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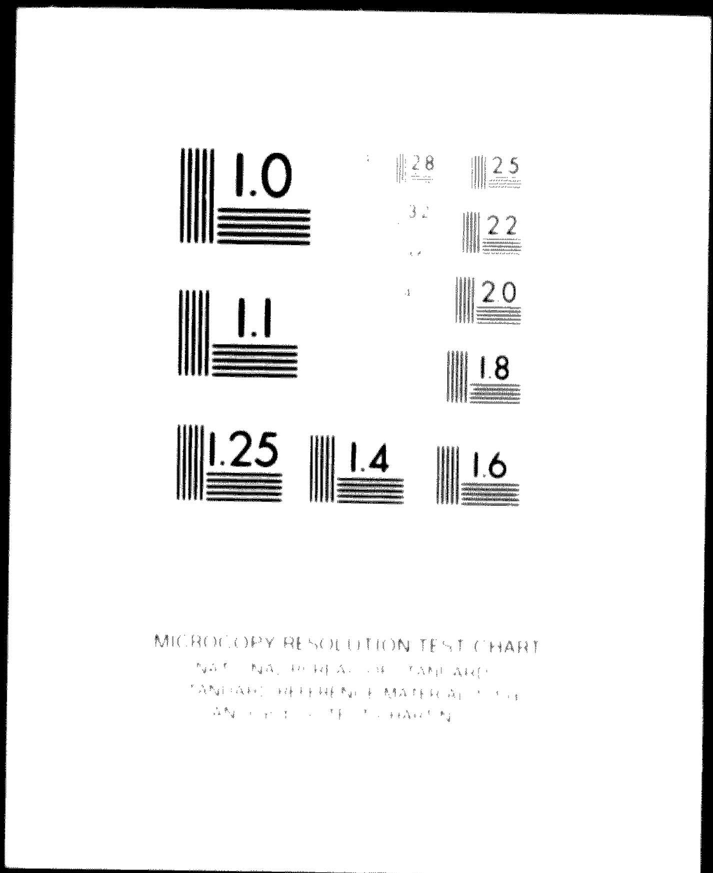

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VOL. II

Malaysia.

A STUDY OF AGRO-BASED & FOOD INDUSTRIES POTENTIAL OF SARAWAK

BY

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TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Location and Boundary

1.1 Sarawak, lying between longitudes 0°50'N and 5°N, and between latitudes 109° 35' East and 115° 45' East with a total area of about 48,300 sq. miles is almost as big as West Malaysia. The setting of Sarawak within Southeast Asia is illustrated in map 1.1. The State has on its south-west, south and south-east the Indonesian Borneo or Kalimantan and on the north-east it is bounded by the other East Malaysian state, Sabah. The South China Sea washes its coast on the north and north-east with the British Protectorate of Brunei forming two pockets within the State on its north-eastern tip.

Climate, Rainfall, etc.

1.2 The climate of Sarawak is typically equatorial monsoonal and owes its characteristics to its proximity to the Equator where seasonal variations are ill-defined. There is no large temperature fluctuations throughout the year. However, the cooling effect of sea winds is greater in the coastal areas than in the interior. The mean annual temperature is 25°C to 26°C (78°F - 80°F) and average monthly temperatures show a range of about 2.2°C (4°F). The maximum and minimum temperatures along with absolute extremes at Kuching, Sibu, Bintulu and Miri airports for the years 1965 - 1970 are shown in Table 1.1.

1.3 The rainfall in Sarawak is rather high and there is hardly any month during the year without some rain. The mean annual rainfall in the State varies from 189.8" in Sungei China to 94.21" at Long Semadoh. The rainfall at various stations in the State are in Table 1.2. The reliability of these figures is not considered very high as readings were carried out by volunteers up to 1969, who were not paid and consequently readings were not often carried out during the holidays.

Map 1.1. The Setting of Sarawak within South-East Asia

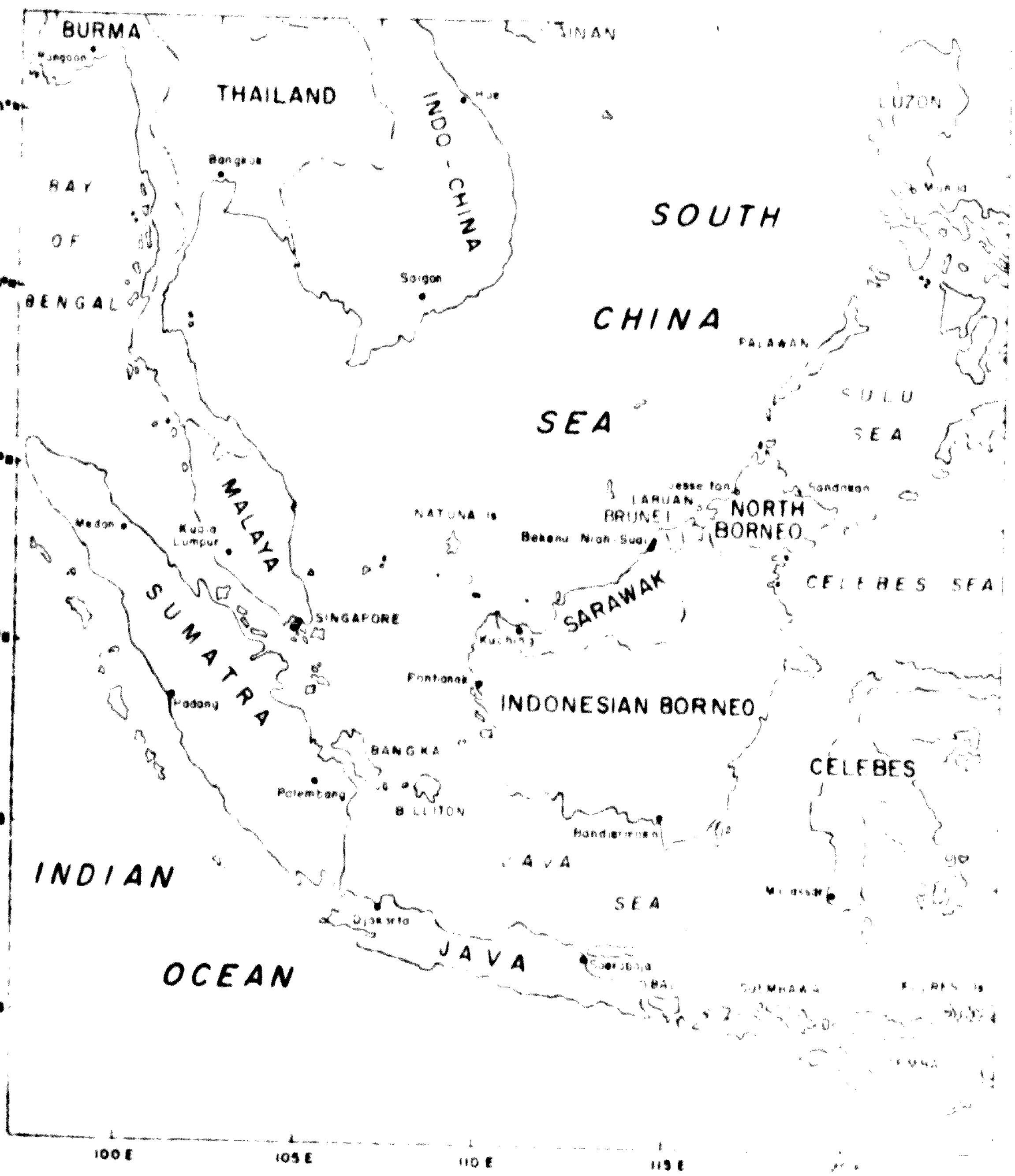

TABLE 1.1

TEMPERATURE AND RELATIVE HUMIDITY AT KUCHING, SIBU, BINTULU AND MIRI

Locality	Year	Air Temperature in Degrees Fahrenheit				Mean Relative Humidity at 2 p.m. %
		Means		Absolute Extremes		
		Daily Maximum	Daily Minimum	Highest Maximum	Lowest Minimum	
KUCHING AIRPORT (85 feet above mean sea level; Latitude 1°29'N; Longitude 110°20'E)	1965	88.1	72.4	94.3	65.6	67
	1966	88.7	73.2	94.3	69.4	69
	1967	88.1	72.7	94.0	66.0	67
	1968	88.0	72.8	93.6	66.0	67
	1969	87.9	73.2	96.3	69.2	69
	1970	88.3	73.4	93.8	69.8	67
SIBU AIRPORT (21 feet above mean sea level; Latitude 2°20'N; Longitude 110°50'E)	1965	88.8	71.5	95.7	62.8	67
	1966	89.3	72.5	95.0	66.7	70
	1967	88.7	71.7	95.9	66.7	67
	1968	89.1	71.7	95.4	63.3	67
	1969	[illegible]	72.3	95.9	66.3	68
	1970	89.3	72.1	95.6	66.7	67
BINTULU (10 feet above mean sea level; Latitude 3°10'N; Longitude 113°02'E)	1965	86.7	72.5	92.0	65.7	73
	1966	87.3	73.5	92.9	68.8	73
	1967	86.5	73.4	93.2	69.0	74
	1968	86.2	72.9	91.7	67.7	73
	1969	86.8	74.1	94.2	68.3	74
	1970	86.7	74.0	93.7	70.3	74.
MIRI (10 feet above mean sea level; Latitude 4°23'N; Longitude 113°59'E)	1965	87.6	73.4	93.2	67.8	74
	1966	88.6	73.8	94.0	68.8	73
	1967	88.4	72.7	93.0	67.5	73
	1968	88.3	72.6	94.0	65.9	72
	1969	87.5	73.4	93.2	68.8	73
	1970	87.1	73.1	93.0	68.8	72

Source: Department of Metrological Services

TABLE 1.2

SUMMARY OF ANNUAL RAINFALL (SARAWAK STATIONS)

		Mean Annual Rainfall		Actual Rainfall for 1970	Deviation from Mean
		Period of Years			
First Division	Kuching	71	158.11	168.75	+10.64
	Sungei China	21	189.82	213.29	+23.47
	Talang Talang Island	7	126.78	71.75	-55.03
	Matang	32	168.85	195.49	+26.64
	Bau	17	129.56	160.72	+31.16
	Tarat	8	139.13	122.16	-16.97
	Lundu	20	131.64	147.99	+16.35
	Tebakang	8	132.60	148.02	+15.42
	Dahan Estate	8	159.83	119.11	-40.72
Second Division	Simanggang	16	159.98	135.60	-24.38
	Lubok Antu	7	124.93	n.a.	n.a.
	Lingga	8	125.64	140.45	+14.81
	Betong	8	146.14	140.65	- 5.49
	Saratok	8	134.39	135.09	+ 0.70
Third Division	Sarikai	13	119.62	135.82	+16.20
	Sibu	22	126.13	115.22	-10.91
	Selalang	8	124.39	n.a.	n.a.
	Mukah	14	136.17	143.34	+ 7.17
	Song	7	108.34	139.88	+31.54
	Rantau Panjang	6	119.75	113.19	- 6.56
	Daro	4	117.10	100.73	-16.37
	Matu	9	120.54	101.62	-18.92
	Belaga	8	142.21	117.25	-24.96
	Kanowit	8	134.90	151.25	+16.35
	Kapit	15	145.58	185.60	+40.02
Fourth Division	Tiris Sibuti	6	123.46	n.a.	n.a.
	Long Akah	6	234.61	n.a.	n.a.
	Miri	31	124.17	125.61	+ 1.44
	Baram	22	112.78	n.a.	n.a.
	Bintulu	33	151.85	158.24	+ 6.39
	Lutong	9	127.52	147.42	+19.90
Fifth Division	Long Semadoh	5	94.21	120.95	+26.74
	Limbang	21	144.22	111.08	-33.14
	Ukong	8	151.38	139.35	-12.03
	Lawas	26	166.09	148.74	-17.35
	Lawas Estate	9	167.45	103.98	-63.47
	Sundar	9	126.48	124.80	- 1.68

Source: (1) Department of Meterological Services
(2) Drainage and Irrigation Department.

n.a. Not available

1.4 However, the higher rainfall occurs during the period from November to March which is known locally as 'Landas' season. Thereafter, it becomes warmer with occasional and very short dry periods during the year.

1.5 The mean relative humidity during 24 hours is 85% while at 2.00 p.m. it is 69% (Please see Table 1.1). The daily mean sunshine hours for the State as a whole are 5.65 hours. The mean sunshine hours, divisionwise, are as below:-

<u>1st Division</u>

Kuching airport - 4.61 hours

<u>3rd Division</u>

Sibu airport - 5.47 hours

<u>4th Division</u>

Bintulu - 5.84 hours

Miri - 6.66 hours

Sunshine hours for Second and Fifth Division are not available.

1.6 No comprehensive information on evaporation is available. In 1963, a "Class A" pan was installed at the station of Kuching airport and some places in other Division. These pans were normally installed on the ground surface and not dug into the ground with the upper side on equal level with the ground surface. This resulted in too high figures due to splash effects and warmth - supply through the rims. The difference in the evaporation between the Divisions are quite high. The mean data are the lowest in the First and Third Division (5.5"), higher in the Second Division (5.9"), and in the Fourth Division (6.1") and the highest in the Fifth Division (6.9"). These differences are due to variations in the rainfall [illegible], humidity and/or wind velocity. As the evaporation in the Fourth and Fifth Division is higher the water requirement for the growth of crops in these Divisions would also be higher.

1.7 The wind direction depend on the season. During the period November - March, the prevailing wind directions are in N.E. ., N. and N.W.. During the period April - October these are S.W. ., W. and S... The changeovers are rather distinct due to the changeover of the inter-tropical front. The surface and wind velocity are generally light i.e. up to 3 miles per hour. Velocities of 13 - 18 miles per hour are only experienced occasionally.

1.8 Thunderstorms occur mostly during April - October normally accompanied by moderate rainfall (0.02" to 0.07" per 10 minutes) but during the Landas season some heavy thunderstorms also occur. Sarawak is situated in a small equatorial belt which is free from cyclones.

*Soils

1.9 Sarawak consists of two distinct provinces; West of Lupar Valley is the relatively stable northern part of the Sunda Shield composed of palaeozoic, mesozoic and tertially igneous and sedimentary rocks; east of the Lupar Valley to the northern tip of the country spreads a broad, southwest-northeast, arcuate belt of thick geosynclinal deltaic sediments ranging from upper cretaceous to recent. Finally, there are extensive young coastal and inland sedimentary plains, overlain in many places by organic sediments.

1.10 The State's topography is strongly related to the under-lining lithology and structure of its rocks. These batholiths and stocks, common in West Sarawak, have formed large isolated masrifs through differential weathering rising by 2,000 feet above low-lying peneplained areas underlain in by sedimentary rocks. Similarly, young exclusive larvaes and piroclastic rocks in central Sarawak form high

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* In discussing the types of soil reference has been made to the following: The analysis of the enviroment of The Bekenu Niah-Suai area, Sarawak by J. ... all.

plateaux at 3,000 feet and prominent mountain ranges at 6,000 - 7,000 feet, respectively. The sedimentary rocks throughout the country are weathered to give distinctive land forms. The older and generally more competent, sandstones and shales have weathered forming linear patterns of high ridges and narrow valleys following the strike of the country. These are especially well developed in the interior water shed areas. Younger sedimentary rocks appear to be generally less resistent to erosion; the shales in particular weather rapidly into systems of small low hills and ridges, which resemble ripple patterns on air photographs. Some of the young sandstone beds, however, are thick and hard and weathered to well developed cuestas and plateaux.

1.11 Plio-pleistocene fluctuations of sea level have resulted in the production of terraces and distinct low erosion surfaces on the hills behind the coastal swamps, particularly in the softer, younger sedimentary rocks of north Sarawak. Weathering and dissection is so rapid, however, that even among the recently produced land forms the belts of shale have already been lowered substantially more than the adjacent sandstones. Limestone throughout Sarawak produces highly distinctive karst morphology.

1.12 Recent deposits are widespread and form extensive alluvial basins both along the coast and for considerable distances up the main rivers. In many places these are covered by peat to depths of at least 30 feet - 40 feet. The growth of these has probably been stimulated by a recent slight rise in sea level which intensifies the already impeded drainage conditions. Thus, in coastal areas there has been widespread sedimentary accretion and in filling of lower river courses behind the off-shore sand bars that develop from sandstone headlands. Peat is subsequently accumulated on the wide estuarine flats between the main rivers.

1.13 Sarawak's vegetation is tropical evergreen and predominantly broad-leaved. There are marked contrasts in physiognomy and composition, however, which can be related to ecological habitats and in particular to soil distribution. The hills are occupied by low land Dipterocarp forests containing in places valuable stands of timber. Secondary forests in Sarawak are due almost entirely to shifting hill padi cultivation.

1.14 The equatorial monsoonal climate throughout Sarawak results in a predominence of the podzolization process in almost all but the most poorly drained soils. The differences between the soils primarily reflect differences in lithology, mineralogy and topography. A few areas of lateritic soils are found only on rocks rich in ferro-magnesium minerals; while podsols are found only on parent materials consisting almost entirely of silica (as quartz) and with almost no iron or aluminium. Topography directly affects the distribution of skeletal soils, which occur predominantly on steep hills and is responsible for poor drainage conditions in which saline clay, clay and peaty soils develop. The precipitous slopes of the karst country underlain by massive and poor limestone support distinctive calcic organic soils.

Population & Economy

1.15 Sarawak has a population of about [illegible] 000,000 (1969 estimates) and the average rate of growth for the period between 1947 - 1960 was 2.5%. Since then the rate of growth has been higher by about 1/2% due to improved health programmes. The estimated density of population is about 17 per square mile and the distribution of population is closely related to land productivity and accessibility.

1.16 The State's population consists mainly of three races viz. Chinese, Malays and different native races with their well-defined distribution and distinct economies. The Chinese are mainly engaged in commerce and in the intensive cultivation of cash crops, [illegible] the main road in the vicinity of urban centres. The Malays inhabit primarily the lower river and mostly fishing villages. Many of them live in the suburbs of large towns and are employed in government departments. The cultivation of rice, coconut and rubber are the main occupations of the Malays in the more rural areas. The native races are restricted to well defined, largely inland parts of the country. They are strongly tied to a subsistence economy, based mainly on rice production and supported by cash crops, such as, rubber in some of the accessible areas.

1.17 The economy of the State has all along been relying heavily on the export of primary forest and agricultural produce viz. timber, rubber and pepper. Lately, discovery of off-shore oil near Miri has given a boost to the State's economy. The export of agricultural produce from Sarawak during the period 1960 - 1970 is shown in Table 1.3.

1.18 In addition to paddy (wet and dried), rubber and pepper are the two major crops of Sarawak, as sago is still largely extractive rendering it to be classified with timber. Table 1.3 would illustrate the importance of these three crops in the export trade and thereby in the economy of Sarawak.

1.19 The importance of agricultural products in the economy is reflected in the attention and money being spent on improving crop production and acreage, and particularly in the search for good agricultural land. Government subsidized rubber and coconut planting schemes were introduced in 1956 and 1959 respectively, prior to which agriculture was wholly unaided. Agriculture is almost entirely in the form of smallholdings since commercial agriculture has not been encouraged to the extent it is in West Malaysia and Sabah. In recent years, the government has actively stimulated agricultural production by way of introducing planting schemes for rice and fruits, in addition to coconut and rubber

Table 1.

SARAWAK EXPORTS OF AGRICULTURAL PRODUCTS FOR T[illegible]

Commodity Description	Unit of Quantity	1960		1961		1962		1963		[illegible]		196[illegible]	
		Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value
Rubber	Ton	4[illegible],4[illegible]	[illegible]	[illegible]	[illegible]3,250,133	43,7[illegible]	72,[illegible]7,147	44,134	[illegible]9,595,2[illegible]5	42,359	[illegible],73	[illegible],[illegible]34	[illegible]
White pepper, unground	Ton	[illegible],393	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],326	17,664,[illegible]	7,732	1[illegible],42[illegible]	7,11[illegible]	[illegible]
Black pepper, unground	Ton	705	[illegible]	[illegible]	[illegible]	[illegible]	7,7[illegible]	[illegible],115	4,725,335	4,3[illegible]2	[illegible]5,021	1[illegible]	[illegible]
Sago Flour and meal	Ton	1[illegible],[illegible]3	[illegible]	[illegible]	[illegible]	31,[illegible]14	4,1[illegible],[illegible]21	33,[illegible]34	5,573,065	57,515	[illegible]3,337	44,155	[illegible]
Coconut oil crude and refined	Ton	1,547	[illegible]	[illegible],15[illegible]	1,[illegible]21,[illegible]7[illegible]	[illegible]	[illegible]	2,121	1,524,621	2,[illegible]	[illegible]	2,[illegible]01	[illegible]
Live bovine cattle, buffaloes and goats	No.	13	[illegible]	1[illegible]1	[illegible]7,[illegible]4[illegible]	17[illegible]	[illegible]	261	[illegible],104	72	[illegible],433	113	[illegible]
Live Swine	No.	74[illegible]	3[illegible],4[illegible]1	[illegible]5[illegible]	31,[illegible]3	[illegible]39	45,[illegible]33	616	25,705	75[illegible]	[illegible]	1,[illegible]47	[illegible]
Live Domestic fowls	No.	4[illegible],423	11[illegible],[illegible]5[illegible]3	[illegible]	107,227	5[illegible],745	1[illegible]4,23[illegible]	52,[illegible]71	22[illegible],326	74,714	2,333	31,4[illegible]4	[illegible]
Live animals chiefly for food	No.	43	110[illegible]	[illegible]	16[illegible]	[illegible]6	1,[illegible]3	1[illegible]	463	-	-	-	[illegible]
Day old chicks and ducklings	100	-	-	-	-	-	-	-	-	34	3,[illegible]9	3[illegible]	[illegible]
Birds eggs in shell	100	4,03[illegible]	43,2[illegible]	4,720	53,554	4,[illegible]	53,34[illegible]	[illegible],593	[illegible],343	3,[illegible]7[illegible]	41,[illegible]	342	[illegible]
Unmilled maize	Ton	5	1,111	15	3,250	46	[illegible],307	17	4,45[illegible]	17	[illegible],53[illegible]	7	[illegible]
Oranges Mandarins fresh	Ton	7	2,24[illegible]	4[illegible]	13,[illegible]21	1[illegible]	4,376	7	2,5[illegible]2	2	2[illegible]	1	[illegible]
Bananas plantains	Ton	2[illegible]5	27,5[illegible]1	11[illegible]	15,223	1[illegible]	13,332	[illegible]6	14,3[illegible]	11[illegible]	15,761	151	[illegible]
Other fresh fruits incl. tropical fruits	Ton	75	14,331	1[illegible]	21,2[illegible]1	74	19,356	61	15,734	64	3,031	127	[illegible]
Other Fresh vegetables	Ton	19[illegible]	[illegible]	447	92,075	41[illegible]	[illegible]3,723	314	66,09[illegible]	234	1,56[illegible]	3[illegible]	[illegible]
Roots and tubers fresh or dried	Ton	25	3,[illegible]21	26	2,700	3[illegible]	2,975	37	4,310	69	3,[illegible]	105	[illegible]
Sago pearl and refuse	Ton	*	14[illegible]	1	397	-	-	-	-	124	3,45[illegible]	1[illegible]	[illegible]
Cocoa beans raw or roasted	lb.	-	-	230	173	[illegible]57	120	[illegible]	150	1,199	25[illegible]	-	[illegible]
Pepper ground	lb.	-	-	-	-	1[illegible]0	355	155	524	150	4[illegible]4	[illegible]61	[illegible]
Cloves incl. fruits and stems	Ton	-	-	-	-	-	-	-	-	-	-	-	[illegible]
Other spices incl. Thyme, etc.	lb.	665	1[illegible]	1,5[illegible]	[illegible]53	10,[illegible]00	1[illegible],043	1,333	270	2,185	[illegible]2[illegible]	-	[illegible]
Rice bran	Ton	256	1[illegible],[illegible]55	242	11,742	219	1[illegible],330	224	1[illegible],762	272	[illegible]	152	[illegible]
Copra cakes and oil seek cakes	Ton	104	1[illegible],[illegible]54	10[illegible]	10,33[illegible]	542	3[illegible],[illegible]15	146	1[illegible],[illegible]35	11[illegible]	16,644	163	[illegible]
Other agricultural products	Val.		2,472		7,0[illegible]		1,123		[illegible],332		3,[illegible]		

SECTION 1

- 1[illegible] -

Table 1.[illegible]

[illegible] AGRICULTURAL PRODUCTS FOR THE YEARS 1960 - 1970

[illegible]	[illegible]	[illegible]		1965		1966		1967		1968		1969		1970	
	[illegible]	Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value	Qt.	Value
[illegible]	[illegible]	[illegible]	[illegible]	[illegible],34	[illegible],453,4[illegible]	[illegible]	[illegible],1[illegible]2,173	2[illegible],445	32,3[illegible]3,14[illegible]	23,734	26,313,574	38,725	49,365,3[illegible]5	21,460	23,976,179
[illegible]	[illegible]	7,732	1[illegible],42[illegible]	7,11[illegible]	[illegible]	7,[illegible]4	[illegible]	1[illegible],[illegible]77	[illegible]	1[illegible],[illegible]26	1[illegible],[illegible]3,353	11,[illegible]	27,604,005	[illegible],230	25,1[illegible]1,720
[illegible]	[illegible]	4,3[illegible]	[illegible]75,021	1[illegible]	[illegible]	[illegible]	1[illegible],574,174	[illegible],724	12,[illegible]	11,[illegible]7	15,574,[illegible]41	10,753	25,2[illegible]3,002	14,791	31,103,304
[illegible]	[illegible]	57,515	[illegible]3,037	44,155	5,[illegible]13,[illegible]23	[illegible]7,31[illegible]	4,734,223	35,[illegible]	4,[illegible]	35,[illegible]73	4,940,401	2[illegible],[illegible]32	3,705,045	2[illegible],072	3,[illegible]35,1[illegible]5
[illegible]	[illegible],21	2,[illegible]	1,[illegible]	2,[illegible]01	1,[illegible]17,750	2,7[illegible]5	2,05[illegible],450	3,[illegible]01	2,204,[illegible]	3,70[illegible]	2,[illegible]2[illegible],[illegible]34	4,144	3,25[illegible],375	4,015	3,447,[illegible]
[illegible]	[illegible],1[illegible]4	72	10,43[illegible]	113	44,[illegible]30	141	57,[illegible]17	214	[illegible]2,[illegible]5	7[illegible]	25,775	132	55,740	61	2[illegible],303
[illegible]	[illegible],7[illegible]5	75[illegible]	39,[illegible]	1,047	140,[illegible]	1,[illegible]3	155,240	2,403	235,7[illegible]	1,064	237,42[illegible]	1,04[illegible]	223,655	2,595	302,345
1	[illegible],[illegible]20	74,714	[illegible]2,333	31,4[illegible]4	337,[illegible]7[illegible]	[illegible]3,490	234,[illegible]57	21,045	1[illegible]2,353	11,[illegible]67	5[illegible],331	3[illegible]	200	40	90
1[illegible]	4[illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	[illegible]4	3,49[illegible]	3[illegible]	1,7[illegible]	344	13,31[illegible]	4[illegible]2	14,[illegible]7[illegible]	301	[illegible],540	117	4,710	433	17,020
[illegible]3	[illegible],43	3,[illegible]7	41,[illegible]	342	4,200	4,3[illegible]	5[illegible],3[illegible]5	2,[illegible]73	1[illegible],[illegible]23	1,630	1[illegible],631	1,905	22,[illegible]2	427	5,743
17	4,45[illegible]	17	[illegible],33[illegible]	7	1,[illegible]40	3[illegible]	[illegible],[illegible]34	44	11,74[illegible]	23	4,5[illegible]7	16	4,[illegible]92	26	6,605
7	[illegible],[illegible]2	2	2[illegible]	1	672	*	255	-	-	-	-	2	1,462	*	1[illegible]90
[illegible]	14,[illegible]	11	15,761	151	25,172	23[illegible]	40,0[illegible]	217	3[illegible],251	103	34,765	159	3[illegible],201	209	30,472
1	1[illegible],7[illegible]4	64	3,[illegible]1	127	30,[illegible]69	190	[illegible]2,7[illegible]7	119	4[illegible],[illegible]19	53	15,070	171	53,3[illegible]3	95	34,791
14	[illegible],[illegible]	234	[illegible]1,50[illegible]	300	76,929	322	63,170	315	[illegible]2,45[illegible]	367	72,[illegible]13	303	75,274	304	73,6[illegible]3
[illegible]7	4,[illegible]10	69	3,[illegible]	105	15,453	[illegible]7	11,665	92	12,407	[illegible]	11,6[illegible]	57	2,249	161	1,761
-	-	124	3,450	1[illegible]	11,372	122	[illegible],327	51	1,700	20	770	19	[illegible]13	43	9[illegible]1
	150	1,13[illegible]	25[illegible]	-	-	-	-	[illegible]12	350	-	-	6,751	2,700	9,043	3,450
[illegible]	[illegible]24	150	4[illegible]4	[illegible]61	[illegible]5[illegible]	3,104	9,075	6,073	17,7[illegible]0	2,740	9,336	4,334	14,547	[illegible]44	3,3[illegible]0
-	-	-	-	-	-	-	-	7	12,193	45	[illegible]2,770	9	16,733	51	202,773
[illegible]3	27[illegible]	2,135	[illegible]2[illegible]	-	-	1,234	4[illegible]7	-	-	-	-	14	220	2,300	[illegible]60
[illegible]4	1[illegible],762	272	1[illegible],[illegible]	152	11,346	163	11,790	166	11,[illegible]4	143	10,412	163	11,600	101	6,[illegible]52
140	1[illegible],[illegible]5	11[illegible]	16,[illegible]44	163	21,0[illegible]2	155	2[illegible],067	99	11,492	99	[illegible],729	95	7,355	12	2,910
	[illegible],[illegible]2		3,[illegible]		3,324		[illegible]07		[illegible]2		304		610		2,353

SECTION 2

and subsidized livestock schemes. Recently, establishments of a Pepper Board has been announced and a subsidy scheme in 1972 has been proposed for the benefit of pepper farmers.

1.20 The land use classification of the State as a whole is in Table 1.4. The total area under agriculture, principally coconut and other prominent crops, and cropland is 10,464.6 square miles accounting for 22% of the State's total land area.

1.21 Lack of communication has been a severe handicap to agricultural development. Immediately after the Second World War there was less than 50 miles of all-weather metalled roads in the country (excepting Kuching town roads) [illegible] 100 miles of rough jeep track. Most of the cultivated land was alongside these roads, navigable rivers and streams. The position has since improved and as to-date the road mileage position is as below:-

1966	593 miles
1970	902 miles

Agro-Industries

1.22 Barring sago production in crude mills, large number of small rice milling operating irregularly on customs basis and a few rubber smoke houses, there is no agro-processing industry worth the mention. On the input side, recently a fertilizer mixing plant has been established in Kuching. For reasons of secrecy, production and other particulars of this unit has not been discussed in the report. The small size of the domestic market currently obtaining and likely to continue for the next 5 - 10 years would necessitate a careful study to ascertain the feasibility of establishing industries belonging to this group. Such studies are time consuming as markets and production in the region as a whole have to be carefully assessed. The team did not have enough time and therefore left it to the UNIDO's consideration if further assistance is to be provided to help him for the job.

TABLE 1.4

LAND USE CLASSES	Percentage	Sq. Miles
1. Settlement and associated non-agricultural lands	0.1%	50.2
2. Horticultural Lands (mainly miscellaneous cultivation and including small areas of fruit trees)	-	30.9
3. Tree, palm and other permanent crops	3.1%	1,453.7
Rubber	2.6%	1,229.5
Oil Palm	-	-
Coconut	0.2%	96.8
Pepper	0.1%	39.6
Sago	0.2%	87.8
4. Crop Land	18.9%	8,980.0
Wet padi	0.6%	290.3
Hill padi land (Bush fallow, shifting cultivation)	18.3%	8,689.7
5. Improved Permanent Pasture (Not Used)	-	-
6. Unused Land	1.4%	653.8
Sheet Lalang (Not Used)	-	-
Other Secondary Growth	1.4%	658.8
7. A Swamp Forest	12%	5,689.8
Mixed swamp forest	9.5%	4,533.2
Alan	1.6%	746.8
Padang Paya	0.9%	409.8
7. B Dry Forest Land	63.1%	30,058.2
Hill Forest	60%	28,577.6
Kerangas Forest	3%	1,412.6
Riverine Forest	0.1%	40.1
Beach Forest	-	28.0
8. Swamp (Paya) (including fresh and salt water and mangrove and nipah)	1.4%	671.3
9. Unproductive Land (Not used)	-	-
All Land Use Classes	100%	47,588.0

Source: Planning Branch, Land & Survey Department, Sarawak

Food Industry

1.23 Food industry in Sarawak is negligible. Apart from 3 biscuit and confectionery factories of reasonably good size, there is no food industry worth the mention. However, in the food industry group fall vermicelli making, sauce making, etc.

1.24 The share of the food industry in proportion to the total manufacturing sector is too meagre as illustrated in Table 16.1

1.25 Sarawak imports large quantities of food items. Their quantity and value for the last five years is shown in Table 1.5. The main sources of supply of these food items are also shown in the table. It would be seen that most of the food supplies are obtained from China, Singapore and West Malaysia.

1.26 Though there are 14 small units bottling non-alcoholic beverages, the larger share of the market is controlled by Fraser & Neave who have a plant in Kuching. These beverage units are capable of meeting the increased demand at least for the next ten years by operating the unutilized capacity.

Land Tenure System

1.25 The land tenure system in Sarawak requires special mention as this has affected large-scale agricultural development greatly. This system is complicated and a sensitive issue having political implications and, therefore, any discussion on this would be out of the scope of this study. However, a note prepared at some stage by the State government is attached as an annexure to this report. Because of this situation and uncertainty of any amendment to facilitate large-scale plantation-type agriculture, all estates suggested in this report do not exceed 10,000 acres except in the case of sugar cane.

SECTION 1

TABLE [illegible].

I[illegible] [illegible] OF I[illegible]PORTA[illegible]T FOO[illegible] [illegible]RO[illegible]UCTS I[illegible]

	Description of Commodity and Unit of [illegible]		1[illegible]7		[illegible]		
			Quantity	Value C.I.F. ([illegible])	Quantity	Value C.I.F. ($)	[illegible]
1.	Meat Extracts and Meat Juices Excl Soup	LB	[illegible]4,1[illegible]1.5[illegible]	[illegible]15,075	5[illegible],243.51	490,[illegible]1	7[illegible],[illegible]
2.	Meat Canned Excluding Infant Foods	CWT	2[illegible],[illegible]3	2,1[illegible]4,33[illegible]	2[illegible],105.01	[illegible],245,33[illegible]	1[illegible],
3.	Milk Condensed Sweetened	1[illegible] LBS	74,17[illegible]	4,7[illegible],31[illegible]	[illegible],7[illegible]2,[illegible]02	[illegible],351	1[illegible],[illegible]
4.	Milk Condensed Unsweetened	1[illegible] LBS	[illegible],7[illegible]1.[illegible]1	335,30[illegible]	7,7[illegible]7.24	4[illegible]4,[illegible]3	7,1[illegible]
5.	Other Preserved Milk N.E.S.	1[illegible] LBS	1,7[illegible].37	13[illegible],102	2,317.9[illegible]	173,1[illegible]	2,
[illegible].	Milk Powdered Full Cream Over 10 lbs Packing	1[illegible] LBS	3,523.[illegible]7	514,3[illegible]	3,5[illegible]7.22	530,[illegible]44	4,[illegible]
7.	Milk Powdered Infant Food	LB	1,[illegible]21,[illegible]7[illegible].5[illegible]	1,[illegible]2[illegible],437	1,1[illegible],5[illegible]6.94	2,[illegible],34[illegible]	1,3[illegible]5,[illegible]
[illegible].	Butter Canned	CWT	1,342.[illegible]	233,457	1,7[illegible]5.5[illegible]	[illegible],1[illegible]7	1,[illegible]
[illegible].	Marine Fish Excl Tuna or Sauries Fish Chilled or Frozen	TON	5[illegible]3.[illegible]5	54[illegible],411	5[illegible]0.86	4[illegible]3,711	[illegible]
1[illegible].	Marine Fish Salted Dried or In Brine	TON	1,[illegible]37.[illegible]7	2,[illegible]23,112	2,[illegible]41.[illegible]3	1,[illegible]	2,1[illegible]
11	Moluscs Salted Dried or Boiled Others	T[illegible]	243.32	34[illegible],253	237.91	3[illegible]3,[illegible]2[illegible]	[illegible]
1[illegible].	Horse Mackerels Canned	T[illegible]	[illegible]57.55	[illegible],25[illegible]	73[illegible].23	[illegible],[illegible]07,3[illegible]	7
	Fish and Fish Preps Canned N.E.S.	TON					[illegible]
13.	Prawns and Shrimps Canned	TON	11[illegible].5[illegible]	[illegible]7,155	10[illegible].93	[illegible]3,3[illegible]	1
14.	Preparations of Crustacea and Molluscs Canned N.E.S.	TON	7.[illegible]2	13,775	[illegible].8[illegible]	21,3[illegible]5	1
15.	Pulot Rice other than in the husk or Undermilled	TON	1,257.37	[illegible]3,5[illegible]3	1,[illegible]6.71	651,142	1,[illegible]
1[illegible].	Rice Broken Excl. for Animal Feeding	TON	7,273.2[illegible]	3,[illegible],[illegible]47	11,[illegible]52.31	[illegible],5[illegible]7,14[illegible]	12,[illegible]
17.	Flours of Wheat and Meslin over 10 lbs Packing	TON	1[illegible],1[illegible]7.29	3,243,735	1[illegible],[illegible]10.44	3,[illegible],307	11,3[illegible]
1[illegible].	Flours of Other Cereals	LB	59[illegible],141.24	172,571	5[illegible]0,5[illegible]6.0[illegible]	153,[illegible]	4[illegible],3[illegible]
1[illegible].	Macaroni Mee and Similar Products	CWT	23,422.24	7[illegible],30[illegible]	23,25[illegible].42	[illegible]34,52[illegible]	33,[illegible]
20.	Biscuits Sweetened	CWT	1[illegible],[illegible]13.3[illegible]	[illegible]3[illegible],[illegible]42	1[illegible],4[illegible]0.41	[illegible]4,[illegible]7	22,[illegible]
21.	Biscuits Unsweetened	CWT	22,[illegible]03.[illegible]3	1,542,[illegible]5[illegible]	21,[illegible]17.07	[illegible],4[illegible]3,423	2[illegible],4
22.	Other preps of Flour Starch or Malt Extract with Cocoa	LB	77[illegible],[illegible]91.[illegible]5	1,4[illegible]6,[illegible]55	77[illegible],[illegible]46.90	[illegible],40[illegible],425	[illegible]
[illegible]	Vegetable Preparations Canned	CWT	3[illegible],[illegible].02	1,[illegible]24,[illegible]1	41,[illegible].[illegible]3	1,570,155	3[illegible],
24.	Refined Beet and Cane Sugar Over [illegible]9 Deg Polarisation	TON	21,[illegible]23.[illegible]3	5,225,1[illegible]0	23,[illegible]2[illegible].74	[illegible],359,559	[illegible]3,
[illegible]5.	Sugar Confectionery not Containing Cocoa	CWT	7,1[illegible]0.45	[illegible]44,23[illegible]	10,531.74	1,[illegible]2[illegible],513	11,
26.	Coffee Beans not Roasted	[illegible]	719.03	1,2[illegible]0,323	6[illegible]3.05	[illegible],101	
[illegible]7.	Coffee Extracts and Essence or Concentrates of Coffee	LB	2,614,1[illegible]0	2[illegible],137	25,[illegible]39.41	251,1[illegible]3	25,
2[illegible].	Chocolate and Chocolate Confectionery	LB	130,493.3[illegible]	257,30[illegible]	22[illegible],517.24	352,[illegible]27	1[illegible],
29.	Tea Black Dust N.E.S.	LB	431,501.[illegible]3	6[illegible]0,439	429,79[illegible].[illegible]9	[illegible]00,[illegible]45	2[illegible]2,
30.	Lard and Other Rendered Pig and Poultry Fat	TON	739.29	[illegible]74,244	1,034.33	[illegible],756	
31.	Margarine Canned	TON	259.23	3[illegible]3,[illegible]05	274.44	3[illegible]7,[illegible]	
32.	Soya Bean Sauce	GAL	153,[illegible]1.5[illegible]	3[illegible]1,2[illegible]2	201,207.72	403,1[illegible]5	27[illegible],
33.	Other Sauces	GAL	75,[illegible]30.4[illegible]	1[illegible]2,355	[illegible]1,059.4[illegible]	[illegible]22,452	117,[illegible]
34.	Beer and Ale	GAL	353,735.34	1,[illegible]10,[illegible]02	29[illegible],207.11	[illegible],4[illegible]7,05[illegible]	3[illegible],
35.	Stout and Porter	GAL	1[illegible]5,7[illegible]6.03	1,14[illegible],5[illegible]1	1[illegible]2,1[illegible]3.3[illegible]	1[illegible]29,3[illegible]	2[illegible]3,
3[illegible].	Cigarettes	LB	1,[illegible]31,4[illegible]2.04	5,[illegible],[illegible]4	1,2[illegible],200.91	[illegible]553,[illegible]65	1,[illegible]17,
37.	Groundnuts Green Shelled	TON	7[illegible]3.14	5[illegible]0,[illegible]3	6[illegible]5.43	[illegible]99,30[illegible]	
3[illegible].	Groundnut Oil for Domestic Use	TON	171.1[illegible]	222,5[illegible]3	27[illegible].47	341,1[illegible]5	
39.	Monosodium Glutamate and Preparations	L[illegible]	255,3[illegible]4.[illegible]	[illegible],55[illegible].3[illegible]	3[illegible],7[illegible]1.55	[illegible]11,5[illegible]	343,

SECTION 2

TABLE [illegible]

[illegible] R[illegible] [illegible] SARAWAK

	[illegible]		19[illegible]		197[illegible]		Principle Exporting Countries
	Quantity	Value C.I.F. ($)	Quantity	Value C.I.F. ($)	Quantity	Value C.I.F. ($)	
	[illegible],243.51	49[illegible],[illegible]31	7[illegible],3[illegible]2.[illegible]4	[illegible],1[illegible]1	4[illegible],72[illegible]	41[illegible],[illegible]	United Kingdom
	2[illegible],1[illegible]5.[illegible]1	[illegible],245,33[illegible]	1[illegible],[illegible]2.33	2,1[illegible]2,[illegible]5	[illegible],43[illegible].[illegible]1	775.350	China Mainland
	[illegible],7[illegible]2,[illegible]2	[illegible],351	1[illegible]5,527.[illegible]	5,555,757	43,7[illegible].5	2,7[illegible],[illegible]4	West Malaysia
	7,7[illegible]7.24	4[illegible]4,[illegible]3	7,175.[illegible]	3[illegible],[illegible]6	3,4[illegible]1.12	177,21[illegible]	West Malaysia
	[illegible],317.[illegible]	173,1[illegible]	2,[illegible]3.40	213,[illegible]17	1,2[illegible].47	4[illegible],243	Denmark
	3,[illegible]7.2[illegible]	530,[illegible]44	4,[illegible]2[illegible].[illegible]2	[illegible]1[illegible],742	1,[illegible]55.72	2[illegible]7,232	United Kingdom, Australia
	1,1[illegible],[illegible].94	2,[illegible]7[illegible],34[illegible]	1,3[illegible]5,3[illegible]0.24	2,653,11[illegible]	[illegible]5[illegible],41[illegible].[illegible]	1,1[illegible]2,[illegible]3[illegible]	Denmark, Australia
	1,7[illegible]5.5[illegible]	2[illegible],1[illegible]7	1,3[illegible].07	2[illegible]1,[illegible]1[illegible]	1,[illegible]45.[illegible]	1[illegible]1,55[illegible]	Australia
	5[illegible].3[illegible]	40[illegible],711	4[illegible]3.1[illegible]	511,[illegible]4	.157.[illegible]2	[illegible]25,[illegible]5	China
	2,[illegible]41.[illegible]3	1,[illegible]5,[illegible]	2,11[illegible].34	2,[illegible]24,[illegible]2	[illegible]41.[illegible]	1,11[illegible],17[illegible]	Singapore
	[illegible]37.91	3[illegible]3,[illegible]2[illegible]	2[illegible]7.[illegible]3	4[illegible]5,034	1[illegible]7.31	2[illegible]5,[illegible]56	China Mainland
	73[illegible].23	1,[illegible]07,3[illegible]	7[illegible]5,72	3[illegible]0,[illegible]13	4[illegible]5.24	534,717	Japan
			25[illegible].[illegible]	442,55[illegible]	15[illegible].7[illegible]	2[illegible]2,702	
	1[illegible].93	[illegible]3,3[illegible]	171.[illegible]7	273,1[illegible]1	114.51	210,017	West Malaysia
	[illegible].[illegible]	21,3[illegible]5	1[illegible]1.5[illegible]	2[illegible]1,[illegible]66	102.35	1[illegible]6,[illegible]1	West Malaysia
	1,[illegible].71	[illegible]51,142	1,7[illegible].[illegible]1	[illegible]3,155	1,075.15	41[illegible],057	Thailand
	11,[illegible]52.31	5,5[illegible]7,14[illegible]	12,720.5[illegible]	4,[illegible]35,171	5,3[illegible]2.[illegible]1	1,[illegible]2,394	Thailand
	1[illegible],[illegible]10.44	3,449,[illegible]07	11,360.75	3,51[illegible],71[illegible]	5,5[illegible].57	1,[illegible]92,59[illegible]	Singapore
	[illegible],[illegible].[illegible]	153,[illegible]5[illegible]	[illegible]4[illegible],36[illegible].52	173,[illegible]54	15[illegible],2[illegible]0.25	44,[illegible]3[illegible]	China Mainland, Thailand
	23,25[illegible].4[illegible]	934,52[illegible]	33,[illegible]3[illegible].72	1,453,12[illegible]	13,5[illegible]1.53	[illegible]35,600	China Mainland
	1[illegible],4[illegible].41	[illegible]4,[illegible]7	22,30[illegible].[illegible]	1,511,554	11,2[illegible]5.11	7[illegible]6,945	West Malaysia
	[illegible]1,[illegible]17.07	1,4[illegible]3,423	25,43[illegible].51	1,23[illegible],[illegible]5	11,[illegible]4.14	5[illegible]1,067	West Malaysia
	77[illegible],[illegible]4[illegible].90	1,40[illegible],425	[illegible],712.75	1,[illegible]55,537	5[illegible],53[illegible].05	[illegible]7[illegible],735	Australia
	41,[illegible].93	1,570,155	3[illegible],[illegible]1.71	1,552,34[illegible]	14,242.[illegible]	[illegible]5,2[illegible]	China Mainland
	[illegible]3,[illegible]2[illegible].74	[illegible],359,559	[illegible]3,[illegible]2[illegible].10	7,7[illegible],324	1[illegible],[illegible]7.14	[illegible],[illegible],[illegible]58	China Mainland, West Malaysia
	1[illegible],531.74	1,[illegible]2[illegible],513	11,[illegible]31.33	1,173,20[illegible]	[illegible]25,3[illegible]1	722,251	West Malaysia
3	[illegible].05	[illegible],101	[illegible]26.5[illegible]	[illegible]50,[illegible]14	340.[illegible]	5[illegible]6 791	Java
	25,[illegible].41	251,1[illegible]3	25,[illegible]15.4[illegible]	250,[illegible]41	20,797.02	1[illegible],[illegible]59	Australia, United Kingdom
	22[illegible],517.24	352,[illegible]27	1[illegible],2[illegible]1,[illegible]	332,466	2[illegible],5[illegible].44	43,230	West Malaysia
	42[illegible],7[illegible].[illegible]	7[illegible],[illegible]	2[illegible]2,521.46	435,125	1[illegible],72[illegible].25	35,[illegible]5	Ceylon
	1,[illegible]34.33	[illegible],75[illegible]	[illegible]36.3[illegible]	[illegible]5,9[illegible]6	3[illegible].07	355,50[illegible]	Hong Kong
	274.44	397,[illegible]	3[illegible].[illegible]9	512,[illegible]3	1[illegible]1.[illegible]2	272,[illegible]52	West Malaysia
	2[illegible]1,2[illegible]7.72	403,195	27[illegible],151.40	555,40[illegible]	1[illegible]2,3[illegible]5.[illegible]	207,942	Singapore, China Mainland
	1,[illegible]59.4[illegible]	222,452	117,726.7[illegible]	294,344	45,24[illegible].[illegible]	115,07[illegible]	Singapore, China Mainland, Hong Kong
	2[illegible],2[illegible]7.11	[illegible],4[illegible]7,[illegible]5[illegible]	3[illegible],157.[illegible]	1,[illegible]1,120	23[illegible],277.35	1,233,[illegible]75	West Malaysia
	1[illegible]2,1[illegible]3.3[illegible]	1,12[illegible],3[illegible]	2[illegible]3,[illegible]3[illegible].[illegible]1	1,213,715	137,71[illegible].54	[illegible]09,797	West Malaysia
4	1,2[illegible],2[illegible].91	[illegible],553,[illegible]65	1,[illegible]17,[illegible]53.7[illegible]	17,222,539	820,487.[illegible]7	[illegible]52,[illegible]75	West Malaysia
3	[illegible].43	[illegible]9,3[illegible]	733.3[illegible]	574,55[illegible]	31[illegible].70	272,1[illegible]	Thailand
	[illegible]7[illegible].47	341,1[illegible]5	220.2[illegible]	292,3[illegible]5	7[illegible].[illegible]	105,[illegible]64	China Mainland, Hong Kong
	3[illegible],7[illegible]1.5[illegible]	[illegible]11,5[illegible]	343,[illegible]5.29	1,325,[illegible]3	213,754.[illegible]2	[illegible]5,453	West Malaysia

1.28 Finally, it is required to mention here that UNIDO's suggested line of presentation of the report could not be strictly adhered to. It was suggested by UNIDO, that "the market minded planner of today's integrated food industries must thoroughly explore both existing and future demand of the domestic and world markets and must assess the priority of the most profitable commodities. He must then turn to the raw material resources and explore the possibility of large-scale industrial production of these resources according to the market situation. He has to estimate the investment and production costs of raw materials delivered to the processing facility ....." It has been considered necessary, in the Sarawak context, to provide some basic information on the crop and also on the uses of various products that the crop can be converted into, before undertaking a market analysis. However, the selection of crops for this report has been made, first of all by considering the market for the products and secondly, the agricultural possibility.

1.29 The agro-processing and food industries suggested in this report would necessitate considerable capital investment. While in many cases it should be possible to raise this capital locally, in the absence of know-how and knowledge of the international market, it would not be possible for the local business community to undertake many of these ventures by themselves. Through the good offices of FIDA, it is suggested that the State Government should contact international firms with the necessary technology and marketing expertise to participate in these ventures. It would be necessary to grant adequate concessions to these firms in view of Sarawak's geographical location and also in consideration of its most under-developed infrastructure.

1.30 The State seriously lacks manpower in both technical and management categories. There is, however, a surplus of unskilled labour. While the agro-industries are most suited for providing employment to unskilled labour and require few skilled labour, these industries are characterised by their needs of management and technical personnel of very high order, which cannot be created overnight. The situation would necessitate the recruitment of personnel from overseas for manning the senior posts immediately. The expatriate officers would be slowly replaced by local citizens through a system of in-plant training combined with an organised programme of sending selected personnel abroad for higher education at University or technical college level. The requirement of personnel of different categories have been indicated in the various projects.

1.31 While preparing this report assistance has been obtained from various publications, file notes, persons both in government and in industry, etc. The list would be too long if all these are to be mentioned individually. However, we are grateful to all those who assisted us in the study.

[illegible]

LAND CLASSIFICATION AND TITLES - SARAWAK

Land in Sarawak is divided into five legal classifications viz:

(a) Mixed Zone Land

(b) Native Area Land

(c) Native Customary Land

(d) Reserved Land

(e) Interior Area Land

(i) Mixed Zone Land

At present there are roughly about 4,600 square miles of land in Sarawak classified as Mixed Zone Land which may be alienated to and acquired by any race living in Sarawak without restriction. [illegible] land cannot be alienated to non-natives, [illegible] may only hold this class of land and they may occupy [illegible] under registered titles. Within this class [illegible] natives may still occupy land under customary tenure [illegible] be alienated to other races until native [illegible] have been extinguished or surrendered to the State.

Registered titles in Mixed Zone Land may be freely dealt with [illegible].

(ii) Native Area Land

There are about [illegible],0[illegible] square miles of land in Sarawak classified as Native Area Land. Only natives may occupy and hold title to this class of land. Much of the area is held under native customary tenure, [illegible] is still [illegible] Native Customary Land. [illegible] titles in respect of Native Area Land may be dealt with [illegible] natives of Sarawak only.

(iii) Native Customary Land

All land held by natives under customary tenure falls within this classification. It is estimated that there are about 18,950 square miles of land over which customary rights have been created. [illegible] land tenure, most of the occupied land in Sarawak [illegible] under this classification.

The land [illegible] in Sarawak before the arrival of Sir James Brooke (1st White Rajah) and, for [illegible] customary tenure in accordance with the Native Customary Law [illegible] land. This Customary Law which in the [illegible], has been [illegible] [illegible] the provisions [illegible] [illegible] :-

(a) the felling of virgin jungle and the occupation of the land thereby cleared;

(b) the planting of land with fruit trees;

(c) the occupation or cultivation of land;

(d) the use of land for a burial ground or shrine;

(e) the use of land of any class for a right of way; or

(f) any other lawful method.

The most common method of creating customary rights is the felling of virgin jungle for farming purposes. The Sarawak Land Code however provides that until title has been issued in respect of the land, such land continues to be State land and any native lawfully in occupation of the land is deemed to hold the land by licence from the State until a title has been issued. If the land is used for agricultural purposes a lease will be issued for 99 years free of premium, rent and other charges. Practically all land held under native customary tenure is unsurveyed and the pattern of rights is so complex and, in fact, invisible.

If the land is transferred or sublet to a person other than a person who, if the proprietor had died intestate immediately prior to the date of the transfer or sublease, would have inherited the land, or where the use of such land is changed from agricultural purposes to any other purpose, the appropriate premium, if any, rent and other charges would become payable.

The majority of native customary land is used for hill padi farming i.e. the farming of land by rotation over an extended period in order to allow the land to lie fallow. This method of farming is known in Sarawak as 'shifting cultivation'.

Since 1.1.195[illegible] Government introduced a measure whereby new rights can only be created by occupying Interior Area Land under a permit issued by Government.

(iv) Reserved Land

This category includes State land which is used by, and reserved to, Government for various public purposes and includes Forest Reserves and Protected Forest, National Parks, etc.

(v) Interior Area Land

Land not falling into any of the other four categories mentioned is classified as Interior Area Land and it comprises mainly of primary forests. This land is to be found in the hinterland where there are steep hills; it is not possible at present to develop such land owing to poor soil conditions and [illegible] problems of access [illegible] yet to be solved.

[illegible] suitable for [illegible]

permanent crops and which is readily accessible is already held under native customary tenure.

2. Extinguishment of Rights - Difficulties in

It has been mentioned earlier that any native lawfully in occupation of Native Customary Land is deemed to hold land by licence from the State. Although this is so, Section 82 of the Sarawak Land Code provides that native customary rights may be extinguished by the direction of the Minister for the time being responsible for land by the payment of compensation or by making available other land over which such rights may be exercised with or without the payment of additional compensation whether for disturbance or the cost of removal or otherwise. The Sarawak Land Code further provides that any person aggrieved by the direction of the Minister may require that the matter be referred to arbitration. In other words the direction issued by the Minister is not conclusive until the decision of arbitration is known.

In practice the Minister has been unwilling to issue such a direction for the extinguishment of customary rights where large areas of land are involved. It would be difficult to make available other land in exchange to the liking of the person concerned. In many instances the natives concerned were reluctant to part with their land and refused to accept compensation. In 1962 a Land Committee was appointed by Sarawak Government to look into the problem of land tenure and land use. This Land Committee made a recommendation that Native Customary Rights should be accorded full ownership and this recommendation has been accepted by Government.

3. Settlement of Rights

Land claimed by natives under native customary tenure are land which have not been surveyed or issued with titles. Before survey can be carried out, the areas have to be demarcated and the rights fully investigated and recorded. Titles will then be issued and thereupon the native customary rights are extinguished. There are provisions in the Sarawak Land Code for the settlement of rights to land but it is not appropriate to introduce settlement over large areas of land where communities still farm on a communal basis and mainly by shifting cultivation.

In order to eliminate land disputes, it is most desirable, when a new development scheme is to be implemented in an area where it has been ascertained that the land is suitable for development, to extinguish the rights by the payment of compensation and surrender by agreement. In other words the land should be unencumbered State Land before a Land Development Scheme could be implemented.

The surrender or extinguishment of native customary rights has always been based on the claims of individuals which is proved to the satisfaction of the Superintendent of Lands and Surveys. As stated earlier there is the practical difficulty of assessing how much land can be cleared of customary rights and made available for alienation without depriving the resident natives of a livelihood under their present system of cultivation. It is the accepted policy of the Sarawak Government not to interfere with the ways of life of the various native races and to make available for general alienation only land in excess of their minimum requirements. Under the system of shifting cultivation a minimum of 60-65 acres of land is required for each family.

Land which is claimed by an individual family is usually scattered in small pieces over a large area and, as a result, the process of recording claims, assessing the needs of the community, extinguishing rights and preparing a layout for alienation to ensure the economic use of the land is a slow process. Where surplus land is available, a soil survey is undertaken to determine the suitability of the soil. All merchantable timbers on the land are extracted by licence issued by the Forest Department before alienation takes place.

4. Survey

The system of land registration in Sarawak is a modified "Torrens System". All land is surveyed and recorded on Cadastral Sheets before alienation. One of the main functions of the Sarawak Land and Survey Department is to ensure that each land to be alienated is surveyed and shown on the cadastral sheets. Cadastral surveys are undertaken with the theodolite in town and suburban areas. In rural areas the surveys are done with the Prismatic Compass and tied on to a close network of theodolite control traverses. The Department is now programming all control traverses for electronic computations.

5. Land Titles

Unencumbered State land i.e. land which is not held under title or subject to Native Customary rights is normally alienated by public auction unless the alienation thereof by private treaty or otherwise has been authorised by any general or special direction of the Minister for the time being responsible for land. Various forms of documents of title still subsist in Sarawak. Some of them were issued under the former land laws. These forms of documents of titles are namely:-

A grant;

A lease;

An "Occupation Ticket"; and

other documents evidencing title to land.

A grant carries a term of 999 years from the date of issue. These grants were issued mostly during the Rajah's rule.

Leases are normally issued for a term of either 60 years or 99 years. When agricultural land held by a native under customary tenure is replaced by a lease, a term of 99 years is granted. Leases issued for use other than agricultural purposes are normally [illegible] sixty years.

Occupation tickets were issued under the previous land laws and generally they were issued in respect of land having no survey ... and are therefore not indefeasible titles. However, these documents are regarded as titles to land and they are subject to similar terms and conditions as leases. Other documents giving title to land would be permits to plant issued under the former land laws.

6. Aims

Sarawak is basically an agricultural country and the Government's ... its general policy of promoting sound agricultural development. In order to achieve this, Government firstly aims to induce the native to gradually abandon his present method of shifting cultivation and develop his land intensively and productively. Secondly, to give land to non-natives who are mainly short of farming land.

Sound agricultural development depends on a system of land tenure which can make available to a farmer an economic unit of land and a system of farming by which the farmer is able to derive an income comparable with the income from other occupations. He must be provided with security of tenure through an indefeasible title in order to encourage him to invest his labour and profits in the development of his farm. He must be able to offer his title as security for such development loans as he may require.

7. Land Committee 1962

The report of the Land Committee appointed by the State Government in 1962 referred to in paragraph 2 was published in 1963 and the Committee's main recommendations were :-

(1) That provision should be made to enable existing customary rights in land, where they are akin to ownership, to be recognised as such without the payment of survey fees, premium or rent.

(2) That the unsuccessful system of individual applications for land should be abolished.

(3) That the village or block system should be used as the basis of land administration and distribution;

(4) That provision should be made for systematic adjudication for -

[illegible] tidy up existing [illegible] [illegible] new blocks [illegible] land; and

(b) [illegible] effect the [illegible] individual [illegible] customary right [illegible].

(6) [illegible] should be abolished and [illegible] be protected by [illegible] may not [illegible] the resident's consent.

(6) [illegible] procedure [illegible] the Land [illegible] should be simplified, as the [illegible] effect [illegible] unnecessary [illegible].

(7) [illegible] agricultural land should be [illegible] provision be made to pay the [illegible] conversion [illegible] by Government).

5. New L[illegible]

[illegible] recommendations of the Land [illegible], the following new legislation was drafted:-

(1) Th[illegible] Registration Bill
(2) Th[illegible] Bill
(3) Th[illegible] Bill
(4) Th[illegible] ([illegible]) Bill.

6. Obj[illegible]

(1) Th[illegible] Bill will replace [illegible], III, VI, VII, VIII and IX of the [illegible] Land Code. It will give effect to the following recommendations of the Land [illegible] that:-

(a) provision be made to enable existing customary [illegible] in land, when they [illegible] to ownership, to be [illegible] such without payment [illegible] survey fees, premium and annual [illegible];

(b) the [illegible] ful system of individual [illegible] land be abolished;

(c) the vil[illegible] block system be used for [illegible] purposes of land administration [illegible].

(2) Th[illegible] Bill will replace Part V [illegible]

[illegible].

[illegible] severely criticized [illegible] rights over [illegible] land and strongly [illegible] adjudication should be [illegible] specific blocks of land [illegible] by Divisional Land Adjudication [illegible] should also be [illegible] Divisional Development Committee. It [illegible] possible to ensure that adjudication of rights would be carried out [illegible] ripe for development.

[illegible] object of this Bill is to [illegible] small parcels [illegible] economic units within [illegible] development, not with [illegible] native but so that [illegible] will have [illegible] of [illegible].

(3) [illegible] Bill will replace Part IV [illegible] Land Code. The procedure [illegible] is used in [illegible] Malaysia and in [illegible] rity, [illegible] Act 1960 [illegible] is [illegible] land [illegible] and policy in [illegible] adopted.

[illegible] Sarawak Land Code, acquisition [illegible], by the Superintendent of Lands and Surveys. The Land [illegible] considered that it was [illegible] for the Superintendent of Lands and Surveys [illegible] responsible for safe-guarding [illegible], to compulsorily extinguish it. [illegible], therefore, made in the Bill for the [illegible] of an ad hoc [illegible] for such acquisition.

As mentioned earlier section 82 of the Sarawak Land Code provides for the extinguishment of native customary rights by direction of the Minister. This is in [illegible] with the Colonial concept that all unalienated land belongs to the Crown and that the natives are licensees of the Crown having only rights of user. This conflict with native "adat" law. Provision is therefore made in the new Bill for the formal adjudication of the rights before acquisition and for the appointment of [illegible] of the native community to facilitate the process of acquisition.

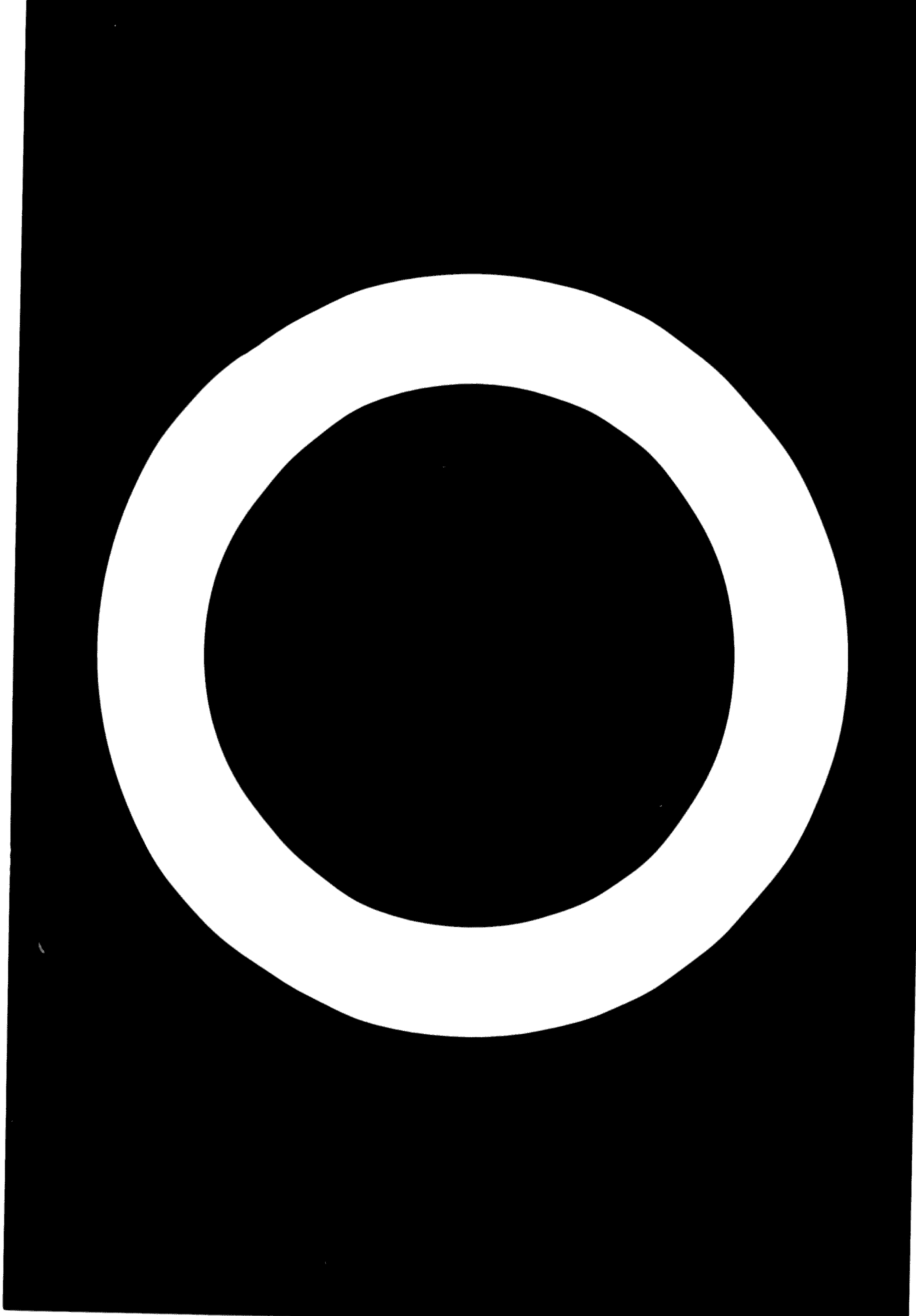
(4) The [illegible] BILL will replace the provisions of Part II of the Sarawak Land Code [illegible] Land Classification.

[illegible] concerned with the [illegible] policy, [illegible] to prevent the native from [illegible] of his land before he had been [illegible] its proper use, but [illegible] which were chosen to effect it. [illegible] effect of reclassification was to place restriction on the land whereas the intention [illegible] restriction on dealings by natives until such time as they could protect themselves.

The Land Committee suggested that native interests could be adequately protected by a simple law restricting native dealings in land. This protection could be gradually relaxed as native communities achieve [illegible] economic parity with the other communities until in due course it could be dispensed with altogether.

1[illegible]. Conclusion

These bills were to be presented to the Council Negri (State Legislative Council) in May 1965 but were withdrawn at the last moment as there appeared to have been inadequate understanding of the full implications of the Bills. This matter is still a sensitive political issue as a result of which the Bills have been shelved for an indefinite period.



CHAPTER II

AGRICULTURAL CROPS

TAPIOCA

The Tapioca Plant

2.1 Tapioca (also known as manioc/cassava/ubi kayu) is a semi shrubbery perennial that grows under cultivation to a height of about 7 feet to 13 feet. The leaves are large and palmate ordinarily with five to seven lobes, borne on a long slender petiole. They grow only towards the end of the branches. As the plant grows, the main stem forks, usually into three branches, and in their turn, the lesser branches divide similarly. The roots or tubers radiate from the stem just below the surface of the ground. Feeder roots growing vertically from the stem and from the storage roots penetrate the soil to a depth of 1½ feet to 3½ feet and this capacity of the tapioca plant to obtain nourishment at some distance below the surface may help to explain its growth on inferior soils.

2.2 Male and female flowers arranged in loose plumes are produced on the same plant. The triangular shaped fruit contains three seeds which are viable and can be used for the propagation of the plant. The number of tuberous roots and their dimensions vary a great deal in form with the different varieties. The roots may reach a size of 1 foot to 4 feet long and 1½ inches to 6 inches in diameter and a weight of 2 lbs. to 18 lbs. or more.

Climatological and Other Requirements for Tapioca Cultivation

2.3 Tapioca is typically a tropical plant though the approximate boundries for its cultivation may be accepted as from 30°N. to 30°S. altitude. The bulk of tapioca growing, however, is located between 20°N. and 20°S. In general, the crop requires a warm humid climate. Temperature is important as all growth stops at about 50°F. (10°C.)

Typically, the crop is grown in areas that are frost-free the year around. The highest root production can be expected in the tropical low lands below 500 feet altitude where average temperatures range from 77°F. to 80°F. (25°C. - 27°C), but some varieties, however, grow at altitudes of up to 5,000 feet.

2.4 The plant produces best when rainfall is fairly abundant, though it can also be grown where the annual rainfall is as low as 20 inches or where it is as high 200 inches. The plant can stand prolonged periods of drought where most other food crops perish.

2.5 As a tropical crop, it can be expected that tapioca is a short day plant. Hot house experiments showed that the optimum light per day is around 12 hours and longer light periods inhibit starch storage.

2.6 Tapioca plant grows best on light sandy loams or loamy sands that are moist, fertile and deep, but it grows well on soils ranging in texture from the sands to the clays and on soil of relatively low fertility. In practice, it is grown in a wide range of soils, provided that the soil texture is friable enough to allow the development of the tubers.

2.7 Tapioca can be produced as an economic crop on soils so depleted by repeated cultivation that they have become unsuitable for other production. On very rich soils, the plant is liable to produce stems and leaves at the expense of roots. In some African countries, freshly cleared forest soils are regarded as being very suitable after they have carried a cereal crop.

2.8 In shifting cultivation, where new forest land is cleared for the plantation of paddy and tapioca, there is no necessity to apply fertilizers. However, with a settled plantation the yield would fall when tapioca has been grown on the land for a number of years in succession or in rotation system, as the soil store of certain nutrients would be reduced and therefore must be returned to the soil by fertilization. Like all rapidly growing plants yielding carbohydrates, tapioca has high nutrient requirements and exhausts the soil very rapidly unless provision is made for the replacement of the nutrients removed or with good rotation. Experiments carried out in many tapioca growing countries have shown significant increases in the yield of roots as well as the starch content with the application of fertilizers.

2.9 Potassium salts favour the formation of starch and nitrogen and phosphorous are essential for growth. However, if the soil contains big quantities of assimilated nitrogen, the results would be heavy development of vegetative growth without corresponding increase in root production. Generally speaking, no fertilization is practiced at present in most parts of Africa and South America except for commercial plantations. In Thailand, only a few farmers apply artificial fertilizers for reasons of high costs and farmers' lack of adequate cash. Most of the farmers, however, use different kinds of organic manures such as cattle and duck manure or garbage.

2.10 Tapioca plant is normally not affected by diseases or pests in many regions. In some other regions, however, the plant may be attacked by some enemies which include one or more of the following:-

(i) Virus diseases,

(ii) Bacterial diseases,

(iii) Mycoses,

(iv) Insects, and

(v) Animals.

2.11 The toxic principle in tapioca is the hydrocyanic acid or prussic acid which is found in roots, branches and leaves of the plant, both in free form or in a chemically-bound form. The plant contains a cyanogenetic glucoside, phaseolunatin that begins to break upon harvest into hydrocyanic acid, acetone and glucose, by the action of the enzyme linase. The presence of hydrocyanic acid is easily recognized by a bitter taste and at the harvest of tapioca roots, varies from harmless to lethal or from a few mgms. to 250 mgms. or more per kgm. of the fresh root. Investigations showed that the glucoside content in the tapioca plant is markedly increased by drought and by potassium deficiency.

2.12 Hydrolysis of the glucoside by the enzyme can be accelerated by soaking the roots in water, crushing or cutting them or by heating. It was found that the hydrocyanic acid content varies little in different tubers of one plant but varies considerably in tubers obtained from different locations. The distribution of the acid in roots also varies in different varieties. In sweet varieties, the major part of the acid is located in the skin and in the exterior corticle layer while the acid is uniformly distributed in all parts of the roots in bitter varieties.

2.13 Although tapioca is an established commercial crop in many countries in the Tropics and hundreds of varieties are in existence very little is known of the nomenclature and identification of the varieties. Various varieties are usually differentiated from each other by their morphological characteristics such as colour of stem, petioles, leaves and tubers but in many instances, the same varieties are known in various places by a number of names.

2.14 The numerous varieties of products are grouped in two main categories: Manihot Palmata and Manihot Aipi or bitter and sweet tapioca. This division is a grouping of economic convenience and it is difficult to distinguish between the two groups by the botanical characteristics. The distinction between them, however, rests upon the content of hydrocyanic acid which caused the toxicity in the roots. This toxicity is not a variety constant and varies from place to place. As such, all tapioca are now regarded as varieties of Manihot Utilissima, and in certain circumstances the bitter type may become sweet and vice versa. Hydrocyanic acid content tends to be higher on poor soils and dry conditions. It has been classified that sweet or non toxic roots contain less than 50 mgms. of hydrocyanic acid per kgm. of fresh root.

2.15 At one time it was thought that the toxicity of the tapioca root was associated with species or varieties but the hydrocyanic acid content was found to vary markedly with growing conditions, soil, moisture, temperature and with the age of the plant. The chemical content of tapioca roots differ considerably. Efforts are being made to organize research and experiments in various regions for the selection of new varieties with high yields and higher storage content. For purposes of nutritional improvements, strains of high-protein content have to be sought.

2.16 In choosing strains, besides the yield of starch, the content of prussic acid should therefore have to be taken into account. Highly poisonous strains are preferred for the planting with the object of starch manufacture, thereby minimizing the danger of thefts.

Uses and World Production

2.17 The starch obtained from tapioca roots and its products have a very wide variety of applications:-

- animal feed preparation;
- human food preparation;
- manufacture of glucose;
- manufacture of dextrine,
- manufacture of monosodium glutamate;
- manufacture of adhesives;
- paper and paper box industries, and
- textile industries.

It is also possible to extract protein from tapioca plant; in addition it is a good source of enzyme which may be utilized in the manufacture of drinks, foodstuffs, liquor, etc.

2.18 Many tropical countries in Asia, Africa, Central and Southern America grow tapioca both in smallholdings and estates. Accurate statistics of the total world production are difficult te obtain as no distinction is made in most cases between the sweet and bitter varieties of tapioca. Some of the countries tend to exclude in the statistics the sweet varieties of tapioca acreage as they are grown mostly in backyards of houses for home consumption. However, the annual production of tapioca roots was estimated to be 85,000,000 - 90,000,000 tons in 1968 as shown in Table 2.1. Also a rough estimate places the total world acreage at 23.245 million acres in 1968 as shown in the table

Table 2.1

WORLD PRODUCTION, AREA AND YIELD OF TAPIOCA ROOTS IN 1968

South America		Production in 000 metric tons	Area 000 heators	Yield in Kgs./hectors
Argentina		273		
Bolivia		160		
Brazil		29,203		
Colombia		900		
Ecuador		280		
Paraguay		1,504		
Peru		500		
Venezuela		341	2409	138
	Sub-total	33,197	(including minor product from other South American Countries)	
Asia				
Ceylon		425		
Taiwan		342		
India		4,520		
Indonesia		11,800		
Malaysia		280		
Philippines		496		
Thailand		2,000		
S.Vietnam		260	2410	87
	Sub-total	20,911		

Table 2.1 (Contd.)

Africa			
Angola	1,545		
Cameroon	762		
Central African Rep.	1,000		
Congo (Brazzaville)	400		
Congo (Kinshasa)	8,100		
Dahomey	1,142		
Ghana	1,446		
Guinea	420		
Ivory Coast	530		
Liberia	430		
Madagascar	910		
Malawi	140		
Mali	110		
Niger	220		
Nigeria	6,700		
Senegal	232		
Tanzania	1,125		
Togo	1,120		
Uganda	2,000	4872	63
Sub-total	30,869		
World Total	85,626	9794	87

(Not including Mainland China)

Source: FAO Production Yearbook

2.19 Brazil is the largest producer of tapioca, accounting for about 30% of the total world production but most of the production is consumed locally and her exports are very small. Other important producers such as Nigeria, Indonesia, Congo, India, Columbia, etc. also follow the same pattern of consumption and export. In the case of Thailand, where rice is the most important staple food, tapioca is very insignificant in their diet and therefore this country is now the world's largest exporter of tapioca. During the last few years there has been a large increase in the production of tapioca by most of the important producing countries both through increased acreages and increased productivity.

