels. At CFA 328,335/t, gross revenues from oil alone were approximately CFA 3,085,692,330 (table 8).

Total full-time equivalent employment at Idenau is 92 workers: 8 -- management and supervision; 6 -- hourly labor; 8 -- miscellaneous; 6 -- transportation; 7 -- maintenance and repairs; 29 -- manufacturing; 18 -- packing, despatch, and kernel picking; 3 -- lab technicians, 14 -- half-time, unspecified. Employment at a large-scale mill is small relative to the labor required for plantation maintenance and harvesting (Moll 1987). Additional employment is generated on the plantations of contract smallholders.

TABLE 7
Capital Costs of the Large-Scale Idenau Mill

Item	Cost (1000 CFA)
Bunch reception	28,923
Sterilizer station	164,861
Mono rail hoist	6,747
Threshing station	57,516
Press station w/ 2 de Wecker twin-screw presses	112,562
Incinerator	66,156
Cake breaker conveyor	11,435
Depericarper	23,292
Nut drying	44,308
Nut crackers	15,925
Separation of cracked mixture	99,482
Drying of kernels	33,623
Crude oil treatment	17,764
Clarification station	61,770
Clarification sludge treatment	98,757
Effluent recovery	7,787
Palm oil storage	61,636
Steam generation	423,848
Power station	165,634
Water supply and steam mains	74,167
Miscellaneous	145,325
Foundations and building	973,760
TOTAL	2,695,278

Source: Mimba 1987.

TABLE 8
Operating Costs at the Idenau Mill (1000 CFA)[a]

General Expenses	
Management salaries and expenses	16,614
Supervisory salaries and expenses	7,671
Other supervision - overseas	1,398
Office expenses and clerical staff	10,896
Light, fuel, and water	7,462
Yard maintenance	233
Sanitation	682
Watchmen	2,448
Store keeping expenses	1,783
Indirect cost of labor	16,928
Maintenance and repairs	673
Motor vehicle operation and repairs	8,953
Medical expenses	1,676
Welfare expenses	6,100
Basket allowance	2,030
Attendance bonus	1,827
Subtotal	87,374
Oil Manufacture	
Transport of residues	7,693
Labor in oil manufacturing	13,293
Lab expenses	4,875
Fuel and lubricants	6,401
Oil machinery maintenance	30,412
Mill building maintenance	372
Mill building cleaning	1,412
Mill building water	1,894
Mill building electricity	6,093
Mill yard maintenance	539
Subtotal	
Despatch of oil	14,456
Total revenue expenditure--oil	173,277
Kernel Manufacture	
Labor	3,931
Lab expenses	1,347
Fuel and lubricants	3,155
Kernel machinery maintenance	4,642
Subtotal	13,075
Packing labor	2,523
Packing materials	5,417
Transport to wharf	4,799
Direct cost of packing and despatch	12,739
Total revenue expenditures - kernels	25,814
Total expenditure	199,091

[a]For the year ending June 30, 1987

Source: Mimba 1987

In 1986, SOCAPALM produced a total of 48,784 t of palm oil at 5 mills. Their total costs amounted to CFA 10,039,781,799 (including CFA 1,067,682,115 for plantation maintenance, CFA 1,069,577,454 for harvesting, CFA 235,268,938 for purchase of fruits, CFA 987,120,716 for milling and despatch, CFA 1,374,103,524 for general expenses, CFA 2,976,628,493 for fixed costs, and CFA 2,329,400,559 in depreciation). Since production and inventories were valued at CFA 10,153,061,891, the company made a profit of CFA 139,592,371.

Minimills have a capacity of 1.0-5.0 t of ffb per hour using scaled-down versions of the technology used by large industry. A 5 t/hour minimill can process the harvest of 1,670 ha of Tenera or 3,340 ha of Dura (Blaak 1984a). Typically, minimills achieve an extraction rate of 9.5% with Dura and 19% with Tenera. They produce crude oil of good quality intended for the local market. The Pioneer minimill was adopted by Unilever simultaneously with a trend toward larger mills to defer the high capital costs of a large-scale mill until new plantations reached a steady level of production. During its first 4 years, a plantation is unproductive and for the next 4-5 years after that, a large mill is likely to be unprofitable due to insufficient raw material (Van Looy 1981). Over 100 Pioneer minimills were established in West Africa, mainly in Nigeria and Zaire after World War II (MacFarlane, Swetman, and Coursey 1984). In the 1960s, political factors promoted larger scale mills and economic factors shifted technology choice toward expellers, turbines, and high pressure boilers. By the 1970s, many of the old Pioneer mills were shut down (Van Looy 1981).