2.20 Though in the early parts of this century, Malaysia was a leader in the world's tapioca flour trade with around 100,000 acres of land under tapioca plantation, production of tapioca has since dropped rapidly yielding place to rubber. At present, it is estimated that an area of about 50,000 acres in West Malaysia is under tapioca of which half is stated to be illegal cultivation. Lately MARA, a government-sponsored organization, has undertaken large-scale plantation of tapioca in Johore and Perak States of West Malaysia. Another proposal is under consideration for establishment of a plantation in the State of Negeri Sembilan.

2.21 In Sarawak, tapioca is grown inter-cropped with hill paddy. As figures of hill paddy cultivation are not available and as the entire area under hill paddy is not inter-cropped with tapioca alone, it is difficult to make an accurate estimate of the sole crop equivalent of tapioca annually in the State. A rough estimate, however, places the total annual area under hill paddy cultivation at 180,000 acres in the State and knowledgeable authorities place the area inter-cropped with tapioca at 50,000 acres.

2.22 Statistics of production are also not available. The Dutch Team on Regional Planning Study of the First Division of Sarawak estimated a total yield of 22,500 tons for the State as a whole and 9,000 tons for the First Division for the year 1967. Farmers, however, stated that the yield per acre of tapioca from inter-cropping was around 1½ tons. This works out to a total production of 75,000 tons of tapioca annually. Either the yield figures provided are wrong or the acreage figure mentioned above is wrong. This discrepancy, however, is of little significance as the entire crop is consumed as an emergency food and normally as feeding stuff to pigs.

World Trade

2.23 The principal markets for tapioca products are in Europe, the European Economic Community being the most important for dried roots, chips, pellets etc. For starch, USA, UK, and Japan are the principle markets. In the absence of complete statistics of world trade on tapioca products, it is difficult to estimate the total quantity entering international trade. However, import statistics of the EEC countries and the USA have indicated a substantial increase in recent years, particularly for dried tapioca roots. Table 2.2 below illustrates the export of tapioca products in 1967 in comparison with the production of tapioca roots in some of the major exporting countries except Indonesia, for which export figures were not available.

Table 2.2

Comparative Statement of Production of Tapioca Roots and Export of Tapioca Products of some major producing countries - 1967

Country	Exports 000' M tons	Production of Roots 000'Mtons	Exports/ Production %
Brazil	21.3	27,268	0.08
Thailand	808.0	1,800	44.89
Madagascar	17.2	900	1.91
Togo	3.3	1,118	0.30
Angola	49.8	1,525	3.27
Malaysia	16.5	310	5.32

Source: F.A.O. Agricultural Services Bulletin on Cassava processing.

2.24 Dried tapioca roots, however, are supplied to the EEC countries mainly by few exporting countries. The share of dried roots in 1967 of these major exporting countries in the principal three countries of the EEC is shown in Table 2.3 below :-

Table 2.3

IMPORTS OF DRIED TAPIOCA ROOTS IN 1967

Importing Country	Germany	The Netherlands	Belgium
Exporting Country	% of export dried roots		
Thailand	63.8	69.3	-
Indonesia	20.1	18.2	45.1
Angola	6.0	-	-
Tanzania	4.7	-	-
Brazil	0.3	-	-
Mainland China	0.2	9.0	37.1
From other Sources	4.9	13.5	17.8
Total	100	100	100

Source: F.A.O. Agricultural Services Bulletin on Cassava Processing.

2.25 The largest international demand for tapioca products as animal feed is in the EEC, especially in Germany and also other western European countries. These countries have the most developed compound animal feed industries and the prices of feed grains have been increasing and therefore are considered the largest outlet for exporting countries of tapioca products. Imports of tapioca products by the EEC countries have been steadily increasing and were 850,000 tons in 1966 which was more than double the volume recorded in 1962. This is indicated in Table 2.4 below:-

Table 2.4

IMPORTS OF TAPIOCA CHIPS AND MEAL INTO THE E.E.C. COUNTRIES

(in Tons)

Country	1962	1963	1964	1965	1966
Germany	366,107	387,267	461,533	519,634	701,709
The Netherlands	1,211	4,738	17,035	76,483	95,530
Belgium	22,958	72,067	105,391	100,203	70,625
France	23,429	19,555	18,013	17,400	15,650
Italy	40	-	-	292	-
Total	413,705	483,626	601,971	709,016	883,514

Source: National Trade Statistics

2.26 The total consumption of animal feed depends on two factors; that is the number of livestock and the consumption per head of livestock. The population of livestock and the consumption per head have been increasing in the EEC countries as would be evident from table 2.5 and 2.6 below:-

Table 2.5

RATE OF INCREASE OF LIVESTOCK NUMBER
(E.E.C. COUNTRIES 1962-1966)

	Germany %	The Netherlands %	Belgium %
Cattle	3.0	8.8	- 2.4
Pigs	0.5	45.5	6.4
Poultry	22.7	- 3.7	-16.6

Source: The Markets for Manioc UNCTAD/GATT 1968

Table 2.6

RATES OF INCREASES OF COMPOUND FEED-STUFF CONSUMPTION
PER HEAD 1963/1965

	Germany %	The Netherlands %	Belgium %
All Cattle	30.0	4.4	17.0
Milk cows	33.5	8.7	18.9
Pigs	26.0	- 5.3	11.1
Poultry	13.3	- 4.5	47.6

Source: The Markets for Manioc UNCTAD/GATT 1968

The figures in Table 2.6 reflect exactly the status of development in the yields of compound animal feedstuffs. In the Netherlands, the most advanced in this field, the rates of increase of compound feedstuff consumption per head are small and there is even a decline in some cases (pigs and poultry). However, in Germany and Belgium the rates of consumption are very high and this will continue for some time before the rate of consumption per head of animal and fowl reaches the Dutch level.

2.27 The maximum content of tapioca in compound feedmills is officially set in Germany as below:-

For pigs	-	10% - 40%
For cattle	-	20% - 25%
For poultry	-	10% - 20%

According to an estimate, the production of compound feedstuff in 1970 in the three major EEC countries were as follows:-

Germany	-	12,000,000 tons
Netherlands	-	7,000,000 tons
Belgium	-	3,000,000 tons

The Dutch and Belgium manufacturers are more quality minded than their German counterparts and they recommend the following as maximum and minimum contents of feedstuff:-

Starch content	-	more than 70%
Raw fibre content	-	less than 5%
Ash content	-	less than 3%
Moisture content	-	less than 30%

The bacterial content is expected to be under 10 million germs per gram.

2.28 Germany imports 70% of the EEC's total requirement of tapioca and Thailand is the major source of their supply. It is reported that the EEC and other European country buyers consider the Thai tapioca products as inferior* and are looking for better products even at a higher price. Other countries exporting tapioca chips/pellets include Indonesia, China, Angola, Tangayika and Brazil. In the EEC market, an ad valorem duty of 10% based on the c.i.f. value is charged on all imports of chips. The current prices of tapioca chips/pellets vary from M 183 - M 246 per ton c.i.f. German port i.e. Hamburg.

2.29 Japan is also fast becoming an important new market for tapioca chips and meal as there has been an increasing demand for raw materials for the compound feeding stuff industry.

2.30 Malaysia has also recently entered into the international market through its production of tapioca flour exclusively from West Malaysia; though the quantity involved is small. From the study of the Thai export pattern, it is seen that the market for chips is the largest one and Malaysia has not succeeded in entering this sector. However, in the flour market the Malaysian export was 3% in terms of volume and 10% by value of the total Thai export in 1966.

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* Prospects of Tapioca cultivation & Pelletisation in Malaysia by A. Pramanik - The Planters.

2.31 It has been stated earlier that USA, UK and Japan are the principal markets for tapioca starch. The current annual consumption of all starch products in the USA is more than 3 million metric tons of which tapioca starch comprises about 4%, of all the commercial starch. The main suppliers to this market is Thailand and Brazil. There has been an annual rise of around 10% of starch consumption in the United States, this being the result of its population growth, new applications of the starch and the growth of certain industries which use starch, particularly the paper and paper box industry. Till the very recent imposition of 10% surcharge on all import, the USA permitted duty-free entry of tapioca starch into the country and its importance in the US market is dependent on the prices relative to that of corn starch and potato starch.

2.32 United Kingdom is also an important market for imported starches. Imports of tapioca and sago starches in this market range between 10,000 - 12,000 tons annually and these are used in food preparation rather than for industrial purposes. Australia and Canada are also increasing their import of tapioca starch.

2.33 The other potentially important market for tapioca starch is Japan because the prices of locally produced starch is high and the traditional production of sweet potato and white potato starch is decreasing in quantity. The local production is about 800,000 tons a year against a national consumption of 1.3 million tons of starch. The import of tapioca starch into Japan increased from about 17,000 tons in 1965 to about 56,000 tons in 1967. However, the general policy in the country is to import raw materials only rather than finished products in order to encourage the local industries. In addition, the government has imposed a quota system of imports and an import duty of 25% on all tapioca products. Trading in tapioca starch by the principal importing and exporting countries in 1967 is shown in Table 2.7 below:-

Table 2.7

IMPORTS OF TAPIOCA STARCH IN 1967 (in metric tons)

Exporting Countries \ Importing Countries	USA	UK	Canada	France	Japan	Total
Thailand	116,906		3,903	579	54,494	175,882
Brazil	18,437		2,801			21,238
Taiwan	1,706					1,706
Mainland China				1,550	1,296	2,846
Togo				1,321		1,321
Malaysia	172	7,420	254			7,846
Singapore		1,683	2,170			1,683
U.S.A. (re-export)						2,170
Total	137,221	9,103	9,128	3,450	55,790	214,692

Source: The Market for Starch UNCTAD/GATT 1969.

2.34 It has been stated previously that there has been large increases in the acreage under tapioca and also an increase in the yield per acre in the producing countries, in view of the rising demand of tapioca products. This has resulted in increased competition. There is also competition from other starches. It is stated that even in Malaysia, the wide application of tapioca chips in the feedmeal industry would in the main depend on the price of its competitor i.e. maize, the supplementary protein ingredients of fishmeal and soya bean meal. Investigations in Malaysia had revealed that the feed millers would be indifferent to using tapioca chips or maize when the price of chips is equivalent to 83% of the price of maize. It would be of interest to note that the price of imported maize in West Malaysia has increased stedily since 1958 from M.178 to .202 per ton c.i.f. in 1967.

2.35 For Malaysia to penetrate into the international market in the face of increasing competition, she has to take into consideration that:-

(i) The economics of international trade require maximum quantities for each shipment and the exporters should, therefore, ensure regular quantities that are available for export year-round.

(ii) Each importing country has a minimum quality standard for each product which therefore necessitates for the exporting country to establish a quality control system to maintain the quality of its exported products to different countries. For example, in the USA about 80% of tapioca starch imported is used for industrial purposes viz. in the manufacture of paper and paper boxes, adhesives dextrin, textile, etc. indicating that quality is not very much of a consideration as price. On the other hand, EEC markets as mentioned previously is very much quality-minded and is even prepared to pay premium prices for superior quality products.

(iii) The export prices have to be based on market prices and therefore exporters should be kept well informed of fluctations and international market trends.

(iv) Bulk shipments are preferred for transportation of products in boxes and therefore it is advisable to have bulk loading facilities in the ports of the exporting countries.

<u>Future Prospects of Tapioca Industry</u>

<u>Feedmeal Industry</u>

2.36 With the rising standard of living, the demand for meat and dairy products is rapidly increasing especially for quality products. Livestock production is progressing fast and the production of meat is significantly increasing in many countries as shown in the following table:-

Table 2.8

Production of Meat (1,000 tons)

Country	Base Year 1961 - 1963	Projection 1975
Belgium (Luxembourg)	513.9	680 - 707
West Germany	2,839.8	3,642 - 3,740
Netherlands	702.1	976 - 1,023
United Kingdom	2,204.0	2,795 - 2,935
Japan	548.6	1,082 - 1,180
Total	6,808.4	9,175 - 9,585

Source: FAO Agricultural Commodities Projections for 1975.

2.37 The use of well balanced compound feeding stuff has proved to be the most efficient way to meet the deficit in home grown natural fodder and also to increase the efficiency in breeding the right type of animal such as dairy cows, beef, broilers or laying hens and pigs. Feeding experiments establish that tapioca provides good quality carbohydrates which may be substituted for corn or barley. However, tapioca must be supplemented by other feeds that are rich in protein and vitamins.

2.38 The consumption of tapioca products such as dried roots, chips and pellets by the compound animal feed industry is likely to increase considerably in the future and therefore, there is scope for undertaking new production wherever conditions justify.

Food and Non-food Industries

2.39 Starch derived products are going into almost every industry and because the application area is so large, the starch industry is vulnerable to attack from more specialized synthetic products.

2.40 In the textile, foundry and paper coating industries, synthetic polymers are presenting a serious threat to starch products but these are still very expensive. Much work is therefore being undertaken to form products combining starch and synthetic polymers so that the best of both materials can be obtained. The future of starch utilization in such industries can be bright if the technical efforts continue and expand to make use of the new synthetic materials rather than to compete with them or oppose them.

2.41 On the other hand, there is no doubt that the future for starch-base products in the food industry is bright. The new and improved methods of production of glucose, syrup and dextrin by enzymes and by direct conversion from the raw materials are going to give stiff competition to sucrose. In addition, there is a new claim that sucrose consumption has certain injurious effects on health while starch products and glucose do not seem to have such adversities. The utilization of glucose, syrup and dextrose is therefore rapidly increasing in the food industry and consequently their production from various starches is continuously expanding.

2.42 The most important raw material used currently in the production of starch is yellow corn. New waxy corns with higher amylosce content and different properties than normal corn have been developed. The market position of tapioca starch is dependent on the possibility of increased utilization in world industry, particularly in the USA. Hence any successfull development of domestic substitutes in that country, such as starches from the waxy varieties of grains (corn and sorgham) and from roots and tubers such as sweet potatoes and white potatoes at lower costs than that of imported tapioca starches, might affect the import of tapioca starch into this main market.

2.43 The rise in population in the tapioca producing countries would also continue to provide a market for tapioca roots and processed products locally. Many countries are coming into production and the international market has become very competitive. For this, it seems unlikely that the European market will attract any large volume of exports from Malaysia. Nevertheless, tapioca might become more important in its contribution to the national economy and its support to the food industry both for local consumption and for export. This could only be attained if tapioca starch is able to compete with the other starches. Improvement of the quality of its products and lowering of the cost of production are the only means to this end.

Bakery

2.44 The habit of eating bread and other similar items made from wheat is universal. At present, about two-thirds of the world's population import only about 20% of the world's wheat production. This situation is expected to be worse since the world's population is likely to double in about the year 2000 which means that world food production including wheat will also have to double.

2.45 The consumption of bread is increasing continually in most of the developing countries including Malaysia. These countries depend generally on imported wheat or wheat flour while various staples such as tapioca and other cereals are grown. Experiments carried out recently have shown the possibility of partial replacement of wheat flour in breadmaking by other flours such as tapioca and soya flours. It would, therefore, be logical to assume that the utilization of tapioca flour will increase considerably in the future in the breadmaking and other bakery industry in many of the developing countries.

2.46 In summing up, it may be said that there are good prospects for tapioca and its products both in food and non-food industries in the foreseeable future, though there might be competition from other starches in certain fields. It is possible in this connection to divide the starch-using industry into three distinct fields in each of which tapioca takes a fundamental different position:-

(i) In industries such as manufacture of re-moistening gums, the position of tapioca starch is still irreplaceable by other forms of starches.

(ii) In industries where thin-boiling, chlorinated and other special starches are required, tapioca has nothing to offer even if it costs cheaper due to the lack of certain desirable characteristics.

(iii) In industries such as compound feeding stuff where interchangeability with other forms of starches is possible, price and marketing conditions are the major controlling factors.

Proposal for Sarawak Production

2.47 From the foregoing analysis of current & future world demand of tapioca products, it would be worthwhile to encourage in Sarawak large-scale tapioca plantation and processing of tapioca into various products for trading in the international market in addition to meeting the small local demand. The import of various tapioca products into Sarawak viz. tapioca flour, tapioca pearl and tapioca flakes for the period 1966 - 1970 are shown in Tables 2.9, 2.10 and 2.11 respectively. Except for the year 1970, when the import increased by more than 100%, the import of tapioca into Sarawak were generally constant around 450 tons, and Thailand had been the traditional source until 1969. In 1970, the import from West Malaysia jumped to 797 tons from 30 tons in 1969.

Table 2.9

Sarawak Imports of Tapioca Flour for 1966-1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Vol.(Ton)	Value(cif)	Vol.(Ton)	Value(cif)	Vol.(Ton)	Value(cif)	Vol.(Ton)	Value(cif)	Vol.(Ton)	Value (cif)
Australia	0.20	59	-	-	-	-	-	-	-	-
China Mainland	247.13	62,593	185.15	54,932	226.40	71,334	132.94	38,128	75.25	21,765
Formosa	0.99	294	-	-	-	-	-	-	-	-
Hong Kong	5.28	1,677	0.94	385	1.58	780	7.06	2,252	5.93	1,721
Indonesia	3.74	2,582	5.75	1,807	6.35	1,769	17.09	3,722	5.54	1.614
Japan	2.98	163	0.38	120	-	-	-	-	-	-
Malaysia, est	12.19	3,904	10.69	3,594	16.44	2,318	30.42	8,904	797.01	164,858
Singapore	14.08	4,556	15.75	5,592	18.64	6,511	13.33	4,054	11.66	3,577
Thailand	173.20	51,939	237.57	71,749	196.91	51,189	220.28	55,503	90.48	25,974
United Kingdom	-	-	-	-	-	-	0.01	14	-	-
Total	464.79	127,767	456.23	138,179	466.32	133,901	421.13	112,577	985.87	219,512

Table 2.10

Sarawak Imports of Tapioca Pearl for 1966-1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
China Mainland	0.27	91	0.18	81	0.12	49	1.50	359	1.01	281
Hong Kong	-	-	0.01	19	-	-	-	-	0.20	52
India	-	-	-	-	0.06	19	-	-	-	-
Indonesia	-	-	0.03	11	0.06	24	0.03	11	-	-
West Malaysia	1.35	484	1.86	484	2.28	757	3.01	371	2.86	955
Singapore	2.36	772	2.69	944	3.67	1,191	7.34	1,554	6.62	2,005
Thailand	7.39	2,801	6.33	2,284	7.44	2,450	18.92	4,282	8.56	2,861
Total	11.37	4,148	11.10	3,823	13.63	4,490	30.80	7,077	19.25	6,154

Table 2.11

Sarawak Imports of Tapioca Flake for 1966-1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
China Mainland	-	-	0.15	118	0.06	47	-	-	-	-
Singapore	-	-	0.06	20	0.09	25	-	-	0.54	409
Thailand	-	-	0.02	40	-	-	-	-	-	-
Hong Kong	-	-	-	-	-	-	0.02	32	-	-
Total	NIL	NIL	0.23	178	0.15	72	0.02	32	0.54	409

The c.i.f. value of imported tapioca flour from West Malaysia in 1970 was around $205 per ton. This is much cheaper compared to the price of $252 per ton c.i.f. paid in 1969 for imported tapioca flour from Thailand.

2.48 The local demand of tapioca product is expected to increase at a minimum average rate of about 5% for the next 10 years, partly due to the rise in population (2½% per annum), and rise (2½% per annum) in the livestock, poultry and bakery industry in the State.

2.49 The Research Division of the State Agriculture Department carried out trials on 16 varieties of tapioca, comprising 8 from West Malaysia and 8 from Sarawak, at their Tarat experimental station in June 1961. The roots were lifted in August 1962. On account of their poor yield and palatability, six varieties, including three local and three from West Malaysia, were dropped out for further trials. From 1966 - 1967 the reamining 10 varieties were tested in a series of four successive trials. Except in 1964 - 1965 season, when there was no maintenance the experimental area was kept clean of weeds by one or two sprayings of paraquet. None of the varieties was affected by pests or diseases. The trial cultivations were performed mechanically.

2.50 The details of the experiments were as follows:-

Design: Six randomised blocks of ten plots each.

Soil Series: Terbat, (World great soil group: Recent Alluvial)

Planting material and distance : Nine-inch stem cuttings at 3 ft. by 3ft.

Plot sizes and growing periods

Year	Plot Size	Planting Date	Lifting Date
1963/64	18 by 36 feet	8 : 11 : 63	18 : 10 : 64
1964/65	18 by 36 feet	19 : 9 : 64	10 : 9 : 65
1965/66	15 by 36 feet	11 : 9 : 65	12 : 9 : 66
1966/67	18 by 30 feet	30 : 6 : 66	29 : 6 : 67

2.51 The results were presented under the following headings:-

(a) Yield of fresh tubers,

(b) Yield of carbohydrates,

(c) Palatability,

(d) Cyanide content.

Yields of tubers

2.52 The mean yields of tubers in tons per acre equivalent were as shown in table 2.12 below:-

Table 2.12

Yield of Tubers, (fresh weight) in tons per acre

Variety \ Year	1964	1965	1966	1967	Mean Annual Yield
Black twig	9.61	10.89	16.33	20.22	14.26
Berat	10.18	10.49	16.33	14.73	12.93
Baloi	12.78	8.72	9.56	18.15	12.30
Kapok	14.51	9.30	13.67	11.50	12.24
Buloh	13.05	8.35	14.87	12.46	12.18
Sawah	15.23	8.48	12.78	11.63	12.03
Kekabu	14.08	8.58	12.23	12.28	11.79
Betawi	9.40	10.69	12.15	14.58	11.70
Ubi Puteh	7.15	8.58	15.56	13.77	11.26
Puteh	7.81	8.90	12.11	10.63	9.86
Standard error	2.45	1.90	2.09	1.43	1.97

Source: **Annual** report of the Research Division, Department of Agriculture, Sarawak.

2.53 It will be seen from the table that there has been variation in the actual yield and the relative yields of the varieties in the different years : yields in 1965 were significantly (p = 0.01), poorer than in 1964 and the yields in both years were significantly less than in either 1966 or 1967.

Over the whole period of the experiment, the yield of Black Twig was shown by the multiple range test to be significantly better, ($p = 0.05$), than all the other varieties and, Berat significantly better than Ubi Puteh or Puteh. Puteh was a significantly poorer yielder than all the others. None of the other yield differences over the four seasons was significant but the generally relatively low yield each season and the low total yield of Kekabu, Betawi, Ubi Puteh and Puteh was suggestive.

Yields of Carbohydrates

2.54 Random samples of tubers of each variety were tested in 1966 and 1967 for carbohydrate content and the results are shown in table 2.13 below. It would appear that the highest yielding variety, Black Twig, has a low percentage of carbohydrate. This, however, does not conform with the findings in West Malaysia where Black Twig was found to have a satisfactory carbohydrate content of 92.0%. The carbohydrate content of the varieties Buloh and Kapok appear to be satisfactory.

Table 2.13

Carbohydrate Content of Tapioca Tubers

Variety	Percentage - on oven-dry basis	
	1966 (whole tubers)	1967 (Flesh Portion only)
Black Twig	68.37	56.60
Berat	78.20	62.20
Baloi	78.67	67.06
Kapok	77.58	81.04
Buloh	77.16	77.19
Sawah	77.21	69.26
Kekabu	79.27	64.33
Betawi	75.62	73.83
Ubi Puteh	74.13	65.06
Puteh	71.02	81.50

Source: Annual Report of the Research Division of the Agriculture Department, Sarawak.

Palatability

2.55 In 1962, 1966 and 1967 each of the varieties was cooked in an identical way and then tasted by a panel who represented the various races of Sarawak. Of the six highest yielding varieties, there was a practically unanimous view that Black Twig was of poor palatability. Opinions of Berat varied but in general, it was regarded as of fair to good quality. Kapok obtained almost universal approval but opinion of Baloi varied - the consensus was that it was of only poor to fair palatability. Buloh and Sawah were considered to be fair to good.

Cyanide Content

2.56 The total cyanide content of the flesh of each variety was determined in 1965 and 1967 and of the leaves in 1967. The results are given in table 2.14 below; these are expressed as parts of prussic acid (HCN) per million parts of total cyanides.

Table 2.14

Cyanide Content of Tapioca Tubers

Variety	Flesh 1965	Flesh 1967	Leaves 1967
Black Twig	141	11	303
Berat	44	8	176
Baloi	45	24	269
Kapok	19	10	231
Buloh	80	11	84
Sawah	54	17	69
Kekabu	29	7	80
Betawi	94	55	266
Ubi Puteh	47	12	194
Puteh	109	25	364

Source: Annual Report of the Research Division of the Agriculture Department, Sarawak.

2.57 The total cyanide is known to vary with the growing conditions, climate, variety, soil moisture, the age of lifting and previous cropping. The content of cyanide in the leaves is of interest both because it does not coincide with findings elsewhere that the glucoside content of the leaves is less than that of the tubers and also because the leaves are commonly eaten by the natives as a vegetable. The much lower cyanide content of all varieties in 1967 compared with 1965 is noteworthy.

2.58 As the available data are too limited to work out any conclusive results, more trials would have to be carried out to identify the most suitable variety of tapioca for plantation in Sarawak. It should also be noted that the above results relate to trials on recent alluvial soils. Such soil types are, however, not obtainable over large areas. Trials were also carried out on peat soil using Black Twig variety. The yield obtained was 18 tons per acre which compares well with the yield obtained from trials in recent alluvial soil.

2.59 Unlike in West Malaysia and in Sabah, agriculture is a smallholder activity in Sarawak, except in the cases of a few small rubber estates. The government policy favoured such development until recently, where a process of rethinking has already begun in this matter. This is indicated by the allocation of 6,000 acres in the Lambir-Subis area in the Fourth Division to Commonwealth Development Corporation for oil palm plantation. Negotiations are also in progress for allocation of large areas for estate type agriculture to companies both local and foreign.

2.60 While smallholder plantation has its socio-economic advantages and also in some cases advantages for feeding raw materials to processing units, under Sarawak conditions, it would be difficult to attract entrepreneurs to establish large-scale processing units based on smallholder crop. Firstly, in the absence of adequate transport facilities either by land or by river, the cost of raw materials at factory site would be too high. Secondly, the native farmers of Sarawak, who control most of the agricultural land under customary rights, are not reliable for efficient and continuous production. These farmers depend largely on shifting cultivation where paddy is grown for their own consumption. The first priority is always accorded to this paddy growing, irrespective of its comparative return. The"non-native" farmers, who could be relied upon, are already making maximum use of their own land and the State's present Land Law would not permit acquisition by them practically any further agricultural land. The alternative, therefore, would be to develop estate-type plantation.

2.61 In the fringes of the estates, the demonstrative effect might encourage farmers to undertake cultivation of the particular crop for selling to the processing factories established by the estates. Such a system would help the local population, both in adapting to modern techniques of agriculture, and also to secure steady employment, wherever applicable, in the estates.

2.62 In view of the foregoing analysis, it is recommended that tapioca plantation in Sarawak should be undertaken on estate basis only.

2.63 There are many suitable areas in Sarawak where large scale tapioca plantation could be undertaken. However, in view of the difficulty in securing land, with the present land tenure system, the State Government, as an alternative and immediate solution, might consider persuading the natives to part with their land at an agreed value which could be either paid in cash or could be converted into shareholdings in the proposed plantation. As large plantations are likely to be promoted by public limited companies only and the investment on land (prior to preparation) is not expected to be high, such companies should have no objection to convert the price of land into shares, wherever necessary. The other alternative is to amend the land laws which would not only be time consuming but also would give rise to a number of socio-political problems.

2.64 Due to the limitations imposed by the inadequacy of infrastructure facilities, tapioca plantation would have to be confined to selected areas. Port facilities are of paramount importance as the proposed tapioca products would be entirely meant for export market. The ports of Sarawak, except for Kuching, do not offer even the minimum of facilities. In view of this, any plantation to be undertaken would have to be near Kuching and easily accessible from Kuching either by road or by navigable rivers. This would only be, possible in the case of suitable areas in the First and Second Divisions of the State.

2.65 Two such areas which might deserve consideration are:

(i) Stenggang-Stungkor in the Bau District of the First Division; and

(ii) Pengulu-Lingoh area in Second Division.

2.66 Both these areas are accessible from Kuching by trunk roads.

2.67 The Stenggang-Stungkor area is about 37 miles from Kuching. In this area about 20,000 acres of land are likely to be available which is occasionally mild steep of around 10^{o} but otherwise flat. At present about 1,000 acres of this area are under new high-yielding rubber and the remainder is under hill paddy or fruit trees. Semi detailed soil survey of the area indicated that the soil belongs to the red-yellow podzolic group and as such not much drainage would be required (please refer to map 2.1).

2.68 The Pengulu-Lingoh area, on Betong-Semanggang Road, and measuring about 17,000 acres, is mostly hilly with grades around 25^{o}. At present the area is largely under hill paddy and fruit trees. According to a reconnaissance survey the soils in this area vary from red-yellow podzolic to peat types and no drainage would also be required (Please refer to map 2.2).

2.69 Though the soils in both the areas are different from the soils on which trial plantation in Sarawak was carried out, as discussed earlier, this soil type is considered to be very good for tapioca growing.

2.70 Both these areas are held by the natives under customary rights.

2.71 The scope of tapioca plantation in the Pengulu-Linggoh area is limited by the fact that mechanized cultivation would be difficult in view of the high gradients and it would be expensive too. Further, the distance from the port of Kuching would also be a deterrent factor.

2.72 The Stenggang-Stungkor area is, therefore, favoured for the first tapioca project in the State.

2.73. It would be evident from the description of climatic conditions discussed under introduction that Sarawak has all the favourable conditions for Tapioca growing.

Land Requirement

2.74 As the tapioca products are proposed to be traded in the export market, the size of production would have to be sufficiently high to keep the overheads to the minimum. Such large-scale production would also enable use of modern equipments for processing.

2.75 It has been established previously that the demand for chips and pellets in the EEC market is extremely good and West Germany is the main entry point for tapioca products, taking around 80% of the EEC requirements. Reportedly, some West German firms are prepared even to take 500,000 tons of tapioca chips/pellets annually. This might grow in volume in view of the FAO forecast in regard to the increase in production of meat during the years ahead.

2.76 Also discussed previously, the starch importing countries are continuously increasing their import and are looking for alternative source for bulk supply of starch as some of the current supplies are unsatisfactory. Sarawak could very well be a source of supply of good quality starch to this potential market. To cater for these markets the areas of production would not only have to be sufficiently high but also the technique of production would have to be sophisticated to produce good quality starch.

2.77 The proposed tapioca project would, therefore, have to be of fairly large size. Suitable production capacity would be 36,000 tons of pellets and 7,200 tons of starch annually.

2.78 Based on a recovery of 40% of pellets and 20% starch, with a minimum yield of 15 tons of fresh roots per acre (as against 18 tons and above that could actually be obtained), the total land requirement for continuous working of the two factories would be 12,600 acres allowing 50% of the area for annual crop rotation. This assumes 300 working days per annum. Should there be additional mature roots from the areas in the fringes by smallholders, it should be possible to absorb this by installing a chipping plant at the plantation site.

2.79 The yield of tapioca generally is reduced from the fifth year crop and therefore additional land is required to be reserved for undertaking plantation to the extent the yield has been reduced, for keeping the factory running continuously.

2.80 In Stenggang-Stungkor, there are 20,000 acres of land and to start with 12,600 acres (9,000 for pellet factory and 3,600 for starch factory) would have to be acquired. As and when additional land is required, there should be no difficulty in carving it out from the total land, provided the entire area is reserved for the tapioca projects.

Economics of Tapioca Plantation for the Pellet Plant

2.81 Due to the absence of adequate information on the proposed location, the calculations on the cost of the tapioca plantation are only approximate. The production cost is worked out for 6,000 acres, though an area of 9,000 acres would be developed for feeding the pellet plant continuously round the year. 50% of the area is proposed to be rotated for reasons explained earlier.

2.82 Based on an average yield of 15 tons per acre (though the actual yield would be much higher), the total yield from 6,000 acres would would be 90,000 tons of fresh tapioca roots. With an average price of M28 per ton delivered at factory gate, the total return would be M2,520,000. With an investment of M3.40 million, this would give a return of 16.6% on the investment capital. It would, therefore, be seen that the plantation alone is a profitable proposition.

Plantation Operations

Land Clearing

2.83 All trees of 24 inches diameter and below along with dead stumps of all sizes must be destumped and burned. Trees of diameter 24 inches and above are to be felled four feet above the ground level for reasons of economy, and its logs pruned and burned. All these operations are to be done by mechanical means. Unburned timber and stumps are to be stacked or heaped around the standing stumps and completely burned.

Once the area is free from fallen timber of all sizes, the land is to be ploughed and harrowed one round only. Areas around standing stumps are to be ploughed and harrowed four feet from base. This can be done by using tractors depending on the grade of the land.

Construction of Roads, Bridges and Drains

2.84 A good network of estate roads is essential for easy transportation. Based on the road length in the oil palm plantation of the Commonwealth Development Corporation in the Fourth Division (which is 1.2 chain per acre), it is estimated that the road requirement would average at one chain of 12 feet wide cambre road per acre. No drainage as such would be required in the plantation but the requirement of bridges over any existing streams would be ascertained only after the land clearing has been completed.

Site for Quarters

2.85 Provisions for quarters have also been made. The actual cost would, however, depend on the need of the personnel recruited. Whenever a person is from a far away place, he would have to be provided with some accommodation. It is expected that most of the junior people would be from the villages around and would not require accommodation provided by the plantation.

Planting

2.86 Planting has to be done mainly in the first year. The planting materials would have to be obtained by developing a nursery or from West Malaysia. The cost per acre of planting material is estimated at M$15 as against M$10 - M$12 in West Malaysia. Though Black Twig variety has been found to be most appropriate for West Malaysian conditions, the Research Division of the Agriculture Department, Sarawak would have to carry out some more trials to identify the most appropriate variety for Sarawak. To start with, however, Black Twig should be appropriate. The planting distance is 3 feet by 3 feet straight line. This would work out to a planting density of 4,840 as against 5,000 per acre assumed for the calculations. The planting material should be cut six inches and dipped in Dieldraw solution before planting. The planting angle should not be more than 12^{o}- 20^{o} and at least two inches should be left above the ground. The dead plants must be replaced within two months after planting. The additional requirement due to this type of replanting, if any, has been compensated by estimating a planting density of 5,000 per acre.

A mechanical planter made in Brazil is being used in Brazil and Mexico. It is a two-row planter, using a tractor driver and two men on the machine to feed cuttings from the reserved bins into the rotating planting turn-table. In operation, the cuttings fall in succession through a hole down into the furrow, opened by a simple furrower. A pair of discs throw dirt into the furrow and floats pulled by chains, pack the soil over the cuttings. The capacity of the planter is about 12 acres per day.

A planting unit was also developed to perform ridging and planting by modifying a ridger to work as a ridger-cum-planter, and a cultivator to work as a six-row planter after the area has been ridged.

A simple machine used in Mexico is a gasoline-powered table saw used to prepare the cuttings for planting. The machine has the advantage of speed and the regularity of the produced cuttings. When compared with manual work the time saving is in the ratio of 3:1.

Weeding

2.37 Manual or Chemical weeding has to be done once in two months after planting.

It is impossible to carry out the first weeding operation between the ridges by a cultivator. However, weeding the top of the ridges mechanically would present a number of difficulties.

Harvesting

2.38 Tapioca is not a crop that lends itself rapidly to mechanical harvesting because of the manner of growth of the tubers. These may spread in growth in the ground to four feet and penetrate 18 to 24 inches. Careless use of machinery for harvesting can damage the tubers, resulting in a darkening due to oxidation and a lowering value of flour.

However, experiments proved that harvest of tapioca roots can be done mechanically. In Mexico and Thailand, mouldboard ploughs have been used to make hand harvesting less tedious. The stalks could be cut successfully by a mid-mounted mower or a topping machine and the roots could be lifted afterwards mechanically by using a mid-mounted disc terracer. In Ghana, an acre could be harvested in 2½ hours by a tractor while ordinarily, five man days would be required, A modified beet or potato harvester was suggested to be used behind the tractor, with a pulling mechanism in place of the digging shores, to raise the tubers by pulling at the cut stems left after topping. The topping machine has a heavy screen mounted on the front of a tractor which pushes down the tops and then a rotary mower on the back of the same tractor cut the downed tops to make harvesting by hand possible. The height at which the tops are cut back can be easily regulated by hand rotary mower.

Planting Preparations/Supervision

2.89 In order to ensure regular supply of planting materials, sheds have to be built at different places in the estate. These sheds would be of the cheap type and their number would depend on the shape of the plantation. In a fairly rectangular shape lot, the number of sheds would be less.

Experimental Plots

2.90 Experiments would have to be carried out regularly to estimate the yield, fertilizer requirements and types of fertilizer, maturity period, etc. Experiments would also have to be carried out to determine the fertilizer responsiveness after continuous planting has been done, suitability of tapioca shoots to be processed into pellets, and other crops as stylo grass, maize and groundnuts for future crop rotation programmes.

Transportation, Internal and External

2.91 Roots harvested would be loaded on to trailers pulled by tractors and carried to the collection stations. Permanent collection stations have been provided for in the estimates. In these collection stations, the trailers would dump the roots from where the lorries would carry the roots to the factory.

2.92 The cost estimates are as below:-

Income and Expenditure Statement of
for 6,000 acres of effective Area of
Tapioca Plantation (for Pellet Factory)

INCOME

Minimum expected yield (less damage which would not exceed 5%)	= 15 tons per acre
Total yield from 6,000 acres = 6000 x 15)	= 90,000 tons
Value per ton of fresh tapioca roots	= M$28
Total Value of roots at factory gate	= (90,000 x 28)
	= M$2,520,000

EXPENDITURE

Capital Expenditure

(A) Land and Development	Per Acre (M$)	Value (M$)
(i) Land acquisition cost plus cost of compensation for standing plants on 9000 acres (for a net cropped area of 6,000 acres, 50% area being assumed for rotation planting)	80	720,000
(ii) Clearing, felling, burning, etc.	200	1,800,000
(iii) Roads, bridges and culverts (roads @ 1 ch. per acre).	20	180,000
Total	300	2,700,000

(B) Farm Equipment

	No. of Units	Unit Cost (M$)	Value (M$)
(i) Tractors (65 HP)	5	10,000	50,000
(ii) 3-tons wooden trailer	5	2,200	11,000
(iii) Disc Harrow	1	14,000	14,000
(iv) Rotavator	1	6,000	6,000
(v) Motor Grader	1	55,000	55,000
(vi) Crawler Dozer	1	160,000	160,000
(vii) Lorries	8	25,000	200,000
(viii) Weighing machine	1	30,000	30,000
(ix) Miscellaneous Equipment			24,000
Total			550,000

(C) Buildings

	Value (M$)
(i) Office building, stores etc.	50,000
(ii) Collection stations (10 units)	40,000
(iii) Shed for planting materials	6,000
(iv) Quarters for staff	50,000
Total	$146,000

Total fixed investment = $3,396,000

Revenue Expenditure

(D) Cost of Materials

	Cost per Acre (M$)	Value (M$)
(i) Planting material	15	90,000
(ii) Transport of planting material	10	60,000
(iii) Weeding materials	15	90,000
(iv) Fertilizers	50	300,000
(v) Transport of roots	6	36,000
(vi) Diesel, lubricants, repairs for tractors.		10,000
(vii) Stationery, telephone etc.		4,000
Total		590,000

(E) Cost of Cultivation (Contract Work)

	Cost per Acre (M$)	Value (M$)
(i) Land preparation including ploughing and harrowing	50	300,000
(ii) Planting	16	96,000
(iii) Fertilizing	28	168,000
(iv) Weeding	20	120,000
(v) Harvesting	80	480,000
Total	194	1,164,000

(F) Cost of Plantation Management

	No.	Wage/Mensem (M$)	Wage/Annum (M$)
(i) Plantation Manager	1	1,000	12,000
(ii) Conductors Grade I	2	500	12,000
(iii) Conductors Grade II	6	300	21,600
(iv) Clerk, typist, stenographer	3	Av. 250	9,000
(v) Tractor and lorry drivers	13	$5/day	19,500
(vi) Office boy	1	100	1,200
Total	26		75,300

Add 15% employment cost — M$11,295

Total cost — M$86,595

Total Revenue Expenditure = M$1,840,595

Working capital (3 months operation) = $\frac{3}{12}$ x 1,840,600

= M$460,125

Depreciation on farm equipment (10%) = M$55,000

Depreciation on building (10%) = M$14,600

Total depreciation per year — M$ 69,600

Interest on working capital @ 10% (current commercial bank rate) = M$46,000

Total cost = M$ (1,840,600+69,600+46,000)

= M$1,956,200

Profit before tax = M$ (2,520,000 - 1,956,200)

= M$563,800

Percentage gross return on capital investment = $\frac{\text{M\$563,800}}{\text{M\$3,396,000}}$

= 16.6

2.93 It would be seen that apart from the profit of 16.6% derived from the investment, the plantation alone would provide 26 employment directly in addition to a large number of unskilled labour employed through the contractors.

2.94 The plantation is proposed to be owned and managed by a company who would also own and manage the tapioca pellet plant discussed later. As the end product of the plantation would be an input to the factory, the foreign exchange earning from the export as also the small amount of foreign exchange earning from the export as also the small amount of foreign exchange saving due to the replacement of imports into the State would reflect only in the estimates of the pellet plant.

The Manufacture of Tapioca Pellets for the Animal Feed Industry

2.95 For the compound animal feed industry, dried tapioca roots and meals in one of the following forms are imported by the European countries.

(i) Tapioca Chips

This is the most common form in which dried tapioca roots are marketed and most exporting countries produce them. The chips are dried in irregular slices of roots which vary in size but their length should not exceed 1¾ - 2 inches so that they could be stored in silos well. These are produced extensively in Thailand, West Malaysia, Indonesia and some parts of Africa.

(ii) Broken Tapioca Roots

These are similar to chips in their appearance, but they are generally thickerand longer.

(iii) Tapioca Pellets

The pellets are obtained from the dried chips and broken roots by grinding and hardening into cylindrical shape of approximately 1 - 1½ inches long and 1/8 - ¼ inches in diameter and are uniform in appearance and texture. At present they are only produced in Thailand, the largest supplier of tapioca products for the animal feedstuff industry. The production of pelletized chips has recently been increasing as they have a ready demand in the European markets. The pellets have the following advantages over the chips:-

(a) The quality of pellets is more uniform;

(b) Occupy an estimated 20% - 25% less space than chips, thus reducing the cost of transport and storage;

(c) Handling charges for loading and unloading are also cheaper;

(d) Pellets usually reach their destination sound and undamaged, while a great part of the sliced chips is damaged in long distance shipment because of sweating and heating of cargo. Pellets are produced by feeding the dried chips into the pelletizing machine and the resulting pellets are screened and bagged for export. The powdered chips which fall down during pelletizing, are repressed into pellets and the process is repeated. There is usually a loss of about 2% - 3% by weight during the process.

(iv) Tapioca Meal

This product is the powdered residue of the chips and roots after processing to extract edible starch. It is generally inferior in quality to chips, pellets and broken roots, has lower starch content and usually contains more sand than these products. The use of tapioca meal in the EEC has declined with the accompanying shift to other tapioca products during the last few years.

(v) Tapioca Refuse or Waste

During the processing of tapioca flour, the residual pulp which is separated from the starch in the screening process is used as an animal feed. It is usually utilized wet with 75% - 80% moisture content in the neighbourhood of the processing factory but sometimes sun-dried before it is sold. This product is considered a by-product of the starch industry and represents about 10% by weight of the tapioca roots. There is no yield of waste/refuge from pelletizing plant which could be marketted.

Processing of Tapioca Chips

2.94 The present method of processing chips in Thailand, Malaysia and some other countries is very simple and comprises the mechanical slicing of tapioca roots and then sun-drying of the slices. The recovery rate of chips from roots is about 38% - 40%. However, the products are considered to be of inferior quality by some quality-conscious feedstuff manufacturers in Germany, Netherlands and Belgium. The processing method is as below:-

(i) Preparation of the Roots

When the roots are not sorted, peeled and washed, the chips are usually brown in colour, have a high content of fibre, sand and foreign objects as well as hydrocyanic acid. In order to produce white chips of superior quality, trimming, peeling and washing of the roots in a better way is necessary.

(ii) Slicing and Shredding

The roots are shredded in a special machine which consists of a rotating notched cutting disc or knife blades mounted on a wooden frame, equipped with a hopper. The tapioca roots are cut into thin slices and pieces as they pass through the machine.

(iii) Drying

Sun-drying is mostly applied. The sliced roots are spread out on drying areas which are concrete floors of varying sizes. To produce good quality chips, the roots must be sliced and dried as quickly as possible after harvest. The chips should be turned periodically during the drying period which is usually about 2 - 3 sunny days until the moisture content reaches 13% - 15%. The chips are considered dry when they are easily broken but too hard to be crumbled by hand. The thickness of the slices also have an effect on the quality of the chips. These thick slices may show to be dry on the surfaces but their moisture content is high inside. When rain threatens during the drying process, the chips are collected by hand or a tractor into piles under a small roof. Interrupted sun-drying affects the quality of the finished chips and pellets. When the semi-dried chips get wet again from rain, they become soggy and upon completion of drying they lose their firm texture. In rainy regions like in Sarawak, where continuous sun-drying would be difficult, a suitable form of artificial heat drying would have to replace sun-drying.

(iv) Pelletizing

The chips so dried are granulated in a hammer mill. The granules are then transported to a storage bin and fed by means of a screw conveyor into the pelletizing press which produces pellets of the required diameter and size.

Cost Estimates

2.95 (i) 90,000 tons of fresh tapioca roots valued at $2,520,000 delivered at factory gate;

(ii) Recovery of pellets at the rate of 40% by weight of fresh roots i.e. 36,000 tons per annum;

(iii) The factory would operate on three shifts for 300 days a year;

(iv) The c.i.f. Hamburg West Germany price of pellet is assumed at $210 per ton as against the current price varying from $183 to $246 per ton depending on the quality.

2.96 From factory to port the company would transport the product by lorries owned by them (it is to be examined whether this or employing contract transport would be more economical). The shipment to West German port would have to be done through Singapore till such time as the Kuching port is fully developed for ocean-going vessels to call regularly. Port charges, loading to ship in Kuching, freight to Singapore, transhipment cost in Singapore, trade from Singapore to Hamburg and insurance together are estimated at $80 per ton i.e. around 38% of the c.i.f. price which is much on the higher side. These assumptions have been made to take care of any price change downwards, though unlikely.

2.97 The sales promotion and sales cost of $5 per ton is considered to be sufficient according to the current trends.

2.98 The return on investment i.e. $435,350 is 23½% which is very encouraging. The investment would be of the order of $1.75 million in addition to a working capital for three months of $1.70 million. The working capital is calculated for three months and assumed to be available from commercial banking sources.

2.99 The pellet plant would directly employ 56 people and also would earn for the country an amount of $7,560,000 as foreign exchange. In addition, this plant would be able to replace import worth $226,075 which is now spent on import of tapioca products into Sarawak.

2.100 Cost Estimates for a Tapioca Pellet Factory

Input - 90,000 tons of fresh tapioca roots

Pellet recovery - 40%

Output - 36,000 tons of pellets

Capital Investment

(A) Land

Land including cost of development 10 acres to be acquired with the plantation).

$20,000

	Area (Sq.ft.)	Unit Cost ($)	Value ($)
(B) Factory Buildings			
(i) Factory proper and godown	20,000	9	180,000
(ii) Office blocks, workshops, etc.	4,000	11	44,000
(iii) Staff quarters			100,000
(iv) Garages	2,400	6	14,400
Total			338,400

(C) Plant and Equipment

(i)	Drying plant	$225,000
(ii)	Milling plant	30,000
(iii)	Pelletizing plant	520,000
(iv)	Preparatory machinery	90,000
		$865,000
(v)	Cost of erection, engineering, design, etc. @ 25% plant cost	$216,250
		$1,081,250

(D) Ancillary fixed cost

(i)	Water works	$100,000
(ii)	Office equipment including typewriters, calculators etc.	25,000
(iii)	Laboratory equipment	10,000
(iv)	Lorries, 5-ton capacity, 6 units @ $25,000 each	150,000
(v)	Fork lift, 2-ton capacity, 1 unit @ $12,000	12,000
(vi)	Land rover, 1 unit @ $16,000	16,000
	Total	$313,000

Total capital investment	=	$1,752,650
Add pre-project expenses (5%)	=	87,630
		$1,840,280

Recurrent Cost

(A) Cost of Materials

		Value ($)
(i)	Fresh tapioca roots, 90,000 tons @ $28.00 per ton at factory gate	2,520,000
(ii)	Sacks for packing 36,000 tons pellets, 17 sacks per ton pellet @ 30 cts.per sack.	183,600
(iii)	Fuel, 10,000 cal. per hour	400,500
(iv)	Electricity, 675 KWH/hr. @ 8 cents per unit, ave. cost.	400,000
(v)	Cost of pumping water	10,000
(vi)	Repairs of machinery	5,000
(vii)	Diesels, lubricants for vehicles	10,000
(viii)	Office stationery, postage, telephone, etc.	10,000
	Total	3,539,100

(B) Labour Cost

(a) General and Sales Administration

		No.	Wage/mensem	Wage/annum
(i)	General Manager	1	$1,500	$18,000
(ii)	Sales Manager	1	1,000	12,000
(iii)	Accounts officer	1	1,000	12,000
(iv)	Stenographers,clerks, typists, etc.	6	Av. 250	18,000
(v)	Receptionist	1	200	2,400
(vi)	Office boy	1	100	1,200
(vii)	Watchman	1	100	1,200
	Total	12		64,800

(b) Factory Administration

		No.	Wage/mensum	Wage/annum
(i)	Factory Manager	1	$1,000	$12,000
(ii)	Supervisor	2	500	12,000
(iii)	Electrical Chargeman	1	400	4,800
(iv)	Mechanical foreman	1	400	4,800
(v)	Chief Clerk	1	350	4,200
(vi)	Junior Clerk	2	200	4,800
(vii)	Laboratory assistant	1	300	3,600
(viii)	Typist	2	200	4,800
(ix)	Office boy	1	100	1,200
(x)	Watchman	1	100	1,200
(xi)	Vehicle drivers	7	$5/day	12,000
	Total	20		65,400

(c) Production Labour

(300 days)

		No.	Wage/day	Wage/annum
(i)	Root reception (female)	9	$3.00	$8,100
(ii)	Operators (Male)	9	$5.00	13,500
(iii)	Packers (Male)	6	$4.00	7,200
	Total	24		28,800

Total labour cost	=	$159,000
Add 15% employment cost	=	23,850
		$182,850

(C) Transport and Sales Promotion Cost

(i) Transport from factory to port
- by company lorries (cost provided for)

(ii) Port charges, loading, insurance, freight to West German port @ $80 per ton. (Initially shipping has to be done through Singapore) — $2,880,000

(iii) Sales promotion including commission @ $5 per ton — 180,000

(iv) Local taxes and insurance @ 1% of capital investment — 18,400

Total — $3,078,400

Depreciation

Depreciation on building @ 10%	$ 33,800
Depreciation on plant and equipment @ 10%	108,100
Depreciation on other equipment @ 10%	31,300
Total	$173,200

Total recurrent cost = $6,973,550

Working capital (3 months operational cost) = $1,743,380

Interest on working capital @ 10% (current commercial bank rate) = 174,350

Total annual cost = $ (6,973,550 + 174,350)

= $7,147,900

Return from Sales

Total production of tapioca pellets = 36,000 tons

CIF price per ton of pellet at West German port = $210

Total return = (36,000 x 210) = $7,560,000

Annual gross profit before tax = $ (7,560,000 - 7,147,900)

= $412,100

Percentage return on capital investment = $412,100 / 1,840,280

= 22.4

Tapioca Starch

2.101 It has been established earlier that United States is the largest consumer of tapioca starch and Japan, Australia and Canada are also fast becoming important markets for this starch. It has also been justified that Sarawak has a good case for producing tapioca starch to cater to these markets.

2.102 Though tapioca starch could be produced in factories of different capacities, starting from 500 lbs. of unbolted flour per day, upwards, a fairly large size factory is suggested in Sarawak in consideration of the economy of production especially with the under-developed infrastructure. As in the case of pellets it is proposed that this factory also own and manage the plantation for supply of roots to the factory.

2.103 For a 24 tons a day tapioca starch factory with an average recovery of 20% (percentage extraction of starch could be as high as 24%) of starch and 10% of refuse/waste from fresh roots, the total requirement of roots works out at 36,000 tons per annum working 300 days.

2.104 With an assumed yield of 15 tons of roots per acre as in the previous case, the total yielding acreage required is 2,400. Allowing for a crop rotation to the extent of 50% of the area per crop the total area required is 3,600. Based on the same assumption made the economics of the plantation of these 3,600 acres is as below:-

Cost estimates for Tapioca Plantation of 2,400 acres of effective area

Income and Expenditure Statement for 2,400 acres of effective area of tapioca plantation (for starch factory)

INCOME

Minimum expected yield (less damage which would not exceed 5%)	=	15 tons per acre
Total yield from 2,400 acres	=	36,000 tons
Value per ton of fresh tapioca roots	=	$28
Total value of roots at factory gate	=	$1,008,000

EXPENDITURE

Capital Expenditure

	Per Acre ($)	Value ($)
(A) Land and Development		
(i) Land acquisition cost plus cost of compensation for standing plants on 3,600 acres (for a net cropped area of 2,400 acres, 50% being assumed for rotation planting)	80	288,000
(ii) Clearing, felling, burning, etc.	200	720,000
(iii) Roads, bridges and culverts (roads 1 chain/acre)	20	72,000
Total	300	1,080,000

(B) Farm Equipment

	No. of Units	Unit cost ($)	Value ($)
(i) Tractors (65 HP)	2	10,000	20,000
(ii) Trailers for tractors	2	2,200	4,400
(iii) Disc harrow	1	14,000	14,000
(iv) Rotavator	1	6,000	6,000
(v) Motor grader	1	55,000	55,000
(vi) Lorries	3	25,000	75,000
(vii) Weighing machine	1	30,000	30,000
(viii) Miscellaneous equipment			5,600
Total			210,000

(C) Buildings

	Value $
(i) Office building, stores, etc.	30,000
(ii) Collection stations (4 units)	16,000
(iii) Shed for planting materials	3,000
(iv) Quarters for staff	30,000
Total	$79,000

Total fixed investment = $1,369,000

Revenue Expenditure

(D) Cost of Materials

	Cost per acre ($)	Value ($)
(i) Planting material	15	36,000
(ii) Transport of planting material	10	24,000
(iii) Weeding materials	15	36,000
(iv) Fertilizers	50	120,000
(v) Transport of roots	6	14,400
(vi) Diesel, lubricants, repairs for tractors		4,000
(vii) Stationery, telephones etc.		2,600
Total		237,000

(E) Cost of Cultivation (contract work)

	Cost per acre ($)	Value ($)
(i) Land preparation including ploughing and harrowing	50	120,000
(ii) Planting	16	38,400
(iii) Fertilizing	28	67,200
(iv) Weeding	20	48,000
(v) Harvesting	80	192,000
Total	194	465,600

(F) Cost of Plantation Management

	No.	Wage/mensem	Wage/annum
(i) Plantation Manager	1	1,000	12,000
(ii) Conductor Grade I	1	500	6,000
(iii) Conductor Grade II	3	300	10,800
(iv) Clerks, typist, stenographers	3	Av.250	9,000
(v) Tractor and lorry drivers	5	$5.00/day	7,500
(vi) Office boy	1	100	1,200
Total	14		46,500

Add 15% employment cost 6,975

Total cost $53,475

Total revenue expenditure = $756,075

Working capital (3 months operation) = $189,000

Depreciation on farm equipment (10%) = $21,000

Depreciation on building (10%) = 7,900

Total depreciation per year $28,900

Interest on working capital @ 10% (current commercial bank rate) = $18,900

Total cost = $ (756,075 + 28,900 + 18,900)

= $803,875

Profit before tax = $ (1,008,000 - 803,875)

= $204,125

Percentage gross return on capital investment = $\frac{204,125}{1369,000}$

= 14.8

It would be seen that the return of ... % is on an investment of $1.37 million. The plantation would employ 14 persons in addition to a large number of workers employed on contract. The roots would be delivered to the factory gate at $28 per ton of fresh roots.

Manufacture of Tapioca Starch

2.104 The factory is designed to operate continuously on three shifts a day for 300 days per year. The product would be of high grade having moisture content between 10% - 12%.

2.105 The processing of tapioca starch involves the separation of the starch granules from the tubers in as pure a form as possible. The granules are locked up in cells together with all other constituents of the protoplasm which can only be removed by purification process in the watery phase. Therefore tapioca starch is produced by the wet milling process.

2.106 After the preparatory operations of washing, peeling and rough cutting the roots are sieved through root graters and a large amount of water is added during the grating operation. The roots' slurry collects in a basin fitted with propellor stirrers and sulphrous acid is added to prevent fermentation.

2.107 The acidified roots slurry is pumped into a re-sieving machine and subsequently pumped into separators for washing and concentrating of starch. The final dewatering of starch milk is done in a series of centrifuges The starch is dried in a drier and finally bagged as tapioca flakes.

2.108 For the production of starch pearls, the moist starch after centrifuging, is fed into open cylindrical rotating pans. During rotation the starch grains adhere together in the form of beads, the size of which depends on the speed of rotation of the pans. The pearls are graded into sizes on a shaking tray and then baked for 3 to 5 minutes at 150°F to 160°F. The baked product is sieved again on a shaking screen to remove any clogging particles and finally dried and packed as tapioca pearls.

2.109 The root cuttings are ground in a special hammer mill and mixed with the fibres from all the sieving machines. These are dewatered, dried and milled into tapioca refuse or waste.

2.110 The processes involved are in the flow diagramme at page 71.

2.111 Cost Estimates of a Tapioca Starch Factory

Input	-	36,000 tons of fresh tapioca roots
Starch recovery	-	20%
Refuse recovery	-	10%
Output	-	7,200 tons of starch and 3,600 tons of refuse

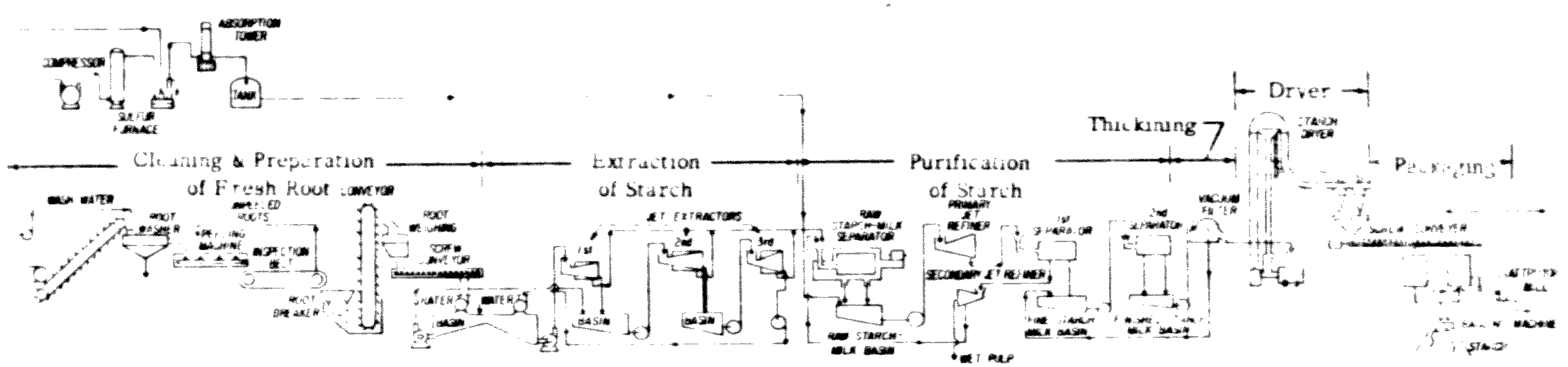
Capital Investment

(A) Land

Land including cost of development
(5 acres to be acquired with the plantation) $10,000

	Area (sq.ft.)	Unit cost ($)	Value ( )
(B) Factory Buildings			
(i) Factory proper and godown	15,000	9	135,000
(ii) Office blocks, workshops etc.	4,000	11	44,000
(iii) Open floor area for drying pulps	15,000	1	15,000
(iv) Staff quarters			60,000
(v) Garages	2,000	6	12,000
Total			266,000

Figure 2.1 : FLOW DIAGRAMME FOR THE MANUFACTURE OF TAPIOCA STARCH



(C) Plant and Equipment

(i) Plant and Equipment : 1,230,000

(a) Cleaning of fresh roots

3 Belt conveyors with suitable gear motors and supports for transporting the roots

1 Rotating root washer with gear motor

1 Root breaker with motor for chopping washed roots

1 Bucket conveyor with gear motor

1 Pre-grater with motor

1 Pump with stainless steel rotor and motor

(b) Extraction of Starch

3 sets extractors with sieves and motors of a set of DSM screens for the separation of starch from fibres

2 screw conveyors with gear motors for grated material

4 pumps with S.S. rotor and motor

(c) Purification of Starch

3 centrifugal separators or continuous channel separators with motors of Dorr Cloves

3 S.S. stirrers with gear motors for the agitation of starch milk in basins

3 pumps with SS rotors and motors

(d) Dewatering and drying of starch

1 rotary vacuum filter with vacuum pump and motors or basket centrifuge

1 fresh drier complete with steam heating, pheumatic, cooking system, ventilation, insulation, supports and motors

3 screw conveyors with gear motors

1 blending machine with conical mixing warm and gear motor

1 sifter and motor

1 sack-filling screw with two sack-filling sockets equipped with motors

(e) Sulfurous Acid Plant

1 air compressor with motor

1 sulfur burning furnace with filler cap and water cooling

1 absorption tower (wood or ceramics)

1 storage tank (wood or concrete)

1 S.S. pump with motor

(f) Water supply and piping

Drilling of two artesian wells

2 centrifugal pumps for well water

Piping inside factory includes valves fittings and condensate line for boiler

(g) Materials handling equipment

2 storage tanks for fuel oil

2 platform scales for roots and starch, fork lift truck and hand carts

(h) Other costs

Packaged boiler to supply steam for drying starch.

Power generation (stand-by unit)

Electricals include switch gear, power distribution, transformers, etc.

Outside lines for water, power and sewage

Maintenance crop equipment

Quality control laboratory equipment

Lorries for transporting roots and starch

(ii)	Cost of installation, engineering, design, etc. @ 25% plant cost	$307,500
	Total	$1,537,500
	Total capital investment =	$1,813,500
	Add pre-project expenses (5%) =	90,675
	Grand Total	$1,904,175

Recurrent Cost

(A) Cost of Materials

		Value ($)
(i)	Fresh tapioca roots, 36,000 tons @ $28 per ton at factory gate	$1,008,000
(ii)	Sacks for packing 7,200 tons starch, 15 sacks per ton starch @ 30 cts. per sack	32,400
(iii)	Sacks for packing waste/refuse, 15 sacks per ton @ 30 cts. per sack.	16,200
(iv)	Fuel oil, 70,000 gallons. @ 70 cts. per gallon.	49,000
(v)	Diesel oil, 24,000 gallons @ 70 cts. per gallon.	16,300
(vi)	Electricity, 116.5 units per ton of starch @ 8 cts. per unit	67,100
(vii)	Water @ 69 cu.m. per ton of starch (cost provided for under water works)	
(viii)	Repairs and maintenance (3% of equipment cost)	45,800
(ix)	General supplies	10,000
	Total	1,245,300

(B) Labour Cost

(a) General Administration

	No.	Wage/mensem	Wage/annum
(i) General Manager	1	1,500	18,000
(ii) Sales Manager	1	1,000	12,000
(iii) Accounts officer	1	1,000	12,000
(iv) Clerks, stenographers typists	5	Av.250	15,000
(v) Receptionist	1	200	2,400
(vi) Office boy	1	100	1,200
(vii) Watchman	1	100	1,200
Total	11		61,800

(b) Factory Administration

	No.	Wage/mensem	Wage/annum
(i) Factory Manager	1	1,000	12,000
(ii) Superintendent (Processing)	1	800	9,600
(iii) Quality control officer	1	600	7,200
(iv) Roots supply officer	1	500	6,000
(v) Electrical chargeman	1	400	4,800
(vi) Mechanical foreman	1	400	4,800
(vii) Foreman for processing operation	3	400	14,400
(viii) Skilled worker for processing operation	21	$5/day	31,500
(ix) Skilled worker for maintenance and transport.	11	$5/day	16,500
(x) Unskilled worker for processing	13	$3.50/day	13,650
(xi) Unskilled worker for maintenance and transport	12	$3.50/day	12,600
(xii) Typist	2	200	4,800
(xiii) Watchman	1	100	1,200
Total	69		139,050

Total labour cost	=	$200,850
Add 15% employment cost	=	$ 30,130
Total		$230,980

(C) Other Cost

(i)	Sales expenses and sale promotion @ 5 per ton	36,000
(ii)	Local taxes and insurance @ 1% of capital investment	19,040
	Total	$55,040

Depreciation

Depreciation on buildings @ 10%	26,600
Depreciation on plant and equipment @ 10%	156,750
Total	$180,350

Total recurrent cost = 1,711,670

Working capital (3 months operational cost) = 427,920

Interest on working capital @ 10%
(current commercial bank rate) = $ 42,790

Total annual cost = (1,711,670 + 42,790)

= 1,754,460

Return from Sales

Total production of tapioca starch	=	7,200 tons
FOB price per ton of starch	=	250
Return from starch	=	1,800,000
Total production of waste/refuse	=	3,600 tons
Price per ton of waste/refuse	=	$100
Return from waste/refuse	=	360,000
Total return	=	2,160,000

Annual gross profit before tax = $(2,160,000 - 1,754,500)
= $405,500

Percentage return on capital investment = $\frac{405,500}{1,904,000}$

= 21.2

2.112 The entire production of starch would be for international market and part of the refuse or waste would also be exported. The rest of the waste would be consumed by the local feedmeal industry. With f.o.b. price of 250 per ton against the c.i.f. Japan price of M.210 and an f.o.b. price of 100 for waste the project would yield a return of 21.2% with an investment of 1.9 million on fixed assets. The working capital is proposed to be obtained on loan from a commercial bank.

Employment

2.113 The starch plant would employ 80 persons and would earn foreign exchange of the order of 2 million annually.

2.114 Last but not the least is the requirement of water and electricity. While provision has been made for arranging the respective water supply by the factory, electricity is expected to be provided by the State-controlled electric supply company.

CHAPTER III

COCONUT

The Coconut Plant and Climatological Requirement for Cultivation

3.1 Coconut is a tropical palm. Philippines, India, Indonesia, Ceylon, South Sea Islands and Malaysia which together account for over 90% of the world's total acreage and production of the crop, lie in the tropical zone between 20°N and 20°S Latitudes. The palm is also grown beyond this region between 23°N and 23°S but not on an extensive or commercial scale or with much success.

3.2 Rainfall and temperature are the most important factors affecting coconut cultivation. The plant can grow and bear fruits with a well distributed rainfull of 40 inches, but for profitable plantation, a rainfall of 40 inches to 100 inches per annum, evenly distributed throughout the year, is necessary. It can withstand much higher rainfall if the soil is well drained. It cannot thrive in regions with long and pronounced dry spells, during which the water table goes down considerably. On the other hand, too high water table is equally harmful. The coconut palm can tolerate a fairly high degree of salinity, and as such, coconuts are grown extensively in the coastal areas.

3.3 The plam requires an equable climate, neither very hot nor very cold. The optimum mean annual temperature for best growth and maximum yield is 27°C with a diurnal variation of 6°C to 7°C. Other requirements for successful growing of the palm are warm and humid conditions and plenty of sunlight.

3.4 Though essentially belonging to the humid regions of the tropics, the coconut palm is highly adaptable and can tolerate a wide range of soil conditions including:-

(i) Coastal sandy tracts with fairly high water table (3 to 4 feet).

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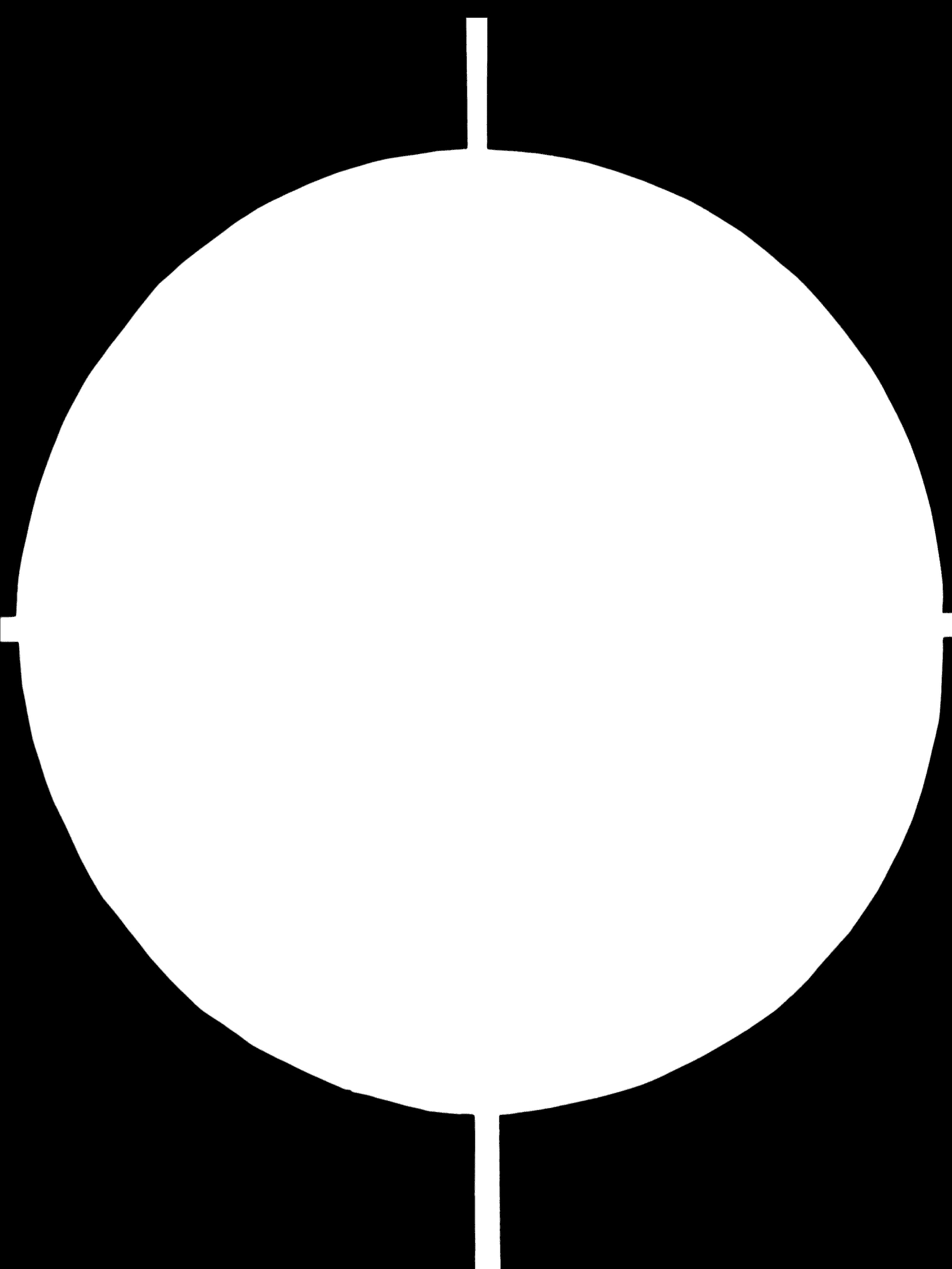

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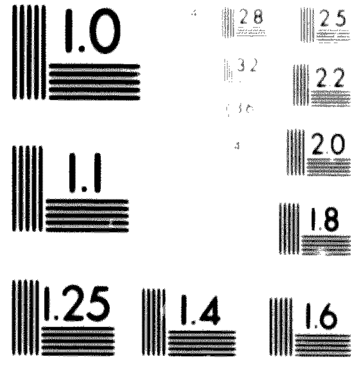

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

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(ii) The clayey areas of the backwaters.

(iii) The midland and upland region lying between the coast and hill slopes with sandy soils and low water table (about 20 feet).

(iv) The laterite and loamy soils of hill slopes with varying percentages of gravel and sand and low water table (20 to 30 feet).

(v) The loamy soils with high water tables during rains and low water tables during summer.

(vi) The alluvial deltaic soils.

(vii) The forest soils in the coastal regions.

3.5 Soils lacking in water holding capacity and suffering from excessive dryness or improper drainage are unsuitable for coconut plantation. The stem bleeding disease is common in tracts where drainage is poor. Palms standing on bunds of rice fields usually give a good yield, as in these regions, sufficient aeration of the roots, adequate supply of water to the plant and good amount of light to the leaves are assured.

3.6 Based on variations in colour, shape and size of the nut, fullness of the kernel, etc. several varieties of coconut are recognized by the planters. The two most important varieties are the "tall" and the "dwarf". In the tall variety, some of the distinct types are New Guinea, Cochin, China, Java and Siam.

3.7 The variety largely cultivated in the coconut growing countries is the "tall" one. It is also known as "west coastal tall". It is a long-lived, hardy palm, commences to bear fruits after 7 to 8 years of planting and has a life of as long as 60 years. It is fairly resistent to diseases and pests. It is generally crosspollinated, although in summer months there are chances of self-pollination. The nuts mature in a period of twelve months.

3.8 The dwarf palm, as the name indicates, is small in stature, has nuts of small sizes and yields copra of inferior quality. It begins to yield in 3 to 3½ years after planting, but has a short life of 30 to 40 years. The variety is grown mainly in favoured localities for its earliness and the attractive yellow or orange colour of the nut. Successful experiments have been conducted by cross-breeding the two varieties. The combined early bearing nature of the dwarf variety and the good yield of nuts quality of the tall palm are factors which make the hybrid palm quite promising and economic.

3.9 One acre of coconut plantation with 30 feet by 30 feet spacing would have 50 palms. Each month one infloresecense is produced from each axil of the leaf. Thus one bunch of coconut a year ripens every month. Usually nuts are collected six times a year.

Uses

3.10 Coconut is one of those few fruits which render themselves to be used fully and for different purposes. All the items that can be produced from coconut are of international commercial significance. The processing of coconut into various products can be divided into three stages, namely, primary, secondary and tertiary. A schematic diagram in Figure 3.1 would give and idea as to what products coconut can be processed into. As would be seen from the figure, three main parts of the fruit are coir, shell and kernel.

31.11 The composition of a coconut expressed in terms of percentage with the range of variation can be illustrated as follows:-

Husk (coir)	-	30 - 50%
Meat (kernel)	-	38 - 28%
Shell	-	20 - 14%
Water	-	12 - 8%

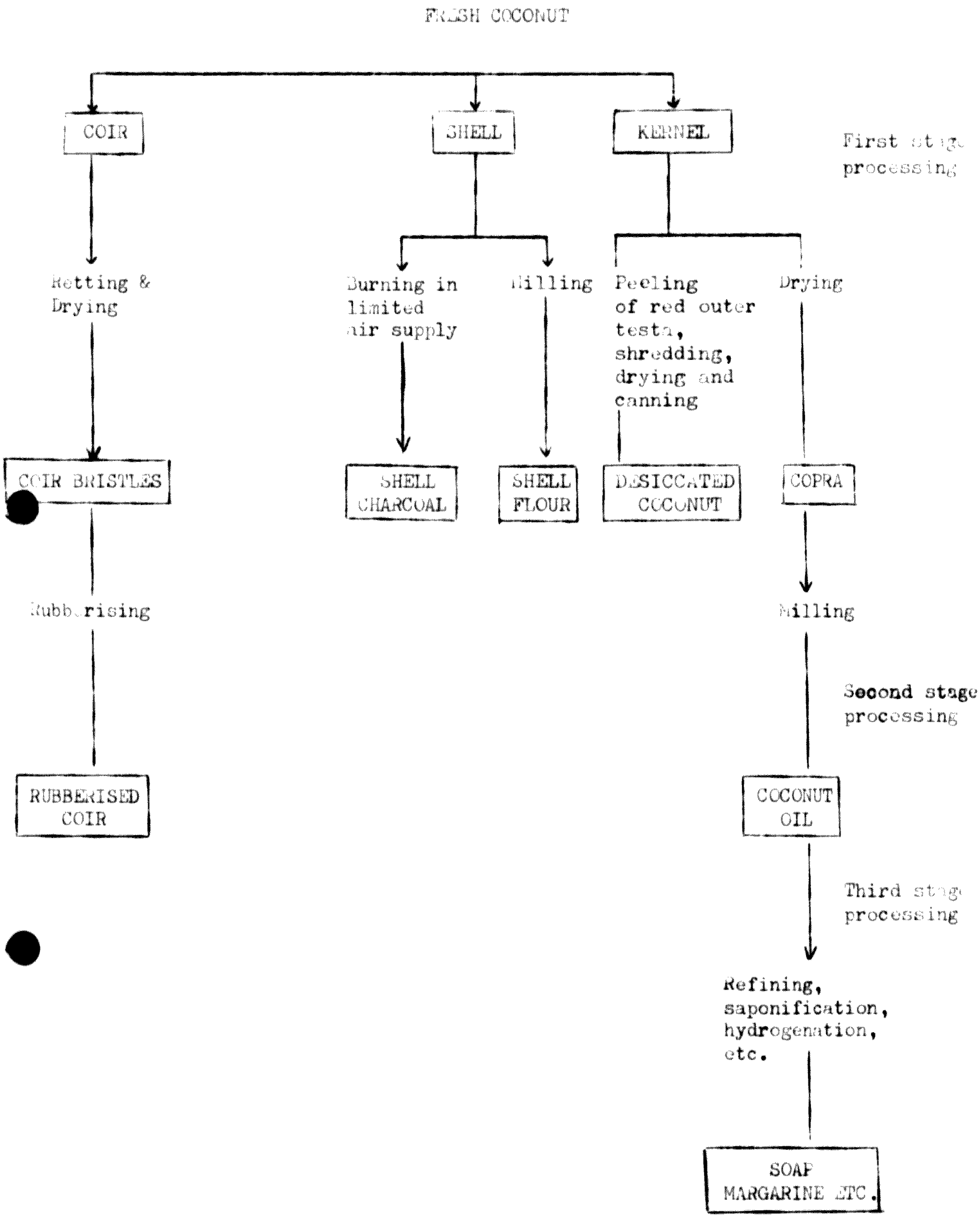

Figure 3.1: The Various Stages of Coconut Processing and the Various Coconut Products

The coir can be converted into bristles and then into rubberised coir through a process of rubberising. The shell can be converted into charcoal by burning under controlled conditions and to flour by simple moulding. The kernel which is the most valued of all can be made into desiccated coconut for use in food industries or to copra which can in turn be converted into oil and then to soap, margarine, etc.