A Dutch firm, International Technological Assistance (ITA) started producing equipment for minimills in 1975. The ITA plant is not a miniature large-scale mill, but an intermediate technology. The capital cost of a turnkey 2 t/hour plant was estimated at $240,000 in 1984 (Blaak 1984a). In 1984, an ITA minimill began operation at Teze in the Northwest Province in Cameroon with donor financing (Blaak 1984b). The Teze mill has a capacity of 0.6 t of ffb per hour to serve a plantation area of 100-150 ha, mostly of Tenera (Van Beuningen, Thijsen, and Rijnsburger 1984).

The capacity use rate was supposed to average 55%, with 70% from March to July and less than 30% between November and February. Operation for a full second shift was limited by the capacity of the steaming kettles. The expected extraction rate of 12% for a mixture of Tenera and Dura was not being achieved, but it was not known whether this was due to the low oil content of the fruit or problems with the process. Although the equipment designs were simple, local fabrication standards were low. Other problems encountered include the unreliable electricity supply and a drought that affected purchases of palm fruit (Van Beuningen, Thijsen, and Rijnsburger 1984).

Artisanal-Scale Firms

Artisanal-scale production of palm oil is an important economic activity in West and Central Africa, generating income and employment for rural producers, and providing a product that matches the tastes of domestic, urban and rural consumers.

Small-scale processing of oil palm adds value locally to an agricultural product with a lower capital investment per unit of output than is possible on a large-scale.

The traditional process cannot compete economically with simple, improved pressing equipment that can be domestically produced. Where the traditional process is still prevalent, an upgraded technology could significantly increase total production of artisanal palm oil by increasing extraction efficiency and the production rate. In some areas, however, potential buyers might already have access to a mechanical press prior to their purchase, so the main effect would be to increase their incomes.

Simplified small-scale expellers are now being domestically produced in Cameroon for the artisanal market. Approximately 3 ha of Tenera or 10 ha of Dura through a farmer's own production or service pressing are needed to justify purchase of a relatively inexpensive, upgraded press (Hyman submitted).

Quality Specifications for Palm Oil

Crude palm oil may be refined in an integrated mill/refinery or separate facility. In West and Central Africa, most consumers prefer crude palm oil for cooking. The demand for margarine and refined/bleached/deodorized (RBD) oil is small although growing (Moll 1987). By contrast, world trade is increasingly dominated by refined oil from Southeast Asia.

Quality requirements differ for crude palm oil on the domestic and export markets. Poor quality crude oil is characterized by high FFA, a high concentration of water and

impurities, and low bleachability. It is difficult and sometimes uneconomical to refine (Hartley and Nwanze 1965). Oxidation products can result in off-flavors and odors as well as poor bleachability. Crude palm oil for export should have high bleachability while FFA, carotene, oxidation, and iron and copper levels should be as low as possible (MacFarlane, Swetman, and Coursey 1984).

Domestic consumers in West and Central Africa prefer an FFA content of 5-7%, and do not mind levels as high as 35% because they are used to the sharp flavor of palm oil produced by the traditional process (Hadley and Hadley 1986). Carotene content is not critical, but concentrations above 1,000 ppm are more nutritious. Tocopherols, including vitamin E, are beneficial antioxidants that are destroyed by heat in processing.

Low concentrations of copper and iron from equipment wear can catalyze oxidation reactions in palm oil. High FFA content in the oil increases the leaching of iron from equipment and storage tanks (Wood and Beattie 1981). FFA is the most difficult aspect of quality to control in palm oil because it depends on the fruit selected, harvesting techniques, conditions and duration of transport and storage, as well as processing techniques (Van Beuningen, Thijsen, and Rijnsburger 1984). Table 9 compares the characteristics of African palm oil produced at various scales of industry.