3.12 An analysis of a coconut (ripe) in terms of various products might be of interest. This is shown in the table below.

Table 3.1

Analysis of a Ripe Coconut

	Milk	Kernel	Copra	Oil Cake	Desiccated Coconut
Water	91.5	46.3	5.8	10.9	3.5
Protein	0.4	4.1	8.9	19.1	6.3
Fat	1.5	37.3	67.0	11.1	57.4
Carbohydrate	4.6	7.9	12.4	41.0	31.5
Fibre	0.0	3.4	4.1	14.1	
Ash	0.8	1.0	1.8	4.0	1.3

3.13 The fruit can also be consumed directly - the water it contains being very sweet and soothing and the fresh flesh is also tasty. In the Asian producing countries, these are consumed directly in substantial quantities and also indirectly in the form of cakes, curry preparations, etc.

3.14 The coir bristles are used for manufacturing foot-mats and the rubberised coir in making seats for passenger cars and buses. Coconut shell flour can be used as a filter material in the plywood and plastic industries and also in the making of mosquito coils; activated carbon from coconut shell is used as an absorption agent for industrial and poisonous gases.

3.15 The coconut oil has many diverse uses both as a food and as an industrial raw material. In the USA, Canada, Japan and Australia, the latter use is more common. In Europe, however, the oil is mostly consumed directly as a food material. The industrial use of coconut oil is more prominent in the manufacture of soaps, detergents, toilet and cosmetic preparations. It is also used as a source of glycerol in the production of nitroglycerine, an important ingredient in the manufacture of explosives. In the rubber industry, the oil is used for making rubber shoes, tyres, etc. It is also used in the pulp industry and in the manufacture of insulating material, synthetic resins for coating the inside of food containers, plastics and safety glass for airplanes and cars.

3.16 In the food industry, the coconut oil is used in the manufacture of margarine, an important butter substitute and in the production of coconut stearin which is used as a chief substitute for the cocoa butter in confectionery products. It is also used as a cooking fat in the developed countries where it is a solid because of the prevailing temperatures and as coconut oil in the tropics.

3.17 The copra cake obtained is a residue after the extraction of oil and it is an important ingredient in the compound animal feedmeal in Europe and elsewhere. It is also directly fed to cattle, lambs and pigs for fattening.

3.18 Use of desiccated coconut is mostly in the manufacture of cakes and pastries.

World Acreage and Production

3.19 According to an ECAFE study of the coconut industry in Asia, the estimated world coconut acreage of the major coconut growing countries in 1963 was as below.

Table 3.2

Coconut Acreages in the Major Coconut Growing Countries - 1963

Countries	Estimated Acreages (million acres)	Percentage of Total Acreage
Indonesia	3.84	27.4
Philippines	3.44	24.6
India	2.08	14.8
Ceylon	1.10	8.0
Malaysia	0.65	4.6
Thailand	0.56	4.0
Papua-New Guinea	0.35	2.5
Mexico	0.20	1.4
Brazil	0.20	1.4
Mozambique	0.18	1.3
Rest of the world	1.40	10.0
Total	14.00	100.0

3.20 This total world acreage is an increase of 5.43 million acres over the corresponding acreage in 1958. In almost all the countries, substantial increase had taken place; in Philippines the acreage rose from 2.48 million to 3.44 million in 1963; in Indonesia from 1.50 million to 3.84 million and in India from 1.69 million to 2.08 million. The increase in the case of Malaysia was very insignificant; - only 50,000 acres. Though data on current acreage is not available, it is estimated that there has not been any substantial increase in the acreage, as would be evident from the world copra production which fluctuated inconsistently during the last decade (Please see table 3.3 below), reaching a record output of 5.41 million tons in 1964, a figure which has not yet been equalled or exceeded since then.

Table 3.3

Estimated World Production of Copra

(1960 - 1969)

(figures in '000 tons)

Year / Country	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969*
Philippines	1291	1193	1255	1491	1411	1431	1585	1312	1270	1205
Indonesia	651	625	380	435	580	475	520	487	619	649
India	246	252	254	255	260	262	266	270	270	275
Ceylon	187	272	304	244	325	270	231	188	190	207
Malaysia	200	194	162	169	146	156	161	178	157	147
Thailand	28	19	22	20	21	21	21	n.a.	n.a.	n.a.
Others	622	691	672	647	664	627	605	656	716	743
	3189	3246	3052	3261	3407	3242	3389	3100	3222	3226

n.a. = not available   * Preliminary Figures

3.21 Production of copra in 1968 came to 3.21 million tons i.e. a slight increase of about4% over that of 1967. According to an FAO forecast, the production in 1969 was likely to exceed that of 1968, as the palms planted or rehabilitated in the decade 1951 - 1960 would have begun production by then.

World Trade

3.22 In the international market, copra and coconut oil are the most important coconut products traded. Though slow moving, copra cake, coir products, desiccated coconuts, shell flour and shell charcoal are also not insignificant.

Copra

3.23 Total exports of copra in 1969 came only to 1.11 million tons. Compared to export figures at the beginning of the decade, world trade in copra has declined in 1969. The drop in exports is actually due to the reduction in shipments from the Philippines, the largest copra exporting country, as changes in exports from the other countries were comparatively less. This has been due to the fact that more and more copra is being processed in Philippines to produce oil instead of exporting copra in the primary form. In 1969, Philippines' export of 375,000 tons alone accounted for 49.8% of the total world export. The other major copra exporters were, in order of importance, Indonesia, Ceylon and Malaysia. India, although a major coconut growing country, occupying third position both in regard to area and production, is a net importer of coconut products, especially copra.

3.24 The export ratio of coconut oil to copra for the period between 1966 to 1969 is shown in the table below.

Table 3.4

Export Ratios of Coconut Oils to Copra

1966 - 1969

Year	Gross Exports of Coconut oil (1,000 tons)	Gross Exports of Copra (1,000 tons)	Ratio of Coconut oil to copra (Gross exports)
1966	525.6	1,425.4	1:27.1
1967	463.4	1,215.8	1:26.2
1968	560.4	1,254.1	1:22.4
1969	460.2	1,077.9	1:23.4

3.25 It might be of interest to note that there has been a declining trend in the ratio of export of coconut oil to copra illustrating that the coconut growing countries are increasingly taking to processing before export.

3.26 The largest copra importers are USA, Australia, New Zealand and the various West European countries as shown in Table 3.5 below.

TABLE NO. 3.5

WORLD IMPORTS OF COPRA

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	10 METRIC TONS						1,000 U.S. DOLLARS					
EUROPE												
BELG LUX	3482	3474	4352	4048	2871	3390	6504	7440	8446	7392	6777	6562
DENMARK	3092	3497	3202	2101	2412	3074	5975	7598	6636	3791	5623	6013
FRANCE	10078	9560	9669	8588	8017	6324	19342	20773	18693	15552	19242	12210
GERMANY FR	27295	23252	28897	23789	15712	17725	53277	52646	56723	43170	36893	34447
ITALY	2444	2275	2106	1936	1745	2102	5053	5412	4700	3642	4097	4462
NETHERLANDS	13220	13599	16770	12591	14166	12363	24357	28013	32243	22142	31231	23771
NORWAY	2461	2211	3132	1768	2014	2257	4852	4819	6541	3239	4760	4493
PORTUGAL	1189	1145	1321	1129	1468	1146	2049	2213	2576	1893	3211	2102
SPAIN	1122	1050	1250	1470	1119	1644	2034	2477	2765	2785	2570	3353
SWEDEN	5689	6936	7185	6715	4496	3699	10907	15077	14567	12267	10856	7299
SWITZERLAND	2241	1563	1172	855	347	1865	4413	3581	2356	1606	725	2801
U.K.	5585	5653	5610	4247	4821	4577	10884	12835	11105	7772	11292	3906
TOTAL	80968	76738	86728	71117	60305	61231	154955	166387	171586	128915	139115	11964
USSR	980	740	560	300	520	400	1453	1904	1351	624	1369	904
NTH CTR AM												
USA	24835	27893	24329	27664	29183	27221	48133	54987	41569	45926	62314	46522
TOTAL	26169	28960	25405	28180	29597	27709	45922	57219	43829	46991	63101	47483
SOUTH AMER												
TOTAL	6814	5362	6206	3596	2266	555	13151	11803	11640	6200	4110	1083
ASIA												
INDIA	7490	4875	3336	2371	1783	2232	15774	13111	7203	5015	4573	4079
JAPAN	7556	9423	10761	11208	12601	10875	15600	18965	19391	20167	27183	20277
SABAH	1696	1083	1053	201	42	348	2153	1457	1248	244	153	491
SARAWAK	-	-	3	67	94	65	-	-	2	75	78	62
W. MALAYSIA	93	107	207	337	712	678	160	223	251	410	953	742
SINGAPORE	2273	2679	2665	1543	1662	2063	4007	5414	4319	2459	2960	3476
TOTAL	22740	20085	22214	18013	18312	18265	42537	43223	40009	32722	38709	33564
AFRICA												
TOTAL	514	392	695	396	376	518	927	808	1119	578	676	866
OCEANIA												
AUSTRALIA	3297	3300	3336	3343	2972	3164	5535	5916	6156	4918	5762	5593
N. ZEALAND	329	373	292	457	553	531	592	687	583	707	1155	995
TOTAL	3626	3673	3628	3799	3524	3695	5947	6603	6739	5625	6917	6523
GRAND TOTAL	141817	135950	145436	125407	114900	112373	264894	287057	276273	221655	253997	210177

Although the total import by these countries has declined, their share of the total copra exported has gone up from 86.4% in 1966 to 90.6% in 1969. The East European countries including USSR are insignificant importers of copra and their imports are even less than those of the developing countries in Asia, Africa and America. The present trend of progressively reduced export of copra is likely to continue from the forseable future in view of the urgent need for creating additional employment in the coconut producing countries. Further, the processes involved in copra crushing being simple, these types of industries also suit these countries.

Coconut Oil

3.27 Exports of coconut oil in 1968 recovered from the drop in 1967 but again experienced a fall in 1969. In 1968, the total exports of the commodity came to 568,900 tons as compared to 474,066 tons in 1967 and 545,114 tons in 1966 (please see table 3.6). In 1969, world export fell to 475,500 tons. With a 47.4% of the total world export, Philippines dominated the market in this field again. Though not producing copra at all, Singapore and Netherlands are also among the major coconut oil exporters. The export from Ceylon also is considerable, and in 1969, the export amounted to 56,100 tons.

3.28 The world import of coconut oil for 1964 - 1969, is shown in Table 3. 7. USA is the principal importer though its imports had indicated an inconsistent trend over the period. The total import of USA was highest in the years 1966 and 1967, and in 1969 the import was 218,634 tons. The other major importers are West Germany, UK, Austria, Italy, Poland and Canada.

3.29 Though the international market trend is not very comfortable for coconut oil, there has been a satisfactory rise in price recently. According to a FAO study, the demand for fats and oils is expected to rise substantially, especially in the centrally planned and

TABLE NO. 3.6

WORLD EXPORTS OF COCONUT OIL

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	METRIC TONS						1,000 U.S. DOLLARS					
EUROPE												
BELG LUX	608	2331	3394	4515	4945	9385	191	762	1055	1300	1806	2272
FRANCE	1435	2049	1087	1383	2094	3446	535	364	468	561	940	1[illegible]
GERMANY FR	1683	1333	1707	5482	1582	5624	496	443	543	1660	537	1573
NETHERLANDS	34041	35886	34394	33545	43369	444374	9509	11261	10061	9002	14945	11294
TOTAL	41388	44079	44792	49655	55686	68047	12129	14409	13346	14105	20072	2[illegible]
NTH CTR AM												
TRINIDAD T	295	235	279	269	679	1697	124	97	117	111	242	620
US[illegible]	869	1104	2414	1332	2061	2541	332	397	766	611	769	864
[illegible]AL	3230	7967	6575	7226	5033	7200	1177	2650	2136	2244	1010	2562
ASIA												
CEYLON	119444	88291	73490	67448	63827	56100	32300	30325	22614	17902	22243	15000
INDONESIA	-	-	1000*	3000*	17406	4008	-	-	300*	950*	7437	356
SARAWAK	2100	2023	2629	3065	3768	4210	554	594	672	750	957	1364
W. MALAYSIA	14750	18340	25471	29496	39028	25281	3939	5342	6467	7455	12330	6[illegible]3
PHILIPPINE	229157	236334	315509	234020	267088	212528	66364	68232	76353	60654	81756	53015
SINGAPORE	15113	17068	28341	26478	51157	34018	4616	5859	7311	7101	14939	9062
TOTAL	381546	365678	448757	365727	444364	336970	108167	111715	115004	95565	140453	8649[illegible]
AFRICA												
KENYA	662	409	354	376	1104	516	139	152	113	134	354	146
M[illegible]IQUE	8413	6477	4323	8885	8347	8178	2159	1834	1246	2115	2735	1962
TANZANIA					2990	4650					1056	1554
TOTAL	13779	10498	8027	13518	15052	13738	3575	3225	2033	3324	4036	3766
OCEANIA												
FIJI	23185	15012	14701	14387	17440	17406	5737	4586	3633	3556	5465	44[illegible]
NEW GUINEA	21435	25945	22251	23553	24434	20893	5193	7595	6568	5303	7701	6465
TOTAL	44653	41241	36963	37940	48768	49523	10934	12263	10202	9359	14984	136[illegible]
GRAND TOTAL	485097	469464	545114	474066	568903	675478	135983	144263	148728	1205971	82205	127055

TABLE NO. 3.7

WORLD IMPORTS OF COCONUT OIL

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	METRIC TONS						1,000 U.S DOLLARS					
EUROPE												
AUSTRIA	11935	9750	12437	11666	7030	7107	3416	3131	3516	3003	2455	2065
BELG LUX	9290	10135	8553	7066	10920	12025	2297	3153	2384	1917	3361	3457
CZECHOSLVK	3332	3903	3553	3622	4072	...	1112*	1396*	1069	1111	1622	...
FRANCE	3156	3932	10550	14916	13319	21512	964	1321	3180	4231	4722	6316
GERMANY FR	47563	58250	39504	43553	60950	16056	12054	17194	9919	11244	19911	4767
ITALY	15675	15334	10679	23997	23339	23344	4544	5221	5631	6670	8436	3512
NETHERLANDS	1419	2765	1611	6237	3303	3742	400	890	432	1759	2792	2439
POLAND	12215	6035	11982	3177	3636	2957	3507	1913	3203	354	2949	419
SPAIN	1122	2681	4730	1337	3137	3235	333	396	1443	553	1113	11034
SWEDEN	3201	2549	1582	305	1513	1272	1014	363	5527	151	703	477
SWITZERLAND	3442	3032	3607	2474	2100	2543	1041	1037	1083	714	605	322
UK	47097	42714	35940	33068	47635	43172	13547	14619	10542	10610	16955	13317
YUGOSLAVIA	466	2253	123	650	632	933	143	707	52	240	207	350
TOTAL	173136	175007	166615	167879	204419	160134	49113	57590	40317	46071	70720	45253
USSR	12900	10200	16900	4000	31900	14700	3340	3533	4933	2313	10769	4000
NTH CTR AM												
CANADA	13030	17970	19342	22215	20475	21557	4940	5681	5302	5397	7066	6455
USA	194800	174683	269020	194963	220759	213634	51158	51016	60234	40531	70306	5522[illegible]
TOTAL	214903	196332	291530	217083	243531	243303	56301	53158	74737	54649	73725	62[illegible]
SOUTH AMER												
GUYANA	-	442	170	436	325	1344	-	192	65	171	100	505
TOTAL	6620	5195	4514	2053	5463	...	2003	2198	1820	1167	2221	..
ASIA												
BURMA	3327	7615	70[illegible]	2000*	1100	2000*	2137	2593	246	650*	4400*	750
CHINA MNL	14774*	10797*	6594*	9461*	9175*	16335*	4450*	3795*	2200*	3200*	3300*	5500*
SABAH	30	-	101	120	113	797	27	-	32	40	46	24
SARAWAK	153	1133	73	36	52	140	52	52	24	13	15	41
W. MALAYSIA	1591	11370	1202	376	1306	2171	434	495	423	238	363	570
PAKISTAN	17237	11731	15727	16372	6000*	10300	5235	4921	5922	5680	2200*	3300*
SINGAPORE	3027	9964	12310	14414	12037	11742	2075	3060	3099	3437	3376	3[illegible]
VIETNAM S	1746*	2450*	2299*	900*	1410*	300*	526*	762*	720*	270*	430*	100
TOTAL	50797	49997	45334	51090	37216	58863	17960	13034	14750	15653	12510	1633
AFRICA												
KENYA	1660	2519	3623	1822	953	1554	465	334	1076	530	334	474
MOROCCO	4400	1051	706	700	396	423	1570*	601	213	200	353	152
S. AFRICA	7407	6647	9320	7186	3313	7632	2076	2297	2533	1893	2056	2130
UGANDA	3330	3035	1850	1044	1391	1789	897	1061	552	310	636	534
UAR	784	1399	1700	1740	2354	3563	252	501	510	509	1056	1235
TOTAL	21643	21541	24576	19391	21759	20492	6624	7397	6920	5337	7366	6355
OCEANIA												
AUSTRALIA	764	831	1130	776	1000	1258	209	261	335	221	333	402
TOTAL	764	831	1130	776	1000	1258	209	261	335	221	333	402
GRAND TOTAL	480053	459652	551219	487500	545233	497700	136063	147176	151812	125916	182664	114100

developing countries. Supplies are also predicted to increase exceeding demand thereby placing restraint on world price. Coconut oil would thus invariably feel the general effects of over supply of fats and oils in the world market, and its price is lekely to decline from the present favourable position. A Task Force set up by the Malaysian Government to study the coconut industry in Malaysia predicted that in view of ending of the Vietnam war, the demand for coconut oil in the explosives industry would also slacken, thus aggravating the total world market situation for coconut oil further.

3.30 Furthermore, the wide belief, though not fully established by medical opinion yet, that excess consumption of highly saturated fats and oils would lead to a build-up of the cholesterol level in human arteries, thus leading to arterio-sceriosis and cardiac complaints. It is, therefore, likely to affect coconut oil consumption as this is a fairly high saturated oil. In the USA, the use of the oil in the manufacture of margarine is being increasingly challenged by other less saturated oils like soya bean, cotton seeds and tasteless fish oils.

3.31 On the bright side, coconut oil is very highly valued for many industries, particularly in the soap, detergent and explosives industries. These properties enable it to command a price premium in the world's fats and oils market. However, if with technological progress, substitutes are identified, coconut oil would lose its market in the industrial field. For the present, the coconut oil is in demand for the manufacture of good lathering soap and shampoos, and in the production of easily decomposable detergents. In fact, if the prices and the rate of substitution observed in the past continue, the demand for coconut oil will increase by as much as 5% to 6% per annum until 1975. This takes into account that the effects of a likely end of Vietnam war are not expected to be felt by the industry until after 1975 or later. A projection of the supply situation in an ECAFE study indicated that in 1975, the supply would be far short of demand by about 417,216 tons of oil. This short supply is likely to result in the continuance of the price rise of coconut oil.

3.32 Apart from the demand and supply, two other factors affect the competitive position of coconut oil in the international market. These are discriminatory tariffs and quantitative restrictions on the entry of coconut oil and other coconut products into the market in the developed countries. The high freight rates charged by the established shipping lines of the developed countries is another deterrent affecting the world coconut growing nations. These factors together affect considerably the position of coconut oil viz-a-viz other competing fats and oils.

3.33 There is a good demand of copra cake in the international market. The total world import of copra cake rose from 486,050 metric tons valued at US$37,602,000 in 1964 to 614,470 metric tons valued at US$56,335,000 in 1966 and then dropped to 509,740 metric tons valued at US$41,862,000 in 1968, then again rose in 1969 to 540,620 metric tons valued at US$42,078,000 (Please see table 3.8).

3.34 The largest supplier of copra cake in the international market has all along been the Philippines followed by Indonesia. In 1969, however, the Indonesian export exceeded those from Philippines by about 300 metric tons (Please see Table 3.9). The importers are mostly the European countries notably Germany, Denmark, Netherlands and Sweden. Though the Danish imports fell markedly after 1967 (from 6,060 tons in 1967 to 3,079 tons in 1969) the Dutch import rose from 3,810 tons in 1964 to 8,208 tons in 1967 and again had a drastic fall in 1968. In 1969, her import increased by about 1,000 tons. The German import has been increasing steadily except in 1967 when the import fell to 32,000 tons. This trend is likely to continue in the European market for a few years in view of the development envisaged in the livestock industry.

TABLE [illegible]

WORLD EXPORTS OF COPRA CAKE & MEAL

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	10 Metric Tons						1,000 U.S. Dollars					
EUROPE												
DENMARK	2120	2003	1313	157[illegible]	1122	1120	1775	17[illegible]	1253	[illegible]	917	[illegible]
FRANCE	1045	367	300	62	115	35[illegible]	722	312	275	54	[illegible]	[illegible]
GERMANY FR	122	224	256	151[illegible]	141	307	101	211	245	1191	127	[illegible]
NETHERLANDS	3194	4102	495	3490	4010	235[illegible]	2655	374	4953	3573	3509	[illegible]
TOTAL	6800	6957	8300	6954	5575	[illegible]	5534	6305	7016	5932	4926	[illegible]
NTH CTL AM												
TOTAL	3[illegible]	133	16	21	-	37	23	115	10	13	-	[illegible]
ASIA												
CEYLON	1754	550	29	4	1[illegible]		1010	661	10	1	7	
INDIA	2560	1093	2014	634	5[illegible]0	[illegible]24	1509	1505	1493	355	345	[illegible]
INDONESIA	15730	12532	142[illegible]0	1[illegible]575	16901	1[illegible]766	[illegible]	5020	5042	3102	1[illegible]5[illegible]	[illegible]
MALAYSIA												
SARAWAK	17	17	16	1[illegible]	[illegible]	1[illegible]	5	7	7	4	3	[illegible]
W. MALAYSIA	10	2	15	13	11	7[illegible]	7	1	10	8	9	[illegible]
PHILIPPINE	19312	1[illegible]493	23435	19301	207[illegible]0	[illegible]	12063	[illegible]	[illegible]	11617	1135[illegible]	[illegible]
SINGAPORE	333	434	363	22[illegible]3	1165	1937	512	[illegible]	210	1321	672	[illegible]
THAILAND	603	[illegible]3	11[illegible]	[illegible]	1[illegible]47	[illegible]	[illegible]	[illegible]	73	259	493	4[illegible]
TOTAL	41059	36372	421[illegible]	401[illegible]2	[illegible]	[illegible]	[illegible]	[illegible]	2[illegible]377	17155	15490	[illegible]
AFRICA												
KENYA	211	223	121	159	22[illegible]	[illegible]	127	1[illegible]	93	10[illegible]	14[illegible]	[illegible]
MOZAMBIQUE	559	42[illegible]	251	556	[illegible]	65[illegible]	243	209	106	330	294	[illegible]
TOTAL	1154	1[illegible]	745	1274	13[illegible]	1759	700	7[illegible]	571	797	966	[illegible]
OCEANIA												
FIJI	967	544	531	512	742	[illegible]	501	32	171	2[illegible]3	450	[illegible]
NEW GUINEA	1193	13[illegible]3	1210	1330	[illegible]	1[illegible]3	619	690	312	73[illegible]	593	[illegible]
TOTAL	2160	1932	1742	1[illegible]43	2570	23[illegible]2	1120	1026	1163	1026	1163	[illegible]
GRAND TOTAL	51211	46514	53457	5025[illegible]	4007[illegible]	50[illegible]3	27577	27547	[illegible]757	24923	22545	[illegible]

Table No. 3.

World Imports of Copra Cake & Meal

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	10 Metric Tons						1,000 U.S. Dollars					
EUROPE												
Belg Lux	1627	1123	9533	1096	1066	399	1256	961	1241	906	531	744
Denmark	7979	6566	5030	6016	3719	3079	6072	5506	4567	4541	2953	2463
France	510	249	519	[illegible]	312	453	400	196	[illegible]	327	[illegible]	353
Germany Fr	[illegible]	32053	33273	32279	36619	37452	22474	27760	36644	27043	[illegible]	29307
Netherlands	3310	2231	2393	[illegible]	3940	[illegible]	2515	1499	[illegible]	5353	2757	4565
Sweden	354[illegible]	3912	3085	345[illegible]	3297	2703	2909	3696	3063	3002	[illegible]	2356
TOTAL	46166	46394	59739	51669	49177	50716	35330	40270	55133	[illegible]	40969	40537
ASIA												
W. Malaysia	1411	1290	1104	1761	1570	[illegible]	1051	1009	754	1064	773	1179
Singapore	703	[illegible]	513	301	73	235	514	665	[illegible]	106	51	145
TOTAL	2439	2703	[illegible]	[illegible]	1794	3346	1722	1937	1197	1375	951	1541
GRAND TOTAL	48605	49597	61447	54068	50974	54062	37602	42207	56335	43267	[illegible]	[illegible]

Desiccated Coconut

3.35 The world market for desiccated coconut has been fluctuating inconsistently over the last six years. The total world import of desiccated coconut fell from 120,250 metric tons in 1964 to 103,877 metric tons in 1967, then again rose to 131,863 metric tons in 1968 and suffered a fall to 110,050 metric tons in 1969. The corresponding price per ton, however, rose from US$289.00 in 1964 to US$421 in 1967 and then fell to US$342.00 in 1969. The main exporters of desiccated coconut have been Philippines and Ceylon. Between them the two countries produce almost the entire quantity of desiccated coconut which enters into international market. The combined total export from these two countries in 1969 was 146,000 tons of which Philippines accounted for 75,900 tons. Smaller quantities are also exported from other minor producing countries such as Tonga (1,092 tons in 1969), Ivory Coast (386 tons in 1969), Brazil (328 tons in 1968), Mexico (449 tons in 1969). The Tonga export was mostly to Australia and New Zealand. The Mexican and Brazilian export went almost entirely to Argentina.

3.36 The Ceylonese and Philippines export to various destinations is shown in the tables below.

Table 3.10

Exports of Desiccated Coconut from Ceylon

(Thousand tons)

Destination	1964	1965	1966	1967	1968
United Kingdom	19.1	[illegible]	17.4	17.2	17.9
Germany	7.5	6.6	3.2	8.6	9.1
Netherlands	3.4	2.9	3.2	3.0	4.3
France	1.7	1.7	1.6	1.8	2.7
Belgium Luxembourg	1.6	1.7	1.7	1.2	1.6
Italy	0.8	0.8	0.7	0.5	0.6
Other countries	[illegible]	[illegible]	18.7	14.0	32.9
Total	[illegible]	[illegible]	[illegible]	46.3	69.1

Source : Ceylon Customs Returns

Table 3.11

Exports of Desiccated Coconut from the Philippines

Destination	1964	1965	1966	1967	1968
United States	58.1	57.4	52.6	48.2	44.7
Other countries	11.1	11.0	14.1	17.9	15.2
Total	69.2	68.4	66.7	66.1	59.9

In the period 1964 - 1969 more than 60% of Ceylon's yearly average production of 60,000 tons went to Western Europe, about 30% to United Kingdom and about the same quantity to the six countries of the EEC. Annual average exports of desiccated coconut from the Philippines amounted to 66,000 tons of which slightly more than 52,000 tons or 80% of total shipment went to the United States.

3.37 The largest market remained U.K. and other European countries, U.S.A. and Canada. Annual imports of desiccated coconut into the United Kingdom averaged 18,000 tons in the period 1964 - 1969. About a third of the total consumption of the desiccated coconut in the United Kingdom is taken up by the chocolate and confectionery industry. The bakers, it is reported, take half of the balance and the rest is traded through grocers.

3.38 The EEC import of desiccated coconut for the years 1964 - 1969 averaged as below:-

West Germany	7,500 tons per annum
Netherlands	4,500 tons per annum
France	2,500 tons per annum
Belgium/Luxemburg	1,400 tons per annum
Italy	50 tons per annum

The West German import has been inconsistent during the period under review though it all along remained above 7,[illegible]00 tons. The Dutch import rose consistently from 2,[illegible]96 tons in 1964 to as high as

4,995 tons in 1969. The French import went down, but slowly, from 3,023 tons to 2,836 tons. The Belgium/Luxemburg import was fairly constant. Italians shot up their imports from 21 tons in 1966 to [illegible]1 tons in 1969 through 57 tons, [illegible].6[illegible] tons in 1967 and 1968 respectively.

3.39 The US market for desiccated coconut fell from 59,400 tons in 1964 to 47,500 tons in 1967. In 1968 there was a sudden rise of import to 68,000 tons. This suffered a fall to 43,000 tons in 1969. It might be of interest to note here that even with this low import in 1969, it was almost equal to total European import during that year. However, the entire US import except for a small quantity is from Philippines. The small suppliers are Jamaica, Ceylon and Canada.

3.40 In view of the rising standard of living in the developed countries, the demand for desiccated coconut is likely to go up. Moreover, it is believed that there is a large potential market existing in the centrally planned countries. It might, however, be necessary for the coconut growing countries to launch massive sales promotion efforts in western markets to popularise the coconut based delicacies known to Asians.

Other Products

3.41 There is a good potential for coir ropes and coir in the European countries particularly in West Germany where rubberised coir is used in the making of passenger car seats and in England for the making of spring coir mattresses, and as wall padding for sound insulation. The demand for coir in the building industry has declined considerably, it having been replaced by other materials such as stain glass and slags which are more resistent to decay and which commanded price advantage. The bulk of the coir now used in West Germany is coming from Ceylon and East African countries. Local demand do exist for coir in the manufacture of brushes, kitchen brooms and dusters but it is insignificantly small.

3.42 Coconut shell flour and shell charcoal would have very little scope for the international market. The main factors limiting the use of coconut shell flour is the very wide variety of competing products that can be used as filler, such as cork, mica, asbestos, nutnut shells and waste from pulp and sawmills. The choice of raw materials is largely determined by the efficiency and low cost of the supplier. As coconut shell flour cannot be used by itself as a filler, but must be combined with other materials, the total amount consumed is consequently small. Locally, except for a very small amount being used to make mosquito coils, the demand for coconut shell flour is insignificant.

3.43 The demand for coconut shell charcoal is largely limited to the activated carbon making industry. It is believed that the demand is in general small, and varies greatly from country to country. However, activated carbon is finding increasingly more applications, particularly for water purification and air pollution control.. From this, it can be inferred that the demand is growing correspondingly, especially in the developed industrial countries. The local demand for activated carbon is still small.

Malaysian Production

3.44 In the world context, Malaysia holds a creditable position with regards to her coconut industry. With a total acreage of about 0.65 million, this country ranked fifth in acreage under coconut in 1963, and accounted for 5% of the total coconut acreage in the world then. In copra production, Malaysia is efficient to the extent that an output of 157,000 tons in 1968 put her in the sixth position.

345. Though Sarawak is a large [illegible] producer of coconut, so far it has not been able to meet even the requirements of its local mills, not to speak of export market. With the government support in the expansion of the coconut plant[illegible] in the State in the coming years,

it should be possible for the State to enter the international market of coconut products.

3.46 Coconut ranks third in terms of acreage in Sarawak - after rubber and paddy. The total area under coconut amounted to 102,000 acres of which 77,000 acres were under productive plantation. The State government initiated a subsidy scheme for planting of coconut in 1959 and by 1970 a total area of 71,000 acres were brought under new coconut plantations under this scheme. During the Second Malaysia Plan, another 35,000 acres are proposed to be planted. Outside the scheme, little or no new plantations have been undertaken by the farmers.

3.47 Coconut areas in Sarawak are concentrated mainly in the first and second Divisions though there are scattered plantations in other Divisions as well, mostly in the coastal areas, where soils are sandy or saline clay. The areawise distribution and acreages under coconut is shown in Table 3.12. It will be observed from the table that there has been an increase in the coconut acreage in the State during the last decade, the largest increase being in the First and Second Divisions which account for almost 80% of the total coconut plantation of the State. Concentration of coconut plantations are indicated in Map 3.1.

3.48 Coconut plantation in Sarawak is a smallholder farming and the average farm size is 5 to 6 acres with a maximum size not exceeding 20 acres. Farmers are mostly Malays with few Chinese as exceptions. Inter-cropping bananas, vegetables, pineapples, dry paddy, tapioca, groundnuts, soya beans and maize is widely practised in Sarawak mostly during the first 6 years of planting. Inter-cropping cocoa with coconut has recently been proved to be very successful and coconut smallholders are increasingly evincing interest in this. It is likely that during the Second Five Year Plan, the

TABLE NO. 3.12

Areawise Distribution and Acreages
under Coconut -(Existing & Proposed)
1959 - 1975

Total as in 1970:

			Percentage	
1st	- 44154)		1st	50%
2nd	- 20[illegible]5)	Total	2nd	25%
3rd	- 113[illegible]3)	86,295	3rd	13%
4th	- 4[illegible])		4th	6%
5th	- 5057)		5th	6%

For S.M.P. - Total Acreage to be planted in Sarawak is 7,000 acres per annum.

Distributed amongst all 5 divisions as follows:

1st - 3500
2nd - 1750
3rd - [illegible]10
4th - 420
5th - 420

Division	District	Areas of Concentration	Cumulative Planted Acreage 1959-65	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Remarks
FIRST	Kuching	Nonok Santubong	21,743	22,704	24,250	25,331	26,631	27,049	28,799	30,549	32,299	34,049	35,799	
	Simunjan	Semera Sebangan Mid-Sadong	13,309	13,655	14,231	15,531	16,500	17,105	18,855	20,605	22,355	24,105	25,855	
Total of First Division			35,052	36,359	[illegible]	40,[illegible]2	43,1[illegible]1	44,154	47,654	51,154	54,654	58,154	61,654	
SECOND	Simanggang	Telebu Bajong Sebuyan Lingga Maludam	7,745	[illegible],102	8,502	[illegible],915	9,461	10,061	10,936	11,811	12,686	13,561	14,436	
	Saribas	Saribas Kabong Sesang Grigat	7,396	7,835	[illegible],135	8,392	10,596	10,824	11,699	12,574	13,449	14,324	15,199	
Total of Second Division			15,141	15,937	16,637	17,307	20,307	2[illegible],[illegible]5	22,635	24,385	26,135	27,[illegible]5	29,635	
THIRD	Sarikei	Belawai Jerijeh Paloh	[illegible]	1,174	1,[illegible]	2,601	3,1[illegible]9	3,7[illegible]9	4,0[illegible]9	4,0[illegible]9	4,6[illegible]9	4,[illegible]9	5,2[illegible]9	
	Binatang	Loba Bahru Tanjong Jol	207	1,530	3,099	3,[illegible]64	[illegible],116	4,416	4,726	5,036	5,346	5,656	5,966	
	Mukah	[illegible]ya Mukah Balingian	1,230	1,4[illegible]0	2,023	2,740	3,131	3,15[illegible]	3,45[illegible]	3,75[illegible]	4,050	4,35[illegible]	4,[illegible]	
Total of Third Division			2,323	4,134	6,951	9,205	10,4[illegible]6	11,363	12,273	13,1[illegible]3	14,093	15,003	15,913	
FOURTH	Bintulu	Kuala Tatau Bintulu	1,4[illegible]0	1,640	2,026	2,376	2,[illegible]	2,7[illegible]7	2,927	3,067	3,207	3,347	3,4[illegible]7	
	Baram	Kuala Baram	499	574	577	727	77[illegible]	7[illegible]9	[illegible]29	1,069	1,209	1,349	1,4[illegible]9	
	Miri	Sibuti	1,14[illegible]	1,167	1,1[illegible]0	1,222	1,26[illegible]	1,262	1,402	1,542	1,682	1,822	1,962	
Total of Fourth Division			3,127	3,381	3,7[illegible]3	4,325	4,[illegible]23	4,[illegible]3	5,25[illegible]	5,673	6,09[illegible]	6,51[illegible]	6,93[illegible]	
FIFTH	Lawas	Kuala Lawas	[illegible]56	1,071	1,29[illegible]	1,45[illegible]	1,5[illegible]3	[illegible],75[illegible]	1,96[illegible]	2,17[illegible]	2,3[illegible]	2,59[illegible]	2,[illegible]	
	Limbang	Limbang	1,995	2,3[illegible]1	2,[illegible]1	2,[illegible]2	3,[illegible]	3,299	3,509	3,71[illegible]	3,929	4,13[illegible]	4,34[illegible]	
Total of Fifth Division			2,[illegible]51	3,402	3,[illegible]	4,3[illegible]	4,[illegible]5	5,[illegible]7	5,477	5,[illegible]97	6,317	6,737	7,157	

new plantations of coconut under the subsidy scheme would be inter-cropped with cocoa particularly in the First and Second Divisions.

3.49 The estimated total production of nuts during the period 1961 - 1970 in Sarawak was as follows:-

Table 3.13

Year	Acreage	Nut Production (Figures in Millions)
1961	38,960	64.28
1962	44,110	72.78
1963	55,410	91.43
1964	61,210	101.00
1965	71,620	118.17
1966	77,400	127.84
1967	85,000	140.25
1968	92,240	152.20
1969	9[illegible],5[illegible]	162.67
1970	105,590	174.22

This increase in the total production of nuts over the period is due more to the increase in palms already planted coming into maturity and start bearing, than to any increase in productivity per acre.

3.50 The production of copra per acre varies widely. For example, a production of 4,400 nuts or 0.9 tons of copra per acre is not uncommon from the productive coconut plantations in Kuching and Simunjan in the First Division. On the other hand, production as low as 0.4 tons is also obtained in some places.

3.51 According to an estimate, a total of 7,300 persons are involved in the coconut plantations in Sarawak. In the smaller plantations, according to the Task Force Report, the current average gross income per acre is about $57, if not inter-cropped.

wherever inter-cropping is practised, the income is estimated to be as high as $200 - $300 per acre.

3.52 The coconut plantation industry of Malaysia in general, and Sarawak in particular, has been a neglected crop, although its importance in the economy of the State and in the food of the population has been great. It would be of interest to note that a population of 1 million in Sarawak consumed an estimated quantity of 36 million fresh nuts directly in 1967.

3.53 The Industry has depended on the research results in other countries for the selection and production of coconut plants. The soil and climatic conditions in these countries being different, adoption of their results is not an appropriate approach to the problem. In Sarawak, recently, trials have only been undertaken on the relationship between coconuts and the various crops approved for inter-cropping in the coconut areas. However, development of high yielding varieties of these crops suitable for different soil types and climate is absolutely necessary in order to sustain the impact of inter-cropping as a means of raising the income of the coconut farmers. In this respect, Sarawak is moving in the right direction and it is expected that coconut would play an increasingly important role in the agricultural development programme of the State. It would, however, be necessary to initiate basic fundamental research into the cultivation of the crop, its manurial requirements and the identification of high yielding palms for selection and breeding. This is no doubt a long term programme but as Sarawak is making improvements to coconut plantation with cocoa inter-cropped, the importance of such an activity cannot be over emphasized.

3.54 As there is a large gap in the farm management data, a techno-economic survey of the coconut industry is necessary to be undertaken. Such a survey would not only provide up-to-date basic data for farm management, but would produce detailed information on the attitude of the farmers towards the crop and inter-cropping. The survey should be designed to produce data that would enable an assessment of the productivity of the industry. It would also indicate exact estimates of local consumption of coconut and coconut products and also include full feasibility studies of the processing and marketing aspects of the industry.

3.55 With the vast potential existing, the programme of rehabilitating and replanting of 35,000 acres is too small and it is suggested that the State government should consider increasing it considerably. Possibilities of expanding the existing acreage to the extent of making them estates (more than 100 acres) should also be looked into. The coastal regions of Sarawak suitable for coconut plantation is around 270 square miles. Tracts of this vast area which is not under coconut is under-utilized. As this type of soil is not economically suited to any other crop, it would be worthwhile considering promotion of a big scheme of coconut plantation, inter-cropped with cocoa on estate basis. This would not only enable production of coconuts to the extent of operating existing coconut oil mills in the State to the full capacity but also undertaking additional production of oil and other coconut products for export markets.

Malaysian Trade

3.56 The import and export of crude and refined coconut oil and also fresh coconut into and out of Sarawak are shown in tables 3.14 - 3.16. It would be seen from the tables that Sarawak is a net exporter of refined coconut oil though the export has not been very substantial. There was, however, a large export of crude oil from the State mainly to Singapore. The export of crude oil rose consistently from 2,397 tons valued at $1.7 million in 1966 to 3,666 tons valued at $3 million in 1970. Due to low income elasticity of demand, the

Table 3.14

Sarawak imports and exports of fresh coconut for 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	100	$	100	$	100	$	100	$	100	$
Imports										
Brunei	-	-	5.00	62	-	-	-	-	-	-
Indonesia	1.60	10	-	-	-	-	-	-	-	-
Sabah	762.00	10,963	692.60	11,269	463.75	7,305	549.91	6,147	6.00	76
Total	763.60	10,937	697.60	11,331	463.75	7,305	549.91	6,147	6.00	76
Exports										
British Caribbean Fed.	2.00	20	-	-	-	-	-	-	-	-
Brunei	37.30	787	0.20	7	7.20	94	9.07	140	17.75	269
Total:	39.30	807	0.20	7	7.20	94	9.07	140	17.75	269

Table 5.15

Sarawak Imports and Exports of Crude Coconut Oil for the year 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
Imports										
Indonesia	-	-	-	-	-	-	-	-	1.43	540
Exports										
Brunei	0.38	247	0.30	250	0.08	85	0.15	130	0.69	738
Hong Kong	86.10	70,313	51.99	34,806	96.54	69,042	108.22	84,206	134.18	110,264
Singapore	2,311.19	1,629,576	2,599.85	1,904,403	3,240.12	2,417,345	3,688.39	2,778,114	3,531.32	2,890,359
Total	2,397.67	1,700,136	2,652.14	1,939,459	3,336.74	2,486,972	3,796.76	2,862,450	3,666.19	3,001,361

Table 3.16

Sarawak imports and exports of coconut oil, refined for the year 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
Imports										
est Malaysia	11.11	10,558	17.29	18,873	7.41	10,889	12.70	17,495	17.40	27,976
Sabah	-	-	-	-	-	-	19.84	20,103	-	-
Philippines	-	-	-	-	-	-	0.30	300	1.51	1,251
Singapore	60.30	62,459	17.71	19,742	43.89	33,884	105.37	87,383	77.89	70,226
Indonesia	0.52	365	0.27	102	-	-	-	-	0.55	.460
Total	71.93	73,382	35.27	38,717	51.30	44,773	138.21	125,281	97.35	99,913
Exports										
Brunei	370.93	341,248	352.29	341,798	328.90	393,599	274.07	319,173	314.13	404,315
Sabah	16.43	15,290	13.35	13,431	41.94	48,023	72.99	76,607	35.29	41,357
Singapore	-	-	0.12	135	0.23	240	0.11	145	-	-
Total	387.36	356,538	365.76	355,364	371.07	441,862	347.17	395,925	349.42	445,672

size of the internal market for crude oil is limited. In view of this, the coconut oil to be produced in the State would have to find outlet in the world market. The world market situation which is at present promising, has been discussed earlier. The copra cake obtained from the processing of coconut oil in the State is consumed fully in the local market, as would be evident from the fact that Sarawak is a net importer of copra cake.

3.57 In regard to future demand of coconuts and its various products in the local market, it should be noted that with the rise in the population, the demand for fresh nuts will grow at the same rate. It has been estimated in the Regional Planning study of the First Division of Sarawak that the demand for fresh nuts for the period 1970 - 1982 in Sarawak would be as below.

Table 3.17

Estimated Consumption of Fresh Coconut in Sarawak

1970 - 1982

(all figures in millions of nuts)

Year	1st Div.	2nd Div.	3rd Div.	4th Div.	5th Div.	Sarawak
1970	14	7	12	6	3	42
1975	16	8	14	7	3	48
1980	19	9	17	8	3	58
1982	20	10	18	9	4	60

The study estimated for Sarawak as a whole and first Division in particular for the period up to 1980. Other estimates in the table 3.17 is made by the UNIDO team.

Marketing System

3.58 The coconut smallholders of Sarawak generally sell their produce of coconut/copra to the local provision shops. Smallholders in the First Division [illegible]

Kuching who will collect the coconut from the river boats which bring copra to the town. Oil mills have arrangements with the shopkeepers to buy the copra/coconut from them after paying the cost of transportation from the river sides to their mills. The same shopkeepers who at one time used to bring Indonesian copra also act as agents of the millers. Lately, supply from Indonesia has dwindled considerably. In fact, during the time of the study, oil millers reported that no more copra was coming from Indonesia at all.

3.59 Direct sales of copra to mills by the coconut smallholders, though should be possible in most cases, is undertaken only by a few enterprising Chinese farmers. The others do not practise this because of the location of the mills being far from the growing areas and also due to lack of adequate funds.

3.60 The present system of copra marketing in Sarawak is indicated diagrammatically below.

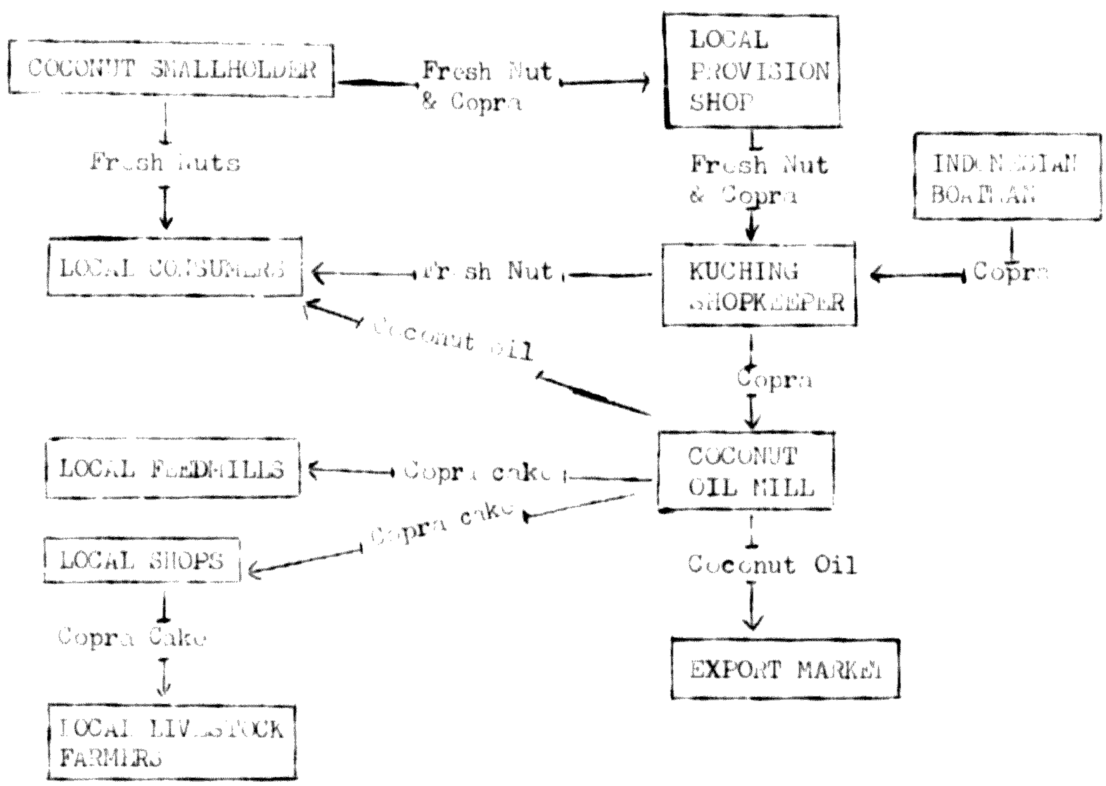

Figure 3.2. Coconut and Copra Marketing Pattern in Sarawak

3.61 The coconuts and coconut products trading pattern of East Malaysia is somewhat peculiar in that though both the sister states i.e. Sarawak and Sabah are comparatively large producers of coconut, there is hardly any co-ordination between the two. Inspite of Sarawak mills working at under capacity due to shortage of copra, Sabah has excess copra which is exported to Singapore. It is an irony in that transport of goods between Sarawak and Sabah takes place through Singapore resulting in excessive cost. The table below will illustrate the trade pattern of coconut and coconut products in West Malaysia, Sabah and Sarawak for the year 1969.

Table 3.18

Trade Pattern of Coconuts & Coconut Products in Malaysia (West Malaysia, Sabah and Sarawak)

(Value in 000$)

Country	West Malaysia	Sabah	Sarawak
Fresh coconut	+ 325.2	+ 74.8	- 6.0
Desiccated coconut	+ 7.9	- 8.2	- 5.4
Copra cake	- 3452.1	n.t.	- 41.9
Copra	- 915.2	+ 564.9	- 189.9
Coconut oil (refined)	+ 10.9	- 712.0	+ 270.6
Coconut oil crude	+19071.5	+ 162.9	+ 2862.5
Total	+21952.4	+ 5082.4	+ 2889.9

n.t. = no transaction

Source: Department of Statistics, Kuala Lumpur.

3.62 It will be seen from the table that Sabah exported copra valued at $565,000 in 1969 whereas Sarawak imported $190,000 worth of copra even with their mills working much below capacity. On the other hand, Sabah imported $712,000 worth of refined coconut oil from places other than Sarawak, which exported to Singapore and elsewhere about $270,000 worth of refined oil. This anomaly can be corrected only with the introduction of regular coastal shipping between the two States.

Price

3.63 The current price of fresh coconut in Sarawak at plantation is around 8 cents to 9 cents and in the retail shops it is sold from 18 cents to 19 cents per nut. The price of copra has gone up by about 30% over the last decade and in 1970 it was about $585 per ton. The price of coconut oil also showed a rising trend during the period, and between 1961 to 1970 the increase was of the order of 40% in Sarawak. This increase has remained steady during the entire period.

Copra production techniques and its effect on price

3.64 The technique adopted for production of copra in Sarawak is extremely poor resulting in very poor quality copra and consequential low yield of oil. The moisture contained in the copra is very high and it often gets mouldy. The average oil yield is reported to be only 48%, which is extremely low compared with international standards.

3.65 Considering the fact that as against a retail price of 18 cents - 19 cents in Kuching for a fresh nut, the farm price of a nut is only based on a price of $26.00 per pikul of copra ex-farm, illustrating once again how poor the standard of processed nuts in the plantation is. In some of the plantations, due to ignorance and poor technique, the copra is at times burned or over-heated resulting in reduced oil content and enhanced FFA content.

Existing Oil Mills

3.66 In 1968 there were 10 mills in Sarawak, all being located in Kuching. One dropped out in 1969 and another in 1970 resulting in 8 mills operating now. Six of the mills producing crude oil using hydraulic press are provided with facilities for production of both crude and refined coconut oil. The remaining two mills concentrate solely on the production of refined oil, though one of them is also equipped for the production of crude oil. The equipment, however, has remained unutilized for a long time mainly due to inadequate supply of copra. The actual production of crude oil in 1969 from all the mills together was only 6,500 tons as against the combined total capacity of 24,4?3 tons per annum. The actual production works out to 26.6% of the potential capacity. The crude oil extraction rates generally vary from 40% - 50%. The position is not better in the refining section where a large capacity is lying idle. In 1968 there was a production of 4,375 tons as against a total refining capacity of 41,900 tons. This works out only to 10.4% of the total potential capacity.

3.67 The six crude oil producers bought 13,361 tons of copra in 1969, the bulk of which was procured through middlemen. This is partly due to the credit line of shopkeeper to farmers and also due to the location of the mills away from the river where copra is landed from the growing areas of Nonok and other places. The moisture is as high as 40%. Nevertheless, the copra coming from Indonesia is more inferior.

3.68 The mills employed 320 paid workers in 1967 full-time and perhaps this has gone down considerably due to closure of some of the mills.

3.69 As the mills are reasonably efficient, development efforts have to be directed to the improvement of the quality of copra by proper drying. Of course, the increase in the acreage with consequential increase in production of coconut and also with increased trade with Sabah might temporarily solve the problem, but in the long run, from the national interest, improvement in the quality of copra would obviously yield higher returns.

3.70 The estimated production of coconuts based on a per acre yield of 4,400 nuts for the various Divisions separately and Sarawak as a whole is shown in Table 3.19. The assumption that 4,400 nuts would be produced per acre is based on the fact that almost all the productive acreages during the period would be under better yielding coconut palms provided by the Agriculture Department through its subsidy scheme.

Table 3.19

Estimated Production of Coconuts

(assumed. 1 acre = 4,400 nuts)

All figures in million nuts

Division \ Year	1971	1972	1973	1974	1975
First	210.0	225.0	240.0	256.0	270.0
Second	99.5	106.5	115.0	122.0	130.0
Third	54.0	58.0	61.8	66.0	70.0
Fourth	23.0	24.6	26.8	28.7	30.5
Fifth	24.0	26.9	27.8	29.6	31.5
Sarawak	410.5	441.0	471.4	503.3	532.0

It would be seen from the table that in 1971 and for that matter during all the subsequent years, the First and Second Division together would account for more than 75% of the total nut production in the State.

3.71 The estimated direct consumption of nut including those by the confectionery industry is shown in table 3.20. This consumption figure is based on a per caput consumption of 40 nuts per annum. The direct consumption of nuts, in fact, would form a very small percentage of total production i.e. 10.5% in 1971 and 9% in 1965 as projected. This fall in the direct consumption in proportion to production is due to the fact that the consumption will rise in the same rate as the rise in the population whereas the production rise is based on acreages progressively coming into bearing.

Table 3.20

Estimated Direct Consumption of Coconut

All figures in million nuts

Division \ Year	1971	1972	1973	1974	1975
First	14.4	14.8	15.2	15.6	16.0
Second	7.2	7.4	7.6	7.8	8.0
Third	12.4	12.8	13.2	13.6	14.0
Fourth	6.2	6.4	6.6	6.8	7.0
Fifth	3.0	3.0	3.0	3.0	3.0
Sarawak	43.2	44.4	45.6	46.8	48.0

3.72 Table 3.21 illustrates the available quantity of nuts, after allowing for direct consumption and for industrial use. In 1971 it is estimated that there would be 367.3 million nuts available in the whole State of which 287.9 million nuts would be available from the First and Second Division combined. Based on a recovery of 48% of oil, the following results have been worked out to illustrate the requirement of nuts for operating the 8 oil mills to full capacity for production of crude oil.

Combined installed capacity of mills	-	24,443 tons of crude oil
Copra input required (based on an average recovery of 48%)	-	$\frac{24,443}{0.48}$ = 50,900 tons
Assuming an average yield of 0.9 tons copra per acre producing 4,400 nuts, total nuts required to feed the mills to full capacity	-	$\frac{50,900 \times 4,400}{0.9}$
	=	248.8 million nuts say, 250 million nuts

Table 3.21

Estimated Availability of Nuts (in millions) for Copra and other Coconut Products

Division \ Year	1971	1972	1973	1974	1975
First	195.6	210.2	224.8	241.4	254.0
Second	92.3	99.1	107.4	114.2	122.0
Third	41.6	45.2	48.6	52.4	56.0
Fourth	16.8	[illegible]	[illegible]	21.9	23.5
Fifth	21.0	23.9	24.8	26.6	28.5
Sarawak	367.3	396.6	425.8	456.5	484.0

3.73 Theoretically speaking, therefore, in 1971 the nut production from the First and Second Division together should be sufficient to feed the mills for full capacity operation. It is however, not so as would be evident from the operations during 1970 and earlier years, when the nut production was perhaps not much less than the estimated production in 1971. The following are perhaps the reasons as to why the mills are constantly operated at a much lower capacity.-

(i) There has not been any organized marketing system;

(ii) Many of the smallholder areas were not operated upon in view of the low price (5 cents - 7 cents) offered to the smallholders compared to the price of 18 cents to 19 cents obtained by the shopkeepers in Kuching and other urban centres;

(iii) In some settlement scheme areas, prospective settlers did not turn up for some reason or other resulting in these areas remaining unharvested;

(iv) The distance of the mills to the plantations is too great and communication is very poor. Some of the areas remain completely isolated and inaccessible during the monsoon period i.e. November - January, resulting in no trading at all ;

(v) Due to poor quality of copra, yield of oil was perhaps, lower than assumed in the calculation above.

3.74 While a study of the operation of the settlement schemes in the State is outside the scope of this project, the other problems might be solved if organizations like the Federal Agricultural Marketing Authority or the Sarawak Development Finance Corporation could undertake the establishment of collection centres at the concentration of coconut plantations and establish modern drying kilns for producing quality copra.

3.75 The capital investment required for such drying centres would not be intensive. Essentially, only a number of kilns would be required. The establishment of these centres by itself would help, to the extent of, producing quality copra. Nevertheless, this would be of no avail unless it is combined with purchasing of nuts or the kernels, by the mills from the farmer at the Government processing centre or at the farmer's door.

3.76 Farmers in Sarawak are no different from their counterparts in other developing countries. Most of them have no capacity to hoard. They expect to sell immediately after harvest, in most cases, irrespective of the price they get. This condition of the farmers is fully exploited by the middle-men and the shopkeepers. To help the farmers in obtaining a fair price for their product, therefore, whether it is FAMA or SDFC, funds have to be provided in the proposed scheme of the copra processing centres so that farmers could be paid cash on delivery. Alternatively, the mills would be persuaded to disperse themselves to the concentration of coconut growing areas, and they should be adequately financed wherever necessary so that the middle-man could be eliminated and a better price to the farmers is assured. In this case, the State Agricultural Department or any other suitable agency would have to introduce and implement a scheme of compulsory quality control if the millers decline to adopt quality control voluntarily.

Proposals for Copra Processing Centres

3.77 As the oil mills are at present located in Kuching, and would remain in the First and Second Division, even if the alternative suggestion made above is accepted, the copra processing centres should be in the First and Second Division only. It is suggested that to start with, 5 such centres should be established, one each in Nonok, Mid-Sadong, Santubong, Kabong and Simanggang. A suitable production capacity for these centres would be in the region of 5 tons per day or 1,500 tons per annum. Depending on the success of these centres, more centres could be established in places like Sebangan, Sajong, Lingga, Maludam, Saribas and Sesang.

3.78 The production of copra essentially comprises drying fresh kernels with about 46% moisture content to a moisture content of about 6%. Although sun-drying may be practised, artificial drying using drying kilns is preferred for the production of quality copra. It is proposed that in the centres suggested, drying be carried out in a rotary or tray dryer. Also, since the entire output will be intended for consumption by the oil mills, who feed the expellers with copra cut out into small pieces, the kernels will be comminuted before drying. This will reduce the time of drying and save heating energy. The de-husking process could be performed manually by breaking the husk against a spike driven into the ground at an angle, or with a cutlass.

Cost Calculation for a Copra Producing Centre

3.79 The following analysis would provide a general notion as to the requirement of a typical copra processing centre, yielding an output of about 1,500 tons of quality copra per annum. For such a centre, 7.5 million nuts would be required, thus necessitating a coconut area of about 1,700 acres. The price of coconut ex-plantation is taken to be 8 cts per nut. As regards the transport of copra from factory to mill, the current rate of $1/- per pikul in Sarawak is very high. It would, therefore, be worthwhile to consider the use of company boats, thus reducing the cost of transportation. From the analysis, it could be seen that with a capital investment of about $160,000, an annual gross income of about $27,000 is obtained, thus yielding a return of about 16.7%.

Cost Estimates for a Copra Processing Centre

Production capacity = 5 tons per day or 1,500 tons per annum

Estimated recovery of copra = 1 ton copra from 5000 nuts

Therefore, number of nuts required = 7,500,000 per annum.

Capital Investment

(A)	Land for factory (including cost of development) 1 acre @ $5,000 per acre	$ 5,000
(B)	Factory building 4000 sq. ft. @ av. $9/sq. ft.	$ 36,000
(C)	(i) Machinery and Equipment:-	$ 90,000
	(a) Copra meat cutting and rasping machine - 1 unit	
	(b) Transport trolleys for rasped material - 1 unit	
	(c) Rotary dryers - 2 units	
	(d) Steam boiler - 1 unit	
	(e) Diesel generator - 1 unit	

and they should be adequately financed wherever necessary so that the middle-man could be eliminated and a better price to the farmers is assured. In this case, the State Agricultural Department or any other suitable agency would have to introduce and implement a scheme of compulsory quality control if the millers decline to adopt quality control voluntarily.

Proposals for Copra Processing Centres

3.77 As the oil mills are at present located in Kuching, and would remain in the First and Second Division, even if the alternative suggestion made above is accepted, the copra processing centres should be in the First and Second Division only. It is suggested that to start with, 5 such centres should be established, one each in Nonok, Mid-Sadong, Santubong, Kabong and Simanggang. A suitable production capacity for these centres would be in the region of 5 tons per day or 1,500 tons per annum. Depending on the success of these centres, more centres could be established in places like Sebangan, Bajong, Lingga, Maludam, Saribas and Sesang.

3.78 The production of copra essentially comprises drying fresh kernels with about 46% moisture content to a moisture content of about 6%. Although sun-drying may be practised, artificial drying using drying kilns is preferred for the production of quality copra. It is proposed that in the centres suggested, drying be carried out in a rotary or tray dryer. Also, since the entire output will be intended for consumption by the oil mills, who feed the expellers with copra cut out into small pieces, the kernels will be comminuted before drying. This will reduce the time of drying and save heating energy. The de-husking process could be performed manually by breaking the husk against a spike driven into the ground at an angle, or with a cutlass.

(c) Other Cost

(i)	Transport of copra from factory to mill @ $5 per ton (as the current rate is very high, it might be worthwhile considering the maintenance of company boats)	$ 7,500
(ii)	Land taxes and insurance @ 1% of capital investment	1,617
(iii)	Depreciation per annum on buildings and plant equipment @ 10%	14,900
	Total	$ 24,017
	Total recurring cost:	$ 711,120
	Working capital (3 months operational cost):	$ 177,780
	Interest on working capital @ 10% (current commercial bank rate):	$ 17,780
	Total annual cost	$ 728,900

Return from Sales

Total production of copra:	1,500 tons
Though the current market price for quality copra is $32 per pikul, this is not expected to remain constant. Hence, for this analysis, a price of $30 per pikul is assumed. Market price of copra ex-mill:	$ 504,per ton
Total return: $(1,500 x 504).	$ 756,000
Annual gross income:	$ 27,100
Percentage return on capital investment:	$ 27,100 / $ 161,700
	= 16.7

3.80 Only 10.4% of the total refinery capacity of 41,900 tons is currently being utilized. With the full capacity operation of the crude oil mills, the total available input to the oil refineries would be only 24,500 tons which would mean utilization of the capacity to the extent of 58.8%. As there is no case at present to create additional capacity for production of crude oil, the refinery sections of the oil mills would have to remain satisfied either with this utilization or they might consider importing crude oil from Sabah which exports 129 tons of crude oil to Singapore annually. The import from Sabah would, however, depend on the improvement of coastal shipping between the two States.

3.81 With the operation of the oil mills to full capacity, there will be a substantial yield of copra cake and meal. Allowing for a loss of 12% due to drying of the copra by the millers before feeding it to the mills, the copra cake yield is estimated at 40% of the input. Thus the total copra cake that would be available from all the mills combined would be 50,900 x 0.4 = 20,360 tons. This production, in addition to replacing the annual import of around 220 tons of copra cake, would mean a surplus of about 20,000 tons for trading in the international market. The demand of copra cake, as has been stated earlier (table 3.8) has been in the rise consistently and the main supplier has been Philippines and Indonesia. The price of copra cake remains around M$240 c.i.f. European port as against the f.o.b. price of $160 ex-Philippines. With a production cost of around $130 per ton ex-Kuching mill (estimated), it should be possible for the Sarawak millers to compete in the international market with Philippines. Moreover, as the quantity is very insignificant, market could be looked for in the region as well, particularly in Sabah and West Malaysia who are also net importers of copra cake. The refined coconut oil would continue to find outlet in the present markets such as Singapore, Hongkong, Sabah and Brunei.

3.82 The combined yield of coconut from First and Second Division plantations has been proposed to be reserved for meeting the full capacity requirement of the oil mills, with production of improved quality copra at different centres. As these processing centres are quite a distance from each other, it would not be possible to collect the husks and shells economically for further processing, especially with the present status of infrastructure. If and when the communication is developed, as envisaged in the Second Malaysia Plan, economic viability of such collection could then be examined.

Proposal for Desiccated Coconut Plant

3.83 At present, however, there is a case for establishment of a desiccated coconut plant in the Third Division of the state. As desiccated coconut plant would essentially require supply of fresh coconuts, it has to be located at the coconut concentration, and the supply of total requirement of raw material for the factory have to be ensured from a reasonable distance. Sarikei, being centrally located with regard to the existing coconut plantations in the Third Division, with comparativelybetter communication facilities, would perhaps be a suitable location. Moreover, quick supply of fresh nut from some of the coconut growing areas in the Second Division could also be obtained at this place.

3.84 Next to Kuching, Sarikei is the most important port where ocean going vessels call, though at irregular intervals. As the end product, i.e. desiccated coconut is intended for the export market, port facility is very important and Sarikei offers the facility.

3.85 The world market situation of desiccated coconut has been discussed earlier in this chapter.

Production Process of Desiccated Coconut

3.86 The dried disintegrated meat of the coconut is known as desiccated coconut. The process of conversion of coconut to desiccated coconut is very simple and it involves tearing out the kernel, grinding it into small particles and then throughly desiccatingit in dryin andfinally packing it. The nuts are first brought from the plantations and stored in bins under cover.

The bins are located in such a way that it is convenient and quick to count out a given number of nuts.

3.87 The nuts are then cracked and kernels are removed with a special type of axe. Sometimes, the kernels get detached from the shell during the storage, and with care these could be removed whole by a hatcheter. The kernels so removed from the nuts with a thick brown skin has to be spoke-shaved. The shaven kernels are then placed inside a tank and sliced in two, in order to release the coconut water, if not already done. The cut pieces are then passed into other tanks and taken through two separate washing stages. The rate of flow through these tanks can be calculated by the input rate at which the hatcheters and tearers are working, allowing for their meal break periods.

3.88 The washed coconut pieces are sterilized in boiling water. Outbreaks of food poisoning in instances had been traced to salmonella organisms present in desiccated coconut. Increasing attention are, therefore, paid by the importing countries, to desiccated coconut as possible sources of infection in food products.

3.89 The sterilized kernel pieces are transferred in wire baskets direct to the disintegrator. This is equipped with a series of adjustable points and blades on a revolving drum which shred the coconut meat into a wet meal.

3.90 The wet meal is then dried by spreading the meal onto trays, usually measuring about 4 ft. sq. and 2½ inches deep, each tray containing about 30 lbs. of wet meal. These trays are usually made of fine metal mesh supported by a wooden frame. The trays are mounted in tiers in a dryer in which hot air is circulated to dry the wet meal thoroughly. The meal taken out of the dryers is known as desiccated coconut.

3.91 Once the desiccation is completed, the coconut has to be tipped out onto a cooling table and subsequently passed to a vibrating screen-type machine for grading. According to the setting of the disintegrator, the desiccated coconut will be graded as fine, medium, and coarse or extra fine, fine and medium. As desiccated coconut is meant for use in food industries, it has to be packed carefully and normal practice is to pack it in 5-ply paper bags with a double glassine liner. Each bag contains 100 lbs. - 110 lbs. It is filled using vibratory packer to shake down the contents before the bags are closed and stitched, either by machine or with a special hand-tool, before shipping.

3.92 In the plant proposed, most of the processes are to be mechanised. The tips of the nuts are first cut off by special fast moving rotary saws with automatic clamping devices. The exposed copra meat is punched out and the water is allowed to be splashed. The open nuts are then subjected to heat treatment which will shrink the meat and crack the shell. By this process, the whole copra ball remains and can be peeled off with special machines. In these special machines, the balls of copra tumble in a fast circulating stream of water around a cylinder coated with abrasive material which enables the whole surface to be evenly peeled with a minimum of waste. Once detached from the peeling machine, the copra is transported to a sterilizer, via an assorting belt. On the assorting belts, balls which were not completely peeled due to irregular size or other reasons can be picked up by hand. After sterilization, the copra is transported to a centrifuge to remove any excess water and then to a cutting and rasping machine for cutting or rasping to required sizes. The product is then dried in tray dryers, thereafter, it is screened, weighed and filled into bags.

3.93 Though smaller capacity plants for production of desiccated coconut are available and also economical, a [illegible] situation of well-developed infrastructure and regular shipping facilities, Sarawak has to plan for a bigger capacity plant in view of the absence of the above-mentioned facilities in the State at present. The capacity proposed therefore is 15 tons of desiccated coconut per day on three shifts. Allowing for an operational loss due to drying and others at 50%, the total kernel input required would be 30 tons. Assuming the kernel weight to be one-third of the full nut, the nut required would be 90 tons. As the nuts would be collected from different plantations, the weight of nuts is unlikely to be uniform and, therefore, the actual weight of nuts to be collected would be much higher. Allowing for a loss of 25%, due to this non-uniform size the actual nut weight required per day would be 112½ tons. The number of nuts required per day would be around 75,000 nuts or per year of 75,000 x 300 = 22.5 million nuts. With an average yield of 4,400 nuts per acre in Sarawak, the total coconut plantation required to feed the plant would be around 5,200 acres. Such an acreage is available in the third Division. Moreover, supplies from Second and Fourth Division are also expected to be forthcoming.

5.94 As against the current price of 18 cents per nut in Kuching and a much lower price i.e. 8 cents in the plantation it is assumed that the price of nut the factory could pay at Sarikei would be 15 cents delivered at factory gate. Thus the total cost of nuts per annum would be:

$$\frac{15}{100} \times 22.5 \text{ million} = \$3,375,000$$

<u>Cost Estimates for the Desiccated Coconut Plant</u>

<u>Capital Investment</u>

(A) Land for factory (including cost of development) - 2 acres at $10,000 per acre $ 20,000

(B) Buildings, including factory building, garage etc. - 10,000 sq. ft. at the average rate of $9 per sq. ft.:	$ 90,000
(C) Machinery and equipment:	$700,000
Automatic rotary nut-cutting machine (3 units)	
Lift for coconut trays - 1 unit	
Fork lift truck for tray movement - 1 unit	
Automatic coconut pealing machines - 5 units	
Sorting belt - 1 unit	
Accelerator belt conveyor - 1 unit	
Sterilising autoclave with through-flow transport - 1 unit	
Dewatering centrifuge - 1 unit	
Accelerator belt conveyor - 1 unit	
Copra meat cutting and rasping machines - 2 units	
Transport trolleys for rasped material - 3 units	
Tray driers - 4 units	
Weighing and bagging machine - 1 unit	
Cost of erection, installation, engineering, design, etc. at 25% of the cost of machinery	$175,000
Total	$875,000
(D) Ancillary fixed cost:	
Water works	$ 50,000
Office equipment, including typewriters, calculators, furniture, etc.	$ 15,000
Lorry - 5 ton capacity (2 unit) at the rate of $25,000	$ 50,000
Land rover - 1 unit at the rate of $16,000	$ 16,000
Total	$131,000

Total capital investment	$1,116,000
Add pre-project expenses at 5%	55,800
Total	$1,171,800

Recurring Cost

(A) Cost of raw materials:

(i)	Cost of 22.5 million nuts at 15¢ each	3,375,000
(ii)	Specially made double-wall bags for packing 4,500 tons of desiccated coconut at the rate of 100 lbs./bag each costing $1.00	100,800
(iii)	Fuel for 3,400 lbs. of steam per hour (equivalent to 170 lbs. of oil per hour) at the rate of $72/ton	40,000
(iv)	Electricity 80 kw. x 24 hours = 1,920 units per day at 8¢ per unit for 300 days	46,080
(v)	Cost of water (provided with electricity cost)	-
(vi)	Repairs and maintenance of plant and machinery	5,000
(vii)	Diesel, petrol, lubricants for vehicles	5,000
(viii)	Office stationery, etc.	5,000
	Total	$3,576,880

(B) Labour cost:

(i) General and Sales Administration

	No.	Wage/mensem	Wage/annum
General Manager	1	$1,500	$18,000
Sales Manager	1	1,200	14,400
Accounts Officer	1	1,000	12,000
Stenographers, Clerks and Typists	4	250 (Av.)	12,000
Office Boys	2	100	2,400
Vehicle Driver	2	$5/day	3,000
	12		$61,800

(ii) Factory Administration

	No.	Wage/mensem	Wage/annum
Factory Manager	1	1,200	$14,400
Electrical Chargeman	1	400	4,800
Mechanical Foreman	1	400	4,800
Clerks	2	200	4,800
Typist	1	200	2,400
Office Boy and Watchman	2	100	2,400
Vehicle Driver	1	$5/day	1,500
	9		$35,100

(iii) Production Labour

	No./Shift	Total/Day for 3 Shifts	Wage Rate per day	Total Wage/Year for 300 Days
Skilled Workers	6	18	$6	$32,400
Semi-skilled Workers	6	18	$5	$27,000
Unskilled Workers (male and female)	10	30	$4	$36,000
	22		Total	$95,400

Total labour cost	=	$192,300
Add 15% as employment cost	=	28,845
Total labour cost		$221,145

(C) Transport and Sales Promotion Cost

(i) Transport from factory to port by company lorry - Cost provided for

(ii) Port charges, loading, insurance, freight to European port @ $80 per ton (assumed). Initial shipping has to be done through Singapore - $360,000

(iii)	Sales promotion including commission @ $5 per ton	-	$22,500
(iv)	Local taxes and insurance at the rate of 1% of capital investment	-	$11,200
	Total		$394,200
	Depreciation of buildings at the rate of 10%	-	$9,000
	Depreciation on plant and equipment at the rate of 10%	-	$87,500
	Depreciation on other equipment at 10%	-	13,100
	Total depreciation per annum		$109,600
	Total recurring cost	=	$4,301,825
	Working capital (3 months operational cost)	=	$1,075,450
	Interest on working capital @ 10% (current commercial bank rate)	=	$107,550

Total annual cost = $(4,301,825 + 107,550)
= $4,409,375

<u>Return from Sales</u>

Total production of desiccated coconut	=	4,500 tons
Average c.i.f. European price (based on 1969)	=	$1,050 per ton
Therefore total return from sales	=	$4,725,000
Annual gross profit before taxes	=	$(4,725,000 - 4,409,400)
	=	$315,600
Percentage return on fixed investment	=	$\frac{315,600}{1,171,800}$
	=	27%

Thus it would be seen that the project would be a highly profitable one.

3.95 As discussed before, a number of useful products can be made from the shell and husks to be obtained during the process of coconut meat extraction. From the 22.5 million nuts, it is estimated that an annual output of husks and shell would be around 12,000 tons and 6,000 tons respectively.

3.96 The husks could be used in the manufacture of rubberised mattresses, needled felt and bristle fibre ropes. The shell could be converted into flour and activated carbon. The processes involved are simple and if the production of these items are further undertaken along with desiccated coconut in an integrated manner, the overhead cost would be substantially reduced. The problem, however, remains that for many of these items, the international market has not been very encouraging. However, with the establishment of a sugar mill, suggested in a subsequent chapter, the demand for activated carbon would be generated. Subsequently, the desiccated coconut project could then be extended to include the manufacture of activated carbon.

CHAPTER IV

COCOA

<u>The Cocoa [illegible]</u>

4.1 The [illegible] indigenous to the Amazon and Orinoco forests of South America, [illegible] cultivated by the Mayas and Aztecs long before the discovery of America. [illegible] believed the cocoa tree to be of divine origin [illegible] probably [illegible] this reason that Linnaeus, the 18th century Swedish [illegible] the name "Theobroma" - food of the Gods - to the [illegible] the cacao species. Although Columbus introduced [illegible] to Europe, the probable commercial valu[illegible] of it was realised [illegible]

4.2 Coco[illegible] the seeds of the trees of the species Theobroma Cacao L. [illegible] is comprised of at least 20 species of small trees ([illegible]), and Theobroma Cacao is the only one of commercial [illegible] which varies widely in shape, colour and [illegible] pod with a thick husk containing 30 - 40 seeds ([illegible] bean) each surrounded by mucilaginous pulp [illegible] 80% water with citric and other acids, glucose, fructose, [illegible]. The pulp proves to be an excellent medium [illegible] micro-organisms, and this is important in [illegible] fermentation. The cocoa bean itself consists of a ke[illegible] with a skin (the testa or shell) representing about [illegible] dry weight.

4.3 The [illegible] divided into two main groups: Criollo and Forastero (also [illegible] Calabacillo). The Criollo trees have pods which are [illegible] ripe, are deeply furrowed, have a rough warty surface [illegible] usually pointed; the beans are plump and have white or pale [illegible] cotyledons. Forastero trees have pods which are [illegible] a smoother surface with only shallow furrows [illegible] are somewhat flattened and have dark purple cotyledons. This classification is fairly clear as regards bean character, but it would not be possible to make a clear-cut distinction on the basis of pod colour and shape. In addition, there are sub-divisions, the most important being the distinction between Amazonian Forasteros and the Trinitarios, the latter having arisen from crossing Criollos and Amazonian Forasteros.

4.4 This division of Criolla, Trinitario and Amazonian Forasteros corresponds with the commercial classification on the basis of flavour. In general, however, the development of flavour and the quality of all types of cocoa would depend largely on the preparation – fermenting and drying of the beans – on the farm or estate. Nevertheless, the different types of cocoa also impart certain differences in flavour. Criollo beans which form about 1% of world production have a distinctive flavour which some manufacturers value for blending purposes; some grades of Criollo, particularly those from certain parts of Venezuela, fetch considerable premiums. Trinitario cocoa constituting about 5% of world production, are also classified as "fine grade" and can command a premium over ordinary cocoa, of which cocoa from Ghana, known commercially as Accra, is the standard type.

4.5 The cocoa tree attains a height of 22 - 30 feet and is an understorey tree of the wet tropical forest, originating in the upper Amazon basin. It has several interesting morphological features. The mode of branching is dimorphic. The seedling forms a vertical stem with leaves arranged spirally; this grows to a height of 3 – 5 feet and then forks into 3, 4 or 5 "fan" branches on which the leaves are arranged alternately. The vertical forms of shoot is known as "chupon" and the tree increases in height by producing chupons from below the "jorquette", the point at which the stem forks. This pattern of growth is repeated and the tree, if unpruned, will add a third or a fourth tier of branches. Chupons are also produced from the base of the trunk. Growth takes place in a series of flushes, the branches adding a short length and a number of leaves, which harden before any further growth takes place.

4.6 The flowers are borne on the trunk and main branches of the tree, occuring in small groups arising from flower cushions which were originally leaf axils. The flowers are quite small - about 0.5" across - and are bisexual. They produce no nectar or scent and, as the pollen is too sticky to be dispersed by wind, means of pollination remain obscure for a long time.

4.7 The cocoa tree produces a vast number of flowers of which only a small proportion are pollinated. The pods take 5 - 6 months to develop and during the first 8 weeks, the young pods, or cherelles, are liable to wilt, thus providing natural thinning of the crop. The ripe pod does not split or drop off the tree. On removal from the pod, the seeds have no dormancy, so that when beans for seed purposes are transported over long distances, special precautions must be taken to preserve their viability.

Climatological, Agricultural and Other Requirements

4.8 The cocoa growing areas in the world are confined to the Tropics and lie within 20°N. and 20°S. Lat. The most ideal rainfall for cocoa growing is from 50" to 120", though there are few areas where cocoa is grown even with a rainfall of less than 50". In some of the later stages, the rainfall is supplemented by irrigation. With a rainfall of more than 120", very little cocoa is grown partly because this usually leads to conditions favouring various fungal diseases and also soils tend to be less fertile under heavy rainfall. The rainfall should be well distributed, although the cocoa tree will withstand a dry season of 3 - 4 months, provided the soil has good moisture-holding capacity.

4.9 The most suitable temperature range for cocoa growing is [illegible]°F. to 90°F. A temperature of less than 60°F. is unsuitable thus setting the limit to the altitude at which cocoa can be grown.

4.10 Most of the cocoa growing areas in the world are below a thousand feet but there are areas, in Columbia for example, where cocoa is grown at 3,000 feet. Strong winds are unfavourable for cocoa growing, as under such conditions, the petioles are easily broken.

4.11 Cocoa trees are grown on a wide variety of soils varying in texture, parent material, pH, and nutrient status. The main requirement is that the soil should provide a firm foothold for the tree and suitable air-moisture conditions throughout the year.

4.12 Cocoa is usually grown under the shade of other larger trees; either trees planted for the purpose or forest trees left after thinning the jungle. Although the shade resembles the natural habitat of the cocoa tree, it has become clear that under such conditions cocoa will not yield its best. Really high yields can be obtained without shade, but this increases the trees' requirements of water and nutrients. Where the soil and the climate cannot meet these requirements, some degree of shade is necessary. Leguminous trees or food crops such as bananas, cocoyams are used for additional temporary shade while the cocoa is growing.

4.13 Seedlings are the prevailing planting material, but vegetative propagation has also been used. The latter method involves a considerable capital outlay when used on a large scale so that the cost per plant is much greater than in the case of seedlings. The best time for planting out seedlings and rooted cuttings in the field is early in the wet season. Trees are usually spaced at 12 - 15 feet apart. Much closer plantation namely 6 - 7 feet are also carried out at places in Africa. Spacing trials, however, indicated that a spacing of 7 - 10 feet gives the highest yields. Young plantings require weeding and control of shade, pests and diseases. As the tree develops, some pruning becomes necessary.

4.14 The cocoa tree growing under favourable conditions will start bearing in its third year and the yield will increase up to the 8th or 9th year, at which age the trees will be yielding 700 - 800 lbs. of dried beans per acre. Yields vary enormously; in most countries they are low, ranging from the low level of 200 lbs. per acre in western Africa to 600 - 700 lbs. in New Britain. Yields of 800 - 1,000 lbs. per acre should readily be achieved when good planting material is given the right conditions, and yields over 3,000 lbs. per acre have been achieved in Ghana where the shade had been removed and fertilizers had been applied.

4.15 Shaded cocoa does not respond to fertilizers except where there is definite deficiency of nutrients; but where the shade is drastically reduced or removed although the tree responds to fertilizer treatment. The quantity of nutrients removed by an average yield of beans is small and even a yield of 1,000 lbs. per acre removes nutrients much less than do most temperate crops. The much higher yields now being achieved in African and South American countries do lead to the removal of considerable quantities of nutrients, particularly potassium, most of which is contained in the pod husk.

4.16 The cocoa crop is harvested over a period of several months, for the trees flower, set fruits and ripen pods in most months of the year. The pattern of cropping depends on the distribution of the rainfall, but during the peak month of harvesting not less than 25% of the crop will be gathered. The ripe pods are removed from the tree by means of cutlasses and are gathered to some convenient point for opening and separation of the wet beans from the pod husk. The wet beans are then taken to the fermentary. On the large farms and estates harvesting takes place at weekly or fortnightly intervals according to the state of the crop; but on the small farms in Africa, the whole crop may be gathered in 3 or 4 pluckings.

4.17 The cocoa tree is subject to attack by a large number of pests and diseases. A few of these have caused severe losses of crop or of trees and a survey conducted in 1956 indicated that the loss in production caused by diseases amounted to 29.4% - rather higher than for any other major crop.

4.18 The most striking of the diseases for young cocoa is the swollen - short disease. The most universal, however, of all the cocoa diseases is black pod, caused by the fungus Phytophthora Palmivora. This disease can be controlled by spraying with copper fungicides, and control measures have been successfully applied.

4.19 The most important group of pests, dangerous to cocoa tree and fruit, are the capsids (or mirids) which occur in many cocoa-growing countries. Attacks on young trees delay development or may even kill **these trees;** on mature trees attacks cause severe defoliation and damage is enhanced by a subsequent invasion by the fungus, Calonectria Rigidiuscula. This leads to the death of the crown of the tree. Spraying with insecticides based on benzene hexachloride effectively controls capsids, and the development of efficient shoulder-mounted mistblowers has led to widespread control of these insects. There are numerous other insects which attack cocoa but none that cause damage on the scale of capsids. Some insects are localised; in most cocoa growing countries, there occurs species of beetles which bore into the stem or branches causing death of part, or even all of the tree.

Preparation of Cocoa Beans

Fermentation and Drying (Curing)

4.20 Fermentation and drying, also sometimes referred to together as curing, are two essential operations the harvested cocoa beans have to undergo before they could be stored or marketed. Fermentation which takes place within a day or two of harvesting the pods is the first process and the quality of cocoa powder and chocolate produced depend on how successful the fermentation has been. If the fermentation is not properly conducted, the flavour of the chocolate will be poor and will be virtually absent if the process is altogether omitted. The fermented beans are then dried.

4.21 Cocoa beans are fermented in many different ways such as:-

(i) in holes in ground,

(ii) in heaps,

(iii) in baskets or boxes.

In Ivory Coast, even old wine barrels are used for the fermentation of cocoa beans.

4.22 The period of fermentation vary widely but generally, it is from 6 to 8 days for Forasters beans and 5 to 6 days for Crillo beans. The durations of fermentation and the methods are so varied that it is difficult to find two identical procedures. On the first day of fermentation, some of the pulp runs away as "screatings" and the temperature begins to rise gradually until by the third day, the bulk is at the maximum of 45°C. The temperature is maintained at this level until the beans are put to dry either in the sun or in an artificial dryer.

4.23 There is very little application of fermentation in holes as the holes could easily become waterlogged and the screating cannot be drained away.

4.24 The heap process is only used in West Africa by the small holder farmers. In this process of fermentation, a conical mound of 500 - 1,000 lbs. of beans is formed on a layer of banana leaves. The mound is then covered, also with banana leaves.

4.25 In areas where rainfall is comparatively high like in Sarawak, the 'sweat box' method is used. This sweat box is a simple wooden box with a series of holes at the bottom which allow the screatings to drain away. Care has to be taken so that the wood used in construction gives no taints to the beans and that nails do not penetrate to the interior as this would cause black marks to appear on the beans. As an improvement lately, three boxes in tiers have been introduced. The beans are shoveled from the upper to the middle box after 2 days and from the middle to the lower box after another 2 days. These transfers have the effect of mixing the beans as well as aerating them. The capacity of the boxes vary considerable from one fermenting site to another, but as long as the depth of the beans does not exceed 3 feet, a satisfactory fermentation is obtained. In this process, the beans are also covered with a layer of leaves. The sweat box method ensures a more uniform fermentation compared to the heap process.

4.26 Whichever may be the process employed for fermentation, the two important conditions to be ensured are that:-

(i) the balance struck between heat production in mass and the heat loss from the mass, is such that the temperature of the beans will rise to about 45°C and then maintain at that level for 2 to 3 days;

(ii) the beans are aerated.

4.27 There is no basic quality difference in the end product from sun drying and artificial drying as long as it is ensured that beans do not form into moulds. Sun drying is possible where rainfall is not excessive and there are considerable number of bright sunny days, as in the case of places like Ghana. In this process, the beans are put on mats uniformly spread over in the sun and this is occasionally raked and turned for uniform drying. With an average bright sunshine of 5 hours per day, complete drying would take from 5 to 10 days.

[illegible].28 For artificial drying many types of dryers are employed. In the simpler types of artificial dryers, drying is carried out by heating the dried floor below by hot air. Pipes are installed within the air space beneath the floor and through them, circulate either water from a boiler or the hot products of combustion from a wood fire or burning oil jets. The drying floor may permit the passage of hot air through the beans (Martin Dryer) and the addition of a fan ([illegible] Dryer) to draw off the moist air is preferred. The roof of the Martin dryer, is sometimes provided with rollers resting on rails so that it can run back in times of fine sunny weather and the drying processes hastened by direct heat from the sun. The smallholders cocoa planters in Sarawak practice this method.

[illegible].29 The Gordon and Mckinnon Dryers are the most popular dryers in the African countries and in Brazil. This dryer consists of a large cylinder, rotating slowly about a horizontal axis, along which hot air flows and escapes into compartment containing the beans. The rotation of the cylinders leads to the rubbing of the beans against each other, and when dry, may exhibit the polished appearance prized by some cocoa buyers. The shell is also rather thinner on account of the abrasive action of one bean on another and there is an increased incidence of broken beans.

[illegible].30 In a Samoan drier, wet beans are spread on to the drying platform of holed aluminium or holed carboard up to a depth of 3" to 4". The beans are turned and raked frequently, especially during the first few hours of drying when the beans tend to clump together. The average drying temperature taken just below the drying platform should be in the range of 57°C - 60°C. At this temperature, drying for 35 - 40 hours will be sufficient to reduce the moisture percentage of the beans down to [illegible] - 7%.

4.31 However, for successful production of the right type of beans, it is essential with all dryers that no chance be given to the beans to be exposed to the product of combustion. This will inevitably result in taints. The test of a successful fermentation and subsequent drying is in the fissured interior of the sample beans when opened; chocolate brown or cinamon in colour. Unfermented or partly fermented beans are respectively slaty and purple coloured. Successful curing combined with the subsequent roasting and conching determines the right chocolate flavour. Cocoa beans need careful storing to protect them from insect attacks, and absorption of moisture, which if exceeds 8%, leads to the development of moulds on and within the bean.

4.32 100 lbs. of beans on successful fermentation and drying would yield 36 lbs. - 44 lbs. of cured beans.

World Acreage and Production of Cocoa Beans

4.33 Several countries have a long history of cocoa production. Cocoa was first planted in Trinidad in the year 1525, was found to be growing in Jamaica in 1965 and was planted in Ceylon early in the 19th century. Many African and South American countries took to cocoa plantation and the largest world producers of cocoa today are Ghana, Nigeria, Ivory Coast, Cameroons in Africa; and Brazil, Equador, Dominican Republic, etc. in the Americas. Of the Asian countries, Philippines, Ceylon and Indonesia have been producing cocoa on an insignificant scale compared to African and South American countries as would be evident from table 4.1.

Table 4.1

World Production of Cocoa Beans (Regional)

Name of the Continent	Production in 100 Metric Tons				
	1964/65	1965/66	1966/67	1967/68	1968/69
Africa	11,967	8,631	9,679	9,782	8,614
Latin America	2,857	3,302	3,489	3,507	3,461
Oceania	250	209	255	285	316
Far East	75	82	79	90	94
Total	15,149	12,229	13,502	13,664	12,485

4.34 Statistics on total world acreage is not available, particularly of the main producing countries in Africa as the crop is grown mostly on smallholder basis. Of the South American countries the productive acreage in Brazil in 1968 was 1.0825 million acres and this was a drop of about 100,000 acres from the previous season. Statistics on the productive acreages in other South American countries are not available.

4.35 Total world production of cocoa fluctuates from season to season considerably. It dropped from 1,499,000 metric tons in 1964/65 to 1,226,000 metric tons in 1968/69. The fall in the production is attributed to the variable weather conditions and also incidence of diseases in the producing countries, especially in West Africa. Though the production in 1969/70, went up to 1,417,000 tons, it was still short of the 1964/65 output.

4.36 The Ghana crop fell to 334,000 tons in 1968/69, some 81,000 tons less than 1967/68 and the lowest since 1959/60. However, the production recovered to 403,000 tons in 1969/70. Nigerian production of about 187,000 tons in 1968/69 was some 48,000 tons less than in the previous year and regained increase to 220,000 tons in 1969/70. Significance for the long-term outlook is that in the

Ivory Coast, production did not decline in 1968/69, while the Cameroon crop surpassed the 100,000 tons mark for the first time.

4.37 The Latin American output remained generally stable. A fall in output in Equador from the 1967/68 record was partly offset by an increase in Brazil where inspite of the smallholder main crop, the 1969/70 output amounted to 197,000 tons, reflecting the Temporao crop (intermediate or mid-harvest crop) which was the largest since 1953/54.

4.38 The world production in 1970/71 was estimated at 1,492,000 metric tons, up by over 5.3% of the 1969/70 harvest. If these estimates were realized, this production would be the second largest on record falling only slightly short of the 1964/65 all-time high production.

4.39 The African production is forecast at about 1,080,000 tons which is 7.4% over the 1969/70 out-turn of 1,008,000 tons. The large African production during this year is attributable primarily to a substantial increase in Nigeria's production which is forecast to reach 300,000 tons level, reflecting the favourable growing conditions, better agricultural practices and the end of Civil War. Furthermore, the higher production price this season has also encouraged farmers to increase output. Ghana's 1970/71 production is forecast to be near the out-put of the previous year. The 1969/70 main crop has been officially revised at 381,911 tons (357,897 long tons) placing the total 1969/70 production at 414,319 metric tons. The 1970/71 main crop production through March 1971, totalled 379,319 tons with a final total expected to approximate the main crop level of the preceding season.

4.40 Crop prospects for the Ivory Coast have also improved considerably and the production is anticipated to exceed the record 1969/70 harvest of 177,000 tons. Because of the less favourable growing conditions, the Cameroon crop will probably fall short of the record 107,000 tons level of the preceding season.

4.41 The Latin American countries including Brazil, Equador, Venezuela, Columbia, etc. accounted for the next highest world production during the entire period. South American production is expected to be 284,000 tons, reflecting lower Brazilian production.

4.42 Brazil's 1970/71 Bahia main crop is placed at 60,000 tons considerably below the large 1969/70 main crop harvest of 91,740 tons. Weather conditions during the early development of the 1971 Bahia Temporão crop had been quite favourable and an out-turn approximating the high level of the 1969 Temporão of 105,000 tons is possible. The total Brazilian production is forecast at 170,000 tons about 14% from the previous season.

4.43 Equador's 1970/71 crop of 60,000 tons is expected to be up by 11% over last season's 54,000 tons. Lower than normal rainfall during the last few months of 1970 and January 1971 will have a beneficial effect in reducing losses from Monilla Pod Rot which usually damages a high percentage of Equador's crop.

4.44 In the Asian scene, the production is not likely to reflect any significant changes.

4.45 The production of cocoa in the main producing countries is shown in table 4.2.

Table 4.2

Production of Cocoa a

(thousand tons)

	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70 1	1970-71 (forecast)
Ghana c	571	410	376	415	334	403	410
Nigeria c	294	182	263	235	187	220	300
Sierra Leone	4	5	4	4	4	4	5
Trinidad and Tobago	5	5	5	6	4	6	5
Grenada	3	2	3	2	3	3	3
Jamaica	2	2	2	2	2	2	2
Papua and New Guinea	21	18	21	24	27	22	29
Western Samoa	3	2	3	2	2	3	3
Ceylon	2	2	3	2	2	2	2
Brazil	116	171	173	145	163	197	170
Dominican Republic	32	28	28	29	21	42	30
Ecuador	48	35	53	70	54	54	60
Mexico	20	24	25	26	26	24	25
Venezuela	22	22	23	24	23	24	25
Colombia	77	17	18	18	18	19	21
Costa Rica	12	7	9	8	10	6	8
Other Latin America b	14	13	11	10	12	12	12
Ivory Coast	145	112	147	144	142	177	180
Cameroun	90	77	85	91	102	107	105
Equatorial Guinea	34	34	35	33	37	25	30
Togo	-	15	16	18	18	23	25
Sao Tome and Principe	11	8	11	10	10	9	10
Other Africa	27	9	14	14	17	22	23
Other Asia and Oceania	6	7	6	8	8	11	9
Total	1,499	1,207	1,334	1,340	1,226	1,417	1,492

1 Source: except otherwise stated, Gill & Duffus Ltd. - Cocoa Market Report, March 1971. a October-September season except for Mexico and Venezuela which relates to the calendar year (last of the two shown). b Includes other West Indies. c Crop purchases.

World Trade

4.46 Cocoa is traded in the international market in various forms such as dry beans, powder, butter and chocolates. Four fifths of the total trade enters as raw beans and the remainder, around 300,000 tons, is ground in the producing countries, and exported as cocoa butter, paste, powder, or cake. The raw beans are sold in two main grades - ordinary and fine. The former grade constitutes about 90% of the world's output. The West African countries and Brazil together produce most of the ordinary grades. Fine grades are mostly produced by Trinidad, Equador and Venezuela.

Raw Cocoa

4.47 The world cocoa bean import in 1969 approximated 1.04 million tons which was a drop of 3% over the 1968 level of import viz. 1.07 million tons. This has been the fourth consecutive year that import of cocoa beans had fallen. Although the poor 1968/69 African crop was largely responsible for the drop in 1969 imports, the general overall decline in world trade in cocoa beans in recent years has been attributed partly to the increased processing of beans by the producing countries. Cocoa bean grindings in most consuming countries have been curtailed because of the high bean prices which have led to the expanded use of cocoa butter extenders and substitutes. The gross imports of cocoa beans by various consuming countries for the period 1965 - 1969 is shown in Table 4.3.

Table 4.3

COCOA BEANS: Gross imports by specified consuming countries, 1969 with comparisons

Continent & Country	1965	1966	1967	1968	1969
	Metric tons	Metric tons	Metric tons	Metric tons	Metric tons
North America:					
Canada	23,178	16,760	17,683	18,032	13,587
United States	360,097	324,393	287,187	231,869	221,954
Total	383,275	341,153	304,870	249,901	235,541
Latin America:					
Argentina	9,828	11,351	7,444	7,521	6,140
Chile	1,583	2,615	1,835	4/ 1,900	3/
Colombia	13,721	17,782	10,735	9,930	9,540
El Salvador	568	398	406	326	3/
Peru	1,530	1,584	710	1,281	947
Uruguay	433	541	474	787	3/
Total	27,663	34,271	21,604	21,745	20,000
Western Europe:					
EC:					
Belgium-Luxembourg	17,154	16,653	17,178	15,957	15,915
France	63,827	64,103	49,914	43,844	39,618
Germany, West	166,928	148,238	137,776	137,211	131,461
Italy	41,580	40,855	45,089	40,675	42,462
Netherlands	119,336	116,553	109,965	112,876	109,732
Subtotal	408,805	386,402	359,922	350,563	339,188
Other Western Europe:					
Austria	13,170	10,455	10,744	13,633	12,542
Denmark	5,165	4,480	4,523	3,795	4,104
Finland	1,604	1,880	2,031	1,928	1,705
Greece	4,047	4,359	4,765	4,698	4,056
Iceland	50	25	35	26	3/
Ireland	7,132	10,658	11,224	9,425	11,332
Norway	5,431	4,996	5,280	4,536	3,913
Portugal	2,501	2,435	2,259	2,194	2,583
Spain	[illegible]	30,902	27,513	40,673	41,185
Sweden	8,546	7,864	7,062	7,027	6,424
Switzerland	14,992	14,341	13,082	14,822	[illegible]
United Kingdom	82,315	107,762	88,562	77,457	[illegible]
Yugoslavia	13,847	13,888	8,976	9,759	9,606
Total	[illegible]	600,447	545,978	540,536	4/ [illegible]

Continent & Country	1965	1966	1967	1968	1969
	Metric tons	Metric tons	Metric tons	Metric tons	Metric tons
Eastern Europe and USSR:					
Bulgaria	6,071	2,688	8,737	11,736	8,080
Czechoslovakia	14,075	19,251	15,464	12,858	3/
Germany, East	15,341	17,960	16,252	19,151	3/
Hungary	12,522	9,833	9,822	10,866	8,765
Poland	16,083	12,290	19,998	22,556	20,813
Romania	5,559	5,136	5,396	7,071	3/
USSR	88,800	56,500	81,700	109,000	98,600
Total	158,451	123,658	157,369	193,238	4/ 175,000
Africa:					
Algeria	669	687	774	457	673
Morocco	334	358	376	357	261
South Africa	3,452	4,077	6,293	6,420	4,362
Tunisia	370	346	512	203	3/
United Arab Republic	1,210	1,344	406	1,034	1,453
Total	6,035	6,812	8,361	8,471	4/ 7,050
Asia and Oceania:					
Australia	12,870	12,013	17,019	11,075	13,045
China, Mainland 2/	13,312	9,406	2,134	1,000	3/
India	644	971	768	894	3/
Israel	1,135	1,486	910	1,355	1,340
Japan	25,298	37,313	32,539	35,461	31,774
Lebanon	445	449	421	468	304
New Zealand	3,879	4,371	5,358	4,386	2,945
Philippines	6,843	5,408	5,630	5,635	2,547
Syria	76	78	95	209	3/
Turkey	1,042	1,359	1,119	1,088	850
Total	65,562	72,854	65,993	61,571	4/ 55,000
Grand **total**	1,235,209	1,179,195	1,104,175	1,075,462	1,039,430

1/ Preliminary. 2/ Based on export data of producing countries.
3/ Not available. 4/ Estimated.

4.48 The imports of cocoa beans into the principal importing countries are shown in table 4.4.

Table 4.4

Imports of Cocoa Beans into Principal Importing Countries

	1968	1969					1970 '000 tons					1971
		1st qtr	2nd qtr	3rd qtr	4th qtr	Total	1st qtr	2nd qtr	3rd qtr	4th qtr	Total	1st qtr
United Kingdom	76.2	52.9	33.7	8.0	6.1	100.7	18.9	29.8	17.1	15.1	80.9	23.5
Canada	17.7	1.3	3.7	5.7	2.7	13.4	1.5	5.1	5.8	4.5	16.9	1.2b
Australia	10.9	3.9	6.6	4.2	0.6	15.3	5.0	3.6	5.4	0.7	14.7	3.7
New Zealand	4.9	0.6	0.5	2.5	0.8	4.4	0.8	3.2	0.2	0.3b		
Irish Republic	9.3	6.0	5.0	-	0.2	11.2	2.4	3.2	1.1	1.3	8.0	5.3b
United States	228.2	52.6	50.4	53.4	62.0	218.4	83.3	60.7	68.7	66.5	279.2	93.0
West Germany	135.0	42.1	28.0	22.5	36.8	129.4	39.3	26.1	23.5	34.0	122.9	
Netherlands	111.1	28.8	27.6	25.8	25.8	108.0	30.1	29.9	25.6	28.6	114.2	10.6a
France	43.2	14.2	8.6	7.0	9.2	39.0	11.9	9.4	7.2	10.5	39.0	
Italy	40.0	11.6	11.7	6.8	11.7	41.8	11.5	10.4	9.5	10.3	41.7	
Belgium	15.7	5.2	2.8	2.4	5.3	15.7	4.9	4.7	4.0	2.7b		
Switzerland	14.6	5.3	3.5	1.7	2.5	13.0	4.5	7.4	3.3	2.5	17.7	6.2
Sweden	6.9	2.0	1.4	1.1	1.8	6.3	2.1	1.1	1.8	1.3	6.3	1.0b
Austria	13.4	3.2	3.6	3.2	2.3	12.3	2.7	4.1	4.0	2.7	13.5	
Japan	34.9	9.2	8.5	10.7	2.9	31.3	6.9	8.6	11.4	7.4	34.3	
Czechoslovakia	12.7	5.0										
Soviet Union	107.3					97.0						
South Africa	6.0	2.1	0.6	0.2	1.4	4.3	3.2	0.3	0.1	0.3b		

a One month only. b Two months only.

4.49 In the EEC market, import of cocoa beans totalled 339,188 tons in 1969, down by about 3.5% from 350, 563 tons in 1968. In 1970, import of cocoa beans recovered from this low level of the preceding year. In general, the EEC imports account for about one-third of the total world imports. Of the EEC countries, West Germany is the largest importer. In fact, her import is only second to the U.S. imports. The other important EEC importer is Netherlands. The imports by remaining European countries are also considerable as would be evident from table 4.4.

4.50 The USA, whose annual import of cocoa beans is about a fourth of the total world import, imported about 280,000 tons in 1970.

4.51 A feature of the world trade in raw cocoa in most recent years has been the rapid expansion in Soviet imports which are met from the large number of producers, and reached a record level in 1968. In the following year, however, imports were significantly lower, reflecting reduced consignments from all principal suppliers except Brazil. The reduction in imports from Ghana, usually the chief source, was especially marked, and Nigeria became the biggest single supplier. The Soviet import of raw cocoa for the period 1960 - 1969 is shown in the table 4.5.

Table 4.5

Imports of Raw Cocoa into the Soviet Union

(thousand tons)

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Ghana	36.0	15.5	35.1	46.4	39.4	65.5	53.3	54.5	37.5	22.3
Nigeria	11.4	..	1.4	..	8.1	10.9	-	15.5	34.3	26.9
Ceylon	0.6	0.1	0.3	0.7	0.6	0.1	0.5	-	1.0	0.5
Brazil	..	4.7	11.0	5.6	15.9	-	1.8	9.1	6.9	21.3
Ecuador	a	-	-	a	a	a	-	0.1	18.2	14.5
Cameroun	a	-	-	a	0.1	-	..	a	5.9	3.9
Other countries	9.2	-	0.1	0.4	1.1	10.9	-	1.2	3.5	7.6b
Total	57.2	20.3	47.9	53.1	65.2	87.4	55.6	80.4	107.3	97.0

a Included, if any, in "Other countries". b Of which Ivory Coast 3.0.

4.52 West German imports are mainly from Ivory Coast while the Netherlands obtain half of her requirements from Nigeria and Ghana. France has been traditionally importing from Ivory Coast. The UK import is mainly from Commonwealth countries of which Ghana and Nigeria together account for 90% of her imports. The US imports are from different countries in Africa and South America. Lately, the imports from African countries increased by nearly 28% and from the South American countries by about 25%.

4.53 On the export side, the world export of cocoa declined from 1,305,?95 metric tons in 1965 to 993.301 tons in 1969 due to progressively smaller crop in corresponding periods.

4.54 Ghana is the largest exporter of cocoa accounting for more than a third of the world exports. The record export of 50,893 tons from Ghana in 1965 is the highest for any country so far.

4.55 Nigeria exports about 20 to 25% of the world exports while Brazil and Ivory Coast have about a tenth of the export trade each.

4.56 The world export of cocoa bean by country for the period 1965 - 1969 is shown in Table 4.6 and the export of raw cocoa by the principal producing countries during 1970 are shown in Table 4.7.

Table 4.6

COCOA BEANS: Exports by Specified Countries, 1965-1969

Continent & Country	1965	1966	1967	1968		1969
	Metric tons	Metric tons	Metric tons	Metric tons		Metric tons
Africa:						
Angola	188	615	497	474		380
Cameroon	77,053	78.053	69,810	69,737		73,825
Comoro Islands	33	69	56	42	2/	[illegible]
Congo, Brazzaville	697	1,087	1,071	1,441	2/	1,400
Congo, Kinshasa	4,163	4,058	5,457	4,398		4,262
Fernando Po and Rio Muni	30,500	36,409	31,512	39,671		[illegible]
Gabon	3,270	3,782	3,910	3,868	2/	3,900
Ghana	501,893	397,874	334,933	335,264		308,622
Ivory Coast	126,409	124,289	105,166	121,465		118,909
Liberia	720	1,524	1,430	2,291		1,945
Malagasy Republic	342	776	643	668		547
Nigeria	310,175	193,265	248,185	208,885		173,608
Sao Tome and Principe	8,854	10,119	11,687	11,806		[illegible]
Sierra Leone	2,979	4,534	3,870	5,038		4,391
Tanzania	[illegible]	132	141	239		360
[illegible]	17,153	17.124	17,435	14,340		18,580
Total	1,084,906	873,710	835.803	819,627		750,100

Continent & Country	1965	1966	1967	1968	1969
	Metric tons	Metric tons	Metric tons	Metric tons	Metric tons
Latin America:					
Brazil	91,966	112,498	114,351	75,815	119,498
Costa Rica	6,763	7,743	7,194	5,200	8,226
Cuba	-	-	-	-	-
Dominica	3/	3/	71	113	149
Dominican Republic	22,432	25,943	23,927	25,266	23,824
Ecuador	39,280	32,208	45,023	65,072	32,400
Grenada	2,998	2,251	2,469	2,916	2,985
Guadeloupe	21	32	1	2	6
Guatemala	547	474	266	400	3/
Haiti 4/	373	245	356	495	3/
Honduras	38	46	88	81	3/
Jamaica	2,253	1,524	606	1,456	1,737
Martinique	10	14	3/	3/	3/
Mexico	9,308	8,442	6,112	5,881	5,314
Nicaragua	313	225	348	139	64
Panama	649	436	396	379	426
St. Lucia	17	259	94	145	106
St. Vincent	40	20	31	24	21
Surinam	202	139	75	55	3/
Trinidad & Tobago	4,866	4,790	4,701	5,989	3,911
Venezuela	12,105	11,795	12,447	14,401	10,278
Total	194,181	209,084	218,556	203,829	208,945
Asia and Oceania:					
Ceylon	1,438	2,161	1,180	1,766	2/ 1,800
Indonesia	20	233	321	261	2/ 275
Malaysia 5/	788	1,058	1,333	1,914	2/ 2,000
New Guinea & Papua	21,151	18,360	21,248	24,364	25,609
New Hebrides	515	696	706	951	2/ 900
Western Samoa	2,896	2,581	3,098	2,111	3,672
Total	26,808	25,089	27,886	31,367	34,256
Grand Total	1,305,895	1,107,883	1,082,245	1,054,823	993,301

1/ Preliminary. 2/ Estimated. 3/ Not available.

4/ Year ending September 30. 5/ Includes West Malaysia and Sabah.

Table 4.7

Exports of Raw Cocoa from Principal Producing Countries

(thousand tons)

	1970					1971
	1st qtr	2nd qtr	3rd qtr	4th qtr	Total	1st qtr
Ghana	95.9	104.7	80.9	92.0	373.5	197.4
Nigeria	47.8	60.0	38.5	46.1	192.4	41.8c
Sierra Leone	3.6	0.1	- bc			
Trinidad	2.8	1.2	1.0	0.9	5.9	
Grenada	0.3d					
Jamaica	0.5	0.3b	0.3b			
Ceylon						
Western Samoa	0.7b	0.4b	0.5b	0.3bc		
Papau and New Guinea	6.0	6.5	5.4	5.2	23.1	7.5
Brazil	22.1c	10.0c	47.9c	25.8c	105.8c	
Ecuador	7.7b	21.1b	9.5b	3.2bc		
Dominican Rep.	6.4	20.6	4.8	0.1c		
Venezuela	3.6b	3.3b	3.2b	1.3b	11.4b	
Costa Rica	0.9b	0.5b	0.2bc			
Mexico	4.3b	1.1b				
Ivory Coast	55.1	9.0	12.2			
Cameroun	34.5	5.4	3.6b		79.7b	
Togo	10.5b	3.8b				
Equatorial Guinea	6.0b	0.8b	0.3b	8.7b	18.8b	
Sao Tome and Principe	3.0	2.2	1.4	1.4c		
Congo (Kinshasa)	1.3b	1.6b				
Total	313.0f	252.6f				

a Revised. b Provisional. c Two months only. d One month only.

e Exports from the State of Bahia only. f Incomplete.

Distribution of exports

The increase of nearly one-third in exports of raw cocoa from Ghana in 1970, compared with 1969, was principally the result of the heavier crop in 1969-70 and reflected increased shipments to most of the major outlets, particularly to the United States, the EEC, the Soviet Union, Yugoslavia and

Japan. As consignments to the United Kingdom and Canada fell, the Commonwealth as a whole took only 14 per cent of the total, as against 21 per cent in the previous year. In the first quarter of 1971 exports to the United States, the EEC and Japan continued to expand markedly, those to the United Kingdom and Canada showed a sharp recovery but those to the Soviet Union, Poland and Czechoslovakia, among others, fell.

Prices of Cocoa

4.56 Cocoa prices fluctuate from year to year. It reached a record high of US 44.3 cents/lb. (N.Y.) in 1958 and thereafter fell sharply to US 17.3 cents in 1965. Since then, there had been a slow but progressive recovery until 1968, probably due to shortage of supply. The price of cocoa somewhat declined during the first half of 1969 from the high levels of late 1968, an average of about US 39 cents a pound. With the rumours, prevailing then, of less favourable prospects of West African production, speculative buying was stimulated and the price rose to US 42 cents in November 1969. The rumours were found to be baseless and the prices began to decline from December 1969 onwards, and in February 1970, the price averaged US 29 cents per pound. The 1969 average price was US 39.5 cents per pound as against US 32.9 cents in 1968 and US 26.4 cents in 1967. The cocoa price fell slightly in 1970 and in 1971 the market remains relatively steady and prices fluctuate fairly narrowly with the tendency to drift lower. The lack of manufacturers' interest and the easier supply position tend to depress prices.

4.57 The average spot prices of raw cocoa on New York and London markets for the period 1958 - 1970 is shown in Table 4.8.

Table 4.8

Average Spot Prices of Raw Cocoa on New York and London Markets

	Ghana fair fermented				Bahia, New York cents per lb
	New York		London in bond ex-store per cwt		
	cents per lb	sterling equivalent s. per cwt	s.	d.	
1958	44.3	353	352	5	43.3
1959	36.6	292	285	6	35.4
1960	28.4	227	225	10	26.8
1961	22.6	181	179	11	22.4
1962	21.0	168	170	1	21.3
1963	25.3	203	208	2	26.5
1964	23.4	188	190	8	23.1
1965	17.3	138	140	7	16.9
1966	24.4	196	196	4	23.0
1967	29.1	233	241	10	26.4
1968	34.4	321	324	8	32.9

As quoted by Gill and Duffus Ltd.

4.58 It is estimated that in the long run, there would be a demand for about 1.8 million tons of cocoa at US 25 cents per pound by 1975. The world production of cocoa is likely to increase but probably by not more than 1.5% to 2% a year. The large percentage increase will probably be in the Ivory Coast and Cameroon which have developed comprehensive production expansion programmes; the restoration of peace in Nigeria has also generated greater activity in the agricultural sector of the country. In Ghana, however, no major expansion is likely to take place as unlike its counterpart producer i.e. Nigeria, the producers' price has not been raised and extension services have not been restored. Some expansion in production is also likely in Latin America and Asia, but the quantities would not be large. In the long term, the price outlook for cocoa would, therefore, appear to be favourable, more so than for most tropical agricultural commodities.

Cocoa Bean Grinding

4.59 World raw cocoa consumption is often measured in terms of grinding of the beans. This is also a good indicator of consumption in individual countries which do not have a large import or export trade in manufactured cocoa product.

4.60 Since 1960, total world cocoa grindings have gradually increased. USA, West Germany, Netherlands and France accounted for more than 50% of the total. Except for USA, where it gradually increased, grinding in other countries showed a fluctuating pattern. In the cocoa producing countries, grinding is gradually rising, though it is still small, being about 21% in 1969.

4.61 Grindings by the European Economic Community in 1969 declined amounting to 336,700 tons compared with 359, 100 tons in 1968. Preliminary data indicate that the 1970 EEC grinds could go up slightly. Grindings by the Netherlands during 1970 amounted to 114,840 tons, an increase of 3.8% over the 1969 grindings. West German grindings during 1970 increased slightly to 125,838 tons. France's 1970 grindings were 53,000 tons and grindings by Italy and Belgium were 42,400 and 17,100 tons respectively. Cocoa bean grindings in the United Kingdom during the third quarter of 1970 fell by 12% from the corresponding period of the previous year. The grindings for the first nine months amounted to only 59,700 long tons, a decline of 13.5% for the same period in 1969. The total 1969 grind was 80,900 long tons. The US cocoa beans grindings in 1970 totalled 265,309 tons which was lower by 1.4% from 1969 grindings of 269,028 tons.

Cocoa Butter, Paste and Powder

4.62 Over the period of the last 10 - 15 years there has been a marked increase in the quantity of beans processed in the producing countries, though the rate of growth has been slow due to lack of capital, management and technical skills. Climate conditions have also made the storage of beans expensive and cumbersome. High level of import duties in most of the major consuming countries has also been another factor affecting faster growth. Even after the Kennedy Round concessions, the duties amount to a considerable proportion of the landed costs and thus tend to make processed cocoa products from the developing countries less competitive in this market. For example, it was agreed that the common external tariff of the EEC on cocoa butter, paste and powder in 1972 will be reduced respectively to 12%, 15% and 16% ad valorem. In Japan, the comparable tariff rates will be 5%, 10% and 30%, unless they are reduced or abolished under the UNCTAD scheme of generalized preference.

4.63 The world trade in cocoa butter showed an underlying upward trend in the sixties though this increase was not particularly apparent during 1967 - 1969. However, a sharp rise earlier on in the decade meant that exports from 1966 at around 130,000 tons per annum were 60% higher than the 1960/1964 average. Shipments from developing countries represented nearly half of the total. Those from Cameroon, Ivory Coast, Nigeria, Equador and Mexico have registered a continuous rise in recent years but consignments from the relatively older exporting countries such as Brazil, the Dominican Republic and Ghana have fallen stiffly.

4.64 Among the developed countries, exports from the Netherlands, which is easily the largest exporter of cocoa butter, accounting for nearly a fifth of the world's total, continued to expand, as did those from West Germany and Japan, although at a much lower level. The main markets for Ghana and Brazil are the United Kingdom, Japan, the Netherlands and the United States. The Netherlands in turn, make heavy consignments to the United Kingdom, and to fellow members of the EEC, particularly West Germany and Belgium, and other markets in Europe, America, Asia and Africa.

4.65 On the other side of the trade, the United Kingdom remains the world's largest import market for cocoa butter although imports have fallen considerably of late, from 28,213 tons in 1966 to 20,939 tons in 1970. The other principal import markets, in order of size are the Netherlands, West Germany, Japan, Belgium, Switzerland, the United States and the Soviet Union. The import and export of cocoa butter by principal countries are shown in tables 4.9 and 4.10.

Table 4.9

Imports of Cocoa Butter into Principal Importing Countries

(tons)

	1965	1966	1967	1968	1969	1970 January to month indicated	
Australia b	3,055	3,615	3,951	3,297	2,975	June	4[illegible]7
Canada	5,887	6,940	5,778	7,387	3,765	September	3,962
United Kingdom	26,873	28,213	25,859	25,355	22,154	December	20,939
Austria	1,403	1,506	1,776	1,340	900	September	62[illegible]
Belgium	6,856	6,719	7,249	7,098	8,166	August	4,552
Denmark	1,346	1,586	1,340	1,205	1,072	October	78[illegible]
Finland	1,630	1,874	2,087	1,732	1,821	October	1,21[illegible]
France	5,860	5,750	6,945	6,261	6,460	..	
W. Germany	4,192	5,583	5,693	9,166	12,512	October	9,702
Italy	295	1,104	1,035	1,164	1,402	September	729
Netherlands	7,455	11,474	16,080	17,116	16,131	October	10,466
Irish Republic a	1,094	1,676	1,306	1,291	936	October	812
Japan a	9,454	14,113	12,730	12,043	8,775	September	5,105
Norway a	1,083	1,206	1,249	1,461	1,223	November	1,243
Sweden	3,216	3,224	2,531	2,652	2,452	October	2,1[illegible]0
Switzerland	7,152	9,536	7,684	8,069	7,713	November	6,909
Soviet Union	5,350	98	689	7,996	12,600		
United States	7,810	9,479	10,343	8,908	6,453	November	14,332

a Includes cocoa paste and or powder. b Year ending June of the year shown.

Table 4.10

Exports of Cocoa Butter from Principal Exporting Countries

	Average 1960-64	1965	1966	1967	1968	1969	1970 January to month indicated	
Cameroun	3,632	6,540	3,743	5,147	7,910	9,821		
Ghana	6,946	21,045	38,821	23,434	19,677	17,734		
Ivory Coast	90c	3,462	6,787	7,005	7,650	7,751	February	1,030
Jamaica	309	52	267	295	238	175		
Nigeria	-	-	-	-	..	10,442		
Brazil	15,501	16,925	20,684	20,629	18,144	15,019		
Ecuador	13	95	990	722	1,742	..		
Dominican Rep. a	1,966	854	72	-	-	9		
Mexico	33	-	196	931	1,392	1,672		
Philippines	499	510	830	780	422	240		
United Kingdom	2,152	1,883	2,687	2,417	2,661	1,683	December	1,536
France	1,791	1,284	1,632	392	66	14		
West Germany	467	2,531	1,941	2,685	2,461	2,278	October	3,514
Italy	5,400	5,315	4,885	4,303	3,236	2,877	September	2,275
Netherlands	36,771	43,804	45,666	49,644	50,035	50,122	October	38,249
Irish Republic a	985	1,764	1,697	2,121	2,528	1,982	October	1,962
Spain	461	419	268	630	910	637	September	374
United States	179	91	183	125	281	214		
Japan	214	1,956	2,286	2,011	3,228	3,500	September	2,029
Total	78,300	111,100	128,300	126,200	132,600	128,800		

a Includes paste and or powder or liquid cocoa. b Including "other countries."

4.66 During the later half of 1960s, the trade in cocoa paste, rose rapidly and exports which totalled 63,700 tons in 1969 are expected to increase again to a record level in 1970. Developing countries, notably Ghana, Nigeria, Cameroon, Ivory Coast and Dominican Republic provide the great bulk of the exports. The principal markets are the United Kingdom, Canada and France. The trade in cocoa paste by the principal exporting and importing countries are shown in Table 4.11.

Table 4.11

Trade in Cocoa Paste

(tons)

	1966	1967	1968	1969
Exports				
Ghana b	23,743	42,245	24,778	..
Nigeria b	-	-	..	10,383
Cameroun b	3,936	9,987	7,463	9,015
Ivory Coast	676	2,582	7,724	6,582
Dominican Rep. c	912	930	597	606
Haiti	1,111	2,463	2,493	..
United Kingdom	939	602	739	847
France	344	172	216	177
W. Germany	4,508	3,648	2,271	3,213
Netherlands	2,612	2,897	2,302	3,472
Italy	999	956	550	784
Total a	40,500	50,800	59,100	63,700
Imports				
Australia d	732	687	1,001	975
Canada b	4,730	8,241	7,788	9,010
United Kingdom	4,405	5,478	7,689	13,064
Argentina c	388	141	1,336	1,239
United States d	3,453	3,922	4,397	3,655
Belgium	6	102	492	815
France	2,713	3,666	13,953	10,942
W. Germany	927	2,020	1,033	2,277
Netherlands	2,522	4,483	5,049	4,122
Irish Rep. b	3,121	3,013	3,694	2,212
Total a	23,300	32,400	47,300	49,800

a Including other countries. b Including cocoa cake and or blocks.
c Including liquid cocoa or cocoa powder. d Chocolate unsweetened.
e Relates to the year ending June of the year stated.

4.67 World exports of cocoa powder have fluctuated between 65,000 tons and 69,000 tons in recent years, nearly 9/10th from developed countries including West Germany, United Kingdom, Italy and the Netherlands. The Netherlands accounted for more than half of the total. Among the principal markets for cocoa powder, the United States alone takes about two-thirds of the trade, followed at a much lower level by West Germany, Canada and France. The imports and exports of cocoa powder by the principal countries are shown in table 4.12.

Table 4.12

Trade in Cocoa Powder

(tons)

	Average 1962-65	1966	1967	1968	1969
Exports					
Ghana	7	4,869	3,585	3,717	..
Ivory Coast	1,320	6,737	325	25	201
Brazil	852	1,639	904	1,259	1,078
Ecuador	5	282	703	784	..
Mexico	-	2	-	2,560	2,746
United Kingdom	4,145	4,927	5,502	5,610	5,388
Belgium	281	360	105	583	1,036
France	1,430	1,057	1,261	1,355	502
W. Germany	8,359	10,506	11,061	10,254	9,814
Italy	4,367	5,007	3,577	3,397	3,115
Netherlands	28,847	29,749	33,504	36,004	36,354
United States	2,434	1,492	1,718	1,971	1,371
Total a	53,100	68,500	64,800	69,800	69,100
Imports					
Australia b	735	663	788	830	858
Canada	2,257	2,868	3,371	3,106	2,929
Philippines	647	1,260	1,571	1,580	1,383
Belgium	1,140	1,365	1,572	1,488	1,512
France	380	1,294	1,053	2,658	2,861
W. Germany	5,284	4,562	4,714	5,756	7,838
Italy	148	267	263	583	779
Netherlands	831	888	1,356	866	638
United States c	37,945	44,338	46,857	53,798	55,103
Total a	60,700	68,400	72,300	81,600	84,300

a Including other countries. b Relates to the year ending of the year shown.
c Includes sweetened/unsweetened cocoa and cake.

4.68 U.S. is the most important market for chocolate products. Most of the US supplies of unswettened chocolate is coming from Mexico, Haiti and Netherlands, followed by Dominican Republic and Ivory Coast. The swettened chocolate bars, not under 10 lbs. each are from Switzerland, Belgium, Dominican Republic and Israel. U. K., Netherlands, Ireland, Czechoslovakia and Belgium and in a small way Dominican Republic and Germany, are exporting swettened chocolate not in bars and blocks. Confectionery coating comes from Switzerland while candy and other confectionery containing cocoa and chocolates are supplied by the United Kingdom, Canada, Germany and other countries.

Malaysian Situation

4.69 The first cocoa plantation in West Malaysia on an estate basis started in 1951 on 1,200 acres in Trengganu. In 1956, another area 1,434 acres approximately was taken up for cocoa plantation in Ulu Trengganu, also on an estate scale. In 1960, inter-cropping trials with coconut was undertaken in Lower Perak and by 1967 an area of 785 acres were successfully inter-cropped. Over to East Malaysia, Borneo Abaca Company was granted pioneer status in 1950s for commercial production of cocoa in Tawau Division of Sabah. At present, this company have 7,000 acres under cocoa. There are also some smallholders in the State scattered on the east coast and also in the Kota Kinabalu Division accounting for another 700 acres of sole crop equivalent of cocoa.

Sarawak Situation

4.70 Though attempts made to introduce cocoa planatation in Sarawak from the 70s of the last century until the end of 1930s failed for reasons not definitely known, it was established by 1949 that cocoa could be successfully grown in the State. Trials were conducted at Tarat Research Station with 500 seedlings of West African Amelonade in 1950. The growth was good and, therefore, seedlings produced from the station were later planted in other places in the First Division and also in the Fourth and Fifth Division. Shortage of adequate extension personnel resulted in the abandoning of these plantations.

4.71 Trial plots at Tarat, however, were maintained and it was found that in the five seasons during 1959 to 1964, the plot measuring 0.38 acres with 15' x 15' spacing yielded cocoa equivalent to a per acre production of 1,671 lbs; while yield from the other plot measuring 0.12 acres with 10' x 10' spacing was equivalent to 1,922 lbs/acre. Though the results were encouraging, it was not possible to undertake plantation of cocoa in a big way as the soil experimented on, viz. Lateritic and Recent alluvial was so very limited in acreage.

4.72 Fresh trials were, therefore, undertaken on a variety of soils, particularly on the saline clay soils. This soil type is obtained in all the Divisions of Sarawak; the two largest areas are the mouths of Sarawak and Rejang Rivers. Some areas in these two regions, which were cleared and drained almost half a century ago are now under variety of crops and these are some of the most productive soils in Sarawak. One of the crops most widely grown in these areas is coconut and the trials undertaken by the Agriculture Department established that these areas have most immediate prospects for cocoa. Soils in these areas have been designated as Pendan Series, leached phase. Clay and silt fractions predominate but more sandy texture occurs in places; typically they contain a high amount of organic matter. Clay features are present throughout the profile. The pH varies between 4 and 5 or slightly more. There are enough exchangable nutrients though these are rapidly leached on draining.

4.73 Trials carried out on red yellow podzolic soil under a shade of Adenanthera Pavonia with seeds of variety of crosses between Trinitario and upper Amazon have also yielded encouraging results so far.

4.74 Observations on diseases and pests in the trial plantation confirmed that these are somewhat similar to those described generally earlier in the chapter. Experiments with fertilizers have not yet yielded any conclusive results.

4.75 Tall coconut grown on marine clays at 30' x 30' spacing have been found to be providing adequate shade for young cocoa at 6 - 8 years, when well maintained. Banana plants with 10' x 10' spacing, have also been found to be providing uniform shed in 10 months. For lateral shade or shelter, Flemingia Congesta and Indigofera teysmanni have been proved to be satisfactory and are easy to establish from seeds.

4.76 With all these experiments, large-scale field trials were initiated in the Deliong-Nonok area of First Division and these trials established that with the right type of clones (hybrid), proper fertilization and maintenance, it is possible to grow cocoa inter-cropped with coconut in Sarawak. It has also been established that cocoa will grow well where coconuts grow well, with the exception that there are some sandy areas where coconuts can grow reasonably well but not cocoa. In addition, small trial plantations were also undertaken in the other Divisions of the State.

4.77 The total acreage so far inter-cropped (cocoa-coconut) is shown in Table 4.13 below.

Table 4.13

Year	Acreage
1967	6
1968	179
1969	314
1970	484
Total	983

4.78 Of these, 722 acres were in the First Division, 200 acres in the Second Division and 61 acres in the Lower Rejang area of the Third Division. The Agriculture Department has plans to increase this acreage throughout the State for the next 5 years and the intention is to inter-crop all the suitable areas under coconut with cocoa.

Cost of Planting and Bringing to Maturity

(Intercropping in Smallholder)

4.79 Assuming that no extra labour force is required for intercropping coconut with cocoa on a smallholding scale, the cost will vary according to stands per acre and planting policies. Under similar spacing, the number of points per acre will be decided by the shape of the land and other conditions. For example a square plot of land will accommodate more stands than a narrow piece of land of similar area. Also with the narrow piece of land having many transverse drains, the total number of stands would be less.

4.80 In the Nonok area, most coconut farmers have planted between 160 points to 200 points of cocoa per acre. Taking an average of 200 points per acre, the cost of planting materials, fertilizers, pesticides and fungicides etc., estimated by the Agro-Economist in the State Agriculture Department would come to about $40 for the first year and $50 for the second year and $60 for the third year. The first yield is likely to be obtained during the third year. Assuming one processing unit for over 20 acres and equal sharing of cost, the per acre cost has been worked out at $90, including transport charges for building materials. Thus the total cost from planting to maturity in three years is $240 per acre.

Yield Prospects

4.81 The yield of cocoa, depending on vagaries of nature, is likely to be erratic. In Sarawak, the expected yield per acre of an average of 200 trees is likely to range from 142 - 400 pounds of dried beans during the first few years and then a larger yield ranging from 800 - 1,000 lbs. during the subsequent years as the tree grows towards a maximum age of yield.

Cost of Production of Cocoa

4.82 According to the State Agriculture Department, in inter-cropping, there will be no extra labour force and general expenses required. The maintenance cost would, however, be around $50 per acre per annum. The cost of harvesting and processing based on West Malaysia's estate management standard is around 10 cents per pound of dried beans produced, and it is expected to be cheaper under smallholders' management in Sarawak. As the labour cost is higher in East Malaysia, compared to those in West Malaysia the Agro-Economist of the State Government assumed a cost of 12 cents per lb. in the following calculations as cost of harvesting and processing for each 11/3 pound (1 katie - a local measure) of dried beans produced. It has also been assumed in the following calculation, an average yield of 4 piculs (1 picul - 133 lbs.) per acre for a duration of 10 years. The production cost calculation is as below:-

Maintenance cost per annum	$50
Harvesting and processing of 4 piculs per annum	$48
Sharing of cost from planting to 1st crop	$24
Transportation plus other charges of beans to Kuching at the rate of $2 per picul	$ 8
Total	$130

Assuming a price of $100 per picul of dried beans ex-Kuching, sales per annum per acre is $400 and the net gain is thus $270.

Cost of Production of Coconut inter-cropped with Cocoa

4.83 With the cost of production of copra at $14 per picul and assuming an average of 12 piculs per acre per annum, the margin of profit with a selling price of $25 per picul would be as below:-

Cost of production per 12 piculs	- 14 x 12 = $168
Sales per annum per acre	- 12 x 25 = $500

Profit margin	- $300-168 = $132
Combined profit from cocoa and coconut inter-cropped would therefore be	- $270+132 = $402/acre/annum

This profit per acre compares very well with profits from other crops under Sarawak conditions, and is therefore increasingly becoming popular with the farmers.

Malaysian Trade

4.84 Though there has been an increased production of cocoa beans in Malaysia during recent years, there has hardly been any consumption locally as there is no processing facility available in the country. The entire production of cocoa beans is therefore exported. The Malaysian export of cocoa beans for the period 1965 - 1969 is shown in Table 4.14.

Table 4.14

Cocoa Beans Export - Malaysia (in lbs.)

	1965	1966	1967	1968	1969
West Malaysia	-	-	692,992	-	939,216
Sabah	939,302	1,692,550	2,247,420	3,132,230	n.a.
Sarawak	-	-	912	-	6,751
Total	939,302	1,692,550	2,941,324	3,132,238	945,967

Sabah has been the main exporter of cocoa while Sarawak entered into the field with a small production of 912 lbs. in 1967. In 1969, the export rose to 6,751 tons. The export of cocoa beans in 1970 was 9,043 tons. The 1971 export is likely to be higher.

4.85 There has been an increasing import of various cocoa products into the country. The combined import of cocoa powder for all the Malaysian states, though inconsistent over a period of years, was 245 tons in 1969 as against 196 tons in 1966, 145 tons in 1967 and 246 tons in 1968 as shown in table 4.15.

Table 4.15

Malaysian Retained Imports of Cocoa Powder

Territory	1966		1967		1968		1969	
	Qty. Lbs.	Value $	Qty. Lbs.	Value $	Qty. Lbs.	Value $	Qty. Lbs.	Value $
W. Malaysia	368,870	541,881	355,545	439,739	384,799	530,800	491,630	739,843
Sabah	10,489	24,146	15,165	35,067	128,654	29,606	12,035	31,172
Sarawak	54,586	81,514	42,610	64,001	37,617	57,834	45,484	70,547
Malaysia	433,945	647,541	413,320	538,807	551,070	618,240	549,149	841,762
Total Tonnage	196 tons		185 tons		246 tons		245 tons	

4.86 The import of chocolate and other cocoa preparations rose consistently up to 1968 and in 1969 there was sudden drop of import to 1,040 tons as shown in table 4.16.

<u>Table 4.16</u>

<u>Malaysia: Retained Imports of Chocolate and other Cocoa Preparations</u>

Territory	1966		1967		1968		1969	
	Qty. Lbs.	Value $	Qty. Lbs.	Value $	Qty. Lbs.	Value $	Qty. Lbs.	Value $
W. Malaysia	1,840,681	3,5[illegible],019	2,074,595	4,075,761	2,249,114	4,794,983	2,072,129	[illegible]
Sabah	240,760	517,101	214,104	443,674	227,432	480,387	167,338	[illegible]
Sarawak	214,302	[illegible]	130,122	257,309	228,517	352,627	79,814	[illegible]
Malaysia	2,295,743	4,4[illegible]0,242	2,418,821	4,776,744	2,875,063	5,627,997	2,319,781	[illegible]
Total Tonnage	1,022 tons		1,080 tons		1,262 tons		1,040 tons	

4.87 The import of cocoa butter, and cocoa paste into Malaysia is not very significant as would be seen from the table at 4.17. Most of these items are imported mainly into West Malaysia.

<u>Table 4.17</u>

<u>Malaysia: Retained Imports of Cocoa Butter, Cocoa Paste, Unsweetened</u>

Territory	1966		1967		1968		1969	
	Qty. Lbs.	Value $	Qty. Lbs.	Value $	Qty. Lbs.	Value $	Qty. Lbs.	Value $
W. Malaysia	14,999	21,280	3,814	7,805	6,598	16,806	6,869	16,079
Sabah	1,680	1,932	-	-	n.a.	n.a.	-	-
Sarawak	4	25	-	-	n.a.	n.a.	-	-
Malaysia	16,683	23,237	3,814	7,805	n.a.	n.a.	6,869	16,079
Total Tonnage	7.5 tons		1.9 tons.		n.a.		3.06 tons	

4.88 The import of cocoa powder, chocolate and other preparations into Sarawak, with their sources, for the period 1966 - 1970, are shown in tables 4.18 and 4.19. The volume of imports in all the cases were erratic.

4.89 Cocoa powder mostly came from Mainland China, Singapore, India and United Kingdom, while chocolate and other preparations came mostly from United Kingdom, Singapore, West Malaysia and Mainland China.

4.90 The price of cocoa powder rose slowly but consistently. As against a price of M$1.49 per lb. in 1966, the price increased to M$1.55 per lb. in 1969. The 1970 price was M$1.51 per lb. reflecting a greater world supply in 1969. The average price of chocolate and other preparations, also reflecting world supply of the basic raw materials, fluctuated between M$1.7[illegible] to M$2.52 per lb.

4.91 Due to the decrease in the European population in the State, the demand of various cocoa and cocoa products during the past decade, has gone down. This has, however, been somewhat offset by the increased consumption by the local population. With the increase in per capita income and also the percentage rise in the population, the consumption of cocoa and cocoa products is likely to increase at the rate of 5 - 7% during the coming years.

Table 4.18

[illegible] Imports and Exports Cocoa Powder for 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	lb.	$	lb.	$	lb.	$	lb.	$	lb.	$
Imports										
Australia	-	-	12.00	28	-	-	90.00	44	-	-
China [illegible]	39,790.00	51,261	30,414.00	39,476	26,413.67	33,771	[illegible],158.92	44,[illegible]	27,181.15	54,93[illegible]
India	-	-	-	-	212.00	568	1,524.00	3,90[illegible]	2,460.00	5,944
Netherlands	3,46[illegible].00	8,506	98.00	245	18.00	54	28.00	88	36.00	103
Singapore	3,01[illegible].69	7,002	5,780.00	13,154	5,381.00	13,30[illegible]	6,064.00	15,38[illegible]	5,283.82	10,816
United Kingdom	8,313.00	14,745	6,162.00	10,718	5,592.00	10,125	2,619.00	6,1[illegible]	1,525.50	3,0[illegible]
U.S.A.	-	-	-	-	0.37	8	-	-	-	-
Other Countries in [illegible] Africa	-	-	144.00	380	-	-	-	-	-	-
Total	54,525.69	81,514	42,610.00	64,001	37,617.04	57,834	45,483.92	70,547	36,486.47	54,851
CIF Price/lb.		1.49		1.50		1.53		1.55		1.51

Table 4.19

Sarawak Imports and Exports of Chocolate and Other Preparations for the Year 1966-1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	lb.	$	lb.	$	lb.	$	lb.	$	lb.	$
Imports										
Australia	33.00	107	24.00	185	120.00	150	14.20	69	-	-
Belgium-Lux.	581.20	1,342	826.07	2,103	2,327.35	5,629	1,691.90	4,102	211.59	448
China Mainland	14,950.67	24,685	4,254.00	6,986	4,738.00	6,004	4,237.00	7,967	-	-
Czechoslovakia	2,720.00	4,682	2,600.00	4,395	2,920.00	3,122	360.00	705	-	-
France	-	-	-	-	508.00	1,013	457.00	1,013	-	-
Germany Federal R.	960.00	550	4,887.50	5,138	3,440.00	3,504	240.00	460	-	-
Hong Kong	106.00	259	-	-	150.00	209	258.00	1,020	-	-
India etc.	3,368.00	5,613	2,425.00	3,890	3,777.00	6,702	3,531.32	6,385	241.00	486
Japan	8,383.72	10,716	24,494.78	48,735	13,944.14	20,482	4,472.31	7,970	29.60	109
West Malaysia	18,070.00	16,438	12,535.00	13,702	99,908.60	60,318	31.50	80	5,232.00	4,578
Netherlands	17,260.59	29,385	9,016.00	12,999	6,772.73	14,236	3,649.82	6,449	675.60	2,081
Singapore	48,776.86	88,643	29,622.79	58,786	25,468.77	59,066	15,306.59	38,834	6,385.81	18,951
Switzerland	502.55	2,175	159.41	1,694	432.25	2,544	295.31	2,376	29.78	129
United Kingdom	98,275.85	194,827	39,333.83	98,046	62,923.45	168,820	45,269.15	124,194	16,775.93	47,808
Eire	120.00	329	-	-	-	-	-	-	-	-
Germany Eastern	160.00	325	320.00	650	-	-	-	-	-	-
U.S.A.	34.13	46	-	-	386.95	510	-	-	9.00	60
U.S.S.R.	-	-	-	-	700.00	318	-	-	-	-
Total	214,302.57	380,122	130,498.38	257,309	228,517.24	352,627	79,814.10	201,624	29,590.31	74,650
C.I.F. Price/lb.		1.78		1.97		1.54		2.52		2.51

Proposal for Cocoa Plantation and Processing in Sarawak

4.92 In the Regional Planning Study report on the First Division of Sarawak, the Dutch team considered that 198,000 acres is suitable for cultivation of cocoa in the First Division alone. They have proposed that by 1990 the State should undertake plantation of 25,000 acres with cocoa in the following manner.

Table 4.20

Year	Acreage (1st Division)
1975	2,000
1980	5,000
1985	15,000
1990	25,000

4.93 This recommendation is perhaps outdated in the sense that at the time the study was made, the successful experimental results of cocoa plantation in Sarawak was not known. The situation by now has changed and it should be worthwhile for the State to consider undertaking large-scale estate-type plantation in the Lambir-Subis area of the Fourth Division with 5,000 acres, in view of the soil suitability and favourable climatic condition of the area. The Commonwealth Development Corporation who have manage plantations in Sarawak is reported to be interested to undertake such plantation.

4.94 The development of inter-cropping in smallholder plantation can continue as this would enhance the poor per acre return of coconut smallholdings without which the coconut farmers might slowly but progressively abandon the plantations. An estate-type plantation could help the farmers with the supply of right type of clones and also technical information for achieving better yields. It would also be possible for the estate to buy the beans from the smallholders for further processing in the estate factory before trading in the international market.

4.55 The estimated total acreage under coconut in **Sarawak** during 1971 - 1975 is shown in the table at 4.21. Assuming that 25% of this area would be inter-cropped with cocoa (the Agriculture Department [illegible] to inter-crop the entire area), by 1975 an area of over 30,000 acres would be under cocoa and coconut inter-cropped.

Table 4.21

Estimated total acreage under Coconut in **Sarawak**

1971 - 1975

Year / Area	1971	1972	1973	1974	1975
First Div.	47,654	51,154	54,654	58,154	61,654
Second Div.	22,635	24,385	26,135	27,885	29,635
Third Div.	12,273	13,183	14,093	15,003	15,913
Fourth Div.	5,258	5,678	6,098	6,518	6,938
Fifth Div.	5,477	5,897	6,317	6,737	7,157
Sarawak	93,297	100,297	107,297	114,297	121,297
25% of total	23,324	25,074	26,824	28,574	30,324

4.56 The total area inter-cropped up to the end of 1970 was only [illegible] acres as against the total coconut acreage of 6,925 (refer tables 4.15 and 3.12). Thus there is a large gap between the actual planted acreage and planned acreage. The State Government therefore would have to intensify their efforts to reduce this gap. Assuming that by 1974 the State Government would catch up with the target, the combined total area inter-cropped in that year would be 28,500 acres. As the plantation up to 1971 is not likely to be more than 5% of the total area, the productive acreage in 1974 would be around 4,600 acres. Based on the average yield of [illegible] lbs. per acre (conservative estimate) during the initial years and [illegible] considering the fact that cocoa trees come to bearing in the third year, in 1974 the total quantity of dried beans available would be [illegible] million lbs.

4.97 If land is allocated for an estate-type plantation immediately in the Lembir-Subis area, some yield would also be available from this plantation by the end of 197[illegible]. Assuming that the productive acreage in the estate would be around 400 acres (estimating conservatively), the total production from this would be 160,000 lbs. based on the same per acre yield of 400 lb. Then the total quantity of dried beans available in 197[illegible] would be 2 million lbs. Such a production would justify establishment of a plant initially for the production of cocoa powder and cocoa butter. The manufacture of chocolates and other products can be undertaken in a second plant subsequently.

4.98 Presently, no company in Malaysia has yet engaged in the large-scale production of chocolate and other cocoa products. However, the Malaysian Government has to date, granted approval in principle to four companies for integrated manufacture of chocolate products, commencing from cocoa beans up to finished chocolate. None of the approved companies have so far commenced production. Of the four factories three are proposed to be located in West Malaysia and the other one in Sabah.

4.99 In view of the established market and also sophisticated nature of production process and consumer preference in the US market, it might not be possible to enter into the US market as also in the market of the European Community. Production of chocolates might be undertaken to cater for the markets of this region including those in Singapore, Thailand, Philippines, etc. The chocolate trade has expanded 60% during the last 10 - 15 years and it is continuing to do so not only in the western countries but also in the centrally planned and developing countries. To cope with the increased demand and in the effort to keep down manufacturing costs, semi-automatic mass producing factories have been established throughout the world. These factories are capable of processing up to 100 tons of cocoa beans daily. The production of unsweetened cocoa, cocoa cake and cocoa butter involves comparatively simpler techniques.

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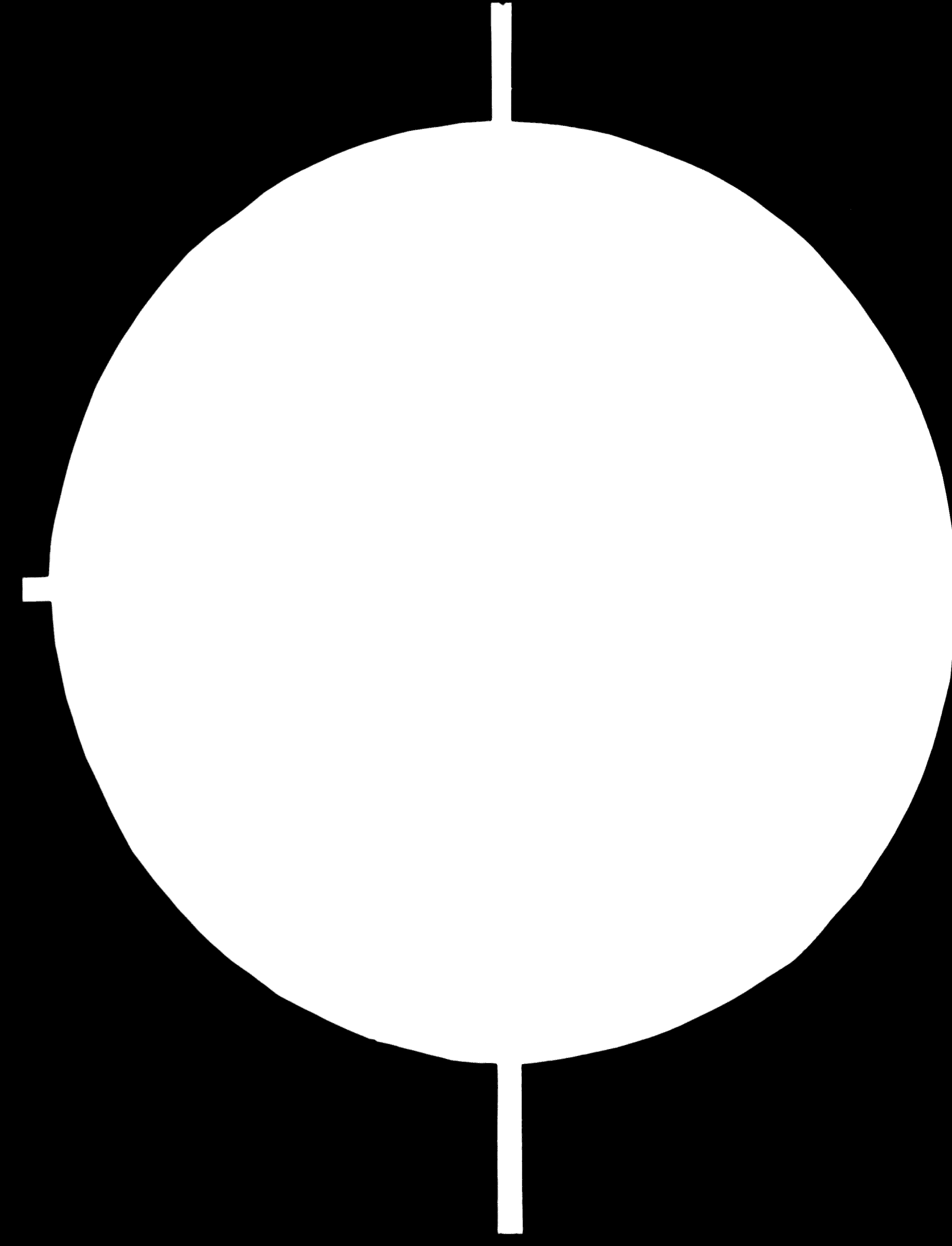

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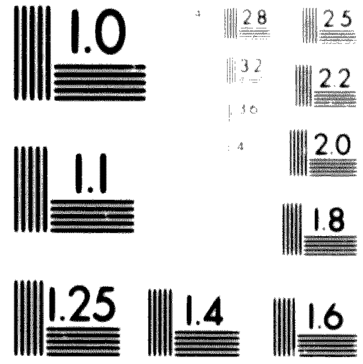

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4.100 The products from these factories are sold under proprietary brands which are world renowned for their particular quality. In order to achieve and maintain this stable quality of flavour, the manufacturers are obliged to [illegible] standard form of cocoa bean mix. This calls for [illegible] formula [illegible]. [illegible] manufacturers use Ghana cocoa as the basic ingredient. Each one has his own secret formula and method of processing, but in almost all cases, it is based on Ghana cocoa. There are, of course, a number of manufacturers of high quality flavour chocolate using special flavour type cocoa beans but this now forms a steadily decreasing percentage of the whole.

4.101 Once a manufacturer is tied to a specific formula, he is unable to vary the [illegible] the quantities of cocoa beans to be bought. He is compelled to purchase the exact quality of beans dictated by the formula; anything worse or even better is not permissible. As Ghana cocoa has a certain fixed percentage to be used by all manufacturers according to his formula, the only option he has is to buy from anywhere the only remaining requirements of cocoa. Ghana cocoa is sold in the [illegible] while cocoa of other origins are sold at a discount. Therefore, in case the proposal of establishing a chocolate factory is given effect to, it would be necessary to import a certain percentage of the total requirement of cocoa for the manufacture of chocolate from Ghana and also it would be necessary to invite an internationally renowned chocolate manufacturer to establish a factory in the State who would invariably expect an area of about 5,000 acres to be allocated to him for estate-type cocoa plantation.

4.102 Fixed formulae also exist for the manufacture of cocoa powder and other flavouring. In the manufacture of cocoa butter, however, the flavouring is not generally of very great importance. Here the fat content of the beans takes precedence over other things, origin being of secondary importance. Much of the inferior cocoa grain in the [illegible] is used [illegible] butter manufacturers.

4.103 Physical and chemical tests of cocoa beans from Sarawak gave the following results:-

> 6 cwts. received in three cases containing polythylene bags, each with [illegible] lbs. of beans.

Weight of 100 beans	-	101 grams
Shell	-	15.8%
Partly brown, partly purple	-	10.0%
Mouldy	-	14.0%
Moth infested	-	3.0%

4.104 The beans were small and they showed some superficial mould. There was a considerable amount of mould within the cotyledons. The very low figure for partly brown and partly purple beans would suggest that they had been over-fermented but tasting tests did not bear this out. The butter in the kernel was 56.4%.

4.105 Small-scale laboratory chocolates were made from beans in each of the cases, although these cases bore no distinguishing marks. The chocolates tasted fairly reasonable from one lot within the normal range of quality but in the case of chocolate made from the other two, the true flavour was marred by the taste of mould. The inference from this is that all the beans would probably have been quite satisfactory, had a little more care been taken in drying and storing.

4.106 It will be of interest to note here that Messrs. Cadbury Brothers who have a chocolate factory in West Malaysia were prepared to pay [illegible]155 per cwt. delivered Bournville for the 6 cwt. received. Currently the current price for best quality Ghana beans is [illegible]165 per cwt. It would thus appear that Sarawak cocoa is suitable for processing into cocoa butter and chocolate products.

Manufacture of Cocoa Products

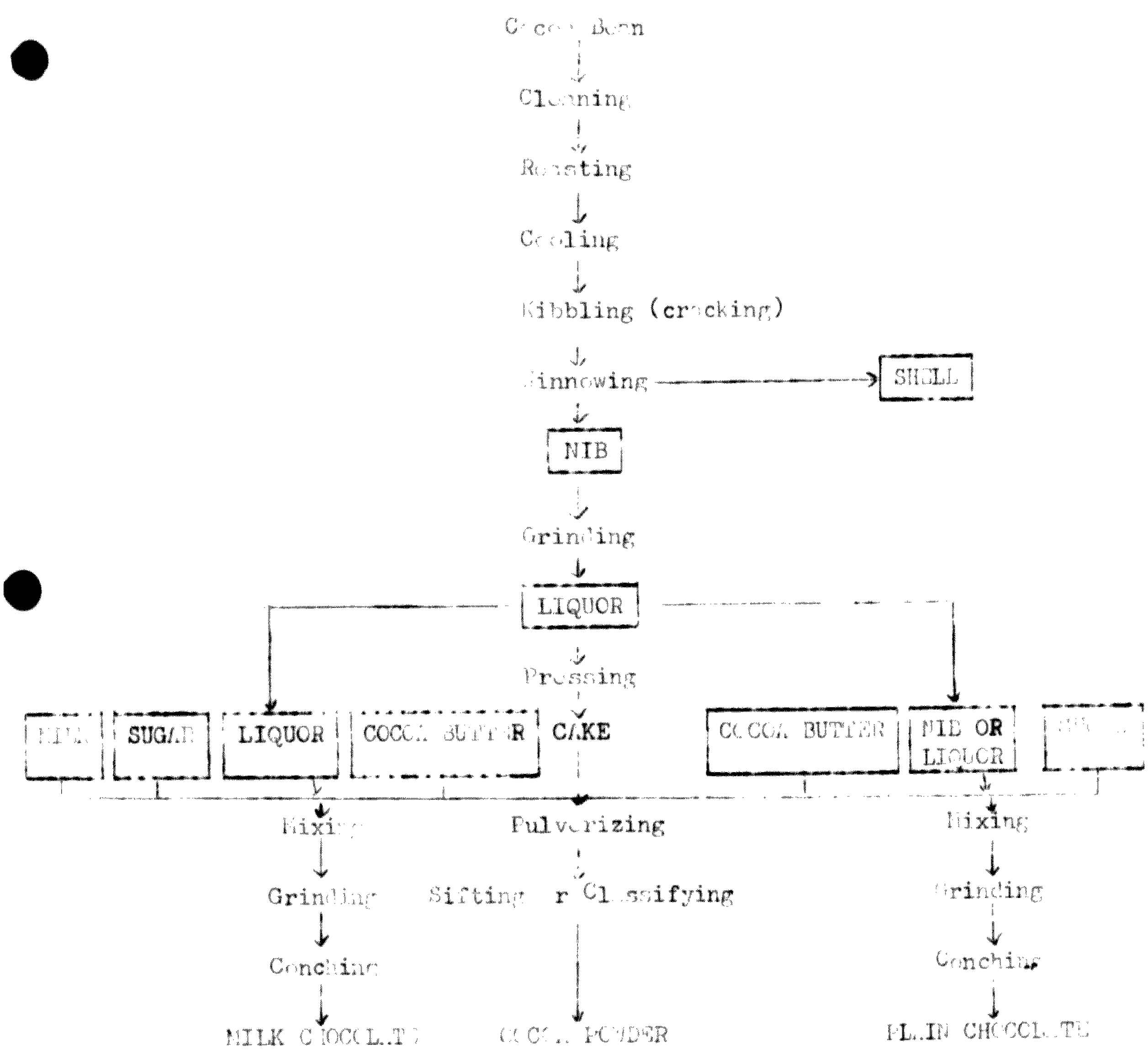
4.107 Dried and cleaned cocoa beans on roasting loosen their shells and develop flavour and aroma. The roasted beans, after being cooled, are cracked and the shells are winnowed away, thus leaving the cotyledons known as nibs. The nibs are then ground to obtain cocoa mass or chocolate liquor.