Conclusions

Palm oil is the principal cooking oil in Cameroon. The domestic industry cannot compete on export markets with the

TABLE 9
A Comparison of the Chemical Characteristics of African Palm Oil.

	Village- or Small-Scale Production	Medium- and Large-Scale Production		
		Crude Now	Crude In Future	Refined
Free fatty acid (%)	3-50	2-5	2.5 max	0.05
Iron (ppm)	6-50	3-10	3.5 max	1.5
Copper (ppm)	ND	0.05-0.4	0.05 max	0.02
Carotene (ppm)	850-1,400	500-1,600	500-1,600	0
Tocopherols (ppm)	30-560	700-1,100	800	NS
Moisture/dirt (%)	0.3-15	0.2-0.5	0.2-0.5	0.02
Peroxide meq/kg (PV)		0-10	0-4	0.4
Anisidine (AV)	ND	0-6	0-4	NS
Totox (2PV-AV)	ND	0-26	0-12	NS

ND - No data
NS - Not significant

Source: MacFarlane, Swetman, and Coursey 1984, from data of Cornelius 1977.

production costs of Southeast Asian firms. The domestic market is protected by import restrictions and a price floor above the world market price.

Over the next 10 years, artisanal-scale production of palm oil in Cameroon will have to increase substantially to meet increased domestic demand, unless imports are allowed. Presently, palm oil consumers in Cameroon bear the costs of the protectionist policy toward the industry, but because of the industry's importance it is unlikely that the government would end the ban on importing palm oil. Moreover, consumers prefer the taste of locally produced palm oil over the refined, imported product. Even if the government allowed imports of refined palm oil, local artisanal production could still be justified by the foreign exchange savings and income generated in rural areas.

Although the large-scale industry is operating at a low capacity use rate, its expansion during this period will be limited by stagnating production of palm fruits on industrial estates. An increase in artisanal palm oil production from existing stands or new plantations is feasible. Sizable quantities of Dura remain unharvested in Cameroon because of the cost of labor for harvesting and processing. It is becoming more difficult to recruit workers for the dangerous task of climbing tall Dura trees to harvest the bunches. Some Dura stands need rehabilitation to improve their yields.

Tenera trees are short enough that they can be harvested using hooks on poles. To date, the total area of Tenera grown by artisanal palm oil producers is small, but growing. About 59,000

ha of Tenera have been planted in Cameroon and an additional 30,000-40,000 ha will be required to meet the expected growth in demand (Hornus, Kamga, and Chaillard 1987). Due to the time lag between plantation establishment and peak production, yields will only increase gradually. As a result, the gap between domestic supply and demand is expected to widen. Thus, greater exploitation of Dura or new plantings of Tenera will probably not depress the price of palm oil over the next 15 years.

At present, most of the artisanal production is from Dura, while the industrial production is from higher-yielding Tenera. To effectively expand their operations, artisanal producers will need to adopt improved, small-scale technologies for oil extraction. Although the inefficient traditional process is still used in some parts of Cameroon, most small-scale commercial producers in the country have access to the services of an old Colin expeller. However, most of these expellers are in disrepair and replacement parts are no longer available. Simpler, less expensive expellers are now being domestically produced by a small workshop in Cameroon.

Increasing the price received by artisanal producers for palm oil could boost the demand for improved, small-scale presses. The government price ceiling on the large-scale product has a negative effect in this regard. Unless it is removed or adjusted sufficiently in the future, production will be dampened in the face of a shortfall. Although artisanal producers could take advantage of seasonal price variations by storing palm oil for 6-12 months, few do so since they have immediate needs for

cash. Another way to increase the rural producer's share is to reduce inefficiencies in distribution by organizing marketing and transport and improving market access in poorly served areas.

Elsewhere in the region, such as in Zaire, Benin, Togo, Ivory Coast, and Guinea-Conakry, the traditional process for palm oil extraction is more prevalent. There, the potential gains in productivity from simple upgraded technologies are large, but it may be more difficult to convince artisanal producers to adopt an improved technology. Also, the profitability of an improved press will not be the same as in Cameroon. Palm oil prices are higher in some countries than they are in the Cameroon, but smallholder planting programs for Tenera are less far along, which tends to reduce the profitability of improved equipment.

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