[illegible] pressing this [illegible], [illegible] of the cocoa butter is extracted. The resulting cake is pulverized into cocoa powder. Extracted butter is used in [illegible] preparation of chocolates by incorporating it with a mixture of [illegible] sugar for sweet chocolate and in a mixture of liquor, sugar and milk to produce milk chocolate.

4.20 The flow diagram of the process is illustrated in figure 4.1.

Figure 4.1

Flow Diagram of Cocoa and Chocolate Production



4.109 In the U.K., unsweetened chocolate liquor is known as "bitter chocolate" or "cocoa lite", and the sweetened product is termed as "sweet chocolate". In Europe, however, "chocolate" refers to the sweetened one. In the U.K., the term "plain chocolate" is used to distinguish it from milk chocolate.

4.110 Cocoa butter itself finds a small use in pharmacy, for it is hard and brittle at room temperature and yet melts at blood heat. Theobromine can be extracted from cocoa wastes (shell and nib dust) and has also some medicinal uses. It is, however, mostly used for the preparation of Coffee. Shell, which accounts for 10 - 12% of the bean, can be used as fertilizer and soil conditioner. It contains vitamin D and therefore, can also be used as animal food. This use, however, is limited to the theobromine present.

4.111 Till recently, manufacture of various cocoa products were confined mostly to the developed countries. Though the processing countries are slowly taking to conversions, the progress in this direction has not been significant mainly due to consumer preference on certain brands (including consumers in the developing countries), and also due to lack of capital and skill. Wherever efforts have been successful in the production of cocoa based products in the developing region, it was due to the internationally renowned chocolate manufacturers establishing their factories there.

Processes

4.112 Being a food industry, the processes involved in the manufacture of cocoa products are highly sophisticated and hygienic requirements are of high order. These processes follow a simple sequence.

4.112 Cocoa beans are normally exported in 140 lbs. bags. On arrival at the factory they are reloaded in silos.

<u>Cleaning</u>

5.113 The beans from the silos are cleaned by subjecting them to a series of cleansing processes. These comprise passage of the beans over magnets for removing metal; through revolving reels to remove twins; over air separators to remove dust and light materials such as, wood; and finally through centrifugal separators for removing stones. The beans are then classified into single whole beans, clusters (comprising two or more beans) and broken and shrivelled beans. Whole single beans are preferred for the best quality products.

<u>Roasting</u>

5.114 The clean beans are then roasted to facilitate removal of the shells from the nib and also to assist in the process of flavour and colour development. During the roasting, volatile acidity and astrigency are reduced and the colour is changed from brown to deeper brown. At the same time the moisture content is also lowered. During the roasting process, cocoa butter from the ruptured fat cells near the surface of the nib is transferred to the shell thus raising its fat content.

5.115 Many types of roasters are in use but the modern roasters are of continuous type, involving, belt drying, continuous rotating drums or counter current drying towers.

5.116 The time and temperature of roasting depend upon the type of bean and the purpose for which it is intended. For example, a relatively light roast sufficient only to dry the beans to facilitate removal of the shell, is given for the production of cocoa butter. For chocolate manufacture, beans are lightly roasted while beans for cocoa manufacture are given a hard roast to develop the required flavour. Generally, the roasting tempterature and time vary respectively from 100°C to 140°C and 45 minutes to 90 minutes.

<u>Cooling and Cracking</u>

5.117 The beans are cooled after roasting and are then cracked by passing through toothed rolls. To remove the shells and radicles of the (germ) from the nib, the cracked beans are passed through a winnowing ...

Winnowing

[illegible] In the winnowing machine, air blasts are directed to the broken beans in order to blow the lighter pieces of shell away from the heavier nib portions. Based on whole roasted beans, yields of [illegible] - 84% of commercially pure nib are achieved. Since absolute separation of shell from the nib is virtually impossible, there is a tolerance of shell permitted to a degree governed by the food regulations of the individual country. In the US, 1.75% by weight of shell is allowed in the nib.

[illegible] The shell so separated contains 4[illegible] - 6[illegible] fat. This is obtained partly by fat transfer during roasting and partly from the fine nib and nib dust left with it after winnowing. This fat can be taken out either by expeller type presses or through solvent extraction. These shells and the expeller cakes mentioned before are used as animal feed, as extender in fertilizers and as a source of theobromine. The composition of nib and shell is shown in Table 4.22.

Table 4.22

Analysis of Nib and Shell from Fermented Cocoa Beans (Ghana)

Component	Percentage Nib[a]	Percentage Shell[b]	Component	Percentage Nib[a]	Percentage Shell[b]
Water	2.13	3.8	Carbohydrates		
Fat	54.6	3.4	glucose	0.10	0.1
Ash			sucrose	0.0	0.0
total	2.74	8.1	starch (Taka-diastase method)	6.14	2.8[c]
water-soluble	1.25	3.5	pectins	4.11	8.[illegible]
water-insoluble	1.49	4.6	fiber	2.13	16.6
silica, etc.	0.05	1.1	cellulose	1.90	13.7
alkalinity (as K_2O)	0.41	2.6	pentosans	1.21	7.1
chlorides	0.014	0.07	mucilage and gums	1.84	9.0
iron (as Fe_2O_3)	0.007	0.03			
			Tannins		
phosphoric acid (as P_2O_5)	[illegible]	[illegible]	tannic acid (Lowenthal's method)	[illegible]	[illegible]
copper	[illegible]	0.004			
			cocoa-purple and cocoa-brown	[illegible]	[illegible]

Table 4.22 (cont'd)

Component	Percentage Nib[a]	Shell[b]	Component	Percentage Nib[a]	Shell[b]
Nitrogen					
total nitrogen	2.16	2.8			
protein nitrogen	1.34	2.1			
ammonia nitrogen	0.042	0.04	Acids		
amide nitrogen	0.036	0.1	acetic (free)	1.136	0.1
theobromine	1.42	1.3	citric		0.7
caffeine	0.066	0.1	oxalic	0.30	0.32
			Extracts		
			cold water	12.29	20.0
			alcohol (85%)	9.67	10.0

[a] From raw fermented beans, represents 88.6% of the whole bean, the remainder 10.7% shell and 0.7% germ (12).

[b] From roasted beans (11).

[c] Other tests indicate that there is no true starch in cocoa shell.

Source: Encyclopedia of Chemical Technology, Vol. 5.

Grinding

4.120 Nibs, which are cellular masses, containing 55% of cocoa butter locked within the cell structure are then subjected to grinding.

4.121 The modern grinding machines are steel disc mills with the discs mounted either horizontally or vertically, and a central steel disc rotating at high speed between two stationary steel faces, all of which are suitably grooved. The nib is fed to the centre of the discs and collected at the outer edge. Some production is also done by cylindrical steel roll refiners and by impact pulverizers of the hammer mill type. Water cooling is provided on the steel disc mills and roll refiners and the temperature is maintained at 70° - 80°C to ensure light r[illegible]ting f[illegible] [illegible] production.

4.122 The particle size of the liquor during production is controlled by microscopic measurements, by test sieves or by sedimentation methods. During grinding, the fat content of the nibs is released and as it is liquified by the frictional heat, it becomes a continuous phase in which the disintegrated cell particles are suspended. As disintegration proceeds, more and more fat is released reducing the viscosity of the mass until it becomes a fluid which is referred to as chocolate liquor or cocoa mass. This has the colour, odour and flavour of chocolate. Since the crisp, dry and easily friable nib requires the least energy for its liquidification, the grinding operation is best carried out as soon as possible after roasting and winnowing while the nib is still warm.

Production of Cocoa Powder

4.123 To produce cocoa powder, the chocolate liquor is hydraulically pressed to remove some of the cocoa butter present. The hard cake from the hydraulic press is pulverized and sieved, and the powder is ready for packeting. The composition of cocoa powder is shown in Table 4.23.

Table 4.23

Analyses of Cocoa Powders

Cocoa Product	Fat	Water %	Protein %[a]	Ash %	Total Carbo-hydrates %	Fiber %	Calorific value, cal/lb.
Breakfast cocoa	23.3	3.9	8.0	5.0	29.0	4.6	1,645
Breakfast cocoa (alkali process)	22.8	5.5	7.5	7.4	29.0	4.5	1,595
Cocoa[b,c]	18.0	4.3	9.0	5.2	31.0	4.8	1,495
Cocoa[c]	11.0	4.2	8.9	5.1	30.5	4.7	1,248
Cocoa, fat-free	0.0	4.7	9.9	5.7	34.0	5.3	887

a The figures given for protein are for the quantity believed to be utilized by the body, and not for the total protein in the cocoa. The biological value of cocoa protein has been given as 37% (14).

b Data from Hartfield and Adams (15).

c Both these cocoas are in the medium-fat range but are of different fat content.

[illegible]

4.124 The modern hydraulic press for production of cocoa powder has up to 24 pots mounted in a horizontal frame. Each pot is provided with a metal filter screen, suitably backed by pot plates, the filling pump exerts a pressure of 200 - 300 pounds/sq. inch and this, in some designs, is used to remove some of the free butter while the filling operation is taking place. Hydraulic pressure of 6,000 lbs./sq. inch is then applied. Each pot takes about 20 lbs. of liquor and will press to 22 - 23% fat in 12 - 15 minutes or 10 - 11% in about 25 minutes. The process is capable of complete automation.

4.125 Various types of hammer mill, impact mill and attrition mill are in use for pulverizing the cake from the pressing operation; usually with some type of built-in grading system, such as mesh screens, cones, or air classifiers, to ensure the desired degree of thickness being achieved. Special plants have been built by some renowned manufacturers in Europe which can control the colour of the finished powder by ensuring correct setting of the fat.

4.126 After pulverizing, the cocoa powder is sieved through fine silk, nylon or wire mesh to remove unbroken bits of press cake and aggregates produced by the conveying system. Sieves between 100 and 250 mesh are commonly used. The cocoa powders at some stage of their manufacture are subjected to alkali treatment to improve their colour, flavour, etc.

Cocoa Butter

4.127 Cocoa butter is a pale-yellow solid with a faint chocolate aroma and flavour. It melts completely at body temperature. The component triglycerides of cocoa butter are given as:

Component Triglycerides	Percent
Trisaturated	3
Mono-unsaturated	
Oleo-distearin	22
Oleo-palmito-stearin	57
Oleo-dipalmitin	4

Component Triglycerides	Percent
Di-unsaturated	
Stearo-diolein	6
Palmito-diolein	7
Tri-unsaturated	
Triolein	1

Mixtures of various vegetable fats are now specially produced as replacement fats for cocoa butter. One such fat, coberine, resembles cocoa butter in its physical properties but it lacks the natural cocoa flavour. Cocoa butter is still universally recognised as the most superior fat ingredient for chocolate production.

4.128 Cocoa butter is obtained during the process of pressing the chocolate liquor for the production of cocoa powder. As cocoa butter is one of the principal ingredients of chocolate, the market demand necessitates processing of cocoa beans primarily for cocoa butter. When this is the objective, extrusion presses or expellers used in the seed oil production is used. The beans for extrusion are conditioned by steaming to facilitate cell rupture and the consequent release of fat. It is then fed continuously to the expeller, which subjects it to intense compression by means of a rotating tapered screw inside a conical outer cage that is provided with progressively smaller clearance. The butter escapes through the slits in the cage wall and the press cake is finally ejected at the end of the screw. The butter is subsequently clarified to remove any solid material by centrifuging and plate filtration. A modern large expeller will press 1,000 lbs/hour, with a residual fat content as low as 8%. This fat can be extracted by solvent extraction.

4.129 The cocoa butter, depending on the desired specification of end products, is deodourised by steam distillation under vacuum.

Sweet Chocolate

.130 Sweet chocolate consists essentially of a fine ground mixture of cocoa nib and sugar with added cocoa butter to enable it to set in the solid form when moulded, or as a firm shell on confectionery centres when used for covering. The incorporation of milk during manufacture produces the milk chocolates. In plain chocolate, milk is used in lower proportion for flavour reasons, and special flavours are provided by the addition of nuts, coffee, malt, honey, molasses, brown sugar, etc. in finely ground form. Moreover, by a suitable choice of beans by chemical treatment, variation of the degree of roasting etc. modification to the flavour and colour of chocolate are obtained. Thus, there is a great diversity of chocolates marketed in the world.

.131 Criollo-type beans are much favoured for the highest quality plain chocolates, but blends with Forastero type are more usual. In milk chocolates, where the proportion of cocoa is low, the strongest flavour Forastero is often preferred.

Refining

.132 As the most outstanding requirement in chocolate is that it should not give any sensation of roughness while heating, all the ingredients are required to be finely ground. In the modern process of refining, the ingredients are previously ground very fine and then mixed in a mixture. The product is passed through a series of roll refiners which have 3 to 6 water cooled hollow steel rolls. The mixture is passed over as many as four sets of such refiners to give the necessary fineness. As the surface area of the solids increases during grinding, an increasing amount of fat is required to maintain fluidity of the paste being ground. Therefore, cocoa butter is mixed between the grinding stages. Modern refiners have capacities of up to [illegible] lbs. per hour and are fitted with hydraulic devices for maintaining controlled pressure between the rolls.

4.133 Where continuous production is envisaged, paste production also takes the continuous as against batch production discussed above. In the continuous paste production, the equipment are so designed to give fully automatic proportioning to provide the correct recipe and producing paste continuously at 4,000 - 5,000 lbs. per hour.

(iii) Chocolates

4.134 For the production of milk chocolates, before the refining is undertaken, all the water from the milk has to be removed. This removal is effected by various methods of which the "crumb" process is used for the highest grade milk chocolate. Fresh milk is condensed with sugar, the chocolate liquor is incorporated and the product is dried under vacuum to a moisture content of 2% or less. This product, termed crumb after breaking [illegible] hammer mills, is mixed to paste with cocoa butter and, extra sugar or chocolate liquor if required, to give the desired recipe. The mixed paste is then fed to the refiners, as discussed previously.

4.135 Apart from mixing with more cocoa butter to provide the correct consistency for moulding, enrobing and addition of the desired flavouring materials, some of the cheaper chocolates receive no further processing.

Conching

4.136 The superior quality chocolates undergo a treatment known as conching, where in the tank with granite bed (longitudinal conch), chocolate is pushed to and fro by a roller travelling backward and forward. The end of the tank is so shaped that chocolate forced against it is splashed back over the rollers into the machine. The time taken in the process is usually 12 hours or less particularly for milk chocolates but may be up to 4 days or even more for the highest quality chocolates.

Tempering

4.137 Before chocolate can be moulded or used for coating confectionery centres, it is necessary for it to be conditioned by the process called tempering. The purpose is to control the solidification of the fats complex which make up cocoa butter. It is a very important operation as it imparts the right gloss and texture to the final product.

4.138 The process of tempering entails reducing the temperature of the chocolate when it leaves the conch and seeding the cooled liquid chocolate with a multitude of fat crystals to provide nuclei for subsequent crystallisation.

4.139 Tempering is carried out in a tempering kettle, which is water jacketted, fitted with a stirring device and is heated by steam coils. The chocolate must be continually stirred during this operation.

Moulding

4.140 Tempered chocolate is machine-deposited into polished metal moulds, previously warmed and carried under the depositer by a moving belt. The filled moulds are shaken to spread the chocolate evenly and to release bubbles and are then passed through a roller supplied with cold air at carefully controlled temperatures to give reasonably rapid setting and the production of good appearance. Provided that the tempering of the deposited chocolate is correct, the change of state of the chocolate will cause it to contract away from the mould so that the solid block can be discharged without difficulty, leaving the moulds clean and after warming, again ready for use. These are then passed on to the enrobbing machine. These are machines where the tempering and enrobbing operations are combined. The chocolate is circulated through a tempering screw - essentially a screw type heat exchanger to cool and mix the chocolate - the excess tempered chocolate being reheated before the recirculation. Such methods are claimed to have the advantages of [illegible] maintained constant temper indefinitely.

Chocolate Couverture

4.141 Chocolate is also produced as couverture. The small manufacturer of chocolates who have no equipment for the complete process can start manufacturing chocolates from the couverture stage.

4.142 The couverture are sold in large boxes of 7, 10, 14 or 28 lbs. The chocolate is processed and tempered in the usual manner before being moulded into blocks. Large-scale chocolate manufacturers sometimes find it convenient to mould large blocks in this way and store them for processing into smaller articles at a later stage. When blocks are used for manufacturing of chocolate, these are required to be re-melted and tempered; moulding is done in the usual way.

4.143 Chocolate is prone to certain defects which may develop if care is not taken during manufacture and storage. The two main defects are fat bloom and sugar bloom. These can be prevented by additives.

Packing

4.144 Cocoa and chocolates are packed in different ways. Though the main purpose of packing is to maintain the quality during its shelf life, the ideal package needs protection against:-

(i) Absorption of moisture,

(ii) Absorption of foreign odours, and

(iii) Insect attack.

4.145 Cocoa is usually packed either in tins with or without lining bags or in printed cardboard cartons lined with bags of moisture resisting film e.g. coated degenerated cellulose.

4.146 Chocolate blocks and bars are usually wrapped individually in plain or printed aluminium foil of 0.01 mm. thick which is again wrapped with a colour printed paper band. Luxury wrappings are also provided befitting occasions such as Christmas presentation, birthday presentation, etc.

Multi-process System of Chocolate Manufacture

4.147 The manufacturing process described above is known as single process system and is suitable for producing best quality chocolates. Automatic equipment have been developed where a number of processes are combined in one operation but the chocolate produced, though good in quality is not the best. This process of chocolate manufacture is known as multi-process system.

4.148 There are various designs of multi-process chocolate making machines. In the Macintyre refiner, the process of grinding, mixing, refining and conching are performed in one single operation. This dispenses with the need for the cocoa mill and sugar mill, the chocolate mixer, the refiner and the conch used in the single process system.

Plant to Manufacture Cocoa Butter and Cocoa Powder

4.149 Based on the local production of cocoa beans, it is proposed that a plant be established, initially for the production of cocoa butter and cocoa powder. A second plant for the manufacture of chocolates and other cocoa products could be considered subsequently.

4.150 For the proposed former plant, a production capacity of about 900 tons of cocoa liquor per annum, working on one eight hours shift per day could be considered initially. A rough cost estimate of such a plant indicates that a capital investment of about $1.52 million, together with working capital of about $565,000 would be required. At the current prices of cocoa products, such an investment would yield a return of about 20% thus indicating a profitable proposition. In addition, a potential employment for more than 34 people would be created.

Cost Estimates of a Cocoa Butter and Cocoa Powder Manufacturing Plant (300 operational days/annum)

Proposed capacity	=	3 tons of cocoa liquor per day of 8 hours shift

Pressed cake yielded would have a fat content of 20 - 22%

Allowing a cleaning and de-shelling and processing loss of 15

Dried cocoa beans required per day	=	(1.15 x 3) tons
	=	3.45 tons

Total dried [illegible] required per annum = 1,0[illegible] t[illegible]

Capital Investment

(A)	Land including cost of development (1 acre is estimated to be sufficient)	$ 15,000
(B)	Factory Buildings average cost of $18 per sq. ft. (covered area may average 15,000 sq. ft., of which a large portion needs to be air-conditioned)	270,000
(C)	(i) Machinery and equipment	900,000
	(a) Cocoa bean cleaning and sorting machine - 1 unit	
	(b) Cocoa bean roaster - 1 unit	
	(c) Cocoa bean breaker - 1 unit	
	(d) Pin type cocoa mill - 1 unit	
	(e) Pumps	
	(f) Cocoa liquor planetary stirring kettles - 2 units	
	(g) Horizontal cocoa butter press - 1 unit	
	(h) Chocolate stirring kettles - 2 units	
	(i) Cocoa butter filter press - 1 unit	
	(j) Cocoa cake breaker - 1 unit	
	(k) Cocoa powder plant - 1 unit	
	(l) Packing machines	
	(ii) Cost of installation, engineering, design etc. 20% machinery cost	180,000
	(iii) Other equipment including automotives and office equipment	75,000
	Total	$1,155,000
	Total capital investment	$1,440,000
	Add pre-project expenses (5%)	72,000
	Grand Total	$1,512,000

Recurrent Cost

[illegible] Cost of Materials

(i)	Cost of 1,040 tons dried cocoa beans @ $75.00 per cwt. delivered at factory	$1,560,000
(ii)	Cost of packing material (assumed @ 10% cost of dried beans)	156,000
(iii)	Electricity = 120 H.P. rated power @ 8¢ per unit average cost	17,280
(iv)	Water = 1,100 gall. per hour @ $1.20 per 1,000 gall.	3,160
(v)	Fuel for 400 lbs./hr. steam at 8 atmos. = 5 tons per day @ $72/ton	108,000
(vi)	Repairs of machinery @ 4% machinery cost	32,000
(vii)	Diesel oil, lubricants etc.	10,000
(viii)	Office stationery, postage, telephone etc.	20,000
	Total	$1,906,440

[illegible] Labour Cost

		No.	Wage/mensem	Wage/annum
(i)	General Manager	1	$2,000	$24,000
(ii)	Factory Manager (engineer)	1	1,500	18,000
(iii)	Accountants & Sales Officers	2	1,000	24,000
(iv)	Stenographers, clerks, typists	7	av. 250	21,000
(v)	Receptionist	1	200	2,400
(vi)	Office boy & watchman	2	100	2,400
(vii)	Drivers	2	200	4,800
(viii)	Skilled workers	3	300	10,800
(ix)	Semi-skilled workers	5	$5 per day	9,000
(x)	Unskilled workers	12	$4 per day	14,400
	Total	34		$130,800

Add 15% employment cost 19,620

$150,420

(c) Other Costs

(i)	Transport from factory by company vehicles (cost provided for)	
(ii)	Sales promotion including commission @ $50 per ton	$ 45,000
(iii)	Local taxes and insurance @ 1% of capital investment	14,400
(iv)	Depreciation of buildings and machinery @ 10%	142,500
	Total	$201,900

Total recurrent cost = $2,258,760

Working capital (3 months operational cost) = $564,690

Interest on working capital @ 10% (current commercial bank rate) = $56,470

Total annual cost = $2,315,230

Return from Sales

Total production of cocoa liquor per annum = 900 tons

Assuming an average price of $1.30 per lb. of cocoa liquor (current prices of per lb. cocoa butter and cocoa powder respectively average $2.70 and $1.10).

Average price of cocoa liquor = $2,912 per ton

Total return from sales = $(900 x 2,912)

= $2,620,800

Annual gross profit before tax = $305,570

Percentage return on capital investment = $\frac{305,750}{1,512,000}$

= 20%

Chocolate Plant

[illegible].151 Due to the numerous varieties of chocolate products that could be produced, it would be difficult to give a detailed analysis of the chocolate plant. However, the following would indicate in general, the requirements of such a plant. A production capacity of about 900 tons per year, working on one eight-hour shift per day, (300 operational days per annum) is again proposed. The shares of the various chocolate items would, however, depend primarily on the consumers' preference.

[illegible].152 It is estimated that 1 acre of land would be required to accommodate the factory buildings, which together would account for a covered area of about 15,000 sq. ft. The equipment required would comprise the following:-

(i) Sorting and cleaning machine

(ii) Cocoa bean roaster

(iii) Cocoa bean husking and winnowing machine

(iv) Cocoa liquor refining mill - pin mill

(v) Feed pumps

(vi) Cocoa liquor planetary stirring kettles

(vii) Four-pot horizontal cocoa press

(viii) Cocoa cake breaker

(ix) Cocoa powder mill

(x) Chocolate stirring kettles

(xi) Sugar mill

(xii) Chocolate mixer

(xiii) Hydrostatic 5 roll refiner

(xiv) Rotary conches

(xv) Horizontal automatic tempering machine

(xvi) Chocolate automatic moulding plant

(xvii) Wrapping machines

Utilities

4.153 Electricity - rated power is 206 H.P.

Water - 2,500 gallons per hour

Steam - 1,100 lbs/hr at 8 atmosphere

Labour

4.154 A total of about 27 persons would be employed directly to operate the plant, whilst another 13 persons would be indirect labour. The direct labour includes:

1 Engineer

4 Skilled workers

7 Semi-skilled workers

15 Unskilled workers

Raw Materials

4.155 The raw materials required include cocoa beans, sugar and milk powder. Both the latter items could be imported from West Malaysia.

Capital Requirement

4.156 The total capital cost of project required is in the region of $2 million. In addition, a working capital (based on 3 months operational cost) of about $550,000 would also be needed. It is estimated that a return on capital investment of about 20% could be realised.

CHAPTER V

SUGAR

5.1 Sugar is the common name for sucrose (or saccharose), a carbohydrate classified as a Disaccharide, with the chemical formula $C_{12}H_{22}O_{11}$. It occurs in many plants and is an important food, valued for its sweet taste and the texture and consistency it imparts to other foods. The two principal sources of granulated sugar are the varieties of:

(i) Sugar cane, a giant grass of the genus Saccharum and various hybrids, and

(ii) Sugar beet (Beta Vulgaris).

There are other commercial sources of sugar although in much smaller quantities. Two of the better known are sugar maple (Acer Saccharum) and sorghum (Sorghum Vulgare). Maple sugar is of too high value as a confection to be refined to granulated sugar. Sorghum sugar is produced mainly for the manufacture of table syrups, and attempts to produce raw sugar from this source have met with little success.

The Sugar cane plant

5.2 Sugar cane is a tall perennial grass, the stalks or canes of which grow normally to some 10 feet in height. The canes measure from 1 inch to 3 inches in diameter, according to variety, and they have prominent joints. The plant normally comes into flower from September to December in the northern hemisphere, and from March to June in the Southern hemisphere. Canes which contain the sucrose are at their richest when the flowers are beginning to fade, and are normally harvested at this time. At harvesting, the canes are cut to the ground, and the upper joints are cut off and used as cuttings for planting. The root stock which is undisturbed, remains and sends up new stems in succeeding seasons.

5.3 The first crop, known as 'plant crop', is normally reaped at the age of from 12 to 16 months; and subsequent 'ratoon crops' are reaped at about 12 months. Different varieties of sugar cane harvest at different periods. Hence, by planting these different age-group varieties, a continuous supply of cane, throughout the year, may be obtained.

5.4 In sugar cane, the carbohydrate is stored in the form of glucose and sucrose. As the cane ripens, the glucose contained in the growing portions of the cane gets converted into sucrose and there is also a corresponding increase in the total solids in the juice. The percentage of sucrose to the total solids is known as 'purity', and this should be above 90% before the canes are cut. The glucose present interferes with the netting of the jaggery and prevents the sucrose from crystalling.

5.5 An analysis of the sugar cane indicates the following constituents and their proportions:-

<u>Table 5.1</u>

<u>Analysis of Sugar Cane</u>

	Cane%	Juice%
Water	74.50	80.90
Sucrose	12.50	18.00
Glucose	1.50	0.50
Free Acid	0.08	
Combined acids	0.12	
Salts	0.50	
Colouring matters, fats and waxes	0.20	
Gums: pectins	0.20	
Albuminoids	0.40	
Dirt, fibres, etc.	10.00	

5.6 Sugar cane growing areas of the world are confined within the tropical and semi-tropical zones, between 33°N and 33°S Lat. In the western hemisphere, the main sugar cane growing areas are: Southeastern U.S., Mexico, Central America, West Indies, Peru, Brazil, Bulgaria and north Argentina. In the eastern hemisphere, Africa (except in the extreme northern and southern portions), India, southern China, Southern Korea, Southern Japan and Indonesia are the important sugar cane growing areas.

5.7 Until the 1920's, the principal source of raw sugar was the so-called noble cane, Saccharum Officinarum. In time, this variety of the cane began to succumb to diseases such as Mosaic, caused by virus and insects like cane borer. In attempts to produce a cane, resistent to these factors, the more famous experimental stations in the cane growing countries of the world succeeded in developing many varieties of hybrid canes capable of withstanding the onslaught of the borer and mosaic. Most of the cane grown in the world today are of these hybrids. These new seedling varieties are designated by initial and numericals, the best known being BOJ (Broefstation Ost Java). Others include PR, CP, CO975, etc. The characteristics of these new varieties are many and widely varied; their uses depend upon the nature of the land, the climate and other factors.

Agricultural and other requirements for sugar cane cultivation

5.8 Although the ideal soil for sugar cane cultivation is fertile loam or clay, sugar cane can flourish on almost any soil provided that the fertilizer choice is carefully made. The three important elements needed for growth and ripening of the sugar cane are nitrogen, phosphorus and potassium. Application of nitrogen induces vegetative growth, and phosphorus is reported to have influence on the yield and quality. Phosphorus generally promotes root development and is best applied near the root zone. Potassium is said to improve the quality in cane, as also the mechanical tissues, which may indirectly be responsible for increased resistance to certain pests and diseases. Thus, a balanced application of N, P and K is highly desirable for sugar cane cultivation.

5.9 The land for sugar cane cultivation is required to be well drained, particularly at places with inadequate rainfall and more dry periods. It is also necessary to have proper irrigation as sugar cane is basically a rain-fed crop. At the same time it is very essential that the crop is not over-irrigated which may lead to water-logged conditions.

5.10 Sugar cane is one crop where climatic conditions take precedence over the quality of soil in its growth. A hot and humid climate with plenty of both moisture and sunshine is required. The best temperature range for successful growing of sugar cane is from 65°F to 85°F and the corresponding rainfall range should be from 60" to 90" per annum. Furthermore, the distribution of the rain should be such that 75% of it fall during the growing season when it is most needed. There is, however, a need of sufficient dry spell of about 2 months for the ripening cane to sweeten. Nevertheless, in certain places, e.g. the Negros Province in the Philippines, sugar cane is grown in large areas inspite of the lack of prolonged dry season.

Products of the Sugar Cane

5.11 The principal product of the sugar cane is raw sugar. The extraction of the sugar cane juice is mostly done by milling, where the cane is pressed between heavy rollers to express out the juice. From this juice, jaggery or crude sugar is produced. The jaggery is then, in turn converted into the various forms of sugar.

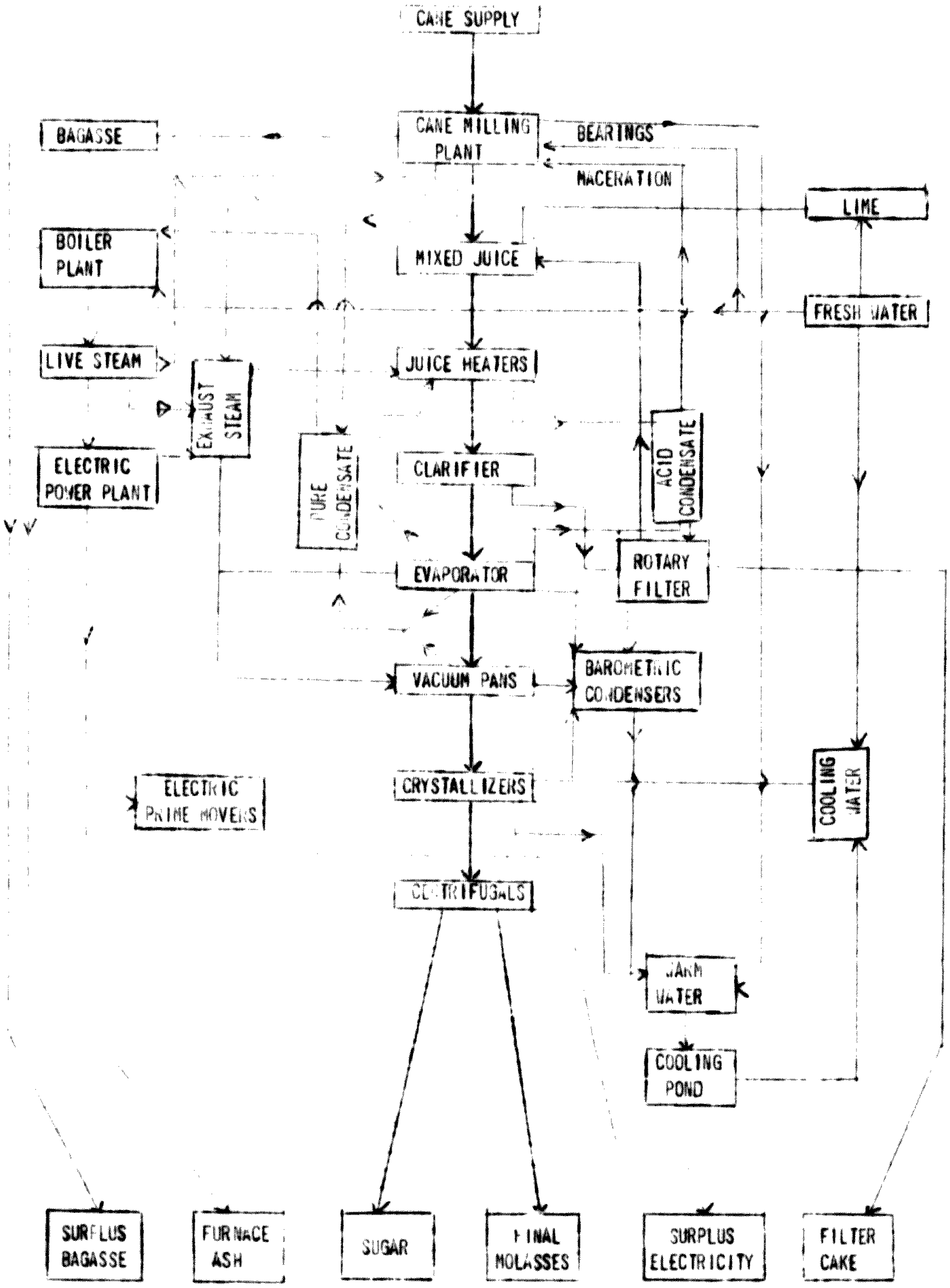
5.12 Some forms of sugar which are of economic importance include brown sugar, white sugar and khandsari sugar. Brown sugar is produced by rubbing sugar syrup (obtained by boiling and evaporating sugar cane juice) with wooden mallets. The resulting material is a light to dark brown powdery material. White sugar or refined sugar is the main form of sugar marketed today. It is being made in factories directly from cane using the vacuum pan process and in refineries by refining purchased jaggery. Khandsari sugar is an inferior sugar which is unsophisticated as a sweetening agent. It contains a large amount of impurities which are normally washed out in a regular sugar mill. It is produced mainly in regions where the area under cane is scattered and not enough cane is available for crushing.

5.13 A simplified flow diagram of a raw sugar factory showing the various end products is shown in Figure 5.1. It could be seen from the figure that in the process of sugar manufacture from sugar cane, a number of by-products are yielded. These include:-

(i) Bagasse
(ii) Filter Cake
(iii) Molasses and
(iv) Some surplus generation of electricity.

FIGURE 5.1

THE RAW CANE SUGAR FACTORY



5.14 Profitable utilisation of the various by-products can greatly enhance the stability of a sugar factory. Depending on the sucrose content, fibre percentage in cane, mill extraction rate, overall recovery etc, the value ratio of by-products to sugar is around 4% - 5% when sold directly. If these by-products could be transformed into some other useful products, it is estimated that this ratio could be increased to 20% to 25%. Some uses of the various by-products are indicated in figure 5.2.

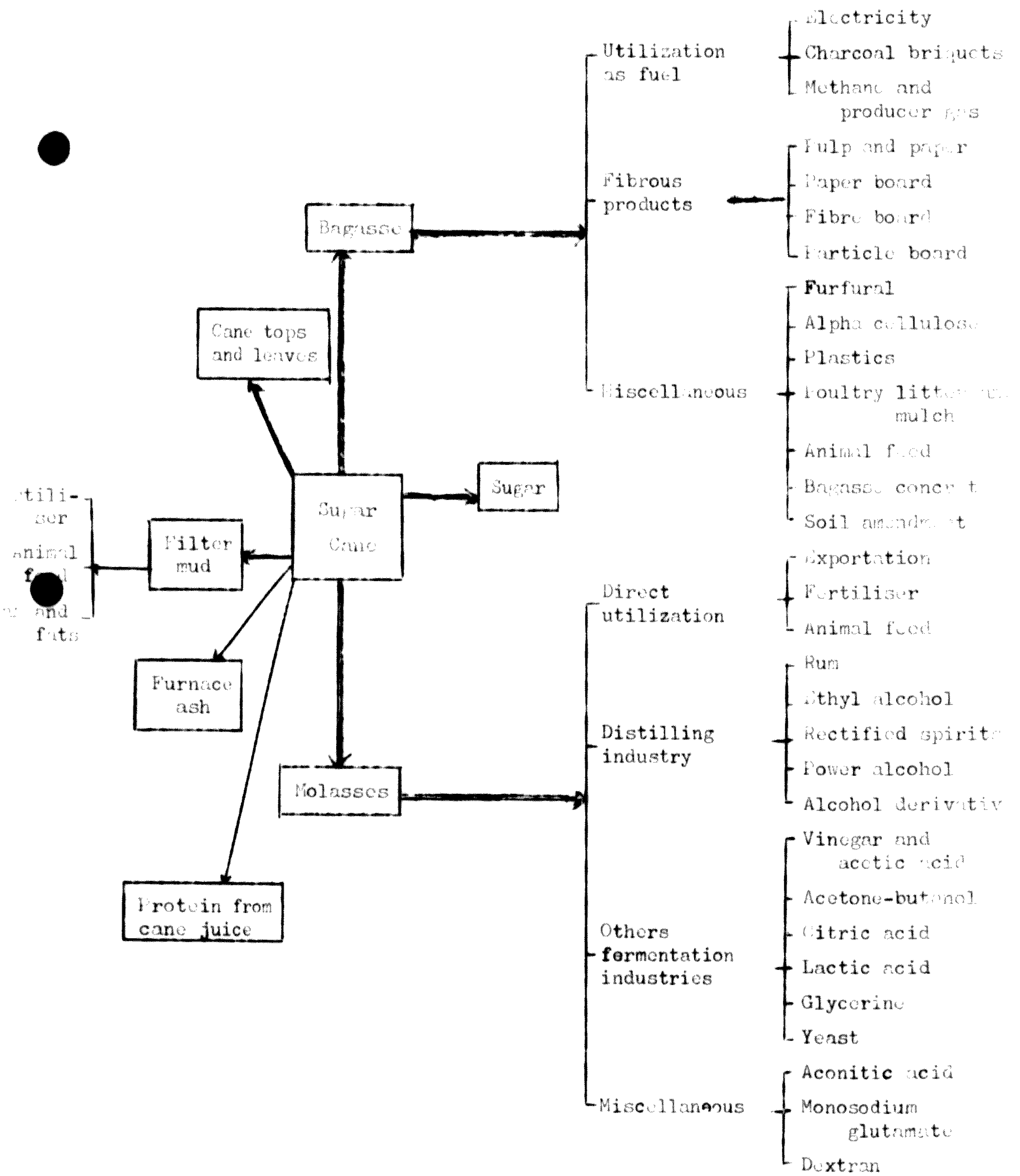


Figure 5.2 By-products of the cane sugar industry and their uses.

Bagasse

5.15 Bagasse is the fibrous residue of cane after the juice has been extracted and contains, besides 48% - 50% of water, cellulose, wax, lignin, etc. Bagasse production ranges from 22% - 35% of cane depending upon its fibre content and the state of maturity thereof. Some of the main uses of bagasse are as follows.-

(i) Fuel

With its good calorific value of 2340 k. cal. per kgm., bagasse forms a ready fuel for steam generation in sugar manufacture. Cane sugar factory boilers are specially designed for burning bagasse. With 12% - 13% fibre on cane, the factory can be self-sufficient in fuel.

(ii) Paper and Board

In case an alternative cheap fuel is available, and on account of its high cellulose content, bagasse can be diverted to the manufacture of paper and boards.

Paper of different grades can be manufactured from bagasse and paper mills in many countries have been established working with bagasse as raw material.

Wall boards and insulating boards can be made from bagasse which is first cooked and subsequently passed through a board machine. Pressing of dry, clean, shredded bagasse under high pressure and a high temperature yields good particle boards.

Filter Cake

5.16 This is a waste material obtained in the clarification of cane juice. The quantity produced is around 1% dry cake per 100 metric tons of cane. The main uses of this filter cake is in fertilizer and wax.

Because of its phosphate and nitrogen content, filter cake serves as a good fertilizer. It is a common practice to dump the filter cake in fields, allow it to decompose and use the resultant material as fertilizer.

Dry filter cake contains nearly 3% - 4% wax which can be recovered by solvent extraction process. This wax finds use in the manufacture of carbon papers, shoe polishes, etc.

Molasses

5.17 A cane sugar factory produces from 3.5% - 4% molasses of cane which is a syrup, viscous liquid rich in sugars and mineral matter. Its main uses are in the cattle feed mixing, distillation of alcohol and in the manufacture of food and fodder yeast.

Molasses produced by defecation methods of clarification is widely used as cattle feed with good results. Molasses from the sulphitation process is, however, not suitable for this purpose. In India, molasses is mostly consumed by distilleries producing industrial alcohol by fermentation and subsequent distillation in continuous working stills. Fermentation of molasses by "Torula" yeast yields protein-rich food which can be used as human food or for feeding cattle.

5.18 The industrial uses of by-products of cane sugar manufacture discussed above, are not to be construed as only of theoretical interest. Many cane sugar producing countries in the world are already exploiting these items commercially.

5.19 Besides the various valuable products mentioned above, some chemicals can also be manufactured from the different by-products of the sugar industry. For example, furfural yeast used in oil refining and nylon manufacture can be extracted from bagasse; and acetic acid and butanol used in chemical, pharmaceutical and other industries can be extracted from molasses. In addition, both Bagasse and filter cake are two sources of activated carbon used in de-colouring oils, chemicals, etc. However, for a new plant, it might be desirable in the initial stages, to confine the use of bagasse to fuel, filter cake to manure, and molasses to a source of industrial alcohol.

Sugar Production and Market

5.20 During the post-war years, there has been a considerable rise in the output of both cane and beet sugar stimulated by greater consumption. Although many new producers of cane have appeared on the world scene, beet has gradually increased its share of the world output of sugar, and in the past years has always exceeded 40% of the total. The world production of sugar has indicated a rising tendency during the recent years. Statistics for centrifugal and non-centrifugal sugar for the period 1964 - 1968 are shown in Tables 5.2 and 5.3 respectively. In the session 1968/69, the total world production of centrifugal sugar reached a height of about 68.1 million tons.

Table 5.2

Centrifugal Sugar (Raw Value) - World Production
(1000 metric tons)

	1964/65	1965/66	1966/67	1967/68	1968/69
Europe	14,819	12,848	13,799	14,578	14,551
U.S.S.R.	10,223	9,196	8,966	10,433	9,709
N+C. America	16,682	14,747	16,965	15,680	15,867
S. America	7,195	8,615	7,924	7,829	7,909
Asia	9,025	9,340	7,715	8,262	9,760
China	2,110*	2,250*	2,420*	2,500*	2,700*
Africa	3,421	3,364	4,204	4,466	4,420
Oceania	2,293	2,300	2,688	2,668	3,169
Total	65,768	62,660	64,681	66,416	68,085

* = Estimates

Source: FAO Production Year Book Vol. 23

Table 5.3

Non-Centrifugal Sugar - World Production
(1000 metric tons)

	1964/65	1965/66	1966/67	1967/68	1968/69
N+C. America	485	480	499	505	499
S. America	928	1,009	1,029	1,052	1,020
Asia	9,554	9,486	8,689	8,866	9,413
China (Main)	599*	635*	635*	726*	726*
Total	11,566	11,610	10,852	11,149	11,658

* = Estimates

Source: FAO Production Year Bood Vol. 23.

5.21 Most of the beet sugar is produced in Europe, the leading countries of production being U.S.S.R., Germany, France, Poland, Czechoslovakia, Italy and the United Kingdom. There is also a considerable industry in the United States which is now second to the U.S.S.R. in the world. Beet sugar is usually refined and consumed in the country where it is grown and sugar cane is produced largely for export in the raw state.

5.22 The world trade in sugar has been rather dormant in the past years. Only about 30% of the total world production entered the international market, of which, about half is exported at special preferential price. Of the remaining, a good proportion is traded under agreement of some form or other (special trading pacts). The two keen importing countries are Canada and Japan, which together take just under a half of the 'free' sugar.

5.23 The world price of sugar is influenced by this free sugar which is only about 7% - 8% of the total world production, with a direct consequence that a relatively small fluctuation in the world production (say 3%) can have an abnormally large influence (20%) on the free export sugar available and therefore its price. There is, therefore, a large fluctuation in sugar prices in the world market and this fluctuation is always over a wide range. Price movements of considerable magnitude at times, have been experienced in the past, and such oscillations had been ignited by outbreak of war, crop failures and imbalances in demand and supply situation. The Korean War inflation has, for example, caused the price of sugar to sky-rocket to unprecedented heights.

5.24 This unstability of sugar prices is generally viewed with concern by the importing countries. As the ups and downs in the world free market prices tend to reflect themselves in the domestic markets, Governments have, therefore, felt it necessary to insulate domestic prices from the effects of external price movements. The problem of minimising or barricading the effects of movement in the world price on the internal price level, has found solution, in most cases, by establishing own plantation and factories.

Malaysian Situation

5.25 Prior to the establishment of the two refineries, Malaysia's total consumption of 330,000 tons of sugar per annum were met by imports from the United Kingdom, India, Mainland China, Taiwan, Hong Kong, Russia and other East European countries. The domestic price level, therefore, was fully opened to the influence of world prices and violent fluctuations in the local retail prices were recorded. In November, 1963, when rising prices caused a crisis in the world market and propelled excited buying and selling, the domestic retail prices also edged upwards and rose to M52 - 53 cents per pound, when three months ago, it was only M37 - 38 cents per lb.

5.26 As a first step towards correcting the situation, two refineries were established. Through a process of long-term buying of raw sugar, and also creating sufficient reserve of it, the two refineries were able to create some form of stability in the sugar price structure. As raw sugar has still got to be imported, this could only be viewed as a temporary measure. In view of this, the Malaysian Government has lately granted approvals for the establishment of four integrated sugar complexes in West Malaysia. These integrated sugar complexes are to start from plantation and ultimately produce refined sugar. The production from these plants is estimated to be as below for the period 1972 - 1975:

Table 5.4

Production of Refined Sugar in thousand tons for the period 1972 - 1975

	1972	1973	1974	1975
Gula Perak	30	40	50	60
Perlis Plantation	-	30	50	60
Gula Johore	-	15	30	50
Gula Negeri	-	-	30	50

It is expected that these four plants together would in time, through their expansion programme, replace the entire import.

Sarawak

5.27 In view of the congestion in the international market for sugar, and the unstability of the international sugar price, sugar to be produced in Sarawak would have to be meant solely for the domestic market. The market analysis, therefore, in regard to the proposed sugar industry for Sarawak would be only confined to the region of Sarawak, Sabah and Brunei, a British protectorate, sandwiched between the two East Malaysian States.

5.28 The annual import of sugar into Sarawak is around 24,000 tons, increasing at a rate of about 7% per annum in volume and 21% in value. The quantities of sugar imported into this State and also into Sabah and Brunei with their respective c.i.f. value during the period 1966-1969 are shown in Table 5.5.

5.29 While the import of sugar into Sabah is around 16,000 tons in 1969, the import into Brunei was 4,250 tons in the same year. The annual rate of increase in import into all the three areas would be somewhat similar and could be assumed at 7%. Today, the total annual import of sugar into the three areas combined is around 45,000 tons per annum.

5.30 The main source of import of sugar into Sarawak and Sabah is Mainland China. However a small quantity also enters into Sabah and Sarawak, from West Malaysia. According to a newspaper report, Brunei has recently created a stockpile of 3,000 tons of sugar imported from West Malaysia. Prior to this, the imports were mostly from Mainland China.

5.31 The c.i.f. price of sugar in 1969 was M$325.50 per ton, as against the retail price equivalent of M$504 per ton at Kuching and other important urban centres in Sarawak. The added cost included a duty of M$145.60 per ton and some profits. Since 1970, however, due to the Government's campaign to support made-in-Malaysia Products, more sugar is being imported from West Malaysia. Though sugar imported from West Malaysia is not subjected to any duty, an excise duty of $175 per ton of refined sugar has already been paid by the Malaysian refineries. This has invariably caused an increase in the price of sugar in Sarawak. In 1970, the average retail price of sugar in the major centres in Sarawak was $571.20 per ton and at present, it is well over $700 per ton. In West Malaysia, the equivalent retail price is $638 per ton.

Table 5.5

Import of Refined Sugar into Sarawak, Sabah & Brunei

State/Country	1966		1967		1968		1969		Remarks
	Quantity	Value c.i.f.	Quantity	Value c.i.f.	Quantity	Value c.i.f.	Quantity	Value c.i.f.	
Sarawak	23004.60	5086904	21823.90	5225106	23826.74	6359559	23929.10	7790324	
Sabah	12940.00	2922487	15745.87	3907503	16760.00	4586535	15060.46	5529922	Main source China
Brunei	4000		4091.47	1074741	4100		4250		

Source: Statistics Department Sarawak.

5.32 Though the annual import figures indicated at Table 5.5 are not sufficient to establish any trend of imports (perhaps due to over-stocking in a year, when a rise in prices is anticipated in the subsequent period), it is obvious that with the rise in population and also with the rise in the per capita income, the consumption of sugar in all the three States would be going up. For West Malaysia, it has been assumed that there would be a total annual rise of sugar consumption, built up as follows:-

(i) 2½% due to population increase,

(ii) 2½% due to the rise in the standard of living,

(iii) 5% due to increased industrial use.

Though the rate of increase in East Malaysia would not be as high as in West Malaysia, particularly in view of the third factor listed above, it could be assumed that at least the present rate of 7% would be maintained. At this rate, the sugar consumption of the three areas combined for the period 1969-1980 is estimated as shown in table 5.6. Marketing of locally produced sugar would, therefore, not be difficult.

Table 5.6

Projected Combined Sugar Consumption of Sarawak, Sabah & Brunei

Year	Quantity
1969	45,000 tons
1970	48,000 "
1971	51,540 "
1972	55,147 "
1973	59,107 "
1974	63,244 "
1975	67,671 "
1976	72,407 "
1977	77,475 "
1978	82,898 "
1979	88,710 "
1980	94,919 "

Proposal for Sugar Industry in Sarawak

5.33 There are different views as to the minimum economic size of a sugar factory. In the Report of the Seminar and Digest of Technical Papers on Integrated Food Processing In Yugoslavia, held from November 4th - 28th, 1968, it has been stated that "a sugar factory today is unprofitable if:-

(a) Daily processing of sugar or sugar beet does not reach at least 4,000 - 5,000 tons a day.

(b) The production cost of the raw material exceeds a certain limit.

(c) The average distance of plantation from the factory exceeds 6 miles.

(d) The average yield of crystalized sugar does not reach a certain minimum.

(e) The daily supply is so organised that the period between harvesting and processing cannot be reduced to at least 24 hours.

and (f) The factory is not supplied throughout the season at an average of 85% - 90% of capacity".

While some of these conditions are essential for profitable production of sugar, the minimum daily crushing capacity indicated above appears to be too high, as would be evident from the Indian experience.

5.34 In India, an average sugar factory produces approximately 16,000 - 18,000 tons of sugar per year with an average recovery of about 9%. The price of sugar cane is much higher compared to the estimated Malaysian price, while the net price of sugar is somewhat lower. In view of this, it should be possible, subject, of course to further detailed study, to produce sugar economically, in a small capacity plant in East Malaysia.

5.35 The four alternative proposals to be considered by the State Government would be:-

(i) The establishment of a refinery to refine imported raw sugar.

(ii) The establishment of more than one small-scale Khandsari plant, producing brown sugar for the market.

(iii) The establishment of a refinery, along with item (ii) above, at a central place, to refine brown sugar obtained from the khandsari units.

and (iv) The establishment of an integrated sugar mill complex of an appropriate size.

5.36 Refining of raw sugar is considered uneconomical unless the capacity is sufficient, say about 100,000 tons per annum. The demand being much lower than this, establishment of a refinery alone, using imported raw sugar would be uneconomical.

5.37 Khandsari sugar is unsophisticated as a sweetening agent. It has a large amount of impurities which are normally washed out in a regular sugar mill. The appearance of the sugar, is not as crystal white as that available in the market, which most of the Malaysian consumers are used to. It would thus be difficult for khandsari sugar to compete in the market and this, in itself would rule out the manufacturing of khandsari sugar in this country. Furthermore, the manufacturing process of khandsari sugar is wasteful as the extraction of juice from cane is not efficient. Because of the small size of operation, the sugar cane is crushed through two or three roller crushers. Such crushers are only capable of extracting normally, around 70% of the juice, as against 90% and above in regular milling tandem. This loss of juice in bagasse is really a proportionate loss of sugar. Khandsari production, therefore, would not be a justifiable proposition in Sarawak conditions.

5.38 In Khandsari manufacture, the loss of juice is normally made up in weight by the impurities that go with it. Hence, if khandsari sugar is to be further processed into refined sugar by milling, the advantage of added impurities is lost, rendering the manufacture of sugar uneconomical. Moreover, independent khandsari units would require substantial part of the sugar making equipment like pans, evaporators, etc. Duplication of these equipment at different locations would not be justified economically.

5.39 The last and only alternative is therefore to examine the possibility of establishing an integrated sugar mill in Sarawak. Two alternatives are possible -

(i) To have two integrated sugar mills - one in each of the States, Sarawak and Sabah. The capacity of the mills should be around 1,500 tons of cane per day working approximately 200 days a year;

or (ii) To establish one mill in either of the states, with a crushing capacity of 3,000 tons of cane per day, working the same number of days in a year.

A decision in regard to this can only be taken after a complete feasibility study in regard to land suitability and its availability and climatic and other conditions etc. at the various sites identified in the two States are undertaken.

Agricultural Suitability in Sarawak

5.40 Though ideal conditions for sugar cane cultivation is not available in any of the areas in Sarawak, particularly in regard to rainfall and dry period, conditions approaching this are stated to be prevailing in certain areas. The rainfall in Sarawak is peculiar in that it varies widely, even within short distances where there is no intervening highlands. Over the year, however, rainfall at all places is well distributed, except during the monsoon season (Landas) from November to January. The dry months are July and August, but even during these months, most of the places also experience some rainfall ranging from 2 inches to 4 inches.

5.41 According to the calendar of farm operation in Sarawak, published by the Department of Agriculture, rubber tapping in the state is estimated to be carried out by smallholders for about 178 days a year, distributed as below:-

January	-	8.2 days
February	-	11.6 "
March	-	13.4 "
April	-	17.2 "
May	-	20.2 "
June	-	19.2 "
July	-	14.2 "
August	-	18.1 "
September	-	17.9 "
October	-	15.1 "
November	-	11.8 "
December	-	10.8 "
Total		177.7 days

This gives a rough indication as to the minimum number of sunny days in Sarawak (the lower number of rubber tapping days during the months of February, March, April, June, July, August, October and November is due to the fact that farmers spend longer time in land preparation, sowing, weeding and harvesting of paddy). Though the above analysis is purely qualitative, it indicates that the available rainfall pattern for sugar cane growing justifies further investigation into the matter.

5.42 An area where conditions appear suitable for sugar cane cultivation is the Lambir-Subis area of the Fourth Division, near Miri. In this area, the required two months of near-complete dryness prevail.

5.43 Temperature variation in this area is also small throughout the year. At Miri, during the last six years, the mean maximum daily temperature was highest in 1966 (88.6°F) and lowest in 1970, (87.1°F). For 1970, the highest mean daily maximum temperature was recorded in May (88.7°F), and the lowest mean daily minimum temperature was recorded in February (72°F). It is noted that the difference between the mean daily maximum and the mean daily minimum temperature all the year round, varies only between 12°F - 15.5°F. Such a temperature and its variation is congenial for plantation and harvesting of sugar cane.

5.44 Constant high temperature all the year round, with the difference in maximum and minimum temperature at around 10°F or less; together with a good amount of moisture in the soil, often encourage vegetative growth. Hence, in Miri, the difference of 12°F - 15.5°F, would serve as a good check to the vegetative growth, particularly in the months of February, July and August. Also, during these months, the soil moisture tends to become less and the total effect is the accelerated ripening of the cane. The cane quality is expected to be maintained for a fairly good period without any deterioration in sucrose content.

5.45 However, the prevailing temperatures might also encourage the growth of weeds and attack by pests and certain diseases. It is thus, important to have proper agricultural practices and close watch during the growth period of the cane so that these adversities could be kept under control.

5.46 The mean relative humidity percentage prevailing at 2.00 p.m. during different months at Miri is as below:-

January	-	78%
February	-	71%
March	-	69%
April	-	75%
May	-	73%
June	-	72%
July	-	70%
August	-	69%
September	-	71%
October	-	74%
November	-	73%
December	-	72%

It has been noted that the actual relative humidity figures, particularly in the morning could be higher than those given above. Such high humid conditions would have a very invigorating effect on the growth of cane.

5.47 No data are available on actual sunshine hours or gms.cal.cm² day. A number of mean bright sunshine daily hours are, however, available and accordingly, the total annual sunshine hours in Miri is 2,365 per year. This sunshine would be adequate for the growth and ripening of the cane.

5.48 Winds are not a major factor in the growth and cultivation of sugar cane though they may affect the cane in as far as lodging is concerned. The velocity of the wind in Miri, is reported to be not more than 314 miles per hour generally. There is, therefore, no danger of damage to the cane crop due to wind velocity any time during the year.

5.49 Experiments on sugar cane growing in various soils under different conditions have been conducted by the Agriculture Department of Sarawak. These experiments, conducted both at the Semongok Research Station in Kuching and the Kebuloh station in Miri, have not been completed yet, as the full crop cycle, (from the plant crop to the end of the second ratoon crop) is not yet over. Though the actual yield results are not available, results so far obtained on the main crop is hopeful.

5.50 The trial results on the three types of soil viz:-

(i) Peat soil

(ii) Red-yellow podzolic soil

(iii) Recent alluvial soil,

along with their production cost per acre at farm, as worked out by the Agriculture Department are shown in tables 5.7, 5.8, and 5.9. (Though trial results obtained from Miri would be more appropriate, these are not available). The crop yield figures for the main crop are based on the actuals, but figures for the ratoon crop are based on West Malaysian experience.

Table 5.7

Peat Soil Condition (Stapok)

Crop	Labour required per acre (Work days)	Cost per acre	$	Gross returns/acre	$
Plant cane	69	Cane setts 1 ton @ $10/ton	10.00	25.56 tons @ $10.34/ton	264.29
		Spray and dip.	20.00		
		Fertilizers:			
		Urea 220 lb.	27.54		
		Dsp 60 lb.	8.62		
		Potash 260 lb.	26.41		
		Corrective minerals:			
		ZnSO4 5lb.	1.13		
		MgSO4 5lb.	1.13		
		CuSO4 15lb.	15.26		
		Dolomite 5 tons	426.66		
		Tool dep.	10.00		
		Sub-total	546.75		
First ratoon	40	Spray material	10.00	19.64 tons @ $10.34/ton	203.08
		Fertilizers	62.57		
		Corrective minerals	17.52		
		Tool dep.	10.00		
		Sub-total	110.09		
Second ratoon	40	Same as first ratoon	110.09	Same as first ratoon	203.08
	149	Total	766.93	Total	670.44
				Loss	96.49

Table 5.8

Red-Yellow Podzolic Soil Condition (Semangok)

Crop	Labour required per acre (work days)	Cost per acre	$	Gross returns/acre	$
Plant cane	50	Ploughing bed Cane setts (1 ton) Spray and dip. Fertilizers: 500 lb. 12:12:17:2 7.6 lb. M/P Tool dep.	65.00 10.00 20.00 56.69 0.77 10.00	27.26 tons @ $10.80/ton	294.41
		Sub-total	162.46		
First ratoon	43		87.00	35% reduction in yield 17.72 tons (estimate)	191.37
Second ratoon	43		87.00	17.72 tons	191.37
Total	136	Total	336.46	Total	677.15
				Income	340.69

Table 5.9

Recent Alluvial (Terbat Series) Soil Condition (Tarat)

Crop	Labour required per acre (work days)	Cost per acre	$	Gross returns/acre	$
Plant cane	50	Ploughing bed Cane setts Spray and dip Fertilizers: 250 lb.S/A 175 lb. DSP 135 lb. M/P Tool dep.	65.00 10.00 20.00 28.34 27.78 15.92 10.00	51.11 tons @ $14.98/ton	765.63
		Sub-total	177.04		
First ratoon	43		92.04	22% reduction in yield 40.888 tons @ $14.98/ton	612.50
Second ratoon	43		92.04	40.888 tons	612.50
Total	136	Total	361.12	Total	1990.63
				Income	1629.51

5.51 The sucrose content of the cane obtained under different experimental conditions varies and as such the price of cane thereof also varies correspondingly. The sucrose content of the cane grown on the three types of soil under experimental conditions was as below:-

Red-yellow podzolic soil (Average of 5 varieties)	-	6.955%
Peat soil (average of 5)	-	6.660%
Recent alluvial soil (Terbat series)	-	9.647%

A total of 32 varieties including local, Indian and Australian were planted. The plant crop from the Indian CO975 on alluvial soil yielded sugar cane with a higher sucrose content. Assuming a raw sugar price of 21 cents per pound and share of sugar value to the plantation at 60%, with a recovery of sugar from cane of 90% and an average sucrose content of 7.5%, the price of sugar cane ex-farm would be $\frac{7.5}{100} \times \frac{90}{100} \times (0.21 \times 2240 \times \frac{60}{100}) = \$19$ per ton

5.52 With this minimum recovery and price of cane, and with a yield of 30 tons of cane per acre per year, it should be economically viable to establish a large scale sugar cane plantation to support a sugar factory with a crushing capacity of say, 1,500 tons per day working for approximately 200 days per annum. On this basis the annual requirement of cane would be 300,000 tons or the equivalent of 10,000 acres of harvestable crop. It is thus proposed, that an area of about 14,000 - 15,000 acres of land be set aside for sugar cane cultivation. Farmers in the vicinity could also be encouraged to plant sugar cane, as there would be a ready market in the factory. Through extension officers, they could be given technical advice on the cultivation of the crop.

The Sugar Factory

5.53 The sugar factory should be centrally situated in the cane growing area, so that the expenditure on cane haulage from the farm to the factory could be reduced to the minimum. It is estimated that an area of about 15 acres would be required for the factory complex, provision being made for extension, keeping in view the future requirements of expansion of industrial activity. A large amount of water would be required in the factory, and it is thus important in the selection of site, that the source of water supply be ascertained.

5.54 The manufacturing process of white sugar directly from cane by double sulphitation process, can be broadly divided into three sections:-

(i) Juice extraction;

(ii) Clarification;

and (iii) Boiling and crystallization.

5.55 Juice Extraction: Sugar cane is passed through two sets of knives, and is fed in chopped condition, to the first mill, where about 60-65% of the juice contained in the cane are extracted. The resulting bagasse is conveyed to the diffuser wherein it is subjected to counter current extraction. The bagasse emerging from the diffuser, with about 75-80% water, is then passed through dewatering mills and the final baggase, containing nearly 48% moisture, is sent to boilers for use as fuel. The juice from the diffuser is combined with the primary juice from the first mill to give mixed juice which is finally sent to the process house.

5.56 Clarification: The mixed juice obtained, is weighed and clarified by the liming and sulphitation method. In this process, the juice, after being heated to 70-75°C in juice heaters is subjected to simultaneous action of lime, sulphur dioxide and if necessary, superphosphate, in a continuously working apparatus. The treated juice is then heated to about 100°C and sent to a continuous settler which allows impurities to settle, thus giving a clear juice for further processing.

The clear juice, containing about 85% water is concentrated in a multiple effect evaporator to about 60-65% solid content. This syrup is again bleached by sulphur dioxide, in a continuous syrup sulphiter and finally filtered or centrifuged in a separator for separation of suspended impurities.

5.57 Boiling and crystallization: The syrup is stored on pan floor for boiling, and crystal formation takes place in vacuum pans. In a battery of pans, sugar crystallization is carried out in three or four stages, the first stage giving marketable sugar and the last stage giving final molasses. The material which is boiled in the pans is dropped into crystallizers, from where it is pumped to centrifuge machines for purging, i.e. separating crystals from mother liquor. The sugar is finally dried in a dryer and graded.

5.58 For producing raw sugar, the juice is clarified by the defecation process where liming and the other filtering procedure are carried out. No bleaching by sulphur dioxide is performed.

5.59 For the factory complex, the main factory buildings required would consist of the following:-

(1) Main factory building including:
- (i) Diffuser house,
- (ii) Mill house,
- (iii) Boiler house,
- (iv) Power houses,
- (v) Process houses
- (vi) Sugar house,
- and (vii) Foundation for machinery.

(2) Administrative building.

(3) Ancilliary buildings including:-
- (i) Store houses and godowns,
- (ii) Offices,

(iii) Workshop,

(iv) Laboratory,

(v) Water storage tank and pump house,

(vi) Canteen, etc.

It is estimated that the total covered area would be around 6 acres. Making provisions for a large cane yard and other factory premises, the total area required for the factory complex would be in the region 13 acres. The total cost of construction of the factory buildings for such a complex is estimated to be about M$2 million.

5.60 The machineries required for the manufacturing process are itemised as follows:-

(I) <u>Cane Feeding and Preparation</u>	<u>Unit</u>
(i) Weighing scales for sugar cane (20 tons capacity)	2
(ii) Cane unloaders (hoisting capacity 10 tons)	2
(iii) Feed tables - electrically driven.	2
(iv) Cane carrier	1
(v) Cane kicker - for regulating cane feed	1
(vi) Cane-cutting knives - two sets of knives, leveller and cutter	2
(vii) Tramp iron separator - for magnetic separation	1

(II) <u>Milling</u>	
(i) Sugar cane mills (840 mm x 1,680 mm)	3
(ii) Hydro-pneumatic pressure regulating system	1
(iii) Intermediate carrier	1
(iv) Steam turbines (300/350 HP for each mill)	3
(v) Mill gearing, tail bars and couplings, and a simple imbibition system.	
(vi) Bagasse elevator (capacity 50 tons/hr.)	1
(vii) Return bagasse carrier (capacity 50 tons/hr).	1

		Unit
(viii)	Overhead crane - 15 tons	1
(ix)	Bagacillo separation and conveying	1
(x)	Diffuser for secondary extraction	1
(xi)	Diffuser juice pumps	2
(xii)	Bagasse conveying system.	

(III) Juice Clarification

(i)	Juice weighing scale (Max. capacity of 120 tons per hour)	1
(ii)	Juice receiving tank (capacity 10 tons)	1
(iii)	Pumps for mixed juice	2
(iv)	Juice heaters	4
(v)	Vapour line juice heater	1
(vi)	Milk of lime preparation	
(vii)	SO_2 generating plant	
(ix)	Sulphured juice pump sets	2
(x)	Continuous clarifier	1
(xi)	Rotary vacuum filter	1
(xii)	Filter cake conveyor	1

(IV) Evaporator

(i)	Quadruple effect evaporator set	1
(ii)	Vapour bleeding arrangements	
(iii)	Multijet spray condenser	1
(iv)	Injection water pump set	1
(v)	Syrup extraction pump sets	2
(vi)	Centrifugal separator	1
(vii)	Soda boiling system	

(V) Syrup Sulphitation

(i)	Continuous syrup sulphiter	1
(ii)	Syrup receiving tank	1
(iii)	Syrup pump sets	2

		Unit
(VI)	<u>Boiling and curing station</u>	
(i)	Pan supply tanks	16
(ii)	Vacuum pans (capacity 50 tons) with Mechanical circulators, Multijet spray condensers, and Injection water pump sets.	2
(iii)	Vacuum pans (capacity 40 tons), with Multijet spray condensers, and Injection water pump sets	3
(iv)	Seed crystallizers (capacity 25 tons)	2
(v)	Vacuum crystallisers (capacity 25 tons)	2
(vi)	Crystallizers, air-cooled (45 tons capacity)	4
(vii)	Continuous crystallizers, water-cooled	2
(viii)	Pumps for massecuites	6
(ix)	Centrifugal station	
(x)	Grass hopper conveyor	1
(xi)	Sugar elevator	1
(xii)	Air dryer for sugar	1
(xiii)	Grader - (four decked)	1
(xiv)	Hand operated monorail crane (for maintenance)	
(xv)	Sugar melter (capacity 6 tons/hr.)	1
(xvi)	Sugar weigh scales	2
(xvii)	Sugar bags stitching & conveying arrangement	
(xviv)	Weighing scale for molasses	1
(VII)	Steam generating plant including two water tube boilers.	
(VIII)	Power Generation & Distribution.	
(IX)	Miscellaneous including machinery supporting structures, pipings, lagging and insulations.	
(X)	Other workshop and laboratory equipments.	

It is estimated that the cost of machinery including refinery would be about M$ 12 million. Allowing a cost for freight, design and installation of about 25% of cost of machinery, the total capital outlay for plant and machinery would be in the region of $15 million.

5.61 From the machinery items listed, it is noted that, provisions have already been made for the installation of power and water supply. It can be assumed that the power, generated by the main turbo-alternator, when the factory is in operation, would be adequate for the entire factory complex. However, during the long period of machinery over-hauling and short periodical stoppages, provision for other sources of power supply would have to be made. A diesel power generator, specially maintained as a stand-by power unit would serve the purpose well.

5.62 The maximum water requirement of the factory would be about 500,000 gallons per day. It is proposed that this water supply be drawn from any suitable river near the factory.

5.63 Besides the capital investment on plant and machinery, it is estimated that a working capital of about M$ 7 million would be required to operate the factory smoothly.

5.64 Assuming a recovery rate of 9.0%, the quantity of sugar produced per day would be 135 tons. Working on 200 days per annum, the total production of sugar for a year would be about 27,000 tons. With an average net sale value of about M$500 per ton, the return per annum from sugar alone would be in the region of M$13.5 million. The economics of sugar manufacturing would depend largely on the total availability of cane at an economic price, on the recovery rate of sugar from cane and on the overall price of sugar which the manufacturer would obtain. In Sarawak, with a price of 33 cents per lb. of sugar, even a small venture is likely to be profitable.

5.65 The sugar industry complex, if established, is expected to generate employment of the following magnitude:-

Plantation staff and labour	-	150
Factory operatives	-	300
Administrative Staff	-	60

Skilled labour is highly required and local personnel would have to be trained to meet this requirement.

CHAPTER VI

COFFEE

The Coffee Plant and Preparation of Beans

6.1 Coffee originated in ancient Abyssinia (present Ethiopia) many centuries ago and was consumed as a food. About the year 575 A.D. Arabians were the first to cultivate the coffee plant and later the first to prepare beverage from the roasted fruit. In the sixteenth century, coffee became a popular drink in Egypt, Syria and Turkey; and early in the seventeenth century it was introduced into Europe. Coffee drinking habit spread rapidly across Europe over the years especially since 1683 as a result of the Second Siege of Vienna by the Turks. Coffee was taken to the western hemisphere in 1725 and planted on the island of Martinique in the West Indies. Later its culture spread through several countries in South America, Central America, West Indies, India, Ceylon and western Africa.

6.2 The commercial coffees of the world are grown in tropical and sub-tropical climates at altitudes up to 5,000 feet, the best grades being grown at higher elevations. Coffee soils should be fairly deep (18"), slightly acidic and well drained. It should be rich in nutrients especially potash with an ample supply of humus.

6.3 The coffee plant is a small tree or shrub growing to a height of 10 to sometime 15 feet and belonging to the family Rubiaceae. The species in commercial use are Coffee Arabica, about 72% of the world production; Coffea Robusta, about 28%, and Coffea Liberica less than 1%. There are several varieties in each of these species. After the rains, the plant normally produces white flowers which give place to the fruit after about six months.

6.4 The fruit is approximately the size of a small cherry and is red or purple when ripe. The outer portion of the fruit is removed during the curing process, leaving the yellowish or light green seeds or coffee beans. These are covered with a tough parchment and the silvery skin known as Spermoderm. Each cherry normally contains two coffee beans.

6.5 Most of the individual coffees from different producing areas possess characteristic flavours. Commercial roasters obtain preferred coffee flavours by blending or mixing the varieties, usually before but sometimes after roasting.

6.6 The coffee beans are required to be cured before it is ready for market. This curing is done either by dry or wet method. Coffee prepared by the dry method are known as "naturals" and those by the wet method as "washed". The wet method usually results in more uniform and high quality coffee.

6.7 The dry method of preparing coffee is used in most parts of Brazil and any other countries where water is scarce during the harvesting season. In this process the ripe cherries are spread on open drying ground and turned frequently each day in order to permit the sun and wind to dry all portions thoroughly. The sun-drying method usually takes two to three weeks. Hot air, steam and other machine-drying devices are also used in some producing countries. After all the coffee cherries are thoroughly dried, they are transferred to the hulling machine for removal of the dry husk. The parchment and the silver skin are usually removed in the same operation.

6.8 In the wet method, the freshly picked coffee cherries are fed into a tank for initial washing. Stones and other foreign materials are also removed. The washed cherries are then fed into the depulping machine to remove the outer skin and most of the pulp of the coffee cherry hence, freeing the coffee beans within. Although the beans are separated from the pulp, they are encased in the parchment skin and parts of the pulp mucilage still cling tightly to these skins. The beans are poured into a fermenting tank usually filled with water. Fermentation removes the last portions of the pulp clinging to the beans. The fermentation period varies in length lasting from 12 hours to as long as several days. Prolonged fermentation may cause undesirable flavours and odours to develop in tbe beans. Sometimes enzymes are used to speed up the fermentation.

6.9 Drying of the beans is done either in the sun or in mechanical dryers. The mechanical dryer, though expensive, is preferred, as drying is usually faster and does not depend on weather conditions. The parchment of the dry beans are broken by rollers and removed by winnowing. Further rubbing and winnowing removes the silvery skin and the beans are lifted in the condition of ordinary green unroasted coffee containing about 12% moisture.

6.10 Coffee prepared by either the dry or the wet method is machine-graded into large, medium and small beans using sieves, oscillating tables and airveyors. Damaged beans and foreign matters are removed by hand-picking and when production is large it is machine-picked. For commercial purposes, coffee is graded by imperfections on a numerical scale (1-6), based on the number of black beans, damaged beans, stones, pieces of hull or other foreign materials present. The coffee processing factories also grade coffee by colour, roasting characteristics and most important, cup quality of the beverage.

Coffee Production and Trade

6.11 The total world coffee production for the period 1965 - 1966 to 1968 - 1969 along with the estimated production for the year 1969-1970 and forecast of production for the year 1970 - 1971 are shown in Table 6.1

Table 6.1

World Production of Coffee

(thousand bags) (1 bag - 132 lbs.)

	1965-66	1966-67	1967-68	1968-69	1969-70e	1970-71f
Kenya	869	926	654	802	912	1,080
Tanzania	812	718	780	950	800	1,000
Uganda	2,574	2,726	2,700	3,470	3,130	3,300
India	1,065	1,305	954	1,209	1,047	1,350
Papua-New Guinea	184	268	247	320	450	500
Other Commonwealth a	600	400	470	470	400	420
Brazil b	37,776	17,505	23,374	16,500	20,600	11,000
Colombia	8,200	7,800	7,600	7,900	8,500	8,300
Costa Rica	973	1,139	1,267	1,156	1,400	1,300
El Salvador	1,766	2,002	2,370	1,925	2,500	1,900
Guatemala	2,101	1,670	1,850	1,740	1,750	1,800
Mexico	3,083	3,000	2,900	2,865	3,050	3,200
Other Latin America c	4,750	5,280	6,030	5,700	5,600	6,200
Angola	3,424	3,761	3,919	3,300	3,400	3,300
Cameroun	1,011	1,104	1,100	1,100	1,200	1,200
Congo (kinshasa)	975	900	1,000	1,000	1,100	1,150
Ethiopia	1,245	1,239	1,349	1,475	1,500	1,600
Ivory Coast	4,543	2,180	4,796	3,502	4,991	4,000
Other Africa a	2,000	1,850	2,400	2,250	2,100	2,400
Indonesia	2,200	1,850	2,150	2,000	2,200	2,300
Other Asia g	800	900	863	915	950	1,000
Total	80,950	58,500	68,800	60,500	67,600	58,300

a Jamaica, Guyana, Trinidad, Ghana, Nigeria, Sierra Leone, Malaysia. b Registrations except 1968 - 1969 and 1969 - 70 (crop estimates) and 1970-71 (forecast). c Cuba, Dominican Republic, Haiti, Honduras, Nicaragua, Panama, Puerto Rico, Bolivia, Ecudor, Paraguay, Peru, Venezuela. a Burundi, Central African Republic, Congo (Brazzaville), Dahomey, Gabon, Guineas, Liberia, Malagasy Republic, Rwanda, Spanish territories in Africa, Togo. e Estimates. f Forecasts. g Hawaii, Philippines, Portuguese Timor, South Vietnam, Yemen.

It would be seen that more than a third of world production of coffee is from Brazil, and the other Latin American countries together account for almost another third of the world production. Though coffee is native of Africa, the combined total production of the African states ranks third, next to Brazil and other Latin American countries combined. Production from Asia and Oceania is not very significant compared to South American and African production. Of the Asian countries, Indonesia is the largest producer of coffee followed by India.

6.12 The production of coffee fluctuates considerably depending on the vagaries of nature. For example, due to severe frost followed by drought in 1968 - 1969 the Brazilian production fell to 16,500,000 bags from its previous year's production of 23,374,000 bags. (1 bag-132 lbs)

6.13 The fluctuation in the production affects the world price of coffee considerably as would be evident from Table 6.2.

Table 6.2

New York : Spot Coffee Prices

(monthly averages, U.S. cents per lb.)

	Brazil-Santos No.4			Brazil-Parana No.4			Colombia MAMS			Guatemala-Prime Washed		
	1969	1970	1971	1969	1970	1971	1969	1970	1971	1969	1970	1971
January	38.50	52.30	53.75	37.78	49.30	52.50	43.95	59.43	52.10	39.78	51.13	45.35
February	38.68	52.35	50.94	37.63	48.88	50.29	43.23	57.18	50.35	39.63	51.08	44.66
March	37.80	53.00	45.65	36.58	50.03	44.63	41.05	57.50	49.93	37.58	53.38	45.95
April	37.30	53.60	43.72	36.28	51.38	42.72	40.05	57.23	48.35	36.63	53.45	44.82
May	37.20	53.95		36.10	51.93		39.85	57.78		35.45	54.85	
June	37.35	54.03		36.13	52.18		40.58	56.80		36.30	54.35	
July	37.53	54.73		36.28	53.55		40.33	56.25		35.48	54.68	
August	38.30	55.78		37.08	54.55		41.38	55.95		36.65	53.90	
September	42.38	56.98		40.85	55.65		45.30	55.65		41.15	52.55	
October	46.90	57.75		45.03	56.33		52.50	56.05		46.78	50.55	
November	48.40	56.33		46.40	54.95		55.75	54.80		46.93	46.98	
December	48.80	54.03		46.35	52.80		55.88	52.45		47.70	44.50	
Annual Average	40.76	54.57		39.37	52.68		44.99	56.42		40.09	51.87	

	El Salvador – Central Standard			Mexico-Prime Washed			Uganda-Washed Cleaned			Uganda-Native Standard		
	1969	1970	1971	1969	1970	1971	1969	1970	1971	1969	1970	1971
January	39.88	51.38	45.40	39.85	51.53	45.43	34.33	39.05	43.10	33.95	38.75	42.70
February	39.65	51.28	44.69	39.65	51.23	44.69	33.65	38.48	42.91	33.40	38.81	42.44
March	37.78	53.53	46.05	37.80	53.50	45.98	31.69	39.70	43.13	31.30	39.43	42.75
April	36.78	54.55	44.97	36.78	54.45	44.82	29.63	41.35	42.69	29.35	41.00	42.28
May	36.63	54.95		36.63	54.95		29.25	42.83		28.88	42.33	
June	36.48	54.50		36.53	54.48		30.35	42.18		30.03	41.68	
July	35.65	54.90		35.60	54.88		31.40	42.75		30.98	42.48	
August	36.75	54.05		36.78	54.05		33.08	42.88		32.70	42.53	
September	41.20	52.70		41.18	52.65		35.05	44.15		34.78	43.53	
October	46.95	50.70		46.90	50.63		38.53	44.60		38.18	43.38	
November	47.00	47.08		46.95	46.98		37.50	42.41		37.18	42.20	
December	47.83	44.53		47.80	44.58		32.53	42.70		37.25	42.30	
Annual Average	40.22	52.01		40.20	51.98		33.49	41.92		33.17	41.52	

In view of this and also due to the dependence of the economy of many countries on this crop, the United Nations Conference on Coffee negotiated a long-term agreement in 1962 signed by the governments of 54 exporting and importing nations. The agreement established basic export quotas for each of the major producing countries. Annual quotas are determined for each coffee year as a percentage of the basic quota. In addition, there are international and national organizations existing to promote coffee sales and to organize and plan research on the scientific and technical improvement of coffee culture, processing and distribution.

6.14 Coffee is traded in various forms such as green coffee beans (unroasted coffee beans), roasted coffee beans, coffee powder, coffee essence etc. The largest quantity traded is in the form of unroasted coffee beans. The total world coffee export during the calendar year 1969 declined slightly compared with 1968 to about 53.8 million bags. However, at the level they were significantly higher than for any other preceding year. The geographical source of world export are South America accounting for around 50% of the world export, Africa accounts for about 30%, While North America accounts for around 14% and Asia and Oceania combined, 5%.

6.15 The export of coffee by country of origin for the period 1965 - 1969 is shown in Table 6.3.

Table [illegible].3

COFFEE: Exports by country of origin, average 1960-64, annual 1965-69

Country of Origin	Average 1960-64	1965	1966	1967 1/	1968 1/	1969 2/
	1,000 bags 3/	1,000 bags 3/	1,000 bags 3/	1,000 bags 3/	1,000 bags 3/	1,000 bags 3/
North America:						
Costa Rica	[illegible]72	[illegible]05	914	1,102	1,142	1,101
Dominican Republic	4[illegible]	403	423	370	3[illegible]2	447
El Salvador	1,[illegible]37	1,[illegible]64	1,[illegible]17	1,[illegible]7	1,[illegible]7[illegible]	1,[illegible]7
Guatemala	1,394	1,5[illegible]	1,[illegible]17	1,35[illegible]	1,572	1,7[illegible]
Haiti	405	3[illegible]	34[illegible]	311	2[illegible]2	[illegible]31
Honduras	27[illegible]	415	3[illegible]3	3[illegible]	440	3[illegible]
Mexico	1,439	1,[illegible]01	1,537	1,241	1,5[illegible]	1,[illegible]
Nicaragua	36[illegible]	470	337	430	474	4[illegible]
Trinidad and Tobago	43	5	40	43	72	4[illegible]
Other 4/	11[illegible]	53	4[illegible]	131	2[illegible]1	[illegible]0
Total North America	7,021	7,162	7,513	7,346	[illegible],203	7,[illegible]01
South America:						
Brazil	1[illegible],025	13,4[illegible]2	1[illegible],[illegible]32	1[illegible],737	1[illegible],45[illegible]	1[illegible],[illegible]3[illegible]
Colombia	[illegible],139	5,[illegible]35	5,565	[illegible],094	[illegible],5[illegible]	[illegible],47[illegible]
Ecuador	47[illegible]	777	72	[illegible]45	[illegible]1[illegible]	[illegible]27
Peru	[illegible]01	576	500	[illegible]93	73	714
Venezuela	373	23[illegible]	303	30[illegible]	161	[illegible]1[illegible]
Other 5/	[illegible]	115	142	121	[illegible]7	[illegible]0
Total South America	24,613	2[illegible],[illegible]3	24,1[illegible]0	24,[illegible]99	26,[illegible]9[illegible]	27,227
Africa:						
Angola	2,125	2,653	2,[illegible]07	3,275	3,144	3,[illegible]
Burundi 6/	7/ 243	22[illegible]	246	314	313	30[illegible]
Cameroon [illegible]/	[illegible]4	715	[illegible]	[illegible]43	1,225	1,13[illegible]
Central African Republic	131	127	1[illegible]	152	137	131
Congo (Kinshasa)	9/ [illegible]04	377	577	[illegible]94	9[illegible]	[illegible]
Ethiopia	1,01[illegible]	1,36[illegible]	1,224	1,227	1,33[illegible]	1,1[illegible]
Guinea	1[illegible]2	1[illegible]	2[illegible]7	20[illegible]	205	150
Ivory Coast	2,7[illegible]2	3,[illegible]04	3,[illegible]24	2,4[illegible]4	3,574	2,[illegible]5[illegible]
Kenya	[illegible]71	[illegible]40	[illegible]	[illegible]4[illegible]	[illegible]27	[illegible]13
Malagasy Republic	72[illegible]	[illegible]34	761	[illegible]32	[illegible]7	[illegible]2[illegible]
Rwanda 6/	7/ 7[illegible]	171	147	1[illegible]7	201	15[illegible]
Equatorial Guinea	11[illegible]	114	150	12[illegible]	12[illegible]	1[illegible]
Tanzania 10/	455	473	[illegible]52	756	[illegible]1[illegible]	[illegible]05
Togo	162	17[illegible]	220	94	17[illegible]	1[illegible]
Uganda	2,14[illegible]	2,[illegible]30	2,7[illegible]	2,[illegible]5[illegible]	2,533	2,[illegible]
Other 11/	302	193	524	331	50[illegible]	41[illegible]
Total Africa	12,362	13,9[illegible]5	15,413	15,01[illegible]	16,711	15,953
Asia and Oceania:						
India	402	401	403	[illegible]00	471	5[illegible]7
Indonesia	1,012	1,[illegible]03	1,502	1,100	1,369	1,2[illegible]
Malaysia 12/	717	204	562	[illegible]20	620	6[illegible]
Yemen	73	[illegible]5	43	27	30	23
Other 13/	153	251	264	360	36[illegible]	2[illegible]
Total Asia and Oceania	2,357	2,724	2,[illegible]64	2,[illegible]07	2,[illegible]59	2,[illegible]70
Grand Total	46,353	44,734	49,950	50,171	54,769	53,7[illegible]1

1/ Revised. 2/ Preliminary. 3/ 132.276 pounds or 60 kilograms. 4/ Includes Cuba, Guadeloupe, Hawaii, Jamaica, Panama and Puerto Rico. 5/ Includes Bolivia, Guyana, Paraguay and Surinam. 6/ Prior to 1963, included in Congo (Kinshasa). 7/ Two-year average, 1963 and 1964. [illegible]/ East Cameroon only. 9/ Includes Burundi and Rwanda prior to 1[illegible]. 10/ Prior to 1964-65 year, was shown as Tanganyika, now includes Zanzibar as well. 11/ Includes Cape Verde, Comoro Islands, Dahomey, Gabon, Ghana, Liberia, Nigeria, Republic of Congo, Sao Tome and Principe, and Sierra Leone. 12/ Data for Malaysia represent estimated re-exports not otherwise shown. 13/ Includes New Caledonia, New Hebrides, [illegible], Papua and New Guinea and Portuguese Timor.

6.16 The share of export by the 9 principal producing countries as a percentage of total world export is shown in Table 6.4. Brazil has all along been the largest exporter accounting for more than a third of total world export. She is followed by Columbia with an export of around 12%.

Table 6.4

COFFEE : Exports by 9 principal producing countries as percentage of world exports

Country of Origin	Average 1960-64	1965	1966	1967	1968	1969
	Percent	Percent	Percent	Percent	Percent	Percent
Angola	4.6	5.9	5.2	6.5	5.7	5.7
Brazil	36.5	30.1	33.7	33.4	33.7	35.4
Colombia	13.2	12.6	11.1	12.1	12.0	12.1
El Salvador	3.5	3.7	3.2	4.0	3.6	3.5
Ethiopia	2.2	3.0	2.5	2.4	2.4	2.0
Guatemala	3.0	3.5	3.6	2.7	2.9	3.2
Ivory Coast	6.0	6.9	6.1	5.0	6.5	5.5
Mexico	3.1	2.9	3.1	2.5	2.9	2.9
Uganda	4.6	5.9	5.6	5.3	4.6	5.5
Total (9 coun.)	76.7	74.5	74.1	73.9	74.3	75.8

Demand Outlook

6.17 The world consumption of coffee has grown at a rate sufficient to produce about 1% a year increase in world exports during the past five years. Based on most recent data from the International Coffee Organization, apparent world consumption (exports + or - inventory changes) in the importing countries now amount to about 54 million bags per year. Of this amount, approximately 50.5 million bags is consumed in quota markets and slightly more than 3 million bags per year in non-quota or NXB markets. Some of these latter countries, particularly Japan have shown rapid increase in consumption during the past few years.

6.18 United States is the largest importer of raw coffee accounting for more than half of the total world import. The other principal importers are the EEC countries of which West Germany account for more than 5 million bags and France's share is around 4 million bags. Of the remaining European countries Sweden take around 1¾ million bags with Italy importing 2½ million bags. The UK import is around 1.5 million bags. The import of raw coffee into the principal importing countries are shown in Table 6.5. The import of coffee both into the large importing countries and the small ones has been increasing over the period of years.

Table 6.5

Imports of raw coffee into the principal importing countries

(thousand bags)

	1968	1969	1970	1971
Canada	1,394	1,363	1,256	167
United Kingdom	1,528	1,704	1,535	541
Australia	292	330	374	101
New Zealand	81	59		
Singapore	207	175		
United States	25,378	20,233	19,726	5,004
West Germany	5,006	5,148	5,169	368
France	4,091	3,974	3,984	
Italy	2,534	2,593	2,742	244
Belgium	1,052	1,139		
Netherlands	1,701	1,968	1,838	209
Sweden	1,769	1,766	1,770	234
Denmark	934	1,000	970	132
Norway	575	654	632	118
Switzerland	719	873	1,008	304
Soviet Union	523	800		
South Africa	260	230		

6.19 Messrs. George Gordon, Paton & Co. of New York estimated the import of coffee per head of population in 1969 as shown in Table 6.6. The estimates are shown in two different sets - one for those countries where imports exceed 10 lbs. per head and for certain other countries where it was lower than 10 lbs. per head. It is interesting to note that imports per capita were highest in the Scandinavian countries with an import of 29 lbs. per person, and is still showing a rising trend. Imports into Austria, Spain and Switzerland also exhibit an appreciable rise, whereas, those into West Germany, France and Canada appear for the present to have stabilized. Imports per person into the United States again declined sharply after showing a recovery in 1968, and dropped further in 1970. Those into the United Kingdom, though rising, were still less than one-seventh of the Swedish level. Among other countries, Japan imported little over 1 lb. per head and Turkey only one-tenth of a pound suggesting the vast opportunities which may exist for boosting coffee consumption and imports through generic product promotion drive.

Table 6.6

Imports of Coffee - Per head of Population

	1967	1968	1969		1967	1968	1969
Sweden	28.4	29.6	29.3	Canada	8.7	8.9	8.6
Denmark	24.1	25.4	26.9	Austria	5.7	6.2	6.8
Finland	23.6	22.9	25.7	Italy	6.1	6.4	6.6
Iceland	24.8	22.3	25.3	East Germany	5.2	5.2	5.1
Norway	20.6	19.9	22.5	Spain	3.7	3.6	4.6
Netherlands	16.5	17.7	20.2	United Kingdom	3.3.	3.7	4.1
Switzerland	13.1	15.5	18.7	Hungary	3.0	4.4	3.7
Belgium	14.3	14.4	15.1	Poland	1.9	1.7	1.9
United States	14.2	16.7	13.2	Japan	0.9	1.0	1.3
West Germany	10.3	11.1	11.2	Soviet Union	0.3	0.3	0.4
France	9.8	10.8	10.4	Turkey	0.1	0.2	0.1

6.20 Coffee is also traded in the international market as soluble coffee. The export of soluble coffee from Brazil for the year 1969 - 1970 are shown in Table 6.7.

Table 6.7

Export Soluble Coffee from Brazil
(1969 - 1970)

(Thousand bags, raw coffee equivalent)

Name of Country	1969	1970
U.K.	117	320
Canada	34	128
United States	654	432
France	10	10
West Germany	57	52
Italy	7	12
Netherlands	13	31
East Germany	12	23
Poland	2	14
Romania	4	2
Soviet Union	-	3
Japan	5	5
Other countries	8	9
	923	1041

6.21 The United States import of soluble coffee in 1970 at 274,600 bags were , over a tenth smaller than those of 1969. In the other countries, the import has considerably increased. It might be of interest to note that though Soviet Union bought from Brazil for the first time in 1970, the other East European countries increased their import of soluble coffee considerably indicating a good potential market in the Soviet zone. Import into Japan increased by over 50% during 1969 making the country the third largest importer.

Malaysian Situation

6.22 Though Government's efforts to encourage coffee growing has started only recently i.e. in 1969, coffee is not a new crop to Malaysia as a whole or Sarawak in particular. Arabian coffee was first grown in Malacca (West Malaysia) in the 18th century which did not prove successful on the plains. In 1875, Liberian coffee was introduced in the Malayan states and this variety spread rapidly throughout the peninsula. Even in the last decade of the 19th century, Malaysia was an important exporter of coffee; and in 1894 alone, the export from Selangor and Perak, the two Malayan states amounted to 4,000 pikuls (1 pikul = 133 lbs.) of coffee. In 1905, Selangor alone exported 107,218 pikuls. By this time, however, most coffee estates had been interplanted with rubber and the production of coffee declined rapidly. In Sarawak, coffee growing was undertaken as a backyard crop from dates unknown. As the time passed, coffee growing became somewhat organized and was recognised as a smallholder crop of minor nature.

6.23 Statistics on the total acreage under coffee in Sarawak is not available because of the scattered and small nature of the plantations developed on the farmers' own efforts.

6.24 The State Government initiated a scheme in 1969 to encourage coffee growing in smallholdings and the total acreage developed under this scheme up-to-date is shown in Table 6.8

Table 6.8

Coffee Acreage developed under Subsidy Scheme

1969 - 1970

Division	1969	1970	Total
First	53	48	101
Second	88	56	144
Third	33	102	135
Fourth	7	47	54
Fifth	8	57	65
Total	189	310	499

6.25 During the Second Malaysia Plan, the State Government proposed to develop a total of another 3,700 acres on smallholder scale.

6.26 Sarawak soil has been found to be suitable for both the Robusta and Liberica types of coffee. The wild growth occasionally found is mostly of the Robusta type, indicating thereby that the Robusta coffee can grow under Sarawak conditions better. Robusta being in demand, the State Government's subsidy scheme encouraged plantation of this variety more.

6.27 Coffee plants bear fruits in about two years time from plantin . The two main cropping seasons are May/June and December/February, but smaller crop ripens throughout the year.

6.28 Trial plantations undertaken at Simongok near Kuching gave a yield varying from 400 - 600 lbs. of dried coffee beans (Robusta type) depending on the fertilizer composition and soil condition. The yield from the Liberica variety has not been obtained yet.

6.29 Assuming an average yield of 500 lbs. per acre, the average total production of coffee in Sarawak from the existing plantations and plantations proposed from 1970 onwards would be as in Table 6.9.

Table 6.9

Estimated Production of Coffee Beans in Sarawak (in lbs.)

1972	1973	1974	1975
94,500	249,500	599,500	949,500

The calculations above are based on assumption that from 1971 onwards another 700 acres to be brought under coffee, would start yielding from 1974 at the latest.

6.30 Land suitable for coffee growing (both Liberica and Robusta) is available in the Baram District of Fourth Division and also in the Fifth Division. It is suggested that two estate-type plantations should be encouraged in the respective areas, each with 5,000 acres. The production from these two estates, along with the production envisaged from the small-holders as worked out in the previous table, would not only replace the import of coffee to Sarawak, but could also partially replace the import of West Malaysia. In addition, the Malaysian quota in the international market which has remained unutilized could also be availed of, if there is a surplus production.

6.31 The import of various coffee and coffee products into the Malaysian states and to Singapore and Brunei for the last five years is shown in Table 6.10.

Table 5.10

IMPORT OF UNROASTED AND ROASTED COFFEE BEANS, COFFEE POWDER AND COFFEE ESSENCE WITH SARAWAK, SABAH, WEST MALAYSIA, SINGAPORE AND BRUNEI - 1966 - 1969

Commodity	Destination	1966		1967		1968		1969	
		Quantity	Value $	Quantity	Value $	Quantity	Value $	Quantity	Value $
Unroasted Coffee Bean (c.c. 071101) (Tons)	Sarawak	723.31	1,413,041	719.03	1,290,223	633.05	1,143,101	626.53	950,914
	Sabah	236.24	503,312	307.23	527,551	404.30	746,143	1,012.31	1,607,605
	W.Malaysia	3,790.79	6,197,671	3,660.01	5,001,420	4,164.2[illegible]	6,616,372	2,490.43	3,070,564
	Singapore	14,332.33	23,102,219	6,319.7[illegible]	10,164,379	12,234.04	16,430,050	10,331.49	15,411,093
	Brunei			119.12	241,093				
Roasted Coffee Bean (c.c. 071102) (lbs.)	Sarawak	Nil	Nil	Nil	Nil	37.50	71	2,451.67	3,149
	Sabah	41,425.32	54,681	64.00	9,713	1,120.00	3,507	2,401.20	5,160
	W. Malaysia	391.45	60,754	130.00	22,706	120.37	39,610		
	Singapore	402.20	67,740	104.00	12,815	13,434.00	13,[illegible]	23,734.65	25,667
	Brunei			2,722.00	3,501				
Coffee Powder (c.c. 071103) (lbs.)	Sarawak	97,379.53	132,521	134,185.09	100,240	151,803.50	150,007	157,404.97	180,450
	Sabah	35,490.59	134,195	110,577.19	171,[illegible]	[illegible]	21[illegible]	156,296.00	219,000
	W. Malaysia	210.05	52,534	327.95	90,377	250.36	77,476		
	Singapore	2,371.29	439,075	315,120.05	512,377	203,304.35	490,500	233,604.27	534,529
	Brunei			120,462.04	102,742				
Coffee Essence (c.c. 071300) (lbs.)	Sarawak	27,903.69	271,930	26,141.60	263,137	25,099.41	251,133	25,615.46	250,941
	Sabah	49,375.75	460,122	46,705.82	404,690	42,315.25	445,360	4,911.00	24,256
	W.Malaysia	2,347.96	2,100,703	31,266.75	2,739,379	390,416.60	3,315,949	45,620.10	446,244
	Singapore	23[illegible],390.94	2,103,602	14.04	10,107	410,161.07	2,952,390	314.94	4,200
	Brunei			10,515.50	177,090				

6.32 It would be seen that the import of coffee 'unroasted, roasted, powder and coffee essence) has been increasing over the period of years.

6.33 Sarawak import of coffee powder rose from 98,000 lbs. in 1966 to 157,500 lbs. in 1969. A somewhat similar rate of increase has also been experienced in Sabah where it rose from 85,490 lbs. in 1966 to 156,296 lbs. in 1969. Import into West Malaysia and Brunei also rose almost at the same rate. There is thus a good case for growing coffee and also converting it into various products such as roasted coffee, coffee powder and soluble (instant) coffee, for the local market. It might be necessary still to import some coffee for blending to produce coffee of local taste.

6.34 The import of coffee in various forms into Sarawak for the period 1966 - 1969 along with their sources and value are shown in Tables 6.11 - 6.14. While Indonesia has been the most important source for unroasted coffee, most of the coffee powder and coffee essence (including instant coffee) came to Sarawak from U.K. West Malaysia and Singapore. In coffee essence, Australia replaced U.K. as the largest source in 1970.

- 143 -

Table 6:11

Sarawak imports and exports of unroasted coffee beans for 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
Imports										
Brazil	11.36	21,926	4.83	7,833	4.53	7,365	6.45	9,887	9.98	[illegible]
Ceylon	-	-	0.13	282	-	-	-	-	-	-
China Mainland	0.92	1,828	0.94	1,674	0.40	680	0.87	1,422	0.98	2,014
India	1.09	2,069	1.28	2,340	1.18	1,301	0.69	1,137	1.71	3,[illegible]
Indonesia	689.07	1,345,195	694.27	1,246,291	680.09	1,135,203	615.57	934,226	686.65	1,214,[illegible]
Japan	-	-	0.64	1,103	-	-	0.55	906	-	-
Malaysia, West	16.22	32,534	12.74	23,437	1.40	2,696	-	-	14.57	31,344
Thailand	3.30	6,768	1.93	3,762	0.36	621	2.36	3,172	3.40	6,[illegible]
U.S.A.	0.27	543	2.32	3,599	0.09	155	-	-	16.89	32,[illegible]
Cuba	0.72	1,425	-	-	-	-	-	-	-	-
Philippines	0.36	748	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	0.09	164	-	-
Total:	723.31	1,413,041	719.08	1,290,323	688.05	1,148,101	626.58	950,914	734.18	1,3[illegible]7,461
Exports	-	-	-	-	-	-	-	-	-	-

Table 6:12

Sarawak imports and exports of roasted coffee bean for 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	lb	$	lb	$	lb	$	lb	$	lb	$
Imports										
Malaysia, West	-	-	-	-	-	-	2,133.00	2,660	-	-
Netherlands	-	-	-	-	-	-	36.00	125	48.00	175
Singapore	-	-	-	-	37.50	71	282.67	364	1,767.49	3,460
Total	NIL	NIL	NIL	NIL	37.50	71	2,451.67	3,149	1,815.49	3,635
Exports	-	-	-	-	-	-	-	-	-	-

Table 6:13

Sarawak imports and exports of coffee powder for 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	lb	$	lb	$	lb	$	lb	$	lb	$
Imports										
Ceylon	-	-	1,061.33	1,440	648.00	532	1,500.25	1,651	7[illegible]5.00	963
China Mainland	225.00	318	12,187.50	14,056	1,000.00	850	192.00	288	-	-
Indonesia	40.00	19	7,628.66	9,303	15,792.00	18,798	8,400.08	9,775	7,410.67	8,646
Malaysia, West	21,651.89	25,536	34,855.58	41,933	35,380.13	41,434	23,[illegible]19.43	28,275	10,[illegible]84.58	12,9[illegible]7
Netherlands	80.00	243	24.00	71	40.50	131	36.00	126	48.00	1[illegible]1
Singapore	71,374.72	86,265	75,127.27	85,720	79,127.75	84,799	119,6[illegible].25	130,731	147,986.10	159,74[illegible]
United Kingdom	2,031.60	2,768	789.00	3,860	870.00	3,087	[illegible]09.57	2,510	397.03	1,473
U.S.A.	2,247.37	10,999	2,511.75	11,857	2,105.15	6,476	1,340.07	4,1[illegible]5	390.00	1,2[illegible]
Australia	96.00	277	-	-	-	-	-	-	87.00	71[illegible]
Sabah	133.00	96	-	-	-	-	1,937.00	2,619	1,200.00	1,656
Other Countries in Central & South America	-	-	-	-	-	-	45.00	290	-	-
Brunei	-	-	-	-	-	-	-	-	50.00	[illegible]0
Japan	-	-	-	-	-	-	-	-	10.00	2[illegible]
Thailand	-	-	-	-	-	-	-	-	65.66	97
Total:	97,879.58	132,521	134,1[illegible]5.09	168,240	134,963.53	156,507	157,484.95	180,450	169,315.04	187,831
Exports										
Singapore	-	-	9.67	19	-	-	-	-	-	-
Thailand	-	-	6.00	6	-	-	-	-	-	-
Brunei	-	-	-	-	-	-	-	-	25.00	57
Total:	NIL	NIL	15.67	25	NIL	NIL	NIL	NIL	25.00	57

Table 6.14

Sarawak imports and exports of coffee essence for 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	lb	$	lb	$	lb	$	lb	$	lb	$
Imports										
Australia	42.00	215	6.00	70	5.50	50	11,384.63	116,929	25,193.74	231,[illegible]
Brazil	111.00	801	9.00	53	-	-	-	-	-	-
France	1.32	25	2.64	49	7.92	149	-	-	-	-
Germany, West	166.50	1,209	145.50	1,049	-	-	-	-	-	-
Israel	360.00	2,516	450.00	2,976	960.00	6,616	840.00	5,702	846.00	5,322
Netherlands	54.00	572	12.00	155	[illegible].00	61	-	-	39.00	40[illegible]
Philippines	804.63	5,711	-	-	-	-	-	-	-	-
United Kingdom	25,568.56	254,519	25,002.71	259,938	22,854.33	235,50[illegible]	13,326.83	12[illegible],016	6,643.90	48,327
U.S.A.	875.68	6,534	513.75	3,867	1,265.66	8,807	63.00	288	173.25	[illegible]
Japan	-	-	-	-	-	-	1.00	6	-	-
Total	27,983.69	271,980	26,141.60	268,137	25,099.41	251,183	25,615.46	250,941	32,895.89	287.328
Exports	-	-	-	-	-	-	-	-	-	-

6.35 With the increased production of green coffee in the State from 1972 onwards, it should be possible to undertake processing of coffee into coffee powder and instant coffee.

Manufacture of Coffee Powder

6.36 In the manufacture of coffee powder the operations involved are blending, roasting, grinding and packing. The first step of the commercial process requires dumping and cleaning of the green coffee to remove strings, lint, dust, hulls and other foreign material. Coffee from different varieties or sources are usually blended either before or after roasting.

6.37 The coffee is roasted by hot combustion gases in rotating cylinders and usually requires 10 - 20 minutes. During the first two-third of this period, the bean heats up at a fairly uniform rate and most of the moisture in the green coffee is removed. During the last few minutes the temperature of the coffee increases rapidly and the beans swell and unfold slightly with a noticeable cracking sound like that of popping corns. A water or air quench is used to stop the roasting reactions and to retard colour development of the beans. Because of the temperature (approximately 400^{o}F) at this stage, most, but not all, of the water is evaporated.

6.38 Roasting is carried out at a temperature of about 800 - 900^{o}F with forced re-circulation of air. Temperature controls and automatic quenches are used.

6.39 The finished and quenched roasted coffee is conveyed to bins where the circulation of air completes the removal of excess heat. Before grinding, it is necessary to remove residual foreign matter, such as stones and tramp iron which may have passed through the green coffee cleaning operation. This is accomplished by an air-lift, adjusted to such a high velocity, that the roasted coffee beans will be carried over into bins above the grinders, while stones, iron and other heavy materials are not lifted into the air stream. The coffee beans flow by gravity to mills for grinding to the desired particle size.

6.40 The roasted coffee is ground in multiple steel cutting rolls which give a uniform particle size distribution. After passing through the bean cracking rolls, the coffee beans are fed between two more rolls, one of which is cut or scored longitudinally whereas the other is cut or scored circumferentially. The pair rolls operate at different speeds in such a way as to cut rather than crush the coffee bean particles. For finer grinds, a second pair of rolls are installed below the main grinding rolls and these are more finely scored and run at higher speed.

6.41 The commercial grinds are regular (for percolators), drip (for dripolators or vacuum-style coffee makers) and fine (for vacuum style coffee makers. However, all-purpose grinds are more popular.

6.42 Ground coffee is packed in vacuum cans of various sizes. The roasted and ground coffee is conveyed, usually by gravity to weighing and filling machines designed to weigh and fill than to evacuate; or evacuate and fill with an inert gas and finally to seal 200 - 300 cans per minute. The can is filled with ground coffee with tapping or vibrating and loosely set cover is partially crimped. The can then passed through the vacuum chamber which is maintained at about 29" of vacuum, the cover is clenched to the can cylinder wall and the can passes through an acid valve or chamber and is stacked in corrugated cartons for shipping.

6.43 Coffee additives and substitutes have been used in all coffee consuming countries. Coffee additives and substitutes include roasted chicory, chick peas, cereal, fruit and vegetable products.

In some locations, consumers actually prefer the non-coffee beverages but usually these materials are used as low-cost beverage sources rather than as coffee.

<u>Manufacture of Instant Coffee</u>

6.44 Instant coffee is the dry water extract of roasted ground coffee. The product consists of brown-coloured, free-flowing particles of uniform size. Most commercial products contain 100% "pure" soluble solids. For the manufacture of instant coffee blending and roasting is done as described earlier.

6.45 Ground coffee blends are selected to achieve the desired flavour characteristics and may be based upon the same blend concepts as are applied to regular roasted coffee. However, major blend adjustments are made to compensate for flavour effects resulting from the soluble process. At present, African Robusta coffee having higher soluble content and lower price are used to a greater extent in soluble coffee than in regular roasted and ground coffee. In this respect, Sarawak has an advantage as the coffee so far grown and also having prospect, are only the Robusta species.

6.46 In the roasting of coffee beans for instant coffee, the batch type or continuous type process are employed as for roasted and ground coffee. The degree of roast is usually a little higher for soluble coffee. It will, however, vary, depending on the variety of coffee and blend used and also the flavour characteristics desired. A small number of "expresso" or Demitasse instant coffee are marketed which are prepared from extremely dark roasted coffee.

6.47 In grindings, standard coffee grinding machines are employed and the grind is adjusted to be most suitable for the type of percolation used. Generally, it is coarser than the regular grind of vacuum-packed coffee. Coarser products are used to avoid the development of excessive pressure and lots of pressure in the percolator hydraulic system. It is important to control the amount and distribution of fines which may interfere with uniform extraction. If the grind is too coarse, adequate extraction concentrates and soluble yields fail to be obtained unless longer time periods and higher temperatures are used.

6.48 In the extraction of soluble coffee, use is made of hot water under pressure. Extraction methods other than percolation are used in the small-scale production of soluble coffee including batch extraction and continuous counter-current extraction. The factors affecting extraction efficiency and production quality are:-

(a) Grind of coffee
(b) Temperature of waterfed to the extractors and temperature profile throughout the system
(c) Percolation time
(d) Ratio of coffee to water
(e) Pre-moisturing or wetting of the ground coffee
(f) Design of extraction equipment and
(g) Flow rate of extraction through the percolation columns.

6.49 The percolators are of cylindrical type with a height to diameter ratio varying from 7:1 to 4:1. These columns are usually operated in series as semi-continuous units of 5 - 10 percolators, with the water flowing counter-current to the coffee. The columns are filled at the top with the ground roasted coffee through a removable cover of wide opening plug valve. The ground coffee may be steamed or wetted with water or coffee extract. Feed water temperatures range from 310° - 360°F and unless the columns are heated, the temperature drops so that the extract drawn off will have cooled to 140°F - 180°F. The flowing extract temperature may be reduced by water cooling in plate heating exchangers to minimise flavour and aroma losses prior to drying.

6.50 The extract from the percolators is drawn off intermittently into insulated tanks. Yield is controlled directly by adjusting the weight to soluble solids drawn off and is dependent primarily upon the properties of the coffee, operating temperature, and percolation time. Commercial competitive products give 34% - 36% soluble yield. The flavour of instant coffee powder is sometimes enhanced by adding some of the natural aroma lost during processing.

6.51 There are various methods of drying. Normally the process adopted is decided by the operating costs, product losses, capital investments and other economic aspects. However, drying is the most important operation in the production of good instant coffee. The following criteria are most important in the drying processes:-

(i) Minimum loss or degration of flavour or aroma;

(ii) Free flowing particles of desired uniform size and shape;

(iii) Suitable bulk density for packaging requirements;

(iv) Desirable product colour; and

(v) Moisture content below 3.5%

6.52 Spread drying is the most commonly used drying process employed in drying instant coffee. The spread dryers are of the Bowen or Swenson type or modification similar to this. The spread dryers are usually constructed of stainless steel and are provided with adequate dust collection systems such as cyclones or back filters. The particles of dried instant coffee are collected from the conical bottom of the spread dryer through a retail valve and conveyed to bulk storage or packaging bins. The process of intant coffee manufacture is illustrated in Figure 6.1.

Figure 6.1

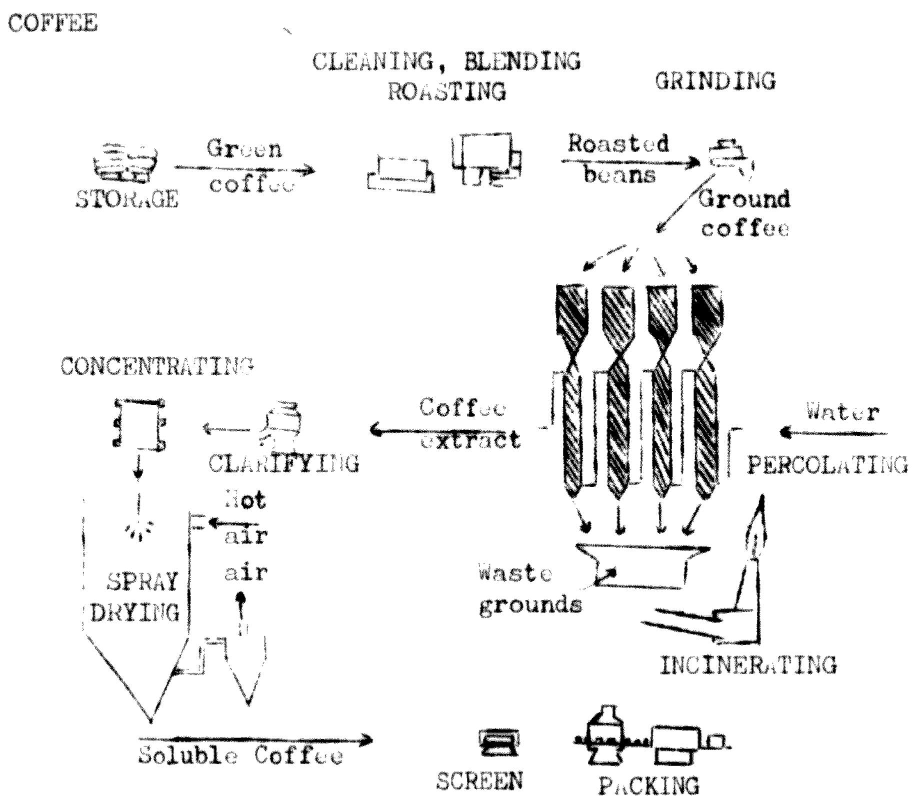


Fig. 6.1 Soluble-coffee process

6.53 The other methods of drying which are applied commercially are vacuum drum, vacuum belt drying and freeze drying. Freeze drying retains more of the desirable flavour and aroma components and also avoid some of the undesirable flavour changes that occur in spread or drum drying. This process is, however, limited in use owing to higher cost and limited capacity.

6.54 Instant coffee for consumer market is usually packed in glass jars of 4 ozs. 8 ozs. and 12 ozs. of coffee. For bulk consumers like institutions, hotels, restaurants, etc. packing is also made in boxes and bags of plastic or paper.

6.55 A protective packing is required primarily to prevent moisture pick-up. Regular instant coffee changes very little in flavour quality during normal periods of storage. However, the powder is hygroscopic and moisture pick-up causes caking and flavour impairment. Moisture content must be kept below 3% and packing rooms are usually conditioned to a relative humidity of 40% or less.

Manufacture of Ground (roasted) Coffee Powder and Soluble (Instant Coffee)

6.56 Roasting of coffee beans (imported and local) is carried out both in West and East Malaysia in cottage type units. So far, no plant has been established for the manufacture of instant coffee. Recently, pioneer approval has been granted to one company for the manufacture of instant coffee in West Malaysia. A fully owned subsidiary of Nestles have been granted non-pioneer approval for the same purpose. While the former factory is proposed to go into production by end of 1972, Nestles are reported to be delaying any commitment in this regard, as they have already captured 70% of the market with imports from their plants elsewhere.

6.57 Pioneer approval has also been granted to an East Malaysian company in Sarawak to produce among other things a product called 'coffees', a preparation containing instant coffee, milk and sugar. This factory is proposed to go into production in early 1973.

6.58 For obvious reasons, the production capacity envisaged of the proposed units cannot be recorded here though it can be said that even if these factories attain a production equivalent to the rated capacity, there would still be ample scope left for a unit in Sarawak to produce coffee powder and instant coffee for catering to the Malaysian market (both east and west) and market in Brunei and Singapore.

6.59 It has been discussed earlier that to obtain the best results, blending of the different varieties of coffee is required:- Robusta coffee bean being the principal one. While the local production of Robusta can be utilised, it might initially be necessary to import some quantity of Arabica coffee from Indonesia or other places, for proper blending. For a factory to produce 110 lbs. of instant coffee powder per hour (or 264,000 lbs per year), working single shift, an investment of around $2.5 million on fixed assets would be required. The plant would be capable of operating three shifts and would be capable of producing 800,000 lbs. of instant coffee powder annually. The equipment could be utilized for the production of coffee powder as well. The requirement of land for the factory would be around 2 acres and the equipment would cost around $1.2 million. The factory building would cost around 400,000.

6.60 **Working Capital requirement** based on three months requirement, working three shifts would be around $1.5 million. Packing materials such as glass jars, polyethylene bags would have to be imported from West Malaysia, and Singapore, till such time the proposed glass plant is established in the State or in Sabah. The plant would employ only 60 people as it is a highly capital-intensive automatic plant. The requirement of electricity would be around 60 kwtts. per hour while the water requirement would be about 70 cu. ft. per hour.

6.61 The diesel oil consumption of the roaster would be approximately 9 lbs. for over 220 lbs. of ground coffee while for the direct oil fire heater used as drying medium for the spray dryer would be 121 lbs. per hour. The steam boiler would require about 194 lbs. of diesel oil.

6.62 Details of the machinery required are as below:-

PRE-TREATMENT SECTION

1. PNEUMATIC CONVEYOR for the transporation of green coffee to the cyclone over the green bean cleaner. The conveyor consists of an inlet funnel and fan supported on a plate with a motor below the green bean dumping hopper. The conveyor line is made of full welded steel tubes, and feeds the green coffee into the cyclone separator on top of the green bean cleaner.

2. GREEN COFFEE CLEANER, with vibratory feeder to ensure a steady supply of the coffee, exhaustor for removal of the dust, cyclone with dust collector underneath, easy to disconnect, screen for separation of courser impurities such as pieces of jute, threads, sand, and small foreign bodies, and including exchange screen. The cleaner is mounted on supporting structure, and is complete with motor and V-belt drive.

3. PNEUMATIC CONVEYOR, for transportation of clean green coffee to green coffee silo. The conveyor consists of inlet funnel and fan which parts will be mounted on foundation plate with a motor underneath the green coffee cleaner. The conveyor line is made of full welded steel tubes, and feeds the coffee into the cyclone separator at the top of the green coffee silo.

4. GREEN COFFEE SILO of aluminized mild steel, consisting of four compartments with separate outlets. Further included is a distributor, consisting of four outlets for feeding the four cells of the green coffee silo. The distributor is designed for remote control from the dumping station. The distributor is provided with a motor as well as a control panel.

5. DEDUSTING UNIT, for distributor and for the outlet from the green coffee silo. The unit consists of filter with seven filter bags, and fan with motor, as well as the necessary duct connections underneath the outlet from the pneumatic conveyor, and at the

outlet from the roasted coffee silo.

6. GREEN COFFEE BLENDING SCALE, with pneumatically operated outlet dampers located underneath the green coffee silo with scale dial and operating panel which is provided with four push-buttons for opening of the silo outlet, and with indicator lights to show open outlets.

7. PNEUMATIC CONVEYOR, as Item 3., with transporation of green coffee from the blending scale to the roaster.

8. COMPLETE COFFEE ROASTING PLANT, consisting of:

   a. Cylindrical, rotating double shell roasting drum with built-in distributing device.
   b. Insulated drum housing.
   c. Exhaust fan for removal of roaster exhaust gas, hot air duct, and cyclone collector for coffee peel.
   d. Special flavour [illegible] device.
   e. Drum inlet and outlet.
   f. Observation panel, sampling device, and instruments.
   g. Diesel oil burner unit, complete with oil pump, oil tank, filter, and magnetic shut-off valve.
   h. Cooling unit with stationary circular cooling screen, exhauster for cooling air, and rotating discharge device.
   i. All necessary air ducting and exhaust stack.

   The roasting plant is furnished complete with necessary motors and driving gears.

9. ROAST COFFEE STONER, to be connected with the roaster. The stoner will be supplied with air via the cooler on the roaster. The stoner will be provided with necessary equipment to permit interconnection in sequence with the roasting and cooling operation prior to stoning.

10. ROASTED COFFEE SILO, of aluminized mild steel, together with a scale for weighing-off roasted coffee.

11. BUCKET ELEVATOR, adjustable to give the type of grinds required for the extraction process. The granulator is provided with grinding head consisting of corrugated rolls giving multiple reduction, and giving a uniform coarse products. The granulator is complete with motor and built-in magnetic separator.

12. ELECTRIC HOIST, inclusive of travelling trolley, to be used for transporation of the weighed ground coffee from the scale to the extraction vessels, exclusive of crane beam.

13. SILO, for granulated coffee, of aluminized mild steel

14. SCALE, for weighing-off the graded, granulated coffee into a bucket belonging to the extraction battery.

B- EXTRACTION SECTION

1. 1 PORTABLE FILLING HOPPER, inclusive of filling spout and butterfly valve located at the bottom outlet of the hopper. The filling hopper will be fabricated in stainless steel,

2. 2 HIGH PRESSURE FEED WATER PUMPS, for supply of water to the extraction battery. the pumps are supplied complete with directly coupled motor and base plate. The pumps are designed for a pressure of up to 20 kgs/cm^2, and are of multiple stop centrifugal type with stainless steel impellers and housing.

3. 1 FLOW CONTROLLER AND RECORDER with control valve for adjustment of the water flow to the extraction battery. This instrument is of the Foxboro manufacture.

4. 2 FEED WATER HEAT EXCHANGERS, for heating of the feed water to the required extraction temperature by means of steam. The heat exchanger consists of a straight-through tube bundle with floating head inside a steam jacket, outside insulated, covered by stainless steel sheets.

5. 5 EXTRACTOR VESSELS with all parts exposed to coffee or extract made of stainless steel AISI 304. Each vessel consists of a vertical tube with conical top and bottom for loading and discharging of the coffee, respectively. Further the vessel is equipped with removable top and bottom filters. The cylindrical part of the extractor is outside insulated and covered with stainless steel sheets.

6. 5 LOADING VALVES TYPE SCHOLZ, complete, made of stainless steel AISI 304.

7. 5 BLOW-DOWN VALVES TYPES "CAMERON", non-lubricated take apart ball valves in full stainless steel AISI 316.

8. INTERNAL PROCESSING PIPE MANIFOLD, inclusive of stainless steel piping, mild steel piping, flanges, fittings, flush valves, non-return valves, etc. The system of processing pipe lines is designed for easy dismantling and cleaning, if necessary.

9. 42 [illegible] VALVES "[illegible]Y-SEACK", in double seal ball valves manufactured in stainless steel AISI 304. The valve is specially designed for coffee-service and seat material is made of re-inforced teflon.

10. 12 GLOBE VALVES HANCOCK in full stainless steel AISI 304 with reinforced teflon seat. The globe valves are built-in into the processing manifold and acting as a throttle valve between the various extractor columns.

11. STEAM VALVES AND STEAM TRAPS in mild steel with flanges. The steam valves and steam traps are built-in into the processing manifold as well as connected to the feed water heat exchanger, and the vacuum loading system.

12. 2 THERMOSTATIC TEMPERATURE CONTROLLERS for manual adjustment of the feed water temperature required on the feed water heat exchanger.

13. VARIOUS MANOMETERS AND THERMOMETERS. The manometers are liquid filled and equipped with diaphram. The thermometers are of the marine design. The parts coming into contact with the product are made of stainless steel, AISI 304.

14. 1 SUPPORTING FRAME, for the extractors and the feed water heat exchanger, constructed in mild steel.

15. 1 SUPPORTING FRAME, for the processing manifold, constructed in mild steel.

16. 1 INTERNAL BLOW-DOWN MANIFOLD executed in heavy duty seamless steel pipe, and designed for giving a minimum of resistance during blow-down.

17. SPOTWISE X-RAYING and PREFABRICATION OF EXTRACTION MANIFOLD. The welding seams in the exchangers will be spotwise X-rayed and the vessels will be hydrostatically pressure tested. The entire extraction manifold will be prefabricated in sections and finally assembled during the erection.

C. - SPRAY DRYING SECTION

1. DOUBLE FILTER STRAINER, of stainless steel AISI 304. The double filter strainer is equipped with a mesh 100 filtering screen, and will thus remove very small insoluble particles from the extract prior to spray drying. The strainer will be located between the extract storage tanks, and the transfer pump connected to the H.P. feed pump.

2. HIGH PRESSURE NOZZLE FEEDING UNIT, with all parts coming into contact with the product made of stainless steel, AISI 304. The pump is with 3 pistons. A centrifugal pump will be feeding extract from the storage tanks to the H.P. pump. Inclusive of motor.

3. CO$_2$-INJECTION SYSTEM, consisting of an inline sparger to distribute the CO_2, and a flow-meter for adjusting the amount of CO_2 required. This system is to be used for control of the final powder bulk density, when necessary.

4. NOZZLE ASSORTMENT of the spraying system type, consisting of nozzle heads of stainless steel AISI 316, as well as inserts and whirl chambers of tungsten carbide. The assortment supplied will be of sufficiently varied size for selecting the correct nozzle combination so as to obtain the best possible particle distribution.

5. EXTERNAL SANITARY PIPING, VALVING AND FITTINGS continuing the processing line between the extract storage tanks, double filter strainer, high pressure feed pump and the nozzle feed system on top of the spray dryer. All piping and valving will be of stainless steel, AISI 304, and designed for easy dismantling and cleaning.

6. NOZZLE FEED SYSTEM AND BY-PASS TANK, consisting of high pressure valve manifold, and flexible high pressure hoses connected to the individual nozzle telescope steel, AISI 304, further, a nozzle by-pass tank will be installed.

7. COMPLETE DRYING TOWER, consisting of new type air disperser, cylindrical section, air outtake ring, and cone equipped with cooling air intake ring. The entire drying tower is made of pre-fabricated sections, with ground-off welding seams, to be assembled and welded together on site, constructed in stainless steel, AISI 304, on an angle framework of mild steel, well insulated with slagwoolbats and covered externally with stainless steel sheeting. Complete with service door, side light, and observation pane.

8. ELECTROMAGNETIC HAMMERS AND AUTOMATIC CONTROL PANEL. The hammers are to be located on the conical bottom of the dryer, and are operated automaticlly from the control panel.

9. MULTI-DUCTS, completely made of stainless steel, AISI 304, each duct equipped with dampers to adjust equally the air flow to the cyclones. The ducts are connected to the air outtake ring on the spray dryer.

10. CYCLONES, completely made of stainless steel, AISI 304, for separation of the re-cycling powder from the outlet drying air. The cyclones are specially designed by Niro Atomizer with a view of highly efficient separation of powder and air at a minimum loss of powder. The individual parts of the cyclones are assembled by means of turn buckles, and are easily accessible for inspection and cleaning. All welding seams are internally and externally ground-off.

11. ROTARY GEAR VALVES placed at the bottom of the cyclones, for recycling powder discharge. The rotary valves are manufactured of stainless steel AISI 304 and driven by a gear motor.

12. MULTI-EXHAUST DUCT, between the cyclone outlets and the exhaust fans, manufactured of galvanized mild steel.

13. AIR EXHAUST FAN, centrifugal type, for suction of air from the drying tower, through the cyclones, to the air exhaust stack. The fan is V-belt driven, with shaft running air cooled ball bearings and is made of welded steel construction, covered with corrosion-resistant painting, complete with V-belts and belt-guards, inclusive of motor.

14. AIR EXHAUST STACK, DAMPER & AIR HOOD, made of galvanized mild steel sheeting.

15. AIR SUPPLY FAN AND AIR INTAKE FILTER , The fan is of centrifugal type, for supply of air to the drying tower, and is executed in accordance with the description for item 13. The air filter is located on the suction side of the supply fan, and will secure that the air is cleaned before entering into the air heater, and then passing to the drying tower. Inclusive of motor.

16. AIR INLET DUCT AND MANUALLY OPERATED DAMPER, made of stainless steel AISI 304.

17. START-UP STACK, SLIDE GATE AND AIR HOOD, in stainless steel AISI 304 execution.

18. DIRECT OIL-FIRED AIR PRE-HEATER, for firing with diesel oil. The combustion gases from an oil burner are used as drying medium after mixing with the pre-heated air to the temperature required. The cylindrical furnace is covered outside by a shell of mild steel. An inner steel shell lined with high grade refractory material forms the combustion chamber with the burner front plate at one end. The air enters into the furnace through the annulus between the inner and outer shells into a mixing chamber. From the mixing chamber, the hot air is carried into the drying tower.

19. COMBUSTION AIR FAN AND AIR FILTER. The fan is of centrifugal type, for supply of the required amount of combustion air to the oil burner in order to secure a perfect combustion in the air heater. The fan construction will be as described under item 13. The air filter will be designed as described under item 15. Inclusive of motor.

20. COMPLETE OIL BURNER UNIT, of high pressure type, inclusive of oil pump with motor, and electric flame failure control, as well as control panel. The ignition of the oil takes place by means of electricity. Further, all necessary internal oil pipe lines, oil pressure manometers, and control valves are included. The oil burner is designed for manual control.

21. PNEUMATIC RECYCLE LINE, made of sanitary stainless steel tube. This line will return the recycling powder to the agglomeration zone of the drying tower.

22. RECYCLING FAN AND AIR FILTER, centrufugal type, as described under 13, for conveying of recycling powder through the pneumatic recycle line. The fan will be made of stainless steel, AISI 304, Inclusive of motor.

23. VIBRATING SCREEN CONVEYOR, with all parts coming into contact with the product made of stainless steel, AISI 304. The conveyor is located at the powder outtake at the bottom of the spray dryer, and will transport powder to the powder bins. Rejected powder will pass on to a separate outtake. The conveyor will be supplied with adjustable vibration unit. Inclusive of spare wire mesh screen.

24. INSTRUMENTATION for the spray drying plant, comprising:

a. 1 multi-colour strip chart recorder, for recording of dryer inlet and outlet temperature, extract temperature prior to drying, and nozzle pressure.

b. 1 indicating thermometer, for measurement of dryer inlet temperature.

c. 1 indicating thermometer, for measurement of dryer outlet temperature.

d. 1 vacuum gauge, for measurement of the vacuum in the spray dryer.

e. 1 indicating pressure gauge for control of the nozzle pressure.

Further, all necessary capillary tubing and bulbs.

15. OPERATION AND CONTROL PANEL. The above instruments will be mounted in a panel where also the motor push-buttons are located, as well as a flow sheet printed in plexiglass, showing the entire spray drying plant, and with signal lamps for the various motor.

D - PACKING SECTION

1. 4 POWDER CONTAINERS, for receiving and transporting the power from the powder sifter to the tilting device.

2. TILTING DEVICE, for tilting and emptying the powder into the powder hopper.

3. UNSCRAMBLER or automatic feed table allowing glass jars to be brought into single file for powder filling?

4. JAR CLEANER consisting of a cleaning nozzle through which compressed air passes and thereby blowing all foreign matter out of the glasses. The cleaner includes a conveyor belt and 360° glass jar turning device.

5. AUTOMATIC FILLING MACHINE with filling heads

6. AUTOMATIC CAPPING AND GLUING MACHINE.

7. LABELLING MACHINE, for automatic labelling of glass jars.

8. SEMI-AUTOMATIC PACKING MACHINE for packing glass jars in cardboard boxes.

9. STAPLING MACHINE "BIB" VI for closing cardboard boxes prior to filling with glass jars.

10. VARIOUS CONVEYOR BELTS for transporting boxes from one machine to the other.

11. PNEUMATIC STAPLING MACHINE, "Air Boxer" for closing carboard box tops.

E - AUXILIARY SECTION

1. 2 FILTERING UNIT, with removable filtering element. The unit is design in stainless steel AISI 304, for all parts coming into contact with the product. The filter is to be used for separation of insoluble particles contained in the extract.

2. 1 PLATE COOLING EXCHANGER, of two-stage type, for cooling extract by means of city water in the first stage and by the water in the second stage. All parts coming into contact with the extract are made of stainless steel AISI 304.

3. **1 SCALE TANK**, for collecting and weighing out each batch of the concentrated extraction battery. The tank is made of stainless steel AISI 304, and furnished with scale to be mounted on the floor.

4. **1 REFRIGERATION UNIT**, complete with all necessary accessories to supply chilled water for cooling of the extract. The unit consist of FREON compressor, condenser, chilled water tank, chilled water circulation pump, agitator, thermostatic and solenoid valves, internal piping and electric motors.

5. **1 WATER DEIONIZING UNIT**, for water softening of the extraction feed water, consisting of deionizing vessel and saturator, inclusive of internal piping and valves. The regeneration of the unit takes place automatically.

6. **1 AIR COMPRESSOR** for pneumatic operation of "CAMERON" blow-down valve and instrument.

7. **1 BLOW-DOWN CYCLONE** for collecting the spend ground coffee waste.

8. **1 FIRE TUBE BOILER**, complete unit with burner, blower, etc. suitable to heat feed water for extraction.

9. **1 AIR CONDITIONING EQUIPMENT**, complete for powder room section only.

F - SPARE PARTS SECTION

Lots of spare parts consisting of nozzles for spray dryers, valves, fittings, etc.

The cost of machinery also include:

- Erection of the entire installation
- Supporting structure, stairways and staging for chamber and extraction battery.
- Piping for water, steam, condensate, and oil up to Niro equipment.
- Storage tank for oil and water.
- Electric wiring and motor starter.
- All masonry and other artisan works.

CHAPTER VII

PINEAPPLE

7.1 Pineapple is a herbaceous perennial which belongs to the genus Ananas of the family Bromelaceae, and is a native of tropical America. Following its discovery by Europeans in 1493, pineapple was widely distributed throughout the tropical countries during the next 150-200 years. Through the centuries, a host of varieties, strains and forms were developed. Through all these varieties show great variation in the appearance of the leaves and some other vegetative characters, they all possess the same distinctive fertile characters and growth habits.

7.2 The pineapple plant has in general, a short stem and shallow roots. The leaves, 2 to 4 feet long, are stiff and slender and are specially adapted for holding moisture, In some varieties, the leaves have sharp spines along the edges.

7.3 The plant is monocotyledonous, and each stalk bears only one compound fruit, which is borne centrally on the plant some 18 months to 2 years after the slip or sucker is planted in the field. While this fruit is developing, the plant produces new shoots from beneath the soil. These shoots can all be subsequently used as sources of planting material. The 'Plant Crop' is generally larger and more succulent than subsequent 'ratoon crops'.

7.4 The quality of pineapple fruit is dependent on a number of important factors, including variety, nutrition, exposure, temperature, rainfall, ripeness and freedom from blemishes, insects or diseases. It is possible, through manipulation of planting time, number of plants per acre, fertilization and by other means, to alter the composition of ripening pineapple fruits. In general, however, varietal differences and effects of weather and relative ripeness of fruit by and large outweight other elements in determining fruit composition.

7.5 Experience in some pineapple growing countries indicated that medium to heavy loams, rich in organic matter and in nutrients and slightly acidic in reaction are most suitable soils for pineapple cultivation. However, results have shown that pineapple can be grown on practically and kind of soils provides they are not water-logged or too clayey.

7.6 In general, pineapple is very sensitive to frost and intense isolation, Shading of plants and fruits frequently results in carbohydrate deficiencies giving rise to small, white, opaque, flavourless pineapples of poor quality. Temperature is very important in the development of the various physical and chemical characteristics important to pineapple products. High temperatures depress ascorbic acid (Vitamin C) and the other organic acids of the fruit. However, moderately high temperatures are necessary to the development of the volatile fractions of flavour. The temperature range in the pineapple growing areas of the world varies from 30°F to 116°F, and the optimum temperature range for the crop has been defined as between 75°F - 85°F. High temperatures of 95°F and over have been observed to be unfavourable for fruit development especially when the relative humidity is also low. The relative humidity for the best growth is within the range of 67% - 95%.

7.7. Adequate rainfall is essential to the proper development of the pineapple plant and of the fruit. The availability of water, especially during both the formation of the fruit, and the final month of the development of the fruit, is essential in determining both fruit size and fruit quality. Under cultural or semi-cultural conditions, pineapple can be grown from sea level to 5,000 feet elevation, and range from semi-arid regions, having 20 inches rainfall, to rain-forest conditions, having 200 inches of rainfall annually.

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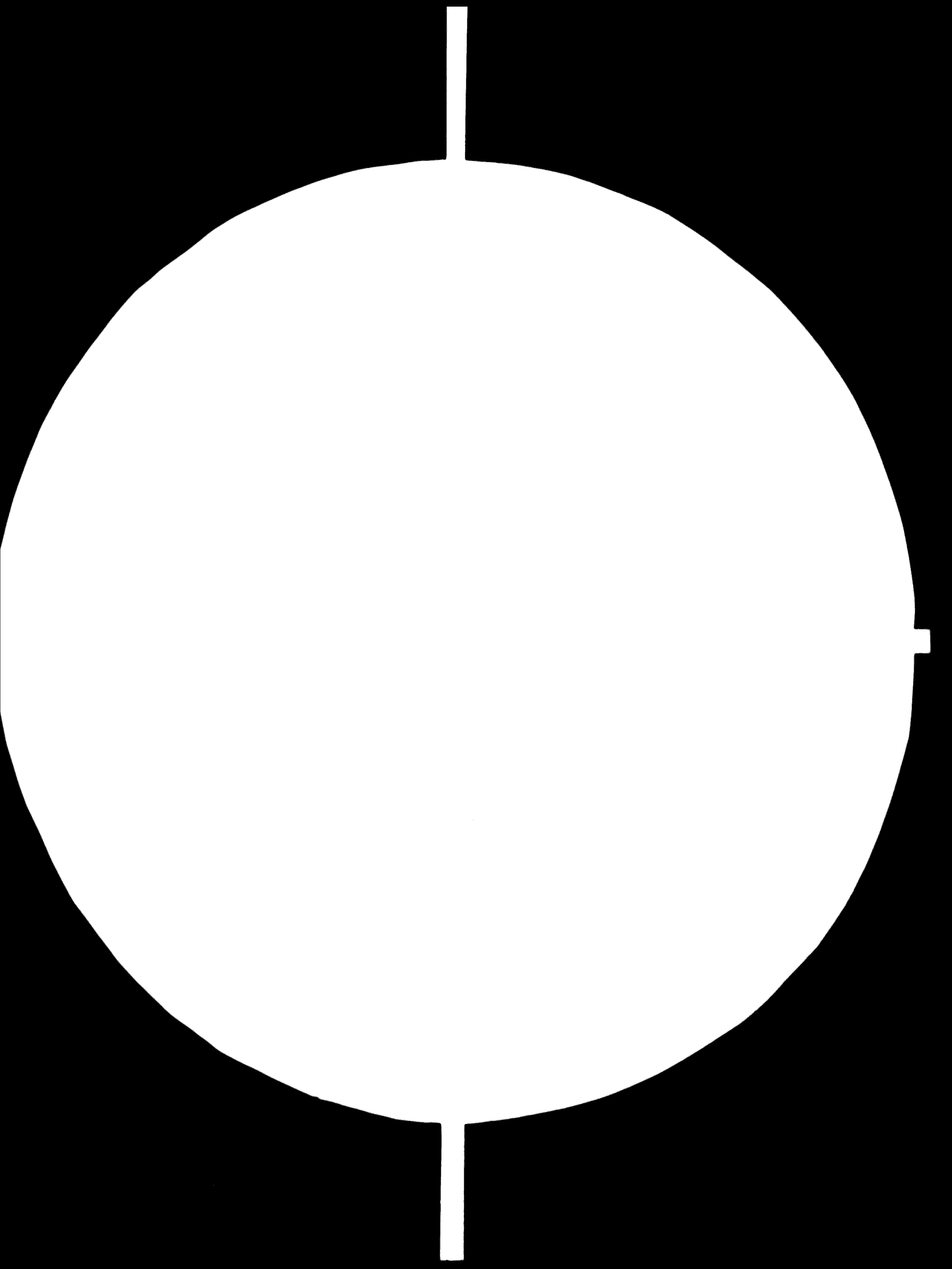

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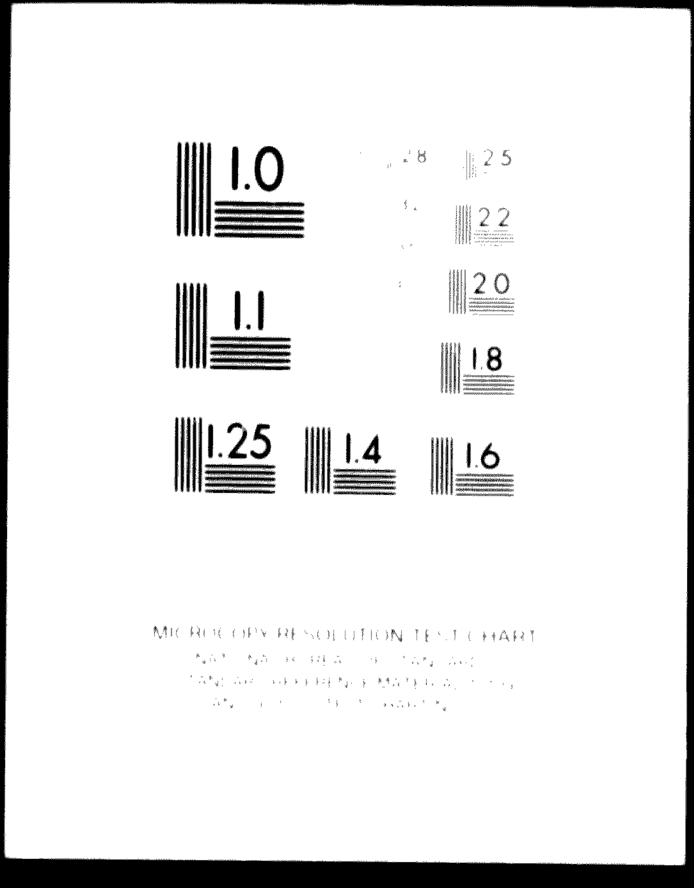

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World Production of Pineapple

7.8 Pineapple is one of those few crops which have experienced a smooth and continuous increase in production all over the world since the end of the Second World War. In 1968, the total world production of pineapple was 3.564 million tons as against 3.02 million tons in 1964, hence **giving** an average rate of increase over the period of approximately 4.5%. The leading pineapple producing countries of the world are USA (Hawaii), Okinawa Islands, Taiwan, Malaysia, South Africa, Philippines, Mexico, Cuba, Australia, Kenya, etc. The production of pineapple in Hawaii rose from 776,000 metric tons in 1964 to 834,000 metric tons in 1968, while the Taiwanese production was 227,000 metric tons and 311,000 metric tons respectively for the corresponding years. Generally, Hawaii alone accounts for about 25% of the total world annual production. The production of pineapple in the principal producing countries is shown in Table 7.1

Table 7.1

Production of Pineapple in the Principal producing Countries of the World

Continent and Country	1964	1965	1966	1967	1968
EUROPE					
Total	33	33	2[illegible]	4	4
N & C AMERICA					
Cuba	42F	26F	20F	17F	20F
Maritinique	21	20	17	20	19
Mexico	198	235	231	251	263
Puerto Rico	65	73	65	65	59
U.S.A.	776	852	855	884	834
Others	9	11	11	11	11
Total	1111	1217	1199	1248	1206
S. AMERICA					
Total	394	408	433	485	559
ASIA					
Cambodia	24	14	15	20	20F
Ceylon	27	40	32	45	37
China Taiwan	227	231	270	296	311
W. Malaysia	314	315	317	350	340F
Pakistan	45	45	57	92	97
Philippines	155	176	188	208	226
Ryukyu Is.	49	68	88	87	75
Thailand	260	301	295	188	200F
Vietnam Rep.	57	48	39	37	34
Total	1158	1238	1301	1323	1340
AFRICA					
Ivory Coast	42	49	61	30	82
Kenya	25F	26F	30F	35F	35F
South Africa	135F	135F	140F	140F	120F
Others	81	88	86	67	76
Total	283	298	317	352	343
OCEANIA					
Australia	83	93	115	130	112
Total	83	93	115	130	112
WORLD TOTAL	3032	3257	3367	3542	3564

7.9 In Hawaii, pineapples are grown almost exclusively for canning, and their production has had a significant influence on the growth of the economy of the islands. In fact today, pineapple ranks next to sugar as a primary source of income and employment in Hawaii. The production of pineapple is carried out in five of the Hawaii's six main islands and there are ten plantations distributed among these five islands. In addition to the large plantations, there is some production of pineapple by small individual growers, who sell their fruit to the major producers on contract basis. The holdings of these small growers vary from 5 acres to 100 acres, with the average plantings probably around 10 acres.

7.10 Hawaii grown mostly the smooth cayenne variety of pineapple, and often at altitides varying from 500 to 1,500 feet, with rainfalls varying from 20" - 30" annually. The plantations are used continuously year after year, as there is no suitable virgin land available for fresh cultivation. The normal practice is to work the plantation on a four-year cycle, which gives a plant, or principal crop, and one ratoon, or second crop. The gross yield of fruit from the full cycle, from individual fields, varies between 40 - 70 tons per acre, while the overall annual yield for the total acreage in Hawaii is estimated to be between 12 - 13 tons per acre. Nowadays, however, the practice of harvesting a second ratoon crop is not often followed as the growers consider it no longer economic, owing to decreasing yields and a shortage of land for planting.

7.11 The pineapple plantation industry in the islands has invested heavily in research on processing and land suitability. Over the period of years, it has built a reputation for being able to supply products of consistently high quality at competitive prices.

7.12 The pineapple industry in Taiwan has recovered from the effects of the second World War, through substantial financial and technical assistance from the United States. It has expanded to such an extent that, in 1961, Taiwan became the world's leading exporter of canned pineapple and the second largest producer, though its output of 58,000 tons was considerably lower than that of Hawaii. However, in 1962 and 1963, the production fell and Taiwan lost its position to Malaysia as the second largest producer.

7.13 Taiwan grows largely the smooth cayenne variety of pineapple and production is mostly in the hands of small holders. Though initially, the yield per acre of the Taiwanese plantations was very low, the governments drive for improved agricultural efficiency has enabled the productivity to increase to 13 - 14 tons per acre.

7.14 The other pineapple producing countries include South Africa, Philippines, Mexico, Cuba, Australia, Kenya etc. Productions from these countries are small and little processing is undertaken. The main variety cultivated is the smooth Cayenne.

7.15 Though Malaysia was an important pineapple producing country during the pre-war period, the pineapple industry was almost destroyed during the war. After the war however, plantations were revived and modernized. Today, she has regained her position and is the second largest pineapple producing country in the world.

7.16 According to the F.A.O. production yearbook (1969) Malaysia's production of pineapple, confined exclusively to West Malaysia, rose from 314,000 metric tons in 1964 to 350,000 metric tons in 1967. However, statistics obtained locally indicated that productions in 1967, 1968 and 1969 were respectively 275,301 long tons, 246,700 long tons and 301,501 long tons. The discripency is due, perhaps, to the existance of a large number of small holdings, for which it is difficult to obtain accurate statistics and different agencies make their own estimates based on materials available.

7.17 The pineapple is planted both on estates basis and on smallholder basis. Till recently, the ratio between the two was about 1:1. With the fall in rubber prices, however, and the establishment of a national cannery, more and more acreages are coming under pineapple thus replacing rubber in small holdings.

7.18 The four most important varieties of pineapple grown in Malaysia are Singapore Spanish, Selangor Green, Sarawak and Mauritius. The characteristics of these varieties are shown in Table 7.2.

7.19 The variety most commonly grown is the Singapore Spanish. The fruits from this variety, which is used in the canning industry, usually weights from 2 - 4 lbs. , and has a good flavour and colour. Its chief disadvantages lies in its deep irregular eyes which often lead to considerable wastage in canning and its relatively low acid content. The Sarawak and Mauritius varieties are mainly grown on a small holder scale.

7.20 When pineapple was first grown in Malaysia, it was on soils derived from quartzite, situated on high elevations. These soils were soon depleted through lack of proper management. Subsequently, pineapple cultivation was shifted to peat soil and this has remained since. Today, 97% of the pineapple holdings are located on peat, 2% on mineral soils and 1% on both peat and mineral soils. Plantation on this soil has however the problem of drainage. Also the spongy nature of the soil has been one of the major reasons for retention of manual cultivation techniques, even in large plantations.

7.21 In Sarawak, pineapple is an insignificant minor crop. It is planted either in backyards, or intercropped with rubber in sandy soils and also on red-yellow podzolic soils. The fruit is grown in scattered [illegible] throughout the State, and there is no reliable statistics available

Table 7.2

CHARACTERS OF THE COMMON LOCAL VARIETIES

Variety	Singapore Spanish	Selangor Green	Sarawak	Mauritius
Utilization	for canning only	for canning only	mainly for fresh fruit market	for fresh fruit market only.
Other names	Singapore canning Singapore Queen Red Jamaica	Selassie Green Spanish	Smooth Cayenne Kew	Malacca Queen Red Ceylon Red Malacca
Malay Names	Nanas Merah	Nanas Hijau	Nanas Sarawak	Nanas Moris Nanas Eropah
Vegetative Characters:				
Plant size	2 - 3 feet	2 - 3 feet	2 - 4 feet	1½ - 2 feet
No. leaves	40 - 50	40 - 50	60 - 80	20 - 40
Leaf margin	Smooth, spinytip	Spiny-tip usually more spines tha S, Spanish	Smooth, spiny-tip	Spiny
Leaf Colouration	Dark green with margin reddish tinge; whitish bloom on abazial surface	Light green throughout whitish bloom on abaxial surface	Green with copper red pigmentation along the middle of abaxial surface.	Bluish green thickly covered with whitish bloom on both surfaces
Slips	2 - 15	1 - 6	0 - 3	0
Suckers	1 - 3	1 - 3	1 - 3	10 - 25
Fruits:				
Weight	2 - 4 lbs.	2 - 4 lbs.	5 - 15 lbs.	1 - 1½ lbs.
Size	4-6" x 6-9"	4-6" x 6-9"	6-9" x 10-18"	4-5" x 6-8"
Shape	Cylindrical	Cylindrical	Cylindrical to tapering	Cylindrical to tapering
No. fruitlets	80 - 90	80 - 90	120 - 160	70 - 120
Eyes	Deep	Deep	Broad and Flat	Bulging
Flesh Colour	Yellow to golden	Yellow to golden	pale yellow to while	yellow
Sugar content (°Brix)	7 - 10	7 - 10	10 - 15	10 - 15
Acid contents (% citric acid)	0.5 - 0.6	0.5 - 0.6	0.7 - 1.0	0.4 - 06
Colour change in fruit ripening	Dark red to orange	green to yellow	dark green to orange	light green to yellow

on the total acreage and production. However, the Dutch Study Team on Regional Planning in the First Division has estimated a sole crop equivalent area of about 600 acres, under pineapple with a production of about 5,000 lbs. per acre. The State's entire production of pineapple is consumed locally and the Agricultural Department has confirmed that there is no import of fresh fruit into the State.

7.22 There are two varieties of pineapple grown in Sarawak viz. Sarawak variety and Singapore Spanish. The Sarawak variety pineapple weights between 5 lbs. - 15 lbs. per fruit before peeling, and the fruit is juicy and sweet. The fruit of the Singapore Spanish variety which weights between 2 lbs. - 4 lbs. is also very sweet.

7.23 The crop is seasonal and at present there is only one harvest annually. The season usually lasts from 2½ - 3 months, beginning in mid-June and stretches till the end of August. There is an off-season crop lasting about 10 - 15 days during December which is of very little economic significance to the growers.

7.24 The Research Division of the Agricultural Department of Sarawak has carried out pineapple plantation trials. These trials have proved that, following the same cultivation practices and level of fertilizer application as in West Malaysia, it is possible to obtain 18 to 19 tons of fruits per acre per annum (Singapore Spanish Variety), with a plantation density of about 17,000 plants per acre, on deep peat soils. It has also been proved that the fruit bearing season could be spread over a longer time by hormone application.

7.25 With the assistance of the Agricultural Department, small scale pineapple plantations have been undertaken by the local farmers, in the Batu Kawa area, in the outskirts of Kuching. The variety planted is the Sarawak Species. These plantations, totalling about 75 acres, yielded about 750 - 1,000 fresh fruits of different sizes per acre.

7.26 The cost estimates of pineapple plantation on peat soils, in Sarawak, have been worked out by the Agricultural Department of the State. These are seen as shown in Table 7.3 below.

Table 7.3

An Estimate of Pineapple Production Cost/Acre

Initial Investment costs per acre

Felling and burning jungle (contract)	$ 170
Clearing, levelling, ploughing (based on Stapok experience)	$ 442
Main drains (86.6 ft./acre @ $1.25 ft; 7 ft. top, 3 ft. dept, 2 ft. bottom)	$ 108.25
Planting material (17,424 plants/acre @ 2.5¢/slip)	$ 435.60
	$1,155.85

(A) Main Crop - Yields 15 months from planting.

Production Costs per acre

(a) Labour (@ $4/- man-day)	Man-day	Cost $
Land Preparation	18	72.00
Planting	12	48.00
Fertilizing	2.6	10.40
Hormone Application	4.7	18.80
Fungicide, pesticide application	3.8	15.20
Weeding	14.1	56.40
Harvesting & Transporting to roadside	25.7	102.80
Clearing drains	3.6	14.40
	84.50	338.00
Plus 25% of above for miscellaneous	21.13	84.50
Sub-Total	105.63	422.50

(b) Other Input Costs

	Cost $
Hormone	8.00
Farm tool and equipment	10.00
Pesticide and fungicide	20.00
Fertilizer	109.48
Quit rent	3.00
Sub-Total	150.48

Total Production Cost per acre	572.98

Yield

18 tons per acre less 12% rejection at factory	35,482 lbs.

(Stapok has indicated 20 tons average. However, this is on newly cleared jungle land).

Hence, production cost per lb. main crop 1.61 ¢

(B) Ratoon crop - Yields 12 months from main crop

Production Costs per acre

(a) Labour (@ $4/Man-day)	Man-day	Cost $
Main crop required minus land preparation and planting	54.50	218.00
Plus 25% for miscellaneous	13.62	54.50
Sub-Total	68.12	272.50

(b) Other Input Cost	
Same as main crop	150.48
Total production cost per acre	$422.98

Yield

13.5 tons per acre less 12% rejection at factory. (¼ less than main crop)	26,611 lbs.
Hence, production cost per lb. ratoon crop	1.59 ¢
Average production cost per lb. of fruit acceptable for canning.	1.60 ¢
Transport cost of pineapple (Gedong to factory site)	0.30 ¢/lb.
(It might be more economical to provide own means of transport)	
Therefore, total average production plus transport costs per lb. fruit	1.90 ¢

From the above cost analysis of pineapple plantation, it could be seen that, beside an initial investment requirement of about $1,156 per acre, the average production plus transport cost is about 1.90 ¢ per lb. of fruit. Compared to West Malaysian estimates, the initial investment cost is very high, mainly due to the higher cost of levelling, ploughing, and planting material. The cost of 2.5 ¢ per slip of planting material assumed, is very high when compared to the cost of 0.9 ¢ per slip estimated in West Malaysia.

7.27 However, the average total production plus transport costs per lb. of fruit estimated compares well with the West Malaysian estimates, though it is also slightly higher. These estimates help to illustrate the scope of pineapple plantation in Sarawak. Some of the costs indicated may be over-estimated, but nevertheless, for Sarawak to compete in the international market, the cost of production of fruit should be lower than that of West Malaysia. Hence, before any large scale plantation is undertaken in the State, the economic viability of the plantation must be carefully examined. Even with the present production cost of fruit in West Malaysia, the pineapple industry is only a marginal industry.

Pineapple Trade

7.28 In the international market, pineapple is mostly traded as a canned product and very little is traded in the form of fruit, Large quantities of canned pineapple enter the international trade, since in many of the producing countries, the domestic market is small, and the industries are largely dependent upon export market for the disposal of their output. With the rising standard of living, the world-consumption of processed fruits, including canned pineapple, is likely to increase. However, it must be emphasized that the market is fast approaching saturation, and as such, the trade in canned pineapple will continue to the very competitive.

7.29 The United Kingdom is still one of the major importers of canned pineapple, although she no longer dominates the world trade as in the pre-war years. Her consumption has lately been exceeded by many other European countries. Besides the United Kingdom, the Federal Republic of Germany, the United States, Canada and Japan also import considerable quantities of canned pineapple and it is noted that these 5 countries together, take more than 80% of the total world trade.

7.30 The consumption of canned pineapple in the Federal Republic of Germany has increased tremendously since the mid-fifities, and import in 1970 reached a record level of 67,443 tons. It is difficult to estimate the probable future trend of the German market, but many importers consider that it has probably reached a saturation point and that consumption will level off at around the 1969 import. It has been stated that, as canned pineapple has become a familiar product to the German housewife, she is becoming more discriminating regarding the quality, and that there is a growing preference for choice of fancy grade packs.

7.31 For many years, Hawaii was the main source of German imports of canned pineapple. Since the late fifties, Taiwan made energetic attempts to capture a considerable share of the expanding market. Taiwan exporters sold their products at prices well below those ruling for Hawaii's canned pineapple and succeeded in selling greatly increased quantities. South Africa also made strenous efforts to gain a foothold in the German market and in fact, soon became the major competitor in this market. Recently, Malaysia, the Philippines, Mexico and Kenya have also managed to enter into this market, hence, threatening the South African and Hawaiian position.

7.32 During the period, 1964 - 1967, Malaysia managed to export canned pineapples in increasing quantities every year. The total export of pineapple from Malaysia, (both fresh and canned) rose from 99,550 tons valued at $36.4 million in 1964 to 103,788 tons valued at $46.34 million in 1967. In 1968, however, although there was a decline in the total Malaysian export, to 95,000 tons, the export of canned pineapple continued to increase, resulting in a continuous increase in the total export value. The export of canned pineapple increased steadily from 42,888 tons valued at $32.68 million in 1964, to 66,066 tons, valued at $47.92 million in 1968. The f.o.b. price per ton of the canned sliced pineapple did not show any appreciable change and remained around $795 per ton. The West Malaysian export of pineapple for the period 1964 - 1968 is shown in Tables 7.4 and 7.5.

Table 7.4

WEST MALAYSIA

NET EXPORT OF PINEAPPLE (JUICE AND CANNED)

Year / Countries	1964 Quantity (Tons)	1964 Value ($1,000)	1965 Quantity (Tons)	1965 Value ($1,000)	1966 Quantity (Tons)	1966 Value ($1,000)	1967 Quantity (Tons)	1967 Value ($1,000)	1968 Quantity (Tons)	1968 Value ($1,000)
Pineapple	55,875	3,333.6	52,319	3,120.0	43,482.	2,634.6	41,086	2,606.9	27,973	1,6[illegible].0
Juice Canned	314	412.3	890	464.1	842	45[illegible].8	9[illegible]0	472.7	967	4[illegible].2
Pineapple Canned	42,861	32,65[illegible].4	53,009	40,058.9	58,015	43,621.1	61,[illegible]	43,261.0	66,066	47,917.4
Total	99,550	36,401.3	106,218	43,643.0	102,339	46,714.5	103,78[illegible]	46,340.6	95,006	50,08[illegible].6

Table 7.5

WEST MALAYSIA

PINEAPPLES CANNED - EXPORTS BY COUNTRIES

Year / Countries	1964 Quantity (Tons)	1964 Value ($1,000)	1965 Quantity (Tons)	1965 Value ($1,000)	1966 Quantity (Tons)	1966 Value ($1,000)	1967 Quantity (Tons)	1967 Value ($1,000)	1968 Quantity (Tons)	1968 Value ($1,000)
United Kingdom	10,719	8,251.4	12,491	9,516.4	18,787	18,374.3	20,[illegible]58	14,347.1	20,511	15,00[illegible].6
U.S.A.	13,049	10,[illegible]52.1	11,510	9,032.9	12,904	9,843.8	14,658	10,640.2	18,256	13,607.9
Spain	710	551.0	753	590.2	3,404	2,596.1	1,637	1,091.0	1,804	1,330.[illegible]
Canada	4,613	3,271.[illegible]	7,705	5,635.8	7,603	5,637.3	8,872	6,337.6	8,637	6,17[illegible].[illegible]
New Zealand	2,007	1,591.5	2,37[illegible]	1,855.6	2,193	1,660.6	2,20[illegible]	1,686.5	2,874	[illegible],0[illegible].[illegible]
West Germany	5,263	3,861.[illegible]	9,321	7,156.1	5,503	4,040.7	5,630	3,791.9	7,220	4,984.7
Others	6,532	4,659.0	8,360	6,282.0	7,638	5,484.8	8,246	5,396.0	6,764	4,7[illegible].7
Total	42,884	32,677.4	53,018	40,0[illegible].0	58,032	43,637.6	61,[illegible]0	43,[illegible]90.3	66,066	47,[illegible].4

7.33 The export of canned juice also increased almost uniformly from 814 tons valued at $4.12 million in 1964 to 967 tons valued at $4.89 million in 1968. It is evident that the short fall in total export in 1968 was accounted for by the drop in the export of fresh fruits.

7.34 Apart from the fact that until recently, there was not much of a promtion drive for Malaysian canned pineapple in the overseas market, it had the disadvantage of higher price in a very highly competitive market. This high price is mainly due to the low recovery rate of canned fruits which is only about 20% or even less in Malaysia, compared to 40% in other countries. The eyes of the Malaysian pineapple being deep, deep peeling is necessary, and further more, the sugar and acid content are also low. The only advantage of the Malaysian pineapple, however, is that the flesh is golden in colour, which makes it attractive to Western buyers.

7.35 The largest market for Malaysian canned pineapple had traditionally been the U.K. and there had been no change during the period under review. The U.K. market accounted for about 30% of the total Malaysian export.

7.36 Malaysia entered the U.S. market for canned pineapple only a decade ago. The total export to this country for the period 1966 - 1970 is shown in the Table 7.6

Table 7.6

Malaysian Export of Pineapple to US Market

Year	Quantity (In Standard Cases) (approx. 45 cases per ton)	Value in M$
1966	615,500	10,150,000
1967	638,700	10,390,000
1968	815,600	12,840,000
1969	785,900	12,490,000
1970	563,000	9,015,000

7.37 The volume of export in 1970 dropped by about 30% from the previous year. Nevertheless, this still formed about 11% of the total U.S. import and 1% of the total U.S. market, including the share of Hawaii. The main competitors were Taiwan, Philippines, Thailand, Mexico and to a lesser extent, Pucto Rico and South Africa. Almost 30% of the total US market consisted of supply from Taiwan, although, Taiwan like Malaysia, has not made much promotional effort in this market. Such large supplies were possible manily because of Taiwan's long trading relations with USA and also due to the fact that canned pineapples of Taiwan origin were traded in US market under a package deal, together with canned mushrooms and mandarin ornages. Furthermore, the low price of Taiwanese product compared to the Malaysia price has been an added attraction for the US importers. In fact, Malaysian canned pineapples in 1970 were higher in price than pineapples of other oriental origin.

7.38 Canned pineapples that came from the Philippines were essentially Hawaiian investment, particularly that of Dole. Though Hawaiian canned pineapple was still the most popular in USA the quality was equated by the higher prices over all other canned pineapples. It is believed that the Hawaiian product has already saturated its market in USA. The import of canned pineapple from the Philippines, backed by Dole's experience meant competitive prices for good qualtiy products. While the Dole quality has been accepted unquestionably by the American consumers, the other suppliers to this market have a lot of hard work to do to make their way.

7.39 Thailand was a newcomer to US market, with about 24,500 standard cases being introduced in 1967. During the first eight months of 1968, it increased its volume by over three times to 84,000 standard cases. In 1970, the import from Thailand has risen to as high as 320,000 standard cases. This was possible mainly due to its promotional efforts, combined with a substantial lowering of price. The quality of Thai pineapple has also improved remarkably over the period.

7.40 The other suppliers of US market, namely, Mexico, Puerto Rico and South Africa are not of much significance and supplies from these sources are obtained only when quick substitutions become necessary due to shortage of supply and delay in delivery from the main sources. However, the prices of canned pineapple from these countries are quite competitive and it is reported that the qualities too are improving fast.

7.41 The US market, though highly competitive, has very good potential for Malaysian canned pineapple. With adequate promotional effort and also the assurance of regular and steady supply, it should be possible for the Malaysian producers, not only to recapture the lost portion of its market in the US, but also to enhance its share of supply. In addition, it would also be necessary to look into ways and means to reduce the cost of production so as to remain competitive in the field. Detailed stidues are required to be carried out into individual factory and plantation for recommending these means and UNIDO might consider undertaking such a study in due course.

7.42 Canada is another very important market for Malaysia canned pineapples. In fact, some 40% of the total Canadian market consist of the Malaysian product. The Canadian import from Malaysia for the period 1966 - 1970 is shown in the Table 7.7.

Table 7.7

Malaysian Export of Pineapple to Canadian Market

Year	Quantity (In Standard Cases)	Value in M$
1966	334,100	5,511,000
1967	420,800	7,050,000
1968	472,200	6,845,600
1969	451,200	6,907,800
1970	50[illegible],200	7,694,900

It would be evident from the table that there has been a steady increase of import from Malaysia in this market. Recently, however, Taiwan, Thailand and South Africa have started offering keen competition with their pineapple at lower prices. It is, however, believed that because of the traditional link, Canadian buyers would still be interested in Malaysian pineapple and it has been forecast that in the next three to five years, the import of Malaysian pineapple into Canada might even double itself.

7.43 The other important market for Malaysian pineapple is Japan as would be evident from the Table 7.8

Table 7.8

Malaysian Export of Pineapple to Japanese Market

Year	Quantity (In Standard Cases)	Value in M$
1966	18,800	274,500
1967	31,033	452,900
1968	46,107	642,900
1969	75,601	1,128,200
1970	79,819	1,248,200

The import of Malaysian canned pineapple into Japan in 1970 formed approximately 3% of the total Japanese market of some 2,260,000 standard cases valued at US$18,375,000. The most outstanding problem in the Japanese market is the Governmental restriction of the Global Quota System, and its interest in protecting the pineapple industry in Okinawa. However, with the rising demand in this market and the proximity of Malaysia, particularly that of Sarawak, to Japan, combined with the increased trade relations developing with Malaysia, Japan is likely to increase its purchases from this country.

7.44 In fact, the international market prospect of canned pineapple in the foreseeable future is bright, and Malaysia can not only continue to occupy its place as an important pineapple exporting country, but also advance its position, However, effective promotional measures must be undertaken; price reduction possibilities must be looked into; and steady continuous supply must be ensured.

Pineapple Industry in Sarawak

7.45 Once the economic viability of the plantation has been established, it would be worthwhile considering the possibility of setting up a pineapple cannery in Sarawak, in view of the good international market existing for the canned pineapple. The Sarawak imports and exports of pineapple and pineapple products are shown in Tables 7.9, 7.10 and 7.11. While there has been a little export of fresh pineapple from Sarawak, quite a substantial amount of canned pineapple and pineapple juice are being imported, In 1970, the total import of canned pineapple and pineapple juice was valued at $81,798. Hence, there is also a good domestic market for the canned product.

7.46 Pineapple canning, and for that matter any agricultural processing industries, have certain special requirements of their own, most important of which is the smooth and regular supply of raw materials. Though in West Malaysia, canneries obtained more than ½ of their total requirement from smallholders' plantations smoothly and efficiently, under Sarawak conditions, it would be difficult to obtain such supplies from the small holders. The problem is mainly attributed to the state's present land tenture system, and also of the fact that, the native farmers of Sarawak are unique to the extent that they would not devote themselves exclusively to one crop even when an economic holding on single crop basis is provided to them. It would, therefore, be necessary to undertake plantation on estate basis and the acreage to be planted would have to be decided on the basis of 100% requirement

Table 7.9

Sarawak Imports and Exports of Fresh Pineapples for 1966 - 1970 (051951)

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
Exports										
Brunei	-	-	0.18	20	-	-	-	-	-	-
Singapore	-	-	-	-	0.01	2	-	-	-	-
United Kingdom	-	-	-	-	0.02	4	-	-	-	-
Sabah	0.02	15	-	-	-	-	-	-	-	-
Total:	0.02	15	0.18	20	0.03	6	-	-	-	-

Table 7.10

Sarawak Imports of Canned Pineapples for 1966 - 1970 (053901)

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
Imports										
Australia	0.06	76	-	-	0.51	688	0.04	54	-	-
China Mainland	0.71	1,014	-	-	0.11	123	0.23	295	-	-
West Malaysia	20.12	18,385	38.72	35,719	42.75	34,381	87.05	67,141	89.74	76,001
Singapore	0.15	157	0.13	97	-	-	-	-	0.08	104
U.S.A.	0.01	20	-	-	0.21	518	0.25	599	0.02	54
Japan	-	-	-	-	-	-	0.01	19	-	-
Formosa	-	-	-	-	0.03	26	-	-	-	-
Total	21.05	19,652	38.85	35,816	43.61	35,736	87.58	68,108	89.84	76,159

Table 7.11

Sarawak Imports of Pineapple Juice for 1966 - 1970 (053501)

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Cwt.		Cwt.	$	Cwt.	$	Cwt.	$	Cwt.	$
Imports										
China Mainland	-	-	20.75	735	-	-	-	-	0.16	8
Isreal	-	-	1.27	63	-	-	-	-	-	-
West Malaysia	9.46	260	5.69	181	10.04	291	9.99	293	46.44	1,483
U.S.A.	10.33	556	3.62	164	20.18	257	4.07	173	0.72	45
Japan	11.13	690	-	-	-	-	-	-	0.19	9
Singapore	2.16	142	-	-	-	-	113.75	3,839	149.29	4,020
United Kingdom	-	-	-	-	-	-	32.14	1,080	0.54	74
Total	33.58	1,648	31.33	1,143	30.22	548	159.95	5,385	197.34	5,639

of the canning factory. It is quite likely that farmers owning land within reasonable distances of the plantation would be encouraged by the demonstrative effect to undertake plantations on smallholdings by themselves. Extension services might then be provided by the Government, to these farmers, and if production from these smallholdings justify, the capacity of the canning unit could be enlarged to absorb the additional production. This, however, would constitute the second stage of development.

7.47 The assistance of the Malayan Pineapple Industry Board could be sought for working out a programme for this second stage. With its experience in West Malaysia, this agency would be able to guide the State Government on the right lines.

7.48 The usual problem of land availability in Sarawak would not affect the estate type pineapple plantation, in view of the large acreages of peat areas available within state land. One such area which appears most promising is the Gedong area. This area, which falls within the Serian Development zone, is the triangle bounded by the Sadong and Batang Krang river and Bukit Ampungan. It is located about 14 miles from Serian Bazaar and is connected to the main Serian-Simanggang road at 2 miles from Serian Bazaar. Communication is hence ensured. The maximum distance to Kuching Port is approximately 50 miles, thus offering scope for utilising the port facilities. (Please see Map 7.1). A semi-detail soil survey of the area has been completed by the State Land and Survey Department recently.

7.49 The Gedong area consisting of peat soil, has a total acreage of about 12,500, all in one block. As such, successful drainage is possible. About 4000 acres of this area have peat less than 10 feet deep, and is most suitable for pineapple cultivation, even with a little drainage. This area could be immediately worked upon, and over a period of years, the remaining area could be utilised. According to the Drainage and Irrigation Department, the area is flooded every year. However, with proper bunding, it is possible to control the flood, and the department has already worked out the cost estimates for this.

7.50 The pineapple canning factory could be located either at the plantation site or at Serian Bazaar, although the siting of the factory near the plantation has the advantage of reducing considerably transportation cost, the location at Serian Bazaar would have the advantage of immediate availability of electricity from the main supply, and of labour from the town. Water would, of course, be available in both the areas in plentiful supply from the rivers. For the cannery complex, an area of about 15 acres would be required to include the cannery, the can making factory, administrative building and workers quarters. The choice of factory site would, thus, depend on the availability of suitable land to accommodate the factory. In this aspect, Serian Bazaar would probably be more favourable.

Pineapple Cannery

7.51 Until and unless the economic viability of pineapple plantation in Sarawak has been indicated, it would be premature to work out a detailed project study on the cannery. However, a brief description on the canning process and an indication of the general production requirements would deem appropriate here.

Canning Process

7.52 The canning of pineapples may be divided into three major operations: the preparation of the fruit, packing it into cans and the actual preservation process. In every cannery, there is a general pattern of operations but the carrying out of these varies considerably according to the degree of mechanization employed. However, in order to compete successfully in the world markets, the preparation of the pineapples, grading and processing must all be carried out hygienically on modern continuous production lines.

7.53 On arrival at the cannery, the fruit is graded for size, then washed to remove dust, vegetable fragments and insects. All immature, over mature, rotten or badly bruised fruit should be removed. After this, the graded fruit is peeled and cored. The cut fruit cylinders are next inspected and any portions of skin, eyes, or decayed spots are trimmed off, after which the fruit is sprayed with water and then cut into slices.

7.54 The slices are next graded for colour, degree of trimming, texture and size, and packed into the cans. The cans filled with fruit are now ready for processing, which could be done either by the 'exhaust' process or the 'vacuum process'. In the exhaust process, hot syrup is added to the fruit filled can, which is then pre-heated in a closed, live steam chamber for a period depending upon the can size. The lid is then sealed and the can is further heated in an agitating steam-pressure heater.

7.55 In the vacuum process, the open cans of fruit are first placed in a vacuum tank where they are subjected to reduced pressure of 25 inches for 5 - 10 seconds. Hence, any air trapped between the fruit cells is sucked out and replaced by hot syrup added immediately afterwards. After syruping, the cans are closed under a vacuum of about 15 inches and are then processed in continuous pressure cookers at a temperature above water boiling point, until the centre temperature of the contents of the can reaches 195°F. The cooking duration varies with the size of can but is usually from 7 to 10 minutes. Expensive complicated plant is required for the vacuum process, and as such, it is generally only adopted where there is a large output and space is limited.

7.56 After processing, the cans are cooled immediately, so that the product does not become over-cooked and hence suffers considerable deterioration in flavour and colour. On cooling, the temperature is reduced from approximately 195^{o}F to 90^{o}F in about 5 minutes. The cans are then kept for about a day in stacks in the cooling room, tested for can leakage and finally labelled and packed in cases.

Production Requirements

7.57 For the establishment of the pineapple cannery, an initial area of about 2000 acres at Gedong could be planted with pineapple, and another 2500 acres reserved for crop rotation. With an average yield of about 14 tons of fruit per acre per annum, and allowing a rejection of 12% at factory, the total quantity of pineapple available for canning per year would be 24,640 tons.

7.58 By the application of hormone, the harvesting season could be spread out, and it is estimated that this could enable the factory to operate a minimum of 180 days a year. The quantity of fruits available for processing per day is thus about 130 tons. Assuming a 20% recovery (with Singapore Spanish variety), the quantity of canned pineapple that could be produced is 26 tons per day. Cans of assorted sizes would be produced, and assuming an average net weight of 1 lb. per can, the annual production capacity would be approximately 4680 tons or 873,600 dozen cans. With this capacity, it should be feasible to incorporate a can-making unit within the factory complex.

7.59 For a factory of the capacity envisaged, the fixed investment required is estimated to be as below:-

Land (4 acres)	$ 20,000
Buildings (Covered area of 30,000 feet)	$240,000
Machinery and Equipment	$500,000
	$760,000

The machinery and equipment required would consist of the following:-

(1) Conveyor with hopper;

(2) Sinks, work tables and belt conveyor;

(3) Cooking kettles and accumulation table;

(4) Can reformers, can flanges, can bottom seamers, can tester and can washer;

(5) H.P. Filter;

(6) Syrup or brine kettles;

(7) Exhaust box, closer, tramway and hoist;

(8) Auxiliary kettle, retorts;

(9) Crates and crate dollies;

(10) Labeler, can conveyor and roller conveyor;

(11) Lift ruck with pellets;

(12) Compressor;

(13) Platform scale;

(14) Boiler;

(15) Scalder, abrasive peeler and grader;

(16) Fruit washer and slicer;

(17) Furniture and fixtures;

(18) Transportation equipment.

7.60 Electrical power of about 30 H.P. connected load would be required to operate the machinery. Water, which would be pumped from nearby rivers would be required in large quantities. It is estimated that about 300,000 gallons would be required per day.

7.61 With the establishment of the cannery, it is estimated that an employment of about 120 would be created/to include all categories of operation. Many of these would, however, be unskilled labour.

CHAPTER VIII

SAGO

The Plant

8.1 Sago is derived from the trunks of palms which are grown in a comparatively small area of the world viz. Malaysia, Indonesia, Brunei and New Guinea. In Malaysia, though there are a few palms in Sabah and West Malaysia, the concentration of sago palms is in Sarawak.

8.2 The two important palms which produce the commercial smooth sago are Metroxylon Sagus Bottl. and M. Rumphii Mart. The former has a smooth foliar sheath and the latter a thorny sheath. There are several recognized varieties and forms of these two species. It is reported that there is no difference in the quality of the sago produced from either of the palms though opinions have been expressed that some types of palms may well furnish higher viscosity flours than others. There is, however, no definite evidence for this.

8.3 The palms reach a height of 30 - 50 feet and have trunks from 15 - 18 inches or more in diameter. M. Ramphii has a somewhat smaller trunk and yields rather less starch than M. Sagus. They have feathery leaves which grow alternately on a stem. The flower truss, which rises above the crown of leaves, is from 2 - 3 yards in length and of a reddish brown colour. The palm flowers only once in its life time and then dies. The root-stock survives and puts up new shoots and trunks which are ready to flower in 8 - 12 years or so. After flowering, and before the fruit is well developed, the palm should be felled for sago production as the reserve of starch in the pith at this stage is at its maximum. Sago palms are also felled for extraction of starch at other stages, and sometimes a palm which has a trunk of only 15 feet in height is used.

8.4 The sago palm is very sensitive to the humidity of the soil and flourishes in swampy areas where it can have its roots in the mud.

It may not necessarily be planted in swamps but requires a very wet climate. There is a good deal of 'hill sago' in Sarawak where the rainfall averages 160 inches per annum over much of the country, and 180 inches or more at the foot of the hills near the coast. However, the plant does not grow so big and does not produce so many shoots as when grown in swampy land. The plant needs a great deal of sunshine, and the growing area must be well cleared before cultivation. The best sago gardens are thus found on the promentories made by a river in its meandering, where there are tracks of loam produced by the mixture of alluvial sand, peat and clay. Where, however, the area is subject to constant flooding the sago palm will take longer to mature. Jungle land (peat soils) will grow palms, but it is generally agreed that the quality of the sago on it is not good. It has been observed that the plant appears to favour shallow swamp (as opposed to deep swamp) and the best palms in Mukah area of Sarawak are grown near the coastal fringes. Sago never exhausts the soil and fertilization is not considered necessary, as long as the dead vegetable matter is returned to the soil.

8.5 Sago palms are considered as semi-wild plants thereby meaning no upkeep is needed. With proper maintenance, however, the cutting of suckers could be reduced by about 2 - 4 years on the same soil. Hence, the usual maturity time of sago palm of 8 - 12 years with no maintenance could be reduced to 6 - 8 years with proper maintenance. Apart from flowering and fruit development, the maturity of the palm is also judged by the angles the leaves make with the vertical trunk. Initially, the leaves are mostly vertical and with maturity i.e. between flowering and fruit development, they start opening up. When fully matured, the leaves would make an angle of about 90 degrees with the vertical and the palm is ready for felling.

<u>Sago Cultivation in Sarawak</u>

8.6 Sago palms are found chiefly in the Oya-Dalat and Mukah districts in the coastal tidal areas of Sarawak. This area consists of a coastline built up of sandy soils which recede inland concavely to salty peat soil. There are also other small pockets of the crop in Balingian, Matu, Saratok, Limbang, etc.

8.7 Sago cultivation in Sarawak has been a monopoly of the native Melanaus for a long time. This was their most important staple food.

8.8 In those early days of the white Rajahs, a very large proportion of its revenue was derived from the sago industry, and this revenue was partly responsible for the taking over of the Mukah and Oya Rivers 100 years ago by the Rajahs. Merchants from Kuching were being prohibited by the rulers of these areas to buy wet sago ("Lemantak") which they intended to take to their factories for refinement into flour (tepong) and export to Singapore. With the pacification of the Mukah district, Malay-speaking middlemen soon settled in the area and they bought raw sago flour stored in the local warehouses until sailing vessels arrive from Kuching. Chinese middlemen then joined the Malay settlers, and in the years before 1900, the Melanaus in response to the expanding trade in Kuching, the increased need for government revenue, and their own growing reliance upon consumer goods brought by the middlemen, were obliged to transform the whole of their social life and economy.

8.9 The Melanaus slowly gave up their relative dependence and safety, on subsistence economy, and took up sale of sago as cash crop though it was subject to recurrent fluctuations of prices in the international market. They also became dependent on middlemen to sell their crop and bring them the necessities of life. The government then, did not concern itself with the improvement of the industry or the trade, thereby the welfare of the Melanaus. Her only interest in the industry was in the collection of revenue.

8.10 The position went unchecked until recently when the government set up a task force to study the industry and make suitable recommendation for putting the industry on a sound footing. Of course, many studies were made earlier also, but no action so far seemed to have been taken on the recommendations made in these studies.

Acreage

8.11 The exact acreage under sago in Sarawak is not known. The acreage cannot also be derived with any accuracy from the export figures, as there is considerable local consumption of sago both for animal feeding and for human consumption. A rough guess, however, places the total estimated acreage in 1952 around 40,000 to 42,000 in the Third Division; and for the whole of Sarawak 74,000 - 150,000 respectively in 1956 and 1960.

8.12 In the sago areas, the palms are cultivated by small farmers in gardens of varying sizes. Suckers are planted 30 - 36 feet apart in shallow holes. According to knowledgeable persons, sago palms are hybrids and must be vegetatively propagated.

Yield

8.13 Information regarding the yield per acre of palms from the sago gardens is not available. However, it is estimated that the yield varies from 5 palms per acre per annum to about 30 palms per acre per annum depending on planting density and the number of trunks produced by a palm in a year. Calculations are, however, based on 6 - 8 palms per acre per annum. Each palm produces on the average 14 logs of about 3 feet long, with each log giving about 8 gallons of wet crude flour.

Uses of Sago Flour

8.14 Sago, as it is, is a starch which has its varied uses in addition to its scope of conversion to other products. In the food industry, it is used in the manufacture of biscuits, confectionery, custard powder, sauces, etc. Because of its easy digestibility sago occupies a very important place in the manufacture of baby food. Of the industrial uses of sago, important ones are in the manufacture of adhesives, textile sizing and finishing, and paper coatings. Dextrin can be extracted from sago for making into gum for envelopes, stamps and tapes. Glucose can be made from sago starch easily which is used as substitute sweetener for cane sugar in food and drinks. It is also used as a gelling agent and filler in some industries.

8.15 Sago starch has also been quoted as being used in the manufacture of good quality photographic mounting pastes, organic chemicals, face & toilet creams, haircream and tooth pastes. It is reported that crude sago could be distilled into spirits or fermented into wines. The demand, however, would depend on its comparative price with tapioca flour.

8.16 Sago pith is suitable for animal fodder and is often fed to poultry in Sarawak while the by-products of the starch industry viz. refuse is readily sold as pig feed, generally for dilution of proprietary rations for growers and finishers. The Department of Agriculture, Sarawak has made a number of studies regarding the use of sago flour and sago refuse in feeding pigs and poultry. The results are very encouraging but there are a number of constraints to its widespread use in animal feed concentrates. These are:-

(i) Sago is very low in protein content and as such, supplementary protein must be added (as in the form of fish meal) to bring up the quality of the animal feeds using it; and

(ii) Fish meal, like other protein additives, is expensive, and too much use of it would raise the cost of the feed rations.

8.17 In another experiment, it was reported that replacement of imported maize was possible and that such substitution would not have any adverse effect on the growth of the fowl. The exact level of substitution is not yet known and there are some indications that it should not exceed 40%. It was also pointed out that the high fibre content of the sago flour was another constraint to its general use in poultry feed rations.

Distribution and Processing Facilities in Sarawak

8.18 There were a total of 30 sago mills in Sarawak in 1969 as against 78 in 1966, 63 in 1967 and 60 in 1968. The distribution of the existing factories are as follows:-

First Division	-	3
Second Division	-	13
Third Division	-	12
Fourth Division	-	2
Fifth Division	-	Nil

The First Division mills are operating in Kuching and the Second and Third Division mills are concentrating in the Sg. Kut, Dalat-Oya, Mukah, Balingian and coastal areas. It would be seen that there has been a great decline in the number of existing sago factories; as with the decline in the market, the smaller and less efficient ones had to wind up their operation. In 1969 the total volume and value of production from the sago mills along with the employment was as shown in Table 8.1.

Table 8.1

Volume, Value and Employment in Sago Mills - 1969

Division	Volume (in pikuls)	Value (M$)	Employment
First	20,519	55,462	12
Second	100,000	637,613	146
Third	97,355	677,875	86
Fourth	13,626	76,614	18

The importance of the industry would therefore be evident in the State's economy and it is now generally accepted that the industry needs modernization for its improvement.

Manufacturing Process

8.19 The following are the two stages in the production of flour from sago palm:-

(i) Production of crude wet starch

(ii) Production of flour

To prevent dehydration, the sago palm is kept emerged in water for a maximum period of 14 days. Emersion in water for a period longer than this would render it difficult to rasp due to too much absorption of water (it should be noted here that before emerging in water the palm is cut into sizes of 3 to 4 feet long). The bark is then stripped with an axe and the logs split. The pith inside is then rasped and then stored in bins. The rasp is then mixed with water, pumped or drawn from the river and is agitated mechanically in a cylinder covered with a wire netting. The suspension of starch and fibre passes through the cylinder and flows along a trough on to a sieve where the fibre is removed. The sieve is also mechanically agitated. The starch suspension then flows to the settling tank where it is collected, and the starch is allowed to settle out of the suspension. The blocks of crude wet starch are later dug out of the tanks by decantation.

8.20 The crude wet starch is then dried in the sun. In the Mukah area, drying is usually done on contract in most factories. The workers take the wet flour from the store, spread it out in the sun and at the same time breaking the lumps of flour. In the course of the day, the flour is turned a number of times to facilitate drying. It is then sieved before being bagged for sale to the exporters in Sibu and Kuching. On a bright sunny day, it takes from 7 - 8 hours to dry one bag of 150 katties (1 kati = 1.33 lbs.) of sago flour and one man can dry an average of 8 bags a day.

8.21 It would be evident from the description above that the method of flour extraction from sago palm followed in Sarawak is very crude with the result that the starch content extracted is poor. Assuming an average weight of a palm at 22.5 pikuls (Each palm is cut into 10 - 18 logs, averaging 14 logs, each weighing about 200 lbs.)and an extraction rate of 40%, the total yield of flour per palm should be about 1,120 lbs. (9 pikuls). In Sarawak however, factories are generally able to extract only about 530 lbs. (4 pikuls) of flour thus losing about 52% of the starch content in every palm processed.

8.22 Though Singapore has no sago plantation, it has the most modern sago processing facilities. The acceptability of sago flour processed in Singapore is very much greater than those processed in Sarawak and one of the several reasons contributing to this, lies in the use of water in washing the flour. Unlike their counterparts in Singapore, where treated water is used for washing sago flour, the mills in Sarawak use dirty river water which is mostly dark brown in colour, peat stained and acid in reaction. This results in a yellowish tinge to the flour. While the acidity is reputed to be affecting the viscosity of the starch slightly, the river water has no effect on the chemical properties of the flour. The other factors which affect the grade of the flour are:-

(a) Fineness of the sieves used in the factory;

(b) Quality of the straining cloth to cover the collecting troughs;

(c) Disposal of wastes.

These factors greatly influence the fibre content of the flour, and the amount of sieving necessary at the drying stage to bring the fibre content down to the acceptable level.

8.23 In Singapore, where the crude rasp and trampled flour is imported by open boat from Indonesia, for refining, the crude flour is placed on a revolving drum half-filled with water and the starch in suspension is carried away and settled in large tanks for 36 hours. The residue is thrown out after being subject to second and third washings. Next, the blocks of starch are mixed with clean water for second and third washings, filtering and settling process in long oblong troughs. The first quality flour which is subject to a greater amount of refining is taken from the centre of the trough while the inferior quality settles at the end. The refined blocks of starch are then removed to a concrete or tiled drying ground, where they are broken up into small fragments to facilitate drying. Artificial drying is done in Singapore although sun-drying is still carried out, whenever possible.

8.24 The better quality flour may be turned into pearl sago by moisturing the flour and passing through a mechanical sieve after which it is cooked in illipe nut oil and subsequently baked.

Processing Cost

8.25 There has not been much of a change in the processing cost of sago during the last decade. In 1962, the cost of converting one palm into flour was 10. This has been cut down to $9.73 per lb, in 1970. During the same period, the price of palm has, however, gone up due to severe competition for mature palms in gardens near and around the town and also due to the high cost of bringing mature palms from areas further inland. The current price of a mature sago palm is 18 as against 8 - 9 in 1962.

8.26 An estimate of the marketing margins based on sales value of the flour obtained from a palm is given in the table below:-

Table 8.2

Marketing margins based on sales value of the flour obtained from one palm

Item	Total Cost	Total Value	% of Total Cost to Total Value
Value of 4 pikuls of dry sago flour sold in Sibu at an average price of $7.10/pikul	-	28.40	100.0
Less cost of transporting flour from Mukah to Sibu	2.00	26.40	7.0
Less cost of drying flour	3.47	22.93	12.2
Less estimated cost of processing palm into flour *	2.00	20.93	7.0
Less cost of preparing palm for rasping	1.26	19.67	4.5
Less cost of transporting palm from inland areas	11.00	8.67	38.7
Less cost of palm (price received by farmer)	7.00	1.67	24.7
∴ profit to the processor	-	1.67	5.9

* includes cost of fuel oil, maintenance costs, wages, bags, etc.

It would be observed from the table that only 25% of the value of the sago flour obtained from one palm is received by the farmer and the profit margin available to the processing unit is only 5.9% or approximately 42 cents per pikul (133 lbs.)

Marketing Procedure

8.27 Sago is exported mostly through (Please see Table 8.3) either Sibu or Tg. Mani. The business is almost monopolised by three exporting houses. The transport charges of Sibu vary from 60 cents to $1.20 per bag of 50 katties depending on the distance. Road transport from the areas to Sibu is still not available. The flour is stored in this port until the ocean-going freighters arrive to take it to Singapore for re-export or to other countries directly. The problem of storage is one of the bottlenecks in the expansion and smooth functioning of the industry. It is reported that many of the consumers have switched over to other flour like tapioca in consideration of the difficulty experienced in obtaining a constant and regular supply of sago flour from Sibu.

Table 8.3

Export of Sago Flour by Port

1966 - 1970

Value in M$ '000

Year / Ports	1966	1967	1968	1969	1970
Kuching	647	626	460	420	221
Semantan	-	3	6	-	-
Sibu	2,384	2,763	3,601	2,801	2,653
Sarikei	26	23	13	6	23
Binatang	4	5	12	-	28
Tg. Mani	1,667	1,388	854	477	909
Miri	0.045	-	0.478	1	0.475
Bintulu	5.0	-	-	-	-

Source: Department of Statistics

8.28 A very sizeable proportion of the total production of sago is locally consumed. The remaining is all exported. As an agricultural raw material export item, it is subjected to the usual vicissituges of market vagaries of demand and supply and also the keen competition of its many substitutes. The quantity of sago exported from Sarawak has steadily increased from 19.683 tons in 1960 to a record of 57.515 tons in 1964. Since then it showed a decline and in 1969 the total export was 28.691 tons only.

World Trade

8.29 In the world market, sago has to compete with all other types of industrial starches such as tapioca, maize, sweet potatoes, rice, wheat, etc. All the starches are to a greater or lesser extent, interchangeable for many uses. For some uses, however, the properties and characteristics of a particular starch make it especially suitable for a particular use, and users would be reluctant to substitute other starches for it, though these other starches might be lower in price. Wherever substitution is possible, obviously the price would be the main consideration.

8.30 In the sago trade, the quality factors demanded of it are as follows:-

(a)	Viscosity	.....	Not less than a reading of 300 Barbender Units on the Barbender Viscograph.
(b)	Whiteness	.....	Not less than 65% reflectance, taking magnesium carbonate as 100%
(c)	Fineness	.....	Not more than 35% of the flour to be retained on a 100 mesh B.S. sieve.
(d)	Crude Fibre	.....	Not more than 1%.
(e)	Ash	.....	Not more than 0.5%.
(f)	Moisture content	.....	Not more than 10%.
(g)	Mineral content	.....	Negligible.

8.31 In considering these quality factors, some explanatory remarks are necessary and these are as follows:-

(i) **Mineral Content:**

The high mineral content found in Sarawak sago has been mentioned to be highly undesirable by two of the biggest potential users of the flour in West Malaysia. These two firms manufacture their products by the biological method, and the high mineral content tends to affect the organisms involved, resulting in a loss of efficiency. The high mineral content is probably the result of using river water in its processing.

(ii) **Moisture Content:**

Complaints about the high moisture content found in Sarawak sago have been a common feature of sago flour consumers' reports. It is unusually high, around 16 - 18% by weight. The flour is sun-dried and insufficient drying is probably the cause. A high moisture content tends to reduce the manufacturers' factory efficiency and to increase their costs since conversion rates are calculated on the basis of dry starch content. Furthermore , a high moisture content does not permit prolonged storage of the flour. It should also be noted that a high moisture content is also undesirable in the food industry.

(iii) **Crude Fibre**

The content of crude fibre and other impurities in sago is usually quite high, and this has often resulted in the need to sieve the flour again upon arrival in the factory before it can be used. A low fibre content can be obtained by using a higher grade mesh (recommended mesh sizes are 80 and 100 B.S.) instead of the present 50 - 60 grade sieves. A low fibre content is demanded by practically all sago users, but it is especially in the food industry that this quality factor is most appreciated.

(iv) Colour:

This is one quality factor which is desired more by the food industry than any other user-industry. At present, Sarawak sago is yellowish to dull white in colour due to the use of peaty river water in its processing. Millers and exporters seem to have a reluctance to wash the flour more to improve its colour for fear of reducing its viscosity, although it has been shown that viscosity would not be affected provided that the repeated washings are done efficiently and quickly.

8.32 The United Kingdom used to be the major importer of Sarawak sago until 1963 when it was displaced by Japan. Since then the British imports have steadily declined from 17,456 tons in 1963 to 2,350 tons in 1970 while the Japanese imports have risen from 19,299 tons in 1963 to a maximum of 22,545 tons in 1967, and then declining to 13,365 tons in 1970. The total Japanese import from all sources however rose from 10,681 in 1966 to 29,186 tons in 1968 and then experienced a decline to 276,289 tons in 1969.

8.33 The other major importers of Sarawak sago is Singapore whose imports have been increasing from 643 tons in 1963 to 12,053 tons in 1970, though it once went as low as 2,879 tons in 1967. Singapore re-exports refined sago mostly to Japan.

8.34 The European market for Sarawak sago has dropped from a little over 16,000 tons in 1960 to only 3,000 tons in 1969 - a decline of some 13,000 tons in a matter of 10 years.

8.35 It is reported that the general drop in import of Sarawak sago to U.K. and other European markets is due to its replacement by other starches of better quality and cheaper price. Moreover, the supply of these latter starches can be obtained regularly as against the uncertain supply of sago from Sarawak. Another cause of declining import by West European countries is the presence of tariff barriers especially in the

EEC countries. The rapid increase of imports by Japan is probably due to the expansion in the textile and confectionery industries in the country. The export of sago flour from Sarawak by destination for the period 1965 - 1970 is shown in table 8.4.

Prices

8.36 Sago is produced in two grades (Grade I & Grade II). The difference in prices between the two varies from $7 to $10 per ton in Japan and $14 to $15 per ton in Europe. In 1960, the average annual price per ton of flour F.O.B. was $142, declining to $132 in 1962. But it rose again to $141 (1963 - 1964), probably because the normal Singapore supply from Indonesia was interrupted by Confrontation. The average annual price slumped again in 1966 to the lowest level in the decade ($127 per ton F.O.B.) when Confrontation ended and Indonesian supplies were once again available to Singapore. But in the last three years (1967 - 1969), it went up again to $134 in 1967 and $139 in 1969. The average F.O.B. price per ton of sago flour for the period 1960 - 1969 is shown in Table 8.5

Table 8.5

Quality, Value and Average FOB Price per ton of Exports of Sago Flour from Sarawak 1960 - 1969

Year	Quantity (ton)	Value ($)	Average F.O.B. Price (per ton)
1960	19,683	2,788,335	142
1961	22,449	3,298,398	135
1962	31,614	4,169,921	132
1963	39,644	5,593,065	141
1964	57,515	8,083,037	141
1965	44,155	5,813,029	132
1966	37,319	4,734,223	127
1967	35,968	4,802,986	134
1968	35,973	4,946,401	138
1969	28,691	3,705,045	139
1970	28,071	3,835,165	133

Table 8.4 **Exports of Sago Flour by Destination 1963 - 1970**

TONS

Destination \ Year	1963	1964	1965	1966	1967	1968	1969	1970
Australia	-	-	-	-	1	-	-	-
Belgium - Luxembourg	-	-	-	-	950	-	25	-
Brunei	-	-	1	-	-	1	1	0.71
Formosa	22	7,196	3,497	-	-	-	-	-
Hong Kong	25	297	239	230	-	445	298	966
Indonesia	0.1	-	-	75	14	39	-	38
Iraq	-	-	-	-	-	100	-	-
Japan	19,304	22.172	20,396	18,105	22,545	17,976	13,365	11,653
Kenya	200	-	410	466	160	200	40	-
Malaysia West	-	-	-	-	30	350	50	-
Middle East	-	25	-	-	-	-	-	-
Netherlands	-	-	-	750	200	300	-	-
New Zealand	-	10	-	-	-	-	-	-
Nigeria	40	-	-	-	-	-	-	-
Singapore	643	7,638	9,678	5,528	2,879	11,442	12,053	10,298
Spain	-	-	-	-	300	400	200	150
United Kingdom	17,460	17,372	9,109	12,005	8,339	4,750	2,350	4,950
Western Europe	1,950	2,806	825	910	-	-	-	-
Others	-	-	-	-	-	70	9	16
TOTAL	39,644	57,515	44,155	37,319	35,968	35,973	28,691	28,071
Value in M$	5,593,065	8,083,037	5,813,029	4,734,223	4,808,986	4,946,401	3,705,045	3,835,165

Source: Department of Statistics

8.37 The average monthly price variation over the last 10 years (1960 - 1969) showed that the price of sago declines towards the middle of the year, and then rising again after September (probably because of the rainy season when it is difficult to move sago logs or flour around), reaching its peak in December - January.

Future Market Prospect of Sago Industry

8.38 The factors which have enabled sago flour to retain its share of the world market for industrial starches despite the complaints about its colour, moisture and fibre contents are as follows:-

(a) Its inherently unique high viscosity, which it is able to develop over a wide range of temperatures well below boiling point, and which it can maintain even at high temperatures.

(b) Its comparatively cheap price compared to other industrial starches.

(c) Its good storage ability under reasonable conditions.

8.39 Market prospects in the future for sago starch or flour are required to be reviewed under three headings: supply, demand and effect of substitutes. Looking at the supply aspect of sago palms, several facts must be taken into account. These are:

(a) It takes the sago palm 12 - 15 years to grow to maturity. This is a very long growing period.

(b) There is, as yet, no organized planting programme for sago palm to ensure future steady supply of palms.

During the boom period of the sago industry from 1946 to 1956, apprehensions were expressed about over-felling the sago crop as a result of the extremely good flour prices then. However, this did not occur because the large accumulation of mature palms left unfelled during the Japanese Occupation Period were not fully exploited before the market for sago flour collapsed. Such fears could still recur if flour prices suddenly become extremely favourable again.

8.40 Prices for palms delivered to the factory door are high at the moment because of the very keen competition among the sago factories for palms, and because of the fact that palms are now only obtainable from areas further up river from the centres of production. Palm prices now vary from $17 to $18 as compared to $8 to $9 in 1962. This is because the supply of palms has declined continuously in recent years as a result of a fair degree of over-felling in the more accessible areas. Based on available statistics, the quantity of flour produced for export per annum is not likely to exceed the present level, provided that there is no upward change in sago flour price, when over-felling will take place.

8.41 To ensure a constant supply of palms to the mills, an organized planting programme of some kind has to be instituted in the sago areas. This could be done either on an estate basis (by private investment) or on a smallholder basis (with government assistance. On top of this, a comprehensive research programme which may be aided by UNIDO is needed to sustain the industry. Such a research programme should include:

(a) research into the development of better methods and techniques in the cultivation of the crop;

(b) research into the production of better varieties of palm giving higher yields; and

(c) research to improve and modernise the present processing methods to reduce processing losses, and to improve the quality of the flour produced.

8.42 On the demand size of future market prospects, most of the people in the trade in Sarawak appear to be optimistic that the world industrial starch market could absorb as much sago as Sarawak could produce. They point to the fact that the market in Japan is very good, with annual imports of around 30,000 tons, which amount is well below the Japanese import quota for sago starch. The Sarawak sago exporters are also optimistic that even at the present price for sago flour there is much scope for the expansion of sago exports even without any improvement in processing or quality control. But with such improvement, sago can easily hold its own against all its competitors because of its inherent physical properties.

8.43 The one single factor weighing **against** all those optimistic beliefs is the fact that Sarawak accounts for well over 90% of Japan's imports of sago flour, as shown in Table 8.6 and should this market be closed for some reason or other, there would be a serious case of over-production, and then prices would fall. This is a very vital problem and steps must be taken to expand the market for Sarawak sago in other countries. The task force which examined the prospects of marketing sago in Australia and New Zealand concluded that there is no scope of expansion in these markets in the feasible future.

Table 8.6

Imports of Tapioca Starch into Japan

			Quantity (tons)	Value (M $)
1966	Thailand		110.7	22,000.00
	Singapore		286.3	55,170.94
	Sarawak		20,220.0	3,966,794.87
	Philippines		64.0	13,273.50
		Total	20,681.0	4,057,239.31
1967	Thailand		331.7	69,017.09
	Singapore		96.8	19,623.93
	Sarawak		24,685.5	5,110,316.23
	Indonesia		106.3	21,760.68
			25,220.3	5,220,717.93
1968	Singapore		101.4	18,581.19
	Malaysia		689.5	139,923.07
	Sarawak		28,151.8	5,787,615.38
	Indonesia		243.5	52,700.85
			29,186.2	5,998,820.49
1969	Thailand		100.6	26,000.00
	Singapore		198.0	41,692.30
	Sarawak		25,475.9	4,832,324.78
	Indonesia		1,854.4	357,213.67
			27,628.9	5,257,230.75

Source: Embassy of Japan, Kuala Lumpur.

8.44 There may be scope for sago to expand its share of the industrial starch market in Japan, as a substitute for the other primary sources of starch, especially tapioca. Such changes, however, can only take place provided prices and quality justify such a move.

8.45 Exports to Europe, especially to the European Common Market countries and Britain, are not expected to increase any significantly in the near future. This is because of the restrictive import policy and high duties of the former and the uncompetitive price/quality factor between sago and other industrial starches, especially maize, in the latter. Exports to other countries are negligible, except to Singapore which re-exports usually after refining.

8.46 The factors affecting the demand for Sarawak sago in West Malaysia are as follows:-

(a) Low starch content of sago as compared with tapioca (72% against 85%).

(b) High transport costs of importing sago from Sarawak into West Malaysia, calculated to be about $43 per ton.

(c) Delays in meeting shipping schedules in Sibu, especially during the rainy season, which makes carrying of a large stock necessary.

(d) Difficulties involved in importing Sarawak sago into West Malaysia which include cumbersome customs procedures, unfavourable credit terms, etc.

(e) Landed sago price slightly higher than tapioca price when calculated on dry starch content, but due to all the above factors it is not economic to substitute sago for tapioca in West Malaysia.

(f) Quality of sago is poorer when compared with tapioca.

Although two large industrial firms in West Malaysia have expressed an interest in using sago flour, and their requirements of flour are in the region of about 10,000 tons a month; both firms said that until and unless the above problems can be overcome, they would continue using tapioca flour.

8.47 The expansion of exports of Sarawak sago in world markets, however, would depend mainly upon the quantity produced and the prices commanded by its competitors in world markets.

8.48 It is therefore urgently necessary that the quality of the sago produced is improved and also the cost of production reduced by using more efficient methods. While the improvement in the quality can be ensured by using treated water for the washing process, any improvement in the technique of production would mean complete change in the layout of the factories. In the present state of the international market for sago starch, the existing sago factories are not likely to be interested in investing additional capital in the factories. Providing treated water at the factory sites which are scattered and mostly in the outlying areas, would also be a time-consuming procedure and would also depend on many other factors. It would, therefore, be desirable to allow the existing factories to operate as at present till such time the market situation improves. In the meantime, it is recommended that either exporters or the SDFC be encouraged to establish factories to refine the crude sago flour output of these factories.

8.49 To start with two refineries may be established: one in Sibu and the other in Tg. Mani each having a capacity of one ton of dried refined sago per hour having a moisture content of 12% with little or no fibre content in the finished product. The refined sago is likely to have a better chance for competing with other starches in the market. The cost estimates of one such refinery has been worked out here.

Establishment of a Sago Refinery

Capacity - 7,200 tons of refined flour per annum

Working 3 shifts of 8 hours each for 300 days a year.

(a) Fixed Costs

		Rate/ Unit	Total Cost
(i)	Land including cost of development - 10,000 sq. ft.	$2/sq. ft.	20,000
(ii)	Building - 1,800 sq. ft. of covered area (factory and office). A third of the factory space i.e. 600 sq. ft. would have to be 3 storey high for drying section.	$12/sq. ft.	$ 21,600
(iii)	Machinery and equipment (Refining equipment and part of drying equipment have to be imported and rest can be fabricated either locally or in West Malaysia).		$ 275,000
(iv)	Transport vehicles (Two 3-ton lorries and one land rover)	$15,000 per lorry and $10,000 per land rover	$ 40,000
(v)	Cost of erection, design and engineering (At the rate of 20% of cost of machinery and equipment)		$ 55,000
		Total	$ 411,600
	Pre-project cost (10% of fixed cost)		41,160
			$ 452,760
		Say	$ 455,000

(B) Cost of Raw Materials

(i)	Sago flour - 7,560 tons (assuming 5% loss in refining) @ $96.40 per ton.	-	$ 728,764*
(ii)	Bags at the rate of 17 bags per ton, each bag costing 30 cents.	-	$ 36,720
(iii)	Twine - 10 cents per ton	-	$ 720
(iv)	Fuel	-	$ 360
(v)	Power and light	-	$ 1,500
(vi)	Water	-	1,000
		Total	$ 769,064
		Say,	$769,000
	Maintenance and repair of machinery	-	$ 500
	Warehouse charges at port	-	$ 500

(C) Factory Labour (3 shifts)

		No.	Wage/month	Wage/annum
(i)	Factory Manager	1	$800	$ 9,600
(ii)	Mechanical Foreman	1	$300	$ 3,600
(iii)	Electrical Supervisor	1	$300	$ 3,600
(iv)	Machine Operators	9	$200	$ 21,600
(v)	Skilled workers	21	$6/day	$ 37,800
(vi)	Unskilled workers (For bagging flour, loading and unloading)	24	$4/day	28,800
(vii)	Lorry and land rover drivers	3	$5/day	$ 4,500
				$109,500
	Add 15% employment cost			$ 16,420
				$125,920
			Say,	$126,000

* This includes transport cost of $8.40 per ton from Mukah to Sibu.

Administrative Cost	No.	Wage/month	Wage/annum
(i) General Manager	1	$1,000	$12,000
(ii) Sales Manager	1	800	9,600
(iii) Clerks	2	250	6,000
(iv) Stenographer/Typist	3	250	9,000
(v) Store Keeper	1	200	2,400
(vi) Office Boys	2	100	2,400
			$41,400
Add 15% employment cost			6,210
			$47,610
Office stationery, telephone etc.			4,390
			$52,000

Depreciation on building and machinery at an average rate of 10% per annum	45,500
Total recurrent cost	993,500
Working capital requirement based on 3 months operation	248,375
Interest on working capital (at the rate of 10% based on current bank rates)	24,838
	$1,018,338
Total annual cost of producing 7,400 tons of refined sago flour delivered by ship at Kuching	$1,018,400
With a current FOB (equivalent) price of $154 for refined flour as against $127 for raw flour currently being obtained, the total price	$1,108,800

Profit before taxes - $1,108,800 - $1,018,400

= $ 90,400

% profit on fixed investment $= \frac{90,400}{455,000}$

= 20%

8.50 From the above calculation, it would appear that with the current price of refined sago flour in the Japanese market, the refining project would be a profitable venture. More so, the project should be looked upon as an indirect means for improving the sago industry of Sarawak as a whole. However, much promotional effort would have to be made for Sarawak refined sago starch to enter into the Japanese market, where the refining facilities are already existing and the Japanese government policy has all along been to import raw material rather than the finished pr duct.

8.51 With this production, refin d sago starch can also compete in the European market as well as regaining its lost position in the United Kingdom.

8.52 Refining of sago in Sarawak would be effected only with the introduction of compulsory quality control. In other words, no export should be allowed from the State without refining. This would gradually necessitate the establishment of more factories of the above sizes, as the total export is around 30,000 tons annually.

CHAPTER IX

OIL PALM

The Oil Palm Plant

9.1 Oil palm or Elaeis Guineensis exists in Africa and it has been used as a source of edible oil in that Continent since ancient times. In Tropical America, a second well defined species of oil palm 'E.Melanococoa' occurs. Some more species of oil palm also occur in the two Continents. Varieties of strands of the species E.Guineensis are at present used in almost all estate plantings throughout the world. The other species, however, are made as breeding material in the search for new genus for the improvement of the commercial oil palm.

9.2 Within the species E. Guineensis, several genetic strands can be recognised on the basis of the fruit characteristics. There are two distinct varieties showing variations in fruit colour. One palm has green fruits which become bright orange as they ripen, while the other has black fruits which become bright red. Variations also occur in shell thickness. Some varieties have very thick shells and a thin outer fleshy layer or pericarp (Var Macrocaria), others have shells of intermediate thickness (Var Dura) and a third variety is totally without shell (Var Pisifera). Tenera, which is a high breed between the thicker shell Dura and the shelless Pisifera, used mostly at present times, has a relatively thin shell and a thick oil containing pericarp.

9.3 The oil palm plants are similar to coconut palms in appearance but has a thicker and more perpendicular trunk on which the leaf basis remain as a rough pattern for about 20 years. The fruits are borne in the leaf axils. An average bunch of fruits of a mature palm weighs between 20 - 24 lbs. and very big ones may weight 48 lbs. or more. The mature bunch consists of 500 or more fruits. The fruit is usually coloured deep violet when young, but turns orange red as it ripens.

The outer portion is composed of a fleshy fibrous pulp and it surrounds a nut which consist of a hard shell enclosing a kernel..

Climatological and Other Requirements

9.4 Oil palm requires a warm tropical climate and a high rainfall and for this reason, its cultivation is at present mainly confined to lowland areas of the humid equatorial regions of the world. From the crop yields, obtained in various parts of the world, it would appear that the ideal climate is one in which the rainfall is never less than the evaporation at any period of the year. Alternatively, the soil must have a storage capacity for retaining previous rainfall, or ground water must be available by sewage and the water table accessible to the roots. Evaporation rates measured in the humid tropics have been found to be of the order of 5 inches per month. If it is assumed that this also applied to evaporation from a tree plantation, then the minimum rainfall required for successful oil palm growing would be of the order of 60 inches per annum, provided this is evenly distributed throughout the year. Generally speaking, rainfall in excess of 80 inches per annum is good for oil palm plantation.

9.5 The success of oil palm growing in low-lying areas with a high water table indicates that the palm can tolerate flooding to a considerable degree. However, as the roots require a predominantly oxidizing environment, the palms would show severe yellowing symptoms if allowed to grow in conditions of stagnant ground waters. Therefore, if flooding occurs, either the water must be removed quickly or the period of flooding should not be too prolonged.

9.6 An essential factor for high yielding in the oil palm and in most other crops is the amount of light received, for it is the photosynthesis taking place in sunlight which is primarily responsible for the growth and fruit production. Sunlight, therefore, is important to successful oil palm growing. Cloudy and misty locations would not be high yielding even though the rainfall may be adequately high.

9.7 The temperature limitations of the oil palm are not clearly known and it is likely that genetic strands can be developed which will produce at lower temperatures than are commonly expected as being suitable, i.e. those of the lowland equatorial zone. At present, however, oil palm growing is confined to these warm equatorial regions, and high altitudes within the tropics are considered unsuitable.

9.8. Oil palm can be grown on a variety of soils provided that adequate drainage have been provided. The best soils for oil palm growing, however, are:-

(a) Upland loam with no stony layer, or compressed ground within 7ft. of the surface. Steep slopes are not suited.

(b) Coastal and river alluvial loams and clayey loams over-lying a pliable clay sub-soil.

(c) Shallow peat soils (not more than 3 ft. in depth) over-lying pliable clay.

(d) Mud soils where shallow peat has shrunk and become mixed with clay sub-soil.

9.9 Oil palms require free drainage together with plentiful supply of water to the roots. The ditches and number of drains required depend largely on the types of soils on which the palms are grown. Coastal alluvial soils, shallow peats and mud soils would require many more and deeper drains than the lighter upland soils. These lighter upland soils have some natural drainage and less power to hold water and such natural drainage on most upland soils will be sufficient.

9.10 The oils of the oil palm are obtained from the fruits and these produce two distinct types of oil. One type is extracted from the pericarp and the other is from the kernel within the shell. The former produces a bright orange oil while the kernel oil is thicker and colourless.

9.11 A mature healthy palm should yield annually up to 260 lbs. fruit bunches containing 40 lbs fruit oil and 9 lbs of dried kernel. With 49 palms to an acre, therefore, a good yield per acre would be in the region of 2000 lbs of fruit oil and 440 lbs of dried kernel.

USES

9.12 The major uses of pericarp oil or palm oil in the past had been for soap making, manufacturing of margarine and for the preparation of cooking oil. Besides these traditional uses, palm oil can be used as a sedative to animal feed stuffs, as a basic ingredient and a substitute for cocoa butter in the confectionery industry, as a lubricant in a number of industrial processes and in ice-cream manufacture. The pericarp oil is also used in the manufacture of fatty acids which are used for water proving, crayons and candle manufacture. There are also other miscellaneous uses of palm oil in small quantities.

9.13 The kernel oil, historically, has been used to a large extent as a substitute for the pericarp oil in the manufacture of margarine and soap, though in the physical properties and chemical composition, the two oils are not widely varied. Palm kernel oil is more like coconut oil in its physical and chemical properties, it being easier to solidify and to decolourise. In the past, palm kernel oil, like palm oil, has been mainly used for the preparation of soap and margarine and compound coconut fat. Its most important use other than the three traditional uses is probably in the manufacture of detergents. The biscuit and confectionery industries [illegible] kernel [illegible] amount while some is also used in ice-cream manufacture. Fatty acids derived from this oil, which has a high lauric acid content, can be used in the manufacture of resins and fatty yeast, as well as detergents. These latter uses, however, consume relatively small quantities of the oil at present.

9.14 In addition to the oil from the kernel, the cake which remains after extraction of the oil forms a valuable by-product for animal feed and in the preparation of animal feed mixtures.

World production

9.15 The world production of palm oil reached the all-time peak of 1.4405 million tons in 1968 from 1.3721 million tons in 1964. The kernel production during the period showed an erratic trend. It rose from 1.0725 million tons in 1964 to 1.1134 million tons in 1965, and then had a fall in 1967 to 0.8801 million tons. The 1968 total world production of palm kernel was 0.9436 million tons of dried kernels. (Please see table 9.1 & 9.2)

9.16 The major palm oil and kernel oil producing countries are Nigeria, Congo, Dahomey, Brazil, Indonesia, Malaysia and Sierra Leone. These countries together accounted for more than 80% of the total world production of palm oil and more than 55% of the total production of kernel oil in 1968. Of these major producing countries, Nigeria has remained the largest producer throughout the period 1948/1968 in terms of the palm oil production. This country alone accounted for about 25% of the palm oil in 1968. West Malaysia's production rose steadily from 1968 to date

9.17 The total West Malaysian production in 1968 was 0.2647 million tons. The East Malaysian State of Sabah which opened its account with 5,300 tons of production in 1965 had an increased production of 8,900 tons in 1966 and 17,400 tons in 1967. In 1968 the production suffered a fall to 12,800 tons.

Table 9.1

Palm Oil - World Production

100 Metric Tons

Notes	Continent and Country	1964	1965	1966	1967	1968
	N + C AMERICA					
1	COSTA RICA	89*	92*	91*	95	102
2,3	HONDURAS	14F	14F	14F	14F	114F
	MEXICO	130F	130F	130F	130F	130F
	TOTAL	233	236	235	239	246
	S. AMERICA					
	BRAZIL	64	85	110	98	102
	COLOMBIA	5*	22*	28*	86*	200*
	ECUADOR	13F	16F	20F	30F	30F
4	PARAGUAY	59	50	45	42	56
5,6	VENEZUELA	15F	15F	15F	15F	15F
	TOTAL	156	188	218	271	403
	ASIA					
7	INDONESIA MALAYSIA	1609	1567	1510	1740	1882
	SABAH	...	33	89	174	128
7	W. MALAYSIA	1220	1487	1863	2168	2647
	TOTAL	2829	3087	3462	4082	4657
	AFRICA					
6	ANGOLA	410*	320*	350*	350F	350F
8	BURUNDI	10F	10F	10F	10F	10F
8	CAMEROON	526	444	394	375	400*

NOTES	CONTINENT AND COUNTRY	1964	1965	1966	1967	1968
	CENTR AF REP	14	10F	7F	5	5
6, 9	CONGO BRAZZ	71F	71F	68	56	57
	CONGO D REP	2093*	1624*	1676*	2032*	2439*
2	DAHOMEY	450	430	301	340	444*
	EQUAT GUINEA	32	28	40*	40*	40*
10	GAMBIA	17*	21*	21*	21*	21*
6	GHANA	430*	370*	370*	380*	380*
6	GUINEA	110*	130*	130*	150*	150*
1	IVORY COAST	280	270	280	298	250*
3	LIBERIA	412F	412F	412F	412F	412F
6	NIGERIA	5150*	5300*	5080*	3250*	3500*
	PORT GUINEA	80F	80F	80F	80F	80F
6	SAO TOME PR	14	14F	14	12	10
6	SIERRA LEONE	390*	390*	400*	410*	420*
	TANZANIA					
	TANGANYIKA	3	2	2	3F	3F
6	TOGO	11	28	28F	28F	28F
	TOTAL	10503	9964	9663	8252	9099
	WORLD TOTAL	13721	13475	13578	12844	14405
	REG. TOTALS					
	LAT AMERICA	389	424	453	510	649
	FAR EAST	2829	3087	3462	4082	4657
	AFRICA	10503	9964	9663	8252	9099

1 - AVERAGE OF 4 YEARS (SECOND AVERAGE)
2 - AVERAGE OF 3 YEARS (FIRST AVERAGE)
3 - AVERAGE OF 2 YEARS (SECOND AVERAGE)
4 - AVERAGE OF 4 YEARS (FIRST AVERAGE)
5 - 1951 (FIRST AVERAGE)
6 - AVERAGE OF 3 YEARS (SECOND AVERAGE)
7 - ESTATES ONLY
8 - 1952 (FIRST AVERAGE)
9 - AVERAGE OF 2 YEARS (FIRST AVERAGE)
10 - 1955 (SECOND AVERAGE)

Table 5.2

PALM KERNELS - WORLD PRODUCTION

100 Metric Tons

NOTES	CONTINENT AND COUNTRY	1964	1965	1966	1967	1968
	N + C AMERICA					
1, 2	COSTA RICA	200F	200F	200F	200F	200F
	HONDURAS	9	9	10F	10F	10F
	MEXICO	257	259	260	261	263
	TOTAL	466	468	470	471	473
	S AMERICA					
3	BRAZIL	1552	1708	1728	1749	1750F
2, 4	ECUADOR	58*	68*	62*	75*	90*
5	PARAGUAY	91*	113*	138*	100*	155*
2	SURINAM	10F	10F	10F	10F	10F
	TOTAL	1711	1899	1938	1934	2005
	ASIA					
6	INDONESIA MALAYSIA	342	325	332*	347	403
	SABAH	1	1	8	17	30
6	W MALAYSIA	305	350	434	491	596
	TOTAL	648	676	774	855	1029
	AFRICA					
7	ANGOLA	213	171	167	168	123
4	BURUNDI	2F	2F	2F	2F	2F
	CAMEROON	417	482	372	380	501*
7, 8	CENTRAL AF REP	11	14	13	10	12
7	CONGO BRAZZ	64	56	40	50	40*
	CONGO D REP	1100*	750*	800*	950*	1050*
1	DAHOMEY	560	495	297	429*	533*
7, 9	EQUAT GUINEA	29	23	16*	17*	20*

NOTES	CONTINENT AND COUNTRY	1964	1965	1966	1967	1968
7	GAMBIA	13	15	19	23	20*
10	GHANA	140*	221*	224*	227*	250*
7, 11	GUINEA	142*	120*	100*	151	120*
11	IVORY COAST	200	230	210	230	230F
7	LIBERIA	68	121	135	140	140*
12	NIGERIA	4079	4564	4249	2232	1933
5, 7	PORT GUINEA	91	90	90*	102	80*
7	SAO TOME PR	35	35	35	33	27
8	SENEGAL	43	38	35	39*	45*
7	SIERRA LEONE TANZANIA	530	501	555	218	664*
2	TANGANYIKA	13	10	11	10	10F
7	TOGO	145	153	166	130	129*
	TOTAL	7895	8091	7536	5541	5929
	WORLD TOTAL	10720	11134	10718	8801	9436
	TEG. TOTALS					
	LAT AMERICA	2177	2367	2408	2405	2478
	FAR EAST	648	676	774	855	1029
	AFRICA	7895	8091	7536	5541	5929

1 - AVERAGE OF 4 YEARS (FIRST AVERAGE)
2 - AVERAGE OF 2 YEARS (SECOND AVERAGE)
3 - BABASSU KERNELS
4 - 1952 (FIRST AVERAGE)
5 - AVERAGE OF 4 YEARS (SECOND AVERAGE)
6 - ESTATES ONLY
7 - EXPORTS
8 - 1956 (SECOND AVERAGE)
9 - AVERAGE OF 2 YEARS (FIRST AVERAGE)
10 - AVERAGE OF 3 YEARS (SECOND AVERAGE)
11 - AVERAGE OF 3 YEARS (FIRST AVERAGE)
12 - PURCHASES FOR EXPORT

World Trade

9.18 The world import and export trade statistics of palm oil are shown in the tables 9.3 and 9.4. The total world export has shown a slight increase, rising from 616,051 metric tons in 1965 to 799,909 tons in 1969. In terms of value however, the total export values of US$146.8 million and US$114.9 million for the two years respectively, have indicated a drop. This could only be attributed to a drop in the unit price of palm oil.

9.19 The major palm oil exporting countries are Nigeria, Malaysia, Indonesia, Congo and Singapore. While the Nigerian exports fell from 152,414 metric tons in 1965 to as low as 5,395 metric tons in 1968, the West Malaysian exports during the period rose from 141,475 metric tons to 267,922 metric tons. In 1969, the export from West Malaysia was 330,809 tons as against Nigeria's 8,122 tons. Meanwhile, Sabah has increased her exports from the meagre 1722 tons in 1965 to 25,934 tons in 1969. The Indonesian exports, on the other hand, have been erratic over the years, but have remained at the region of 130,000 metric tons. The Congolese exports have also increased, rising from 81,131 tons in 1965 to 132,982 tons in 1969. Singapore, though not a producer, exported 42,678 tons in 1965 and went on steadily to 113,171 tons in 1969.

9.20 The main importers of palm oil are Germany, France, Belgium and Luxembourg, U.K. Netherlands, Italy and Ireland in Europe; and Canada, U.S.A. and Costa Rica in North America. The major Asian importing countries, apart from Singapore which imports for re-export, are Iraq, Japan and the Philippines. India, which was previously another major importer of palm oil in Asia, has reduced her import considerably, falling from 55,733 tons in 1964 to 290 tons in 1969. This was mainly due to her switching over to animal fat for the soap industry, and her increased coconut and groundnut production for the margarine industry.

Table 3.3
Palm Oil - Imports

	QUANTITY					VALUE				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
	Metric Tons					1,000 U.S. Dollars				
EUROPE										
Belg Lux	27651	26375	28012	27777	22266	7330	6339	6435	5015	3711
Czechoslvk	373	1472	603	445	...	253*	333	145	79	...
Denmark	1190	677	1403	1173	3543	340	167	332	230	572
France	36730	40347	42105	35083	35170	10406	10539	10347	7024	6343
Germany Fr.	102565	114351	93101	120393	132433	27076	27303	23010	23033	21745
Hungary	1046	404	335	460	460	345	122	96	113	113
Ireland	2901	4707	2500	2306	3330	794	1156	577	433	524
Italy	32046	33113	36310	36075	53361	3716	3033	3660	7140	9155
Netherlands	64549	63933	64564	71083	77445	16299	15204	14345	11590	12415
Poland	1393	-	2245	1661	3917	344	--	537	397	615
Portugal	13730	15027	15606	14250	17343	2345	3562	3339	2309	3101
Spain	274	1520	695	2030	7460	70	372	157	373	1207
Sweden	2244	2199	1323	2986	3474	607	520	423	540	656
Switzerland	2697	2700	2437	2543	2511	363	354	717	651	609
U.K.	117130	150246	93706	103739	139401	30033	34650	22196	13502	21965
Yugoslavia	3600	1343	474	743	426	1573	449	157	204	111
Others	617	340	306	472	513	222	106	94	120	136
Total	411350	456502	397230	434234	504053	103175	109609	91617	78859	83063
USSR	2000	3003	1500	1400	1500	331	763	312	230	240
N + C America										
Canada	3579	12133	9307	3499	16422	2023	2593	2042	1372	2304
Costa Rica	600	2751	1350	1231	1515	131	753	299	363	226
USA	2974	34422	29143	46351	72502	720	7774	5450	7425	10473
Others	544	583	313	246	237	160	162	35	69	67
Total	12697	49394	41172	56377	90600	3034	11237	7876	9235	13075
South America										
Chile	1306	1953	2765	573	...	393	473	313	127	...
Others	191	24	100	1763	219	52	3	33	377	146
Total	1997	1977	2865	2336	...	450	481	351	504	...
Asia										
Ceylon	796	1013	573	544	...	241	263	135	101	...
China Mainland	434*	124*	1016*	..	..	125*	30*	210*	-	-
India	7465	10323	7573	1465	290	2060	2391	1819	331	36
Iraq	50104	36015	51390	54012	58323	13733	9733	11315	9740	9232
Israel	260	242	485	2119	320	115	94	145	524	193
Japan	16415	20170	22029	23073	41811	4322	4 53	4960	4309	6746
W. Malaysia	307	140	49	36	64	114	47	11	13	14
Pakistan	.	3550*	2482*	1020*	914*	4	1233	507	239	260
Philippine	5555	5739	6302	3151	8210	1402	1244	1324	1231	1216
Singapore	49763	53305	67541	53393	113224	12204	13023	13817	7743	15733
Syria	1295	1399	1362	2379	1631	299	394	363	463	246
Others	314	266	241	560	663	114	67	35	164	170
Total	131771	133691	162043	157307	226679	34913	32332	35191	25513	34100

Table 9.4

Palm Oil – Exports

	QUANTITY					VALUE				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
	Metric Tons					1,000 U.S. Dollars				
Europe										
Belg Lux	4537	5515	5380	4931	3935	1400	1549	1396	1113	741
France	551	643	1013	656	430	223	261	353	175	141
Germany Fr.	3391	2384	2174	3984	4316	1290	877	614	1005	1170
Netherlands	5697	8127	8492	11239	16396	1942	2399	2454	2469	3336
Others	308	669	539	351	303	416	202	167	301	339
Total	15934	17343	18096	21411	26435	5271	5233	4934	5063	6327
N + C America										
Cost Rica	386	298	137	34	24	114	90	40	10	3
Honduras	916	313	-	1330	...	122	83	-	352	...
Total	1302	611	137	1364	...	236	173	40	362	...
South America										
Paraguay	2523	2684	2110	2032	4047	305	384	324	267	505
Total	2523	2684	2110	2032	4047	305	384	324	267	505
Asia										
Indonesia	125900	177100	133302	152409	119563	27303	33400	23561	19517	15176
Sabah	1722	3336	3297	18042	25934	413	662	1729	2493	3325
W. Malaysia	141475	131231	130010	267922	330309	34609	33563	36165	33156	46659
Singapore	47673	55947	62535	91434	113171	11699	11369	12724	12930	16122
Total	316303	417791	334811	529936	590213	74037	84544	74195	73157	81351
Africa										
Angola	14612	14493	15436	11715	10914	2460	2796	2313	2039	1759
Cameroon	12356	5693	9933	7327	6301	3053	924	1360	1163	942
Congo	31131	34769	116631	153300	132932	13961*	15571*	21794*	24300*	19269*
Dahomey	13257	9907	8515	10067	13000*	3004	1324	1069	1693	2100*
Equ Guinea	3632	3000*	3048	3000*	2500*	539	510*	534	500*	400*
Gabon	1135	330	1032	1390	929	231	194	201	202	111
Ivorycoast	1203	630	513	194	2025	343	137	137	49	376
Nigeria	152414	145499	16729	3395	8122	33055	30697	3527	399	1213
S Tume Pr.	371	630	543	331	246	153	123	33	64	40
Others	243	356	2147	745	340	34	213	433	169	167
Total	231439	266047	174537	187014	177860	66952	52939	32466	31033	26331
Grand Total	613051	704976	579741	751307	799309	146301	143323	112009	109932	114924

9.21 The world import and export trade statistics of palm kernel oil are shown in tables 9.5 and 9.6. Compared to palm oil, the volume of trade in palm kernel oil is quite small. However, there has been a continuous increase, rising from 96,606 metric tons in 1965, to 152,786 tons in 1969. The average prices of palm kernel oil, over the years, have been within the region of US$250 to US$300 per metric ton.

9.22 The major exporting countries of palm kernel oil are Congo, Nigeria, Netherlands and Dahomey. While Congo, Netherlands and Dahomey have gradually increased their exports over the years, the Nigerian exports indicated a large lift from 964 metric tons in 1965 to 32599 metric tons in 1966. Thereafter, the Nigerian exports remained quite constant. There is no export of palm kernel oil from Malaysia.

9.23 The principal importing countries of palm kernel oil are U.K., Germany, France and Italy in Europe; and U.S.A. and Canadian America. The Asian and African imports were small. U.K., Germany and France have indicated an increase in their import, and in 1969, they together imported about 65,538 metric tons of palm kernel oil, valued at about US$18.8 million. The Italian imports have shown an erratic trend over the years. Netherlands, though a major exporting country of palm kernel oil, also imported the commodity. In 1969, her import was 13,790 metric tons valued at US$3.785 million. The U.S.A. imports have been erratic, but remained at the region 50,000 metric tons per year.

Table 3.5

Palm Kernel Oil - Imports

	QUANTITY					VALUE				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
	Metric Tons					1,000 U.S. Dollars				
EUROPE										
Austria	3120	1291	631	1743	1063	1053	369	195	533	315
Belg Lux	1553	1203	3123	2205	3395	476	379	373	740	939
France	6069	7410	3365	7772	3607	1900	2197	2260	2693	2377
Germany	14520	15662	10013	19610	27031	4736	4558	2551	6657	7634
Hungary	75	371	200	3300	393	26	114	59	1084	122
Ireland	493	253	683	974	370	247	92	136	303	240
Italy	9073	10240	9995	7727	9153	3035	3025	2620	2354	2293
Netherlands	1601	545	2534	6934	13790	556	159	700	2219	3705
Portugal	724	395	470	50	245	221	272	136	2	30
Spain	51	121	117	131	690	24	55	56	55	204
Sweden	1545	1023	1371	301	576	570	341	392	339	194
Switzerland	240	117	317	417	229	17	35	97	139	67
U.K.	932	15340	34361	23239	29950	233	4503	9213	7512	3707
Others	414	14	110	195	342	177	3	45	119	97
Total	41320	54990	72903	74990	95394	13441	16112	19464	24304	27109
N + C America										
Canada	4430	4165	5493	5488	6537	1537	1223	1453	1332	1327
USA	37920	52505	44225	54945	45063	12459	15434	11946	19405	12990
Others	3	21	3	...	13	3	26	3	...	13
Total	42411	56691	49726	60433	51623	13999	16733	13402	21237	14335
South America										
Argentina	...	1808	2230	641	...	...	653	300	216	...
Others	1107	163	23	43	70	255	45	10	13	20
Total	1107	1971	2253	689	70	255	698	310	229	20
Japan	550	307	1311	1122	625	424	591	936	761	485
Others	933	68	328	9	633	267	26	85	2	30
Total	1483	375	1639	1131	1258	691	617	1021	763	565
Africa										
Ghana	334	357	406	401	503	119	103	114	169	199
Kenya	45	72	343	92	32	20	26	99	31	31
Morocco	1343	530	240	1052	1256	457	202	75	364	363
Zambia	702	336	539	675	677	291	168	253	240	317
South Africa	2933	1776	2527	2465	2410	923	473	617	767	647
Sudan	30	105	20	139	72	33	47	3	74	30
Others	212	...	20	196	137	33	...	9	73	40
Total	5654	3442	4202	5121	5244	1946	1070	1215	1763	1667
Oceania										
Australia	366	954	516	1020	609	333	336	151	394	224
Grand Total	92341	117326	131242	143394	154347	30670	35567	36064	43241	44633

Table 3.6

Palm Kernel Oil - Exports

	QUANTITY					VALUE				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
	Metric Tons					1,000 U.S. Dollars				
EUROPE										
Belg Lux	2351	1013	1025	1123	1143	324	303	2[illegible]3	343	339
Denmark	1110	20	51	1579	1002	339	3	15	632	275
France	576	535	96	37	950	163	164	35	36	257
Germany Fr.	725[illegible]	1710	3104	2789	3010	2337	550	954	1040	1040
Ireland	161	163	137	30	152	60	75	55	12	57
Netherlands	19739	13002	10233	19427	33297	6214	5133	2374	6329	9560
Switzerlands	795	396	1502	2273	1232	572	637	912	1117	313
U.K.	4556	600	1273	2419	1164	1562	216	392	774	391
Others	750	22	645	0	4	205	15	133	6	1
Total	37296	22961	18071	29741	42763	12456	7161	5703	10302	12312
N + C America										
Honduras	...	263	1933	...	...	...	66	434	...	...
SOUTH AMERICA										
Paraguay	3193	4245	4113	6047	4793	1056	1362	1302	2103	1623
ASIA										
Japan	3072	2721	950	1503	3045	979	746	256	560	324
Singapore	...	519	7	335	1314	...	106	3	65	261
Total	3072	3240	957	1838	4359	979	852	259	625	1085
AFRICA										
Angola	1303	1212	1457	705	908	394	232	319	222	25[illegible]
Cameroon	1132	923	757	325	372	333	263	141	36	215
Congo Dr.	32900	31900	41300	54300*	40460	9050*	6699*	7650*	15900*	9913
Dahomey	16691	11693	16736	22715	20000	3933	2423	3626	7204	5400*
Ivory Coast	...	...	2426	1364	804	...	...	604	530	205
Nigeria	964	32599	37735	27262	37276	316	9215	10145	9313	10307
Others	...	...	4455	1506	51	...	...	1037	351	11
Total	53040	73332	105416	109177	100371	14032	13837	23522	33606	26959
Grand Total	96606	109043	130495	146353	152736	20573	23329	31275	47141	41970

Demand Forecast

9.24 From the world production statistics of palm oil and palm kernel, it is believed that in the world as a whole, no more than a modest expansion in the production of these commodities is likely to take place in the foreseeable future, regardless of continuous rapid growth of oil palm production in West Malaysia and Sabah.

9.25 The increase in demand for any commodity results mainly from the growth of production and from an increase in per capita income. According to a study by the FAO, the world population was expected to reach 3,500,000,000 in 1970 and the average rate of growth of world population from 1950 - 1959 was estimated at 1.7% per year and thereafter a more rapid growth. If the per capita income remained unchanged, the growth of population may alone bring about 1.7% or higher increase in the demand of consumer goods including palm oil.

2.26 Increasing per capita income will generally result in increased purchase of commodities unless the commodity in question is an inferior product. The effect of change in per capita income on the purchase of a commodity depends both on the magnitude of the change in income and on the income elasticity demand for a particular commodity i.e. the percentage change in quantity demand for a 1% change in income. As accurate information regarding the trend of change per capita income and the income elasticity demand for oil palm products is not avaible, the exact income effect on the demand for oil palm products is difficult to predict. The combined effect of the population and the income may however, estimated to result in a 3% increase in the demand of palm oil only.

9.27 The future prospects for oil palm products will also depend on the technological advances. These will affect the degree of which oil palm products can be substituted with other fats and oils and vice versa. The general tendency seems to indicate that the proportion of oil palm products used in the three traditional outlets viz. soap, margarine and compound cooking fat manufacture, tends to decline while the proportion of these commodities, used for other purposes tends to increase. Animal fats and other oils have become more and more important in competing with oil palm products in the decade ending 1965, but this tendency seems now to be stabilizing. Fats and oils have always been readily interchangeable in most industrial uses, and this situation is continuing with every use of oil products. The demand for oil palm products will, therefore, become more dependent on how their prices compare with those of other fats and oils although there is no doubt that, with the continued growth of population and rising standard of living, the world demand for fats and oils in general will continue to increase.

9.28 Based on the above analysis, it may be concluded that the expansion in the production of palm oil and palm kernels in the world is not likely to surpass the increase in demand for these products and no over-supply of oil palm products can be forseen in the near future. The range of substitutability of other oils for oil palm products in terms of price tends to be small. The market prospects of palm oil products must, therefore, be bright and the average prices of these products should be quite favourable.

9.29 Palm oil production in West Malaysia has increased considerably from 1955 to 1970 and it is likely to expand even further in the near future, particularly when Malaysia is taken as a whole including Sabah and Sarawak. From estimates of world production, even with the increase of oil palm acreage of 17,000 to 20,000 per year, there would not be any danger of causing over-supply of this commodity in the world market. It has, however, been cautioned that with price elasticity demand, the percentage change in quantity demanded for a 1% change in price of palm oil is considered relatively low. The surplus can be ruinous, as, prices of the product which have an inelastic demand are highly responsive to change in supply and demand conditions.

Sarawak Situation

9.30 Sarawak is a late comer into the oil palm industry, and though there is a small production from a 100-acre experimental plantation in the government agricultural research station in the Fourth Division, the fruits are rejected due to the absence of any processing facility.

9.31 The Commonwealth Development Corporation, a British-owned organisation, having cocoa and oil palm plantations both in West Malaysia and Sabah, have obtained an allocation of 7,000 acres for oil palm planting in the Lambis-Subis area in the Fourth Division, Sarawak. The plantation in the area is likely to be completed in stages by 1972. The CDC have recently asked the State authorities for allocation of another 5,500 acres preferably in the same area. It's plantation so far completed are as follows:-

1969/1971	-	2,000 acres
1971	-	2,000 acres
1972	-	2,000 acres

By July 1973, harvest would be available from 500 acres of the 1969 plantation.

9.32 As the planting materials used are of hybrid varieties, the yield expected at full maturity is 10 tons per acre. The first, second and third-year yields are likely to be 3 tons, 6 tons and 8 tons respectively per acre. The extractable oil from the first year's harvest is expected to be 14% and at maximum maturity, in the fourth year from first harvest, to be 20%. The kernel oil extraction is expected to rise from 3½% in the first year to a maximum of 4% at full maturity.

9.33 The Agricultural Research Station plantation of 100 acres is adjacent to the CDC's plantation. It is gathered that the research station also intends to extend its acreage by another 200 acres.

9.34 Encouraged by the success of the trial plantation of the Agricultural Department, the State Development Finance Corporation has also worked out a plan for undertaking oil palm plantation on a large scale, with the view to settling farmers under the settlement programme. The SDFC plan includes oil palm plantations in two areas on the Miri-Bintulu Road in the Lambis-Subis area of the Fourth Division. These areas are separated by a distance of about 13 miles.

9.35 The first area is at the 31st mile, known as Bukit Peninjau Scheme. The plantation programme for this area is as follows:-

1st Phase	1970	749 acres
2nd Phase	1971	1,634 acres (Up to August, 1971 half the area has already been planted).
3rd Phase	1973	1,734 acres.

A plan to encourage plantation of a thousand acres on the fringes of this area, on land held by natives under customary rights, has also been worked out.

9.36 The second area, popularly known as Southern Complex and located at the 43rd - 46 mile, Miri-Bintulu Road, has a total acreage of 20,000. According to preliminary investigations, about 10,000 acres or 50% of the area might be suitable for plantation. The tentative planting programme for this area is as below:-

1st year	1972	3,700 acres
2nd year	1973	4,000 acres
3rd year	1974	2,000 acres

9.37 The SDFC is reported to be having a fresh look into their original plan of operating the oil palm plantations in these areas under the settlement programme. Instead, they are now seriously considering management of the plantations on estate basis. To manage the plantation on estate pattern would be a step in the right direction as would be evident from subsequent discussions in this section on the economic aspect of an oil palm plantation and processing.

9.38 There was a proposal for establishment of a processing plant for the three plantations discussed above to be jointly owned by the SDFC and CDC. This proposal has however, fallen through, reportedly due to the attitude of the CDC in regard to management control. The CDC wanted to have full control over the management of the factory which the SDFC is not prepared to concede. While CDC with its experience, no doubt would run the plantation and processing plant better than SDFC, which have little or no experience in the field, the SDFC's claim for active participation in the management cannot be dismissed in consideration of creating local expertise.

9.39 Oil palm processing is not new to Malaysia and there are local companies in West Malaysia, which have adequate experience in managing plantations and processing oil palm plantations. It might be worthwhile for the SDFC to consider inviting one of these firms to have a joint venture with them in the management of the plantation and proposed processing plant. It would be unwise for the SDFC to go alone even with the help of one or two technical advisers from abroad. Oil palm is no more primitive industry and modern techniques of management and production have to be adopted in full, particularly in consideration of the increasing competition in the international market among oils and fats from different regions.

9.40 A decision on this cannot also wait for long as the harvested fruit has to be processed within a specified time, failing which, the oil in the fruit would be a complete waste. The idea of the SDFC to install small capacity mills, as reported, does not appear to be sound from the economic point of view. It is thus proposed that the two areas should have a common processing plant once an experienced collaborator is identified.

9.41 As the market of palm oil, kernel oil and dry kernel is abroad, shipping facilities are very important. The existing facilities are however, very inadequate. According to information, the CDC intend to ship their palm oil, when the processing plant goes into operation in 197[illegible], from a bulk installation at Piasan near Miri by shallow draft boats. By [illegible] 1964, when the kernel processing plant is established, their kernel would also be shipped in the same way.

9.42 The SDFC on the other hand, is depending on the proposed development of Kuala Baram port. It is however, reported that Kuala Baram might ultimatelt be found an uneconomic proposition due to requirement of continuous heavy dredging. As such, it might be advisable for the SDFC to begin considering provision for bulk installation also. As success of oil palm plantation depends not only on the suitability of soil and climatic conditions alone, but on the availability of good transport facilities, it would be worthwhile for the State Government to consider developing these facilities urgently as the other factors are very favourable for oil palm cultivation.

It might also be desirable, if possible, to replace many of the rubber areas under smallholdings in the Lambis-Subis area by oil palm, once adequate processing facilities are established. In West Malaysia, such replacement of rubber with oil palm has been going on for quite a time now.

9.43 The Government has recently realized that heavy dependence on one agricultural commodity for the economy of the country is harmful, particularly in the face of continuous drop in rubber prices in recent years. It has been recognized that agrixultural diversification is desirable, not only in order to protect against the short-run economic instability, but also in the long-run balances of international payment position. As it is now, if the contribution of agriculture to the national economic development is to be increased, increase in the yield of rubber thereby reducing its production cost to enable it to compete with synthetic rubber in the open international market alone would not help.

The range and output of other agricultural commodities with local processing facilities have also to be recognized. Oil palm is one of these commodities which have a bright future for expansion.

9.44 The acreage of oil palm has increased considerably in the West Malaysian states over the last 20 years, and in Sabah, for the last one decade or so. Production of oil palm has been proved beyond any doubt to be profitable under the prevailing price situation. As Sarawak has conditions favourable for the production of oil palm and the experimental trial stage is already over, the government should encourage the planting of at least 30,000 acres of oil palm in 5 or 6 estates in the Lanbis-Subis area of the State. These estates should be provided with processing facilities to produce palm oil, and the ultimate aim should be to put up a refining and hydrogenation plant to refine a large percentage of the output. The later production would be meant partly for the local market and mostly for export to the regional markets of South East Asia.

9.45 As the palm oil processing plants are normally standard ones, and the SDFC and CDC are already taking action to set up their respective plants, it would consider a duplication of effort to give an account of oil extraction in this report. As such some data on a refining and hydrogenation plant with a capacity of 40 tons of hard fat per day, is provided. It is proposed that UNIDO might be requested to make a detailed study of the project and to provide a feasibility report.

Establishment of a Palm Oil Refining and Hydrogenation Plant

Process:

9.46 Crude palm oil when extracted from the fruit by a process of mechanical expression or solvent extraction, will not consist solely of fat. It will be contaminated with a lot of impurities such as free fatty acids (f.f.a.), coloriferous substances, phosphatides, tocopherol, sterol and dissolved mosture, the majority of which are objectionable and have to be removed if the oil is intended for edible use. This is done by refining.

Alkali Refining or Neutralisation

9.47 The first stage of process of refining is to treat the crude oil with an alkali: Caustic soda (NaOH) or soda ash (Na_2CO_3) is commonly used. The mixture is heated by steam coils and the alkali combines with the free fatty acids and converts them into soap which is washed out and the oil separated by centrifuging.

Bleaching

9.48 Palm oil is brownish-red in colour and for many products including margarine and high grade soaps, alkali refining alone does not produce a sufficient light coloured oil and additional bleaching treatment is required.

9.49 Fuller's earth ranging from 0.5% to 5%, is added to the oil and the temperature raised to about 120°C (250°F) while a vacuum is maintained. The oil is then cooled to about 70°C (160°F) and filtered to remove the Fuller's earth together with the colour absorbed on it.

Deodorisation

9.50 Although the oil has been bleached and neutralised, it will still be found to possess both odour and taste. Deodorisation is a process of steam distillation in which the relatively non volatile oil is maintained at a high temperature and under reduced pressure while it is stripped of the relatively volatile constituents responsible for flavour and odour. The application of reduced pressure during the operation protected the hot oil from atmospheric oxidation, prevents undue hydrolysis of the oil by the steam and greatly reduced the quantity of steam requirement.

Hydrogenation

9.51 The process of hydrogenation or the conversion of liquid unsaturated oil into a solid fat is brought about as follows:-

(i) Heating:

The refined oil is heated to about 120°C (250°F) under vacuum in the presence of a catalyst, usually nickel.

(ii) Hydrogenation:

The heated oil is stirred, the vacuum shut off and hydrogen admitted into the vessel at a pressure of 40 lb/sq.in. This pressure is maintained as the hydrogen is absorbed by the oil. This absorption of hydrogen is accompanied by the production of heat. The temperature of the reactor is kept at 12°C by running cold water through an outer jacket.

(iii) Cooling:

When oil is considered to be hydrogenated sufficiently (this is measured chemically by determining the iodine value), the vacuum is [illegible] and the oil cooled to about 80°C. (176°F). The nickel catalyst is then removed from the hydrogenated fat by filtration.

9.52 After hydrogenation, the liquid fraction disappears almost entirely, the hydrogenated palm oil being a soft white fat at ordinary temperatures.

Requirements of Space, Equipment, Utilities, Labour and Other Charges

Space:

9.53 For a plant with an annual capacity of 12,000 tons an area of about 1 to 2 acres is required with factory floor space of about 30,000 sq.ft.

Equipment:

9.54 The main equipment required for a refining and hydrogenating plant is as follows:-

(a) oil tanks and pumps
(b) hardening autoclave
(c) temperature and pressure recorder
(d) catalyst filter press and mixer
(e) vacuum receiver and pump
(f) dryer
(g) condenser
(h) washer

Water, Power, Fuel and Labour

9.55 For the production of 40 tons of hard fat per day, or 12,000 tons per annum, the requirement of power would be approximately 11,000 kw of electricity, and 7 tons of fuel per day. Water consumption would be about 24,000 gallons per day.

9.56 A direct labour force of around 45 persons would be necessary for the operation of the plant, working on 3 shifts.

Cost of Production:

Production capacity of plant (per annum)	12,000 tons (24 hours)
Total capital cost of project	$6,500,000
Cost of imported plant & equipment CIF	$1,967,000
Cost of raw materials	$9,247,800
Utilities	$ 474,000
Labour Cost	$ 181,800
Administration cost	$ 84,000
Fixed expenses	$ 826,500
Unit cost of production (per ton)	$ 985.90

9.57 The brief analysis provided above are more illustrative than exhaustive, and as such, a fully feasibility study is required to be undertaken. On request, UNIDO might consider providing assistance in this respect, to the State Government.

CHAPTER X

CASHEW NUT

The Plant

10.1 The cashew tree is a native of Brazil. Though in common with rubber trees, it has been planted and extensively cultivated in India, Africa, East and West Indies, Philippines, Bahamas and to a small extent Thailand, Ceylon and Malaysia. However, commercial production of cashew nuts in sufficient quantity is at present only confined to India, Mozambique, Tangayika, Kenya and Brazil. Ceylon, Nigeria and Senegal are also beginning to undertake some commercial production. The African production has lately been increased.

Cultivation & Harvesting

10.2 The cashew tree is not at all choosy in so far as plantation requirement is concerned. It can flourish even in the poorest soils with no fertilizer, irrigation or other cultural practices. Leaf mulches and compostings will, however, conserve moisture in hot weather and hence help to maintain the higher yields. Heavy rains at blossoming time, on the contrary, can ruin the fruit and adversely affect the yield of nuts. Therefore, in the location of the plants, rainfall intensity is an important factor.

10.3 The cashew tree starts bearing fruits at the end of three years from planting. The fruit consists of a nut with a false "fruit" also called "apple". Some trees produce nuts with yellow apples and some with red apples. The cashew nut forms first on the end of the stem which subsequently swells to form the apple with the nut attached externally. The first year's yield of nut may vary from 7 - 10 lbs. per tree and the yield would rise rapidly in successive seasons. It has been reported that a fully grown tree yields as much as 200 pounds of nuts in a season. A fair estimated average yield, however, for a mature tree, should be around 70 lbs. a year.

10.4 For a maximum sustained yield, it has been found in several areas that there should be only 16 mature trees to an acre. With an average yield of 70 lbs. of nuts from each mature tree, the per acre yield would be around 1,120 lbs. or half a ton. Trials have proved that this yield might greatly be improved by selection and culling of aged trees, by keeping the trees free of pests and by good cultivation practices.

10.5 In India, the main crop of cashew nut is harvested in March to May and a small crop in October and November. These latter months coincide with the main harvest period in East Africa, Mozambique, Tangayika and Kenya. By importing cashew nuts from the African countries to India during these months, the Indian factories are able to run smoothly around the year. In Central America, Bahamas and the West Indies, the cashew trees bear in May to July.

10.6 Birds, squirrels and monkeys are the three major enemies of cashew nut planters. They are attracted to the cashew nut plantations by the ripe fruits. Mature nuts are normally picked from the trees by the planters prior to full ripening and natural falling of the apples and nuts to the ground. If this is practised, no use can be made of the apple, as once the nut is detached, the fruit will wither and not ripen. After drying, (the maximum moisture content < 8%) the nuts can be stored without deterioration for a fairly long period, in some places, up to as long as 2 years. Nevertheless, storage for any length of time involves financial considerations both in relation to cost of space and building, and financing a purchased crop.

Uses

10.7 The entire cashew-nut kernels are consumed mainly as "dessert nuts" either fresh or salted and roasted. The nut is often eaten as an accompaniment to liquor or cocktails. To a lesser extent, the kernels are used in confectionery and bakery - but here mainly splits and pieces are used, rather than the whole nut. In some countries, kernels are used to produce a cashew nut butter spread. Investigations are being made into the possibilities of producing flour, from the lower grade kernels, to compete with almond flour. Such cashew flour production would, obviously, produce an edible oil as a by-product.

10.8 The cashew nut shell liquid (CNSL) is an oil having many uses in the paint, chemical, plastic and allied industries. The CNSL's polymerising properties make it useful in these industries; and as a friction modifier, it is important in the production of brake linings. There are said to be about 400 patents based on CNSL.

10.9 The cashew 'apple' can be used for jam-making, for fruit juices and for making alcoholic beverages. It can also be eaten as it is. As actual harvesting time has to be very accurate, if the whole fruit is to be utilised, only on plantations can such full utilisation be considered.

World Production, Consumption & Trade

10.10 It is difficult to estimate the total world production of cashew nuts as it is largely a smallholder crop in the important producing countries. It is also not possible to make a reasonable estimate from the export figures, in view of the fact that a substantial quantity is consumed locally.

10.11 India is the largest producer of cashew nuts and its total exports of cashew nut products account for some 3.5% of her total exports and the annual gross foreign exchange earnings are around N180 million. As two-thirds of her raw nut supplies are obtained from Tanzania and Mozambique, the net foreign exchange earnings come to around 90 million. The Indian cashew nut industry is reported to be employing some 200,000 - 250,000 workers.

10.12 In Mozambique, cashew crop accounted for around 19% of the total exports in 1965 or around $57 million. Eighty percents of this consisted of raw nuts to India and the balance were made of kernel and a small quantity of CNSL. The industry is stated to be employing 13,000 workers including 1,400 in the Mosita plant which has an annual capacity of 12,000 tons of raw nuts.

10.13 For Tanzania, the export of raw cashew nuts has been an important source of foreign exchange earnings, and in 1966 this accounted for 6.6% of the total export. In recent years, the foreign exchange earning from these nuts increased considerably, and according to the International Trade Centre estimates, in 1971, the total export would be of the order of 7,500 metric tons. Moreover, due to the establishment of new processing plants in the country, the export would experience an enhanced value. The factory at Tanita, processing some 9,000 tons of raw nuts, and the new one at Mtwara, processing a little over 9,000 tons, together employ around 2,000 workers.

10.14 Kenya is not a large exporter compared to the countries discussed above though cashew nuts account for about 1% of its total exports. Lately, however, with the establishment of a processing plant, the total value added to the export has increased by about 30%. The employment generated in this factory is around 1,000 persons.

10.15 The shelling and peeling capacity in Brazil is around 5,000 tons and CNSL is also extracted in this country.

10.16 Senegal, Nigeria, Ivory Coast, Dahomey, Togo and Angola are pontential growers, though their output is still small. The harvest in each country is no more than 500 tons in one season. The production in other countries such as Ceylon, Cambodia, Malaysia, Indonesia, the Philippines, Thailand, West Indies, Guatemala, Colombia and Venezuela are small. No cashew nut from these countries, except a small quantity from Malagassy and Dahomey, enter into the international trade.

10.17 The world export of cashew nut kernel for the period 1955 - 56 and estimated export in 1971 from the various producing countries is shown in Table 10.1.

Table 10.1

WORLD EXPORTS OF CASHEW-NUT KERNELS SHOWING COUNTRIES OF ORIGIN (000 metric tons)

Year	World total	India[1]	Mozambique	Tanzania	Kenya	Brazil	Portugal	Malagasy	Others
1955	31.4	31.4							
1960	45.5	43.6	1.3			0.6			
1961	43.2	41.7	1.1			0.4			
1962	51.1	48.6	1.9			0.6			
1963	54.7	51.0	2.6			1.1			
1964	60.4	55.7	3.5		0.1	1.1			
1965	57.2	51.2	4.0	0.1	0.2	0.7	1.0		
1966	60.3	50.8	5.7	0.6	0.2	2.0	1.0		
Estimate									
1971	78.0	48.0	14.0	7.5	3.0	4.0	0	0.5	1.0

[1] Indian statistical year April - March.

Sources: National Foreign Trade Statistics.

10.18 The supply of raw cashew nut has considerably increased in recent years mainly as a result of the introduction of mechanical processing. It is estimated that the output of kernel, though increased substantially, is not as big as that of CNSL which is estimated to have doubled between 1966 - 1971.

10.19 The world export of kernels in 1966 was about 60,000 tons and the estimated export in 1971 is 78,000 tons. It would be seen from Table 10.1 that the exports of kernel from Mozambique, Tanzania, Portugal, Kenya and Brazil which were 9,000 - 10,000 tons in 1966 are estimated to have increased to some 30,000 tons in 1971. In addition, some of the smaller producing countries such as Malagasy, Nigeria, Dahomey, Togo, Colombia and Ceylon may well have started small processing plants for their own domestic crops.

10.20 The estimated world consumption of cashew nut kernels for the period 1962 - 1966 is shown in Table 10.2.

Table 10.2

Estimated World Consumption of Cashew-Nut Kernels

	1962	1963	1964	1965	1966	Average 1962/66	Population in millions in 1964	1962/1966 average per head in grammes
United States I	29,248	34,355	31,577	29,761	30,752	31,139	192.1	162
Canada I	1,570	1,792	1,789	1,881	1,438	1,714	19.3	89
Australia E	1,559	1,551	1,856	1,583	1,592	1,629	11.1	147
New Zealand E	190	153	186	169	112	162	2.6	62
South Africa E	207	220e	246	309	320e	254	17.5	15
Japan E	354	369	498	511	542	459	96.9	5
Hong Kong E	377	355	413	402	692	448	3.7	121
Lebanon E	148	213	242	244	305	230	2.3	100
Czechoslovakia E	162	1,186	140	80	439	400	14.2	28
Bulgaria E	659	59	-	-	-	..	8.2	..
Germany, East E	4,306	3,355	3,780	3,119	2,799	3,472	16.0	217
Poland E	360	168	324	187	131	235	31.2	8
USSR E	5,175	7,819	12,723	11,527	15,418	10,532	227.7	46
Belgium I	172	171	182	184	241	190	9.4	20
France I	639	620	591	500e	540	538	48.4	11
Germany, F.R. E	1,222	1,369	1,098	1,095	1,100e	1,176	56.1	21
Italy E	322	117	149	103	61	151	51.1	3
Netherlands I	430	509	582	463	576	512	12.1	42
Sweden I	219	199	203	142	141	181	7.7	24
Switzerland E	37	71	41	100	40	58	5.9	10
United Kingdom I	2,278	2,100	3,518	3,265	4,887	3,210	54.2	59
Argentina E	200	244	232	401	400e	295	22.0	13
Other countries total	500e	500e	500e	500e	500e	500e	-	-
GRAND TOTAL	50,500e	57,500e	61,000e	56,500e	63,000e	57,700e	-	-

Notes: I - Figures taken from National Statistics; E - Totals from Exporting countries Statistics; e - ITC estimates. Indigenous consumptuon of about 4,000 to 5,000 tons in India and 1,000t in Brazil is not taken into account.

Source: National Foreign Trade Statistics and ITC Statistical Yearbook 1965.

It would be seen that United States is the largest cashew nut consuming country, taking around half the total world production. The average consumption of cashew nut kernel in the United States during this period was 31,000 tons per year or about 54% of the world's total production. The quantity sold in this country is fairly stable and there is not much of a scope in this market for the future world production to depend on. Kernels in the US are mainly used as an adjunct to cocktail drinking, which are sold in consumer packs either alone or mixed with other nuts, roasted and salted. Between 80% - 85% of United States' import consists of whole kernels. This high percentage of wholes is explained by the fact that only a small share of consumption can be attributed to the confectionery and bakery trades where broken grades are usually used.

10.21 Outside Eastern Europe and the Soviet Union, the United Kingdom, Canada, Australia, the Federal Republic of Germany and Japan are the main cashew nut kernel importing countries in addition to USA. The annual import of these countries exceed 1,000 tons of kernel. In these countries a comparatively large part of the import find their way into the confectionery and bakery industries.

10.22 In northern Europe, where alcoholic drinks are served more frequently than wine, salted nuts, fish sticks, pretzels or crackers are favourites. The size of this "drink accessory" market is considerable and by the use of promotion directed to consumer level, the cashew kernel should be able to increase this level in the market substantially.

10.23 Japan is another country where cashew nut has found a good market. Prospects have been bright especially after the introduction of the duty concession during the Kennedy Round from the present 20% ad valorem to 5% on January 1, 1972.

10.24 Cashew nut kernels are exported to Eastern European countries including the Soviet Union by India. The trade which started in 1956 has rapidly developed to a very high level. In 1966 - 67, the Eastern European countries imported a total of 18,000 tons from India which is almost equal to 30% of the total world's imports. The USSR alone took 15,000 tons and Eastern Germany accounted for another 3,000 tons. Between 60% - 65% of USSR imports are wholes, while East Germany's imports consist almost exclusively of broken grades. The nuts are said to be used mainly in the confectionary industry, but, because of the high nutritional value of the cashew nut, they are also eaten as they are.

10.25 The export of cashew nuts to Eastern European countries are entirely based on trade agreements. It is reported that producing countries other than India can also establish such trade agreement with these countries. It should, however, be borne in mind that cashew nut sales to Eastern European markets are part of the overall means of paying for imports of capital goods from these countries.

10.26 The kernel consumption per capita is highest in Eastern Germany with an average of 217 grams of cashew kernel for the period 1962 - 1966. This is followed by the United States (162 grams) and Australia (147 grams) for the same period. Other high per capita consuming countries are Hong Kong (121 grams), Lebanon (100 grams) and Canada (89 grams). In Western Europe, the rate of per capita consumption is generally low, but the United Kingdom (a per capita consumption of say 59 grams) and the Netherlands (a per capita consumption of 42 grams) are exceptions. The per capita consumption of kernel in USSR was 46 grams per year during the period 1962 - 1966. However, in 1966 it was as high as 67 grams.

10.27 Price development in world markets depend largely on the continuity of prices in the USSR and other East European countries. The size and continuity of the trade with East Europe is a matter of great concern to the whole of the industry - even rumours of a cutback in USSR purchases would cause a fall in prices. In view of the large market size in this country, the prices quoted in the USA is also a major determinant for price levels in other countries.

10.28 Cashew kernel prices are also affected by the links that seem to have been established between the prices of all edible nuts. The closest competitor of cashew kernels are shelled almonds. A substitution relationship exists in the field of mixed nuts and almonds seem to be the price-leader for cashew kernels.

10.29 The cashew shell prices ranged between US 45 - 55 cents per lb. until 1964, when they rose to US 57 - 67 cents per lb. Exceptionally, the prices reached above US 70 cents per lb. Prices vary considerably from grade to grade and there are major differences between the prices for wholes and those for scorched grades and pieces. Low count whole kernels fetch the highest prices and, generally, there is a step-down in price for each lower grade: scorched wholes, white butts and splits and thereafter the other scorched and dessert grades. For example, in 1967 the average price for the best quality whole 320 was around US 60 cents per lb. Pieces ran at around US 34 - 37 cents per lb. Table 10.3 illustrates the average export unit values for cashew kernel for the period 1962 - 1966. On the average, India appears to be obtaining the higher prices, probably due to the grading composition of Indian exports being higher than those from other countries.

Table 10.3

Development of export unit values (fob) of cashew kernels during 1962 - 66, at US dollars per metric tons

Country	1962	1963	1964	1965	1966
Tanzania	-	-	1,041	1,011	1,065
Kenya			919	1,010	949
Mozambique	[illegible]	794	909	962	979
Portugal	-	-	-	890	918
Brazil	652	[illegible]	779	1,004	-
	1961/62	1962/63	1963/64	1964/65	1965/66
India	914	837	882	1,096	1,103

Source: National Export Statistics.

10.30 Prices for almond kernels are about US 300 per ton higher than cashew nuts. Almond prices are determined partly by the United States domestic crop and the European prices which in turn are determined by the Italian and Spanish crops, combined with the European demand for this nut. There is no connection between the prices of Brazil nuts and cashew/almond prices. The size and quality of the crop is a major determinant for the former.

10.31 The major western importing countries viz. United States, Canada, Australia, United Kingdom, Federal Republic of Germany or Japan do not impose any quantitative restriction on import of cashew kernels. The customs tariff for selected consuming countries are indicated in Table 10.4.

Table 10.4

Custom Tariff for Some Selected Consumer Countries

Country	Base tariff 1967	Kennedy Round Concessions
EEC (Belgium, Luxembourg, Netherlands, France, Italy, Germany)	5% - not salted and tinned 22% salted and tinned	2.5% from 1.7.1968 17%
United States	1.3 cents per lb.	free from 1.1.1968
Australia	$0.037 per lb $0.025 for Commonwealth	none none
United Kingdom	10% - Commonwealth free	none
Japan	20%	5%*
Canada	1 cent per lb. Commonwealth preference 3 cents per lb. general tariff	free free
Austria	free	free
Denmark	free - raw Kernels not treated 27% roasted and salted, tinned	free free
Norway	N.Kr.0.70 per kg. raw kernels not treated N.Kr.1.20 per kg. roasted, salted and tinned	free N.Kr.0.20 per kg.
Portugal	P.G. Esc 3.20 per kg.	none
Sweden	free raw and kernels S.Kr.0.30 per kg. roasted, salted and tinned	free free
Switzerland	Sw.Fr.15 - per 100 kg.	Sw.Fr.7.50 per 100 kg. implemented 1.1.1968
New Zealand	free	free
South Africa	4.7%	none

*The concession for Japan is given in four stages: 40% on 1st July 1968; 20% on 1st January 1970; 20% on 1st January 1971 and 20% on 1st January 1972.

except Japan and Switzerland, all importing countries have a comparatively low tariff. These two countries have however, given considerable concessions during the Kennedy Round. Japan, particularly where concessions are of great importance, has yielded considerably. The improved competitive position of cashew kernels in relation to other local or imported nuts could lead to a considerable increase in consumption, if the necessary publicity efforts are made by the producing countries.

Cashew Nut Shell Liquid (CNSL)

10.34 The exports of cashew nut shell liquid from 1955 - 1966, and estimated production of 1971 are shown in Table 10.5. It would be observed that the countries' production and trade of CNSL has increased rapidly. The Indian exports rose from 1,300 metric tons in 1955 to 11,600 metric tons in 1966 and India has always been the major exporter of CNSL. The estimated production of Mozambique in 1971 is very close to that of India. This is due to the mechanisation of the industry in Mozambique. The estimated 1971 production will be high in view of the higher extraction rate of the new East African plants.

Table 10.5

World exports of CNSL Showing the exporting countries and estimated production of CNSL in 1967 and 1971

(Thousand metric tons)

Year	World trade	India	Mozambique	Brazil	Tanzania	Kenya	Malagasy	Portugal	Other
1955	1.3	1.3	-	-					
1960	7.5	5.8	1.0	0.7					
1961	7.1	6.2	0.9	1.1					
1962	8.9	6.7	1.4	0.8					
1963	9.8	8.0	1.0	0.8					
1964	16.5	13.8	1.2	1.5					
1965	14.8	13.0	1.0	0.8					
1966	15.3	11.6	2.1	1.6					
Est. prod. 1971	31.5	11.	11.0	1.5	4.[illegible]	1.5	1.0	-	0.5

e = estimate

Source: National foreign trade statistics.

10.33 United States is the largest market for CNSL, consuming some 50 - 55% of the world supplies in recent years (please see Table 10.6). In 1963, some 24% of the world supplies went to U.K. and in 1965, the shipments to that country were estimated at 38% of the world exports; re-exports of the raw CNSL appeared to be nil. There was, however, some re-export from U.K. of treated CNSL to all West European countries. The Japanese import was about 10% - 15% of the world's total trade in CNSL. The International Trade Centre predicted that consumption of CNSL is likely to increase in western European and Australian markets, the other prospective markets being Eastern Europe.

Table 10.6

Estimated World Imports of Cashew Nut Shell Liquid (CNSL)

Based on Figures of supplying countries

(metric tons)

	1962		1963		1964		1965		1966	
	Tons	% of total	Tons	% of total	Tons	% of total	Tons	% of total	Tons	% of total
United States	4898	55%	5435	55%	8427	54%	7030	48%	8210	54%
Australia	220	2.5%	236	3%	307	2%	241	2%	82	1%
Japan	1034	12%	1403	14%	2240	14%	1514	10%	1954	13%
Korea	-	-	80	1%	64	-	60	0.5%	50	
Germany East	-	-	-	-	-	-	-	-	5	..
France	16		51	0.5%	42)	1%	2)		5	..
Germany F.	27	0.5	26	-	48)		40)	0.5%	8	
Netherlands	9	..	97	1%	106	1%	40)		113	1%
United Kingdom	2554	29%	2346	24%	4324	28%	5647	38%	4584	30%
Portugal			40	0.5%	-	-	-	-	-	-
Sweden	5	..	5)		-	-	-	-	-	-
Greece	-	-	25)		30	..	40	..	40)	
Spain	2	..	1)		2	..			)	
Italy	74	1.0%	16)	1%	15	..	143	1%	54)	1%
Czechoslovakia	-	-	-)		-	-	2	..	30)	
Yugoslavia	-	-	-)		-	-	-	-	1)	
Israel	-	-	25)	-	-	-	-	-	-	-
Others	7		23	-			2			
Total	8849	100%	9859	100%	15549	100%	14761	100%	15212	100%

Source: National Foreign Trade Statistics for India - Brazil - Mozambique.

Note: 1964-66, estimated total Mozambique exports to US.

Price

10.34 The average unit values f.o.b. of Indian exports of CNSL are shown in table 10.7. In 196[illegible], the CNSL prices reached a peak of more than US$ [illegible]00 c.i.f. New York, but later in 1967, and at the beginning of 196[illegible], this fell to below US$200. The price level of about US$ 150 - US$ 1[illegible]0 is not an unrealistic target even with the present sharp increase in production. It should be noted, however, that as a result of over-supply, prices could well fall temporarily below even this level.

Table 10.7

Average Unit Values f.o.b. of Indian Exports of CNSL

Year	Value
1962	US$ 207 per metric tons
1963	US$ 260 " " "
1964	US$ 30[illegible] " " "
1965	US$ 325 " " "
1966	US$ 267 " " "
1967*	US$ 211 " " "

* [illegible] months of 1967 only.

10.35 The CNSL price development for the period 1960 - 1968 is shown in Table 10.8.

Table 10.8

CNSL Price Development 1960; 1968 US$ per long ton

Year	Price-CIF New York	Year	Price - CIF New York
1960	$200 - 275	1965	$300 - 400
1961	$200 - 275	1966	$250 - 350
1962	$225 - 300	1967	$200 - 300
1963	$225 - 325	1968	$175 - 275
1964	$225 - 375		

10.36 The source of demand for CNSL appears to be in the increasing number of uses to which it can be applied. Manufacturers and users appear reticent about disclosing the precise details of their various usages for CNSL, but the fact, as evidenced by the state of the market, is that demand seems to have remained ahead of supply, despite a 300% increase in 10 years. There is no discernable basis for any relationship between movements in CNSL and cashew kernel prices from the demand side; since, however, CNSL is the by-product of nut processing for kernel production, some minor influence could be exerted from the supply side, but this is not likely to be a factor of great importance. Producers would scarcely be likely, for example, to curtail total production of kernels and CNSL, merely because of a decline in CNSL price. On the other hand, advances in price will obviously represent a stimulus to more efficient recovery of the potentially available volume of CNSL in the weight of nuts processed for kernel extraction.

10.37 The overall profitability of the cashew nut industry in any country might well turn upon the contribution to the gross returns represented by the sale of CNSL. By greater efficiency in processing it is conceivable that the volume of it recovered for sale may well get closer to 15% than 10% of the net weight of the raw nuts processed. By improving grading, and supplying an oil with specifications meeting particular requirements, a higher overall average price per ton might be obtained. With the installation of detoxicising facilities before shipment i.e. removing the irritant factor which makes it dangerous to handle, the price per ton to producers might, on recent price trends, be further enhanced.

10.38 Detoxicising would also help to remove difficulties over workman's compensation claims that have arisen at times at shipping ports, caused by handling of the toxic products.

10.39 In considering the future demand, it seems wise to assume that CNSL will meet increasing competition as a binder resin from many of the synthetic resins which are being produced very cheaply. The evidence suggests that the use of CNSL as a thermo-setting binder resin is in fact already decreasing.

10.40 On the other hand, its use as a friction modifier is increasing, and demand for it in this field remains strong, an increasing number of applications being discovered. For this purpose its properties are, apparently, unique. It is stated to be the only available natural product which in one molecule combines the ability to polymerize and the ability to condense with an aldehyde donor. It has also good acid and alkali resistance. It has therefore a place of some importance in the manufacture, in particular, of brake-linings; and in industrial beltings and similar equipment, also in clutches and other "friction" point equipment; for reinforcing synthetic rubber and in laminating or impregnating materials where oil or acid resistance is required.

10.41 Another field in which it is reported from the USA, the United Kingdom and Australia that CNSL is finding increased use is in the manufacture of industrial paper laminates. Other uses for CNSL which have been explored, apparently to some advantage, are as a waterproofing material for the production of timbers and bamboos, and mixing with cement; also as preservative for fishing nets, and textiles. Other directions in which the use of CNSL has been considered, besides increased use in brake linings, are as an anti-corrosive on metals; and for the prevention of boiler-scale; in the manufacture of lacquers, varnishes and enamels; as an insecticide for the preservation of books; in the manufacture of emery powder; and in some pharmaceutical products. The Cashew Export Promotion Council of India has recently published a two volume (1,000 pages) compilation setting out all of the [illegible] patents taken out in USA, England, Japan and India for the use of CNSL in the manufacture of resins, colours, dyes, electrical insulation material, cements, armatures, adhesives, laminated products, oils, paints, lacquers, water proofing and many other uses.

10.42 Japan, in addition to USA and the UK, has been a significant purchaser of CNSL, and it is not unreasonable to suppose that as its use extends in various industries in those countries demand for it will arise too from manufacturers in European countries, and the USSR. Since the latter, together with West European countries, has become a significant market for the cashew kernels, it seems unlikely that the properties, and availability, of CNSL from India, and elsewhere, will not become increasingly known to industrial users in these countries too. The Soviet Union does not at present import any CNSL. Hence demand for CNSL, as for the cashew kernel, seems likely to remain firm and such supplies as become available should find a market for some years.

10.43 There is also no quantitative restriction on the import of CNSL by the consuming countries. The duties and taxes on this commodity present no substantial hindrance to the trade as would be evident from Table 10.[illegible].

Table 10.9

Duties in Some Selected Countries including Kennedy Round Concession

Country	1967 duty	Kennedy Round Concession
EEC	5.8%	None
United States	free	free
Australia	free	free
United Kingdom	10%	none
	10% - Commonwealth free	free
Japan	15%	none
Canada	free	free
Austria	crude 8%	free
	other 12%	free
Norway	NKr 16 per 100 kgs.	free
Portugal	free from Portuguese Provinces	free
Sweden	free	free
Switzerland	SwF 1 per 100 kgs.	none (binding tariff)

10.44 Though there is no import of CNSL into Malaysia as a whole or in Sarawak in particular, there is a substantial import of cashew kernel into this country. The imports of cashew kernel into Malaysia is shown together with that of Brazil nut. However, the popularity of Brazil nut is not as large as that of cashew nut. Market enquiries reveal that of the total imports, 80% is of cashew nut. Besides this market, there is also substantial imports into Singapore and Brunei. The total Singapore import is almost equal to that of West Malaysia. Thus there is a substantial demand for cashew nut in the region. The total Malaysian imports of Brazil nuts and cashew nuts for the period 1967 - 1970 is shown in Table 10.10.

Table 10.10

Retained Imports of Brazil Nuts and Cashew nuts (051.712) (1967 - 1970)

	1967		1968		1969		1970	
	Value (Cwt)	Value (CIF)	Value (Cwt)	Value (CIF$)	Value (Cwt)	Value (CIF)	Value (Cwt)	Value (CIF)
West Malaysia	963.53	20[illegible],[illegible]41	[illegible]79.27	145,[illegible]34	1,554.46	258,612	2,007.0[illegible]	27[illegible],[illegible]
Sarawak	42.99	[illegible],726	45.71	10,779	139.97	31,711	17[illegible].57	43,[illegible]
Sabah	16[illegible].[illegible]6	[illegible],277	169.20	31,3[illegible]	212.10	47,951	300.45	6[illegible],[illegible]
Total	1,169.58	23[illegible],4[illegible]4	1,094.18	188,[illegible]05	1,906.53	338,274	2,487.02	381,624

10.45 It is difficult to define precisely what determines the level of demand for cashew kernels. Broadly, however, the demand may be considered as within the luxury demand category and the rising high level of income in Malaysia, as any other developed and developing countries, assures a firm demand for cashew nuts.

Sarawak Situation

10.46 In Sarawak, some trial plantations of cashew nut were carried out in Batu Balat area of the First Division. In the first year of harvesting, i.e. at the end of three years of planting, a yield of 300 lbs. per acre per harvest was recorded. The State Government is now seriously considering plantation of large areas by the settlers of Lambir Land Development Scheme in the Dusun lots in the Fourth Division. According to the soil agronomist, the yield in Sarawak would range from [illegible]50 lbs. to 1,100 lbs. of nuts per mature acre from 49 points of 30 x 30 sq. ft. planting. With the kernel content of 25% by weight, the average annual yield of kernels/acre would be around 250 lbs. assuming an average yield of 1,000 lbs. of nuts per acre. With a uniform market price of $2.50 per lb. (local) of kernels, the gross return per acre under cashew nut from kernels

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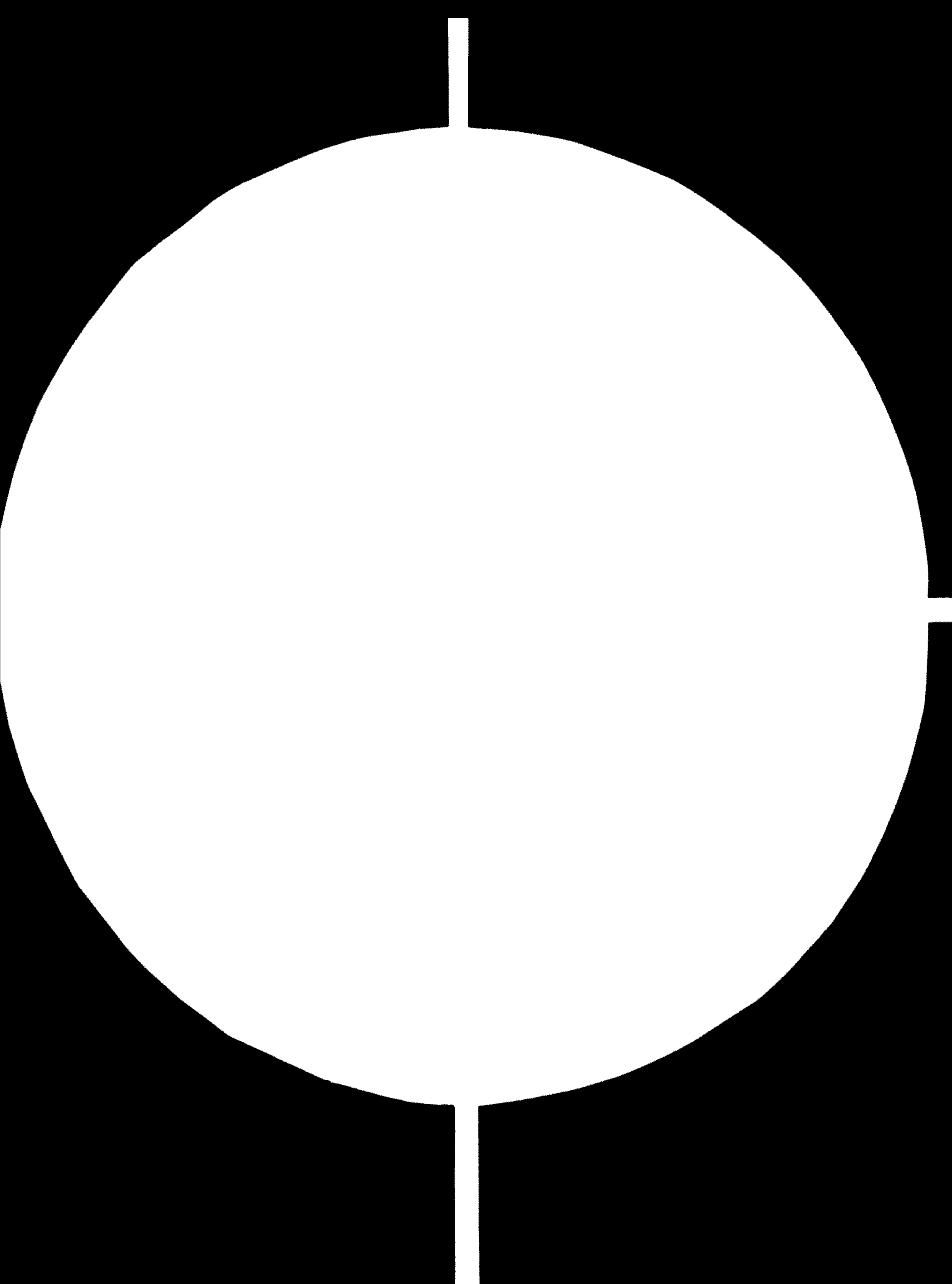

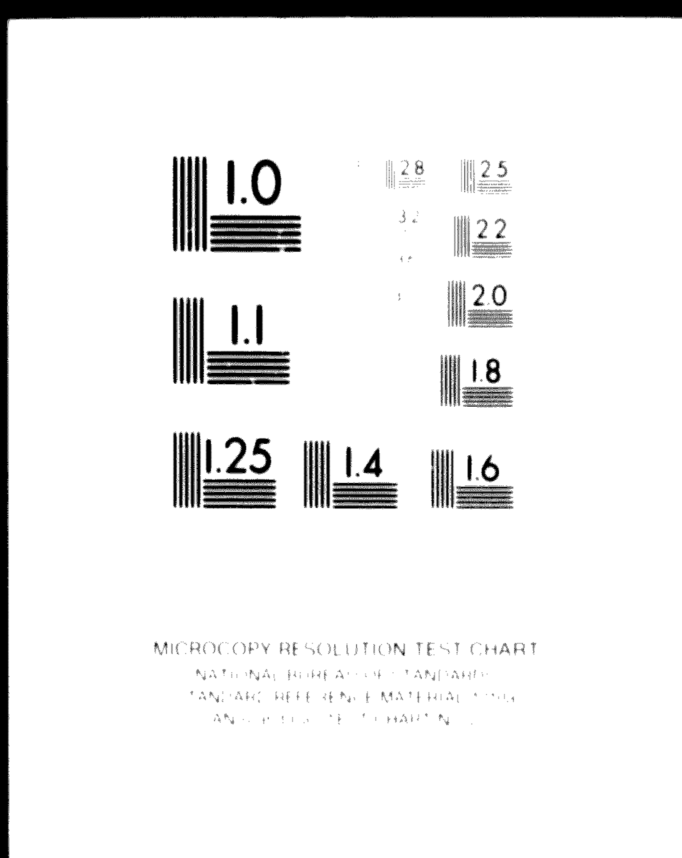

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alone would be $625. This return per acre is quite good compared to many other crops in Sarawak's soil conditions.

10.47 The suitability of Sarawak's soil for cultivation of crops being limited, it is suggested that a large-scale cashew plantation should be undertaken in the Fourth Division (Lambir-Subis area). As land areas are available in the Lambir-Subis region, an area of 10,000 acres should be earmarked for cashew plantation over the period of the next 5 years at the rate of 2,000 acres per year. The estimated total yield of nuts, kernel and CNSL per acre from 1974 onwards is in Table 10.11.

Table 10.11

Estimated Production of Cashew Nut, Cashew Kernel and CNSL from 6000 acres - 1974 - 1979 (in lbs)

	1974	1975	1976	1977	1978	1979
Cashew Nut	600,000	2,400,000	4,400,000	6,600,000	8,800,000	10,600,000
Cashew Kernel	150,000	600,000	1,100,000	1,650,000	2,200,000	2,650,000
CNSL	33,000	132,000	242,000	363,000	484,000	583,000

Estimated Yield of Nuts from harvest:
1st year - 500 lbs.
2nd year - Av. 900 lbs.
3rd year - 1,000 lbs.
4th year - 1,100 lbs.
5th year - 1,100 lbs.
6th year - 1,100 lbs.

Production of kernel - based on 25% yield.

Production of CNSL - based on 5.5% yield.

10.48 The weight of kernels yielded from a given tonnage of raw nuts grown in East Africa seems generally to be lower than that yielded from nuts grown in India. The Indian nuts, on average, yield a weight of kernels equal to 25% - 30% of the raw nut weight; whereas in the case of East African nuts, the yield of kernels is about 21 - 24% of the weight of the raw nut. In this respect, Malaysia in general and Sarawak in particular, is comparable to India with its yield of 30%. On a yield of 25% (to be conservative) total availability of cashew nut kernel for the period 1974 - 1979 has been calculated and shown in Table 10.11.

10.49 With this production, a small mechanical processing plant can be established in the State, to process roughly 3,000 tons of raw nuts only working two shifts on a total of 268 working days.

Establishment of a Cashew Nut Processing Plant

Process

10.50 After harvesting and separating from the apple, the raw nuts are brought in bags to a concrete yard for drying. The nuts are spread over the concrete floor and drying is continued for a few days, until the colour changes from green to brown. During the drying process, the immature and bad nuts are discarded. As the nuts have to be stored for a fairly long time at least until the next harvest, careful drying is very important. The maximum moisture content should not exceed 8%. The dried nuts are stored under shelter to ensure that the moisture content is not increased.

10.51 The further processing of cashew nut involves pre-treatment, roasting, shelling, drying, sweating, grading and finally filling, sealing and packing.

10.52 The raw nuts are soaked in water for about 12 hours and then taken out. They are, thereafter, heaped up for a further period of about 1[illegible] hours [illegible] the drying of the nuts so that the outer shells may absorb sufficient moisture and are fit to go into roasting.

10.53 The various methods of roasting are: open pan, rotating drum and oil bath. In the open pan method, which is no longer in use, the nuts are roasted in an open iron pan placed on a circular earthenware furnace erected three feet above the ground and fed by the cashew nut shells.

10.54 In the rotating drum method, the nuts are placed in a hopper and fed through an intake chute into the rotating drum which is made of a steel cylinder 2 feet in diameter and 8 feet long lying horizontally with a small tilt of three inches. The chute is of 6 inches diameter which drops nuts at the raised end of the drum. The raw nuts catch fire and slide down the drum as it rotates. As they come out from the lower end, dripping water extinguishes the flame. The nuts are then applied with ash and clay to absorb the caustic oil. When cool enough, they are taken to the shelling section.

10.55 In the oil bath method, a steel tank nine feet long at the top and tapering down to the bottom to a length of seven feet, with an internal width of about two feet, is used as a bath. Running lengthwise at the top, down the sides and at the bottom are endless chains which carry trays. Raw nuts are dropped into the bath by means of a conveyor. While floating, the moving trays drag them down to the bottom and lift them up again at the other end connected to a discharge chute. As they travel along the chute, residual shell liquid is collected through the perforated bottom; further collection of shell liquid is done when they are centrifuged. The nuts so roasted are taken out and cooled down by applying ash and then sent out for shelling.

10.56 Shelling is a skilled operation and in India this has been acquired by the local folk traditionally. Roasted nuts are placed one by one on a wooden block and with a small hammer, it is knocked to crack open. The amount of pressure to be applied and the angle at which the hammer is to be applied and the nut to be held, are the most important considerations, needed high operational skill. Inaccuracy in any of these might break or split the kernels thus reducing their value considerably.

10.57 Once the nuts are cracked open, the kernels with the adhered seed testa, are taken to the drying house for heating in an oven. Heating is necessary, for removing the seed testa (peeling) as well as for removing excess moisture which can cause mould in storage. The kernels are spread over perforated sieve trays 3ft. x 1½ft. of 20 lb. capacity, and then pushed inside the oven. The drying takes 4 hours and is done at a constant temperature of 190°F. Uniform heating is essential so as to ensure that the seed testa becomes shrivelled thus helping easy peeling of the seed testa.

10.58 After peeling, the kernels become very brittle and susceptible to breakage. They have therefore, to be subjected to an indispensable process known as 'wetting' (i.e. to absorb moisture) to prevent splitting and breaking.

10.59 **The kernels are then graded,** usually, according to size. Whole kernels (called "wholes") without chips or blemishes are graded on 'counts', that is, the number of kernels required to make up a pound in weight. The grade 'A' kernels are required to have the characteristic shape; shall be white, pale ivory or light ash in colour; reasonably dry; and free from insect damage, damaged kernels and black or brown spots.

They have also to be free from rancid kernels and completely free from testa.

10.60 The whole kernels conforming to these specifications are then sorted according to size viz. W210, W240 up to W500 to the count. A tolerance of 5% is generally allowed.

10.61 In addition to wholes, there are broken grades as well. Butts are kernels broken crosswise and naturally chipped, and kernels which split naturally lengthwise are called splits. Large pieces are kernels which are broken into more than two pieces and not passing through a 4-mesh 16 SWG sieve; small pieces are pieces that are smaller than the large pieces but not passing through a 6-mesh 20 SWG sieve. Finally, there is a grade called "baby bits" which are broken kernels smaller than those described but not passing through a 10 mesh 24 SWG sieve. These wholes, butts, splits, large and small pieces and baby bits are normally white, scorched or dessert kernels.

10.62 During processing, the major part of the kernel (some 65% - 70%) remain white. There are about 10% scorched and the quantity of dessert grades depend on the quality of the raw nuts.

10.63 The graded kernels are poured into tins similar in size and shape to those used for kerosene oil by the oil companies. The empty tins are placed on the platform of an agitating machine and the kernels are slowly moved through a hole in the plate directly above the opening of the tins. With the operation of the machine, the kernels start falling into the tins and because of the agitation, the tin is well filled.

10.64 The manufacturing process of cashew shell liquid can be carried out manually or mechanically. Cashew shell liquid is very dangerous to handle. The Indian women labourers working in the cashew nut factories have developed a certain degree of immunity from the toxic tingling effects of the shell liquid. Hence, in consideration of the higher labour cost and the dangerous nature of the liquid, it might not be possible to have the operations done manually in Sarawak, and therefore, the mechanised process has been suggested.

10.65 In the mechanised processing system, the raw material is meticulously cleaned (freed of leaves, earth and other debris), and empty nuts are separated out by a pneumatic system. Then follows a first grading into sizes (small, medium and large) and the nuts are washed. After these operations and before the second phase, the nuts are moistened.

10.66 The nuts are roasted in an oven with an extraction of between 5.5 and 7 per cent of C.S.L. They are then dried in a centrifuge. Subsequently, they are cooled and re-graded into eight different sizes, according to the largest vertical diameter of the nut.

10.67 The nuts then undergo a shelling process and each size of nuts has its own group of machines. After this, the de-shelled nuts (shells and kernels) are conveyed to the pneumatic group of machines. The empty shells and kernels are sorted; nuts and kernels that have not been fully detached are pneumatically recovered; broken kernels and nuts of an irregular shape are sorted out and as soon as the shells are cut, the two cotyledons of the kernel separate automatically.

10.68 The empty shells, completely separated out from the kernels, are carried outside the factory by a pneumatic system, while the kernels are dried, so as to facilitate peeling. Two sets of machines are used for peeling. One is used for peeling the "wholes"; and the other for peeling the splits and pieces coming from the shelling section, and also those broken kernels that come from the "whole" peeling machine.

1[illegible].69 At the end of each of these two operation-lines, electronic machines are installed to separate out the kernels that have been perfectly peeled from those which are not completely peeled. The latter are conveyed to a manual peeling bench where the "splits" and pieces are graded and put into boxes. At the same time, the wholes are graded according to the accepted standards (240, 320, 450, 500 etc.) and put into boxes. When the kernels have passed through mechanical "peeling" section, 80 per cent of the kernels have been completely peeled. The remaining 20 per cent can be put through a second mechanical blanching cycle and then be finished off manually.

1[illegible].70 The economic capacity for a mechanical plant would be in the region of 3000 tons of raw nuts per annum. Based on a recovery of 25% kernel and 5.5% CNSL, the production per annum would be 750 tons of kernels and 165 tons of CNSL. The cost estimates of such a plant, together with the general production requirement are given to serve as a guide to indicate the order of magnitude.

<u>Cost of estimates of a Cashew nut processing plant (mechanical)</u>

(a) <u>Fixed costs</u>

(i) Land - 2 acres (including cost of development) $10,000

(ii) Building - 46,500 sq.ft. @ flat rate of $10 per sq. ft. $465,000

(a) Factory - 27,000 sq. ft.

(b) Storage space - 15,000 sq. ft.

(c) Office - 4,500 sq. ft.

(iii) Machinery and equipment (including 25% for engineering, design and installation) $1,603,750

(a) Processing machinery $945,000

(b) Electronic equipment $ 46,000

(c) Sundry equipment 144,000

(d) Electrical installation 96,000

(e) 2 5-ton lorries and 1 [illegible] rover. 5[illegible],000

Total fixed cost .. $2,0[illegible],750

(B) Variable Costs

(i) Raw Materials:-

(a) Raw Cashew nuts - 3,000 tons @ ¢300 per ton (estimated) — ¢900,000

(b) Packing material @ 5% of raw nuts — ¢30,000

¢930,000

(ii) Power, Water and Fuel:-

(a) Power - 220 kw x 16 hrs. x 268 days @ 8¢ per unit — ¢75,500

(b) Water - 5 million gallons @ ¢1 per 1,000 gallons. — ¢5,000

(c) Fuel (Diesel) - 6.5 gallons per ton of raw nuts @ 70¢ per gallon. — ¢13,700

¢94,200

(iii) Labour Cost.-

	No.	Wage/month	Wage/annum
(a) General Manager	1	¢1,500	¢18,000
(b) Sales Manager	1	¢1,200	¢14,400
(c) Section Supervisor	4	¢700	¢33,600
(d) Machine Operator	8	400	¢38,400
(e) Labourer (Skilled Unskilled)(including vehicle drivers)	250	¢4.50/day	
(f) Clerks, stenographers, etc.	8	¢300	¢28,800
(g) Office boys and guard	4	100	¢4,800
	276		438,500
Add 15% employment cost			¢65,800
Total			¢504,300

(iv) Depreciation on building and machinery @ 10% per annum. — 207,575

(v) Sales commission freight to U.S. port 10% per ton of production (estimated) $ 91,500

Working capital required (raw nuts for 6 months and other variable cost for 3 months) $681,470

Interest on working capital 10% (current commercial bank rate) $ 68,200

Total production cost $1,896,075

Return from Sales

From a 3000 tons/annum capacity plant, the likely out-turn is 750 tons of kernel, based on 25% recovery and 165 tons of CNSL, based on 5.5% recovery.

Assuming the various grades yielded and the corresponding prices in U.S. are as shown below, the total sales return would be about $2,771,670.

White wholes	-	46%-345 tons @ $4368/ton	=	$1,506,960
Scorched wholes	-	6%-45 tons @ $3225/ton	=	145,125
Dessert wholes	-	10%-75 tons @ $2890/ton	=	$ 216,750
White pieces	-	31%-232.5 tons @ $3024/ton	=	$ 703,080
Scorched pieces	-	3%-22.5 tons @ $2890/ton	=	$ 65,025
Dessert pieces	-	4%-30 tons @ $2016/ton	=	$ 60,480
Cashew nut shell liquid	-	165 tons @ $450/ton	=	$ 74,250
				$2,771,670

Annual gross profit before tax = $ 875,600

Therefore, percentage return on investment = $ 875,600 / $2,078,750 = 42%

It would be seen from the above analysis that the percentage return on investment is very high. This is due to the very good prices for cashew nut products in the international market today. If such good prices are maintained, the proposed cashew nut project would be highly profitable and should be undertaken in the very near future.

CHAPTER XI

SOYA BEANS

Uses

11.1 Soya bean yields a "soft" oil which is used principally as an edible oil, especially in the manufacture of margarine and compound cooking fat. It is also used in the industrial field, among which important ones are paints, enamels, insecticides, soaps, disinfectants, etc. In Asian countries, the use of soya beans is mainly in sauce-making.

11.2 In the United States, 88% - 90% of the total production of soya bean oil is used in edible products and the remaining 10% - 20% for industrial purposes.

11.3 Soya beans, when crushed, yields a high-protein meal which is valued as an animal feeding stuff. The meal is also used as a fertilizer and in the manufacture of plastics and adhesives. From the mature beans, macaroni-type ice-cream powder and other foods are manufactured. Soya bean can also be eaten directly. Lecithine used in the manufacture of chocolates can also be extracted from soya beans.

11.4 The yield of oil from soya beans by modern processing methods is around 19% 20%.

World Production

11.5 United States and China are the two main producers of soya beans, together accounting for over 90% of the total world production. The US production of soya beans increased from 19.08 million metric tons in 1964 to 30.02 million metric tons in 1968 while China's production remained around 11 million metric tons during the period. The total world production has increased from 32.33 million tons in

1964 to 43.61 million metric tons in 1968. The world production of soya beans by the various countries are shown in Table 11.1.

Table 11.1

World Production of Soya Bean

In 1000 Metric Tons

Continent and Country	1948-1952	1952-1956	1964	1965	1966	1967	1968
Europe							
Total	26	20	14	14	32	50	50
U.S.S.R.	166	123	285	421	586	543	528
N & C America							
U.S.A.	7312	9428	19076	23014	23270	26564	30023
Total	7397	9561	19326	23291	25594	26887	30381
S. America							
Brazil	78	101	305	523	595	716	654
Total	55	106	369	608	685	835	791
Asia							
China (Taiwan)	13	21	58	66	63	75	73
Indonesia	270	339	392	356	353	484	389
Japan	375	458	240	230	199	190	163
Total	1017	1209	1125	1083	1078	1245	1170
China (Main)	7282	9577	11180	10970	10970	11100	10670
Africa							
Total	17	23	34	33	29	25	23
World Total	15952	20625	32333	36420	38974	40685	43613

11.6 The increase in soya beans production in the United States in recent years is due to the restrictions on the cultivation of wheat, maize and cotton and also as a result of the government price support scheme for soya beans. This crop is now the fourth most important field crop in the United States. In the other producing countries such as Brazil also production has increased. In fact, there has been an increase both in acreage and production of soya beans all over the world.

World Trade

11.7 Being the major producers, the United States and China dominate the international trade also in soya beans. Their combined annual exports account for more than 90% of the volume of soya beans entering the world trade. The only other significant exporters are Canada, Brazil and Nigeria (please see Table 11.2).

11.8 Japan, West Germany and the Soviet Union are the foremost markets for soya beans. About 60% of the world trade in this crop is directed towards these three countries. The Japanese import of soya beans rose from 1.16 million tons in 1964 to 2.60 million tons in 1969. Bulk of this import came from the United States though some imports were also made from China and Brazil. A greater proportion of the imported soya beans is crushed for oil production in Japan, which some quantities are also utilised directly in the manufacture of feeding stuff. For crushing purposes, the oil content is an important factor and it is reported that Japanese crushers prefer American soya beans to those from East Africa because the beans are larger and have an oil content of 20% compared with an estimated 18% oil content from East African soya beans.

11.9 West Germany imports the bulk of its soya beans from the United States with China as the most important secondary source. Imported soya beans are crushed for edible purposes and practically all the oil produced is used domestically for the production of margarine. Denmark and Netherlands are both important markets for soya beans and the imports have been rising in recent years. United States is the main supplier in both the cases although in some years, Denmark imported small quantities from Nigeria.

TABLE 11.2

EXPORTS - SOYA BEANS

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	10 METRIC TONS						1 000 U.S. DOLLARS					
EUROPE												
Belg Lux	9	4	4	2	5	393	6	4	5	2	6	405
France	440	-	-	1	1	1	4[illegible]9	1	-	3	3	3
Germany Fr	70	167	33	9	210	27	31	230	52	20	240	42
Netherlands	64	2	4	2	5	202	60	4	6	4		229
Romania	-	-	53*	371*	[illegible]*	406*	-	-	65*	400*	1000*	400*
Yugoslavia	-	-	-	-	3[illegible]5*	2[illegible]0	-	-	-	-	40[illegible]	194
Total	5[illegible]3	173	[illegible]	3[illegible]5	15[illegible]0	1228	652	239	12[illegible]	42[illegible]	1[illegible]74	1273
NTH C'R AM												
Canada	5235	[illegible]25	[illegible]315	[illegible]	4245	2031	5346	[illegible]237	10121	7359	4424	1977
USA	570195	[illegible]	[illegible]701	716[illegible]	[illegible]01203	[illegible]	566[illegible]02	650066	759[illegible]05	771554	1[illegible]043	[illegible]222[illegible]7
T[illegible]	575430	[illegible]	[illegible]77676	72341[illegible]	[illegible]0544[illegible]	[illegible]42	57223[illegible]	659303	770026	77[illegible]913	[illegible]14467	24264
SOUTH AMERICA												
Argentina	1	-	49	-	1	...	2	-	37	-	1	...
Brazil	-	7529	12124	30454	65[illegible]6	31015	-	7343	1302[illegible]	29243	6291	2[illegible]24
Paraguay	31	131	435	130	300	[illegible]	13	[illegible]4	332	104	240	44
Total	32	7660	1260[illegible]	305[illegible]4	6[illegible]7	31103	15	7427	13397	29347	6532	29203
ASIA												
Cambodia	407	[illegible]51	67	-	500	...	362	954	[illegible]7	-	735	...
China Mnl	49[illegible]41*	57[illegible]60*	55[illegible]10*	56490*	57130*	4[illegible]770*	61200*	76[illegible]00*	716[illegible]*	72300*	73200*	56100*
Hong Kong	223	57[illegible]	[illegible]4[illegible]	402	313	223	307	771	[illegible]01[illegible]	4[illegible]5	442	342
Indonesia	-	50*	120[illegible]*	[illegible]	[illegible]32	75	-	11*	700*	103	247	13
Japan		-	447	75	61	-	73	9	624	10[illegible]	9[illegible]	-
Korea Rep	-	-	25	-	-	-	-	-	3	-	-	-
Laos	2	4	2	-	-	-	1	3	1	-	-	-
MALAYSIA												
Sa[illegible]k	-	-	-	-	-	1	-	-	-	1	1	2
W Malaysia	1	1	-	1	-	-	1	1	-	1	-	-
Singapore	747	[illegible]11	70[illegible]	[illegible]55	[illegible]33	707	907	10[illegible]	[illegible]00	102[illegible]	37[illegible]	[illegible]14
Thailand	432	161	561	590	349	497	450	217	703	727	44[illegible]	27
Turkey	204	92	-	-	-	-	343	97	-	-	-	-
Total	51[illegible]07	60206	5[illegible]03	59107	60107	50[illegible]63	63650	79952	75531	74[illegible]39	76131	5[illegible]633
AFRICA												
Kenya	-	3	-	3	-	-	-	3	-	4	-	-
Nigeria	77	1532	1245	5[illegible]5	1419	666	752	1700	134[illegible]	507	1337	[illegible]64
RHOD NYAS												
Rhodesia	11	9	-	-	-	-	12		-	-	-	-
S Africa	-	-	-	13	-		-	-	-	13	-	12
Tanzania					-	1[illegible]					-	2[illegible]
Tanganyik	134	[illegible]0	7	15			141	[illegible]3		12		
Uganda	4[illegible]	20	27	194	104	104	31	1[illegible]	31	227	[illegible]4	[illegible]4
Total	[illegible]63	1[illegible]44	1270	[illegible]1[illegible]	1523	7[illegible]5	[illegible]36	1[illegible]22	13[illegible]7	[illegible]5[illegible]	1431	[illegible]00
OCEANIA												
Australi	-	-	-	-	1	1	-	-	-	-	1	[illegible]
[illegible]	-	-	[illegible]	11	13	...	-	-	[illegible]		[illegible]	...
Total	-	-	[illegible]	11	14	...	-	-	[illegible]		1	...
Grand Total	[illegible]4	[illegible]7541	7[illegible]534	14314	7[illegible]557	[illegible]4	[illegible]74[illegible]1	[illegible]4 743	[illegible]47	[illegible]3[illegible]4	[illegible]4[illegible]	[illegible]

11.10 Swedish import of soya beans increased from 50 tons in 1964 to 5,190 tons in 1965 and then declined to 20 tons in 1966. The import in 1969 was 1,250 tons. This later rise in the import was due to doubling the extraction capacity of the only processing plant in Sweden.

11.11 The British import of soya bean increased from 294,390 tons in 1964 to 324,350 tons in 1969. The main sources of the British import are United States, Canada and China with a sizeable quantity coming from Nigeria.

11.12 The growth of imports of soya beans reflects the increased usage of soya bean oil as an edible oil and also the good price which soya bean cake and meal fetch as an animal feeding stuff. The import of soya bean cake and meal account for roughly 20% of the 3 million tons of oilseed cake and meal annually imported into the British market.

11.13 American soya beans, the most widely traded crop, fall into four main grades and are classified within these grades according to moisture content and the percentage of supplying beans, damaged beans and foreign material. The maximum percentage permissible under these headings for each grain is shwon in Table 11.3 but discounts and primia may be allowed where these percentages are exceeded or lowered.

11.14 The No. 2 grade makes up the bulk of the trade in American soya beans. There is no stipulation as to the oil content as this is generally considered to be regular and reliable in case of American supply. China, however, trades solely on oil content

TABLE 11.3

IMPORTS - SOYA BEANS

	QUANTITY						VALUE					
	1964	1965	1966	1967	1968	1969	1964	1965	1966	1967	1968	1969
	10 METRIC TONS						1 000 U.S. DOLLARS					
EUROPE												
Austria	25	12	13	13	11	1[illegible]	40	20	27	22	21	23
Belg Lux	14093	13[illegible]02	17571	23200	24055	25616	15130	15526	20520	26135	26390	26219
Bulgaria	-	-	-	175	1000	3000	-	-	-	100*	1050*	3700*
Czechoslovakia	2503	2517	2540	2332	2195	2700*	2855*	2922*	3111	2601	2349	2[illegible]*
Denmark	37203	40415	30557	45031	3[illegible]013	41613	39330	452[illegible]5	3479[illegible]	52456	41444	42757
Finland	5751	4250	[illegible]705	6265	4051	4351	6543	4[illegible]	7745	7156	4495	4[illegible]
France	10237	1[illegible]52	11771	13044	5[illegible]2	5705	214[illegible]2	12927	143[illegible]1	16037	54[illegible]7	6155
Germany E	1[illegible]1 *	50[illegible]*	-	403*	-	3570*	1172*	5[illegible]*	-	520*	-	37[illegible]*
Germany Fr	1404[illegible]1	12[illegible]1[illegible]	1[illegible]7	160121	1446[illegible]	1397[illegible]3	150071	1474[illegible]7	10741[illegible]	1[illegible]3102	153[illegible]32	14[illegible]7
Greece	4	3	51	4	-	-	6	6	54	7	-	..
Hungary	1577	3023	2345	3641	3[illegible]	300	1947	3570	2[illegible]20	4072	307	3[illegible]
Ireland	-	110	-	-	-	111	-	11[illegible]	-	1	-	112
Italy	32401	44049	53007	59427	52302	60660	35033	51011	59597	70071	60673	630[illegible]3
Netherlands	45[illegible]5	30007	42[illegible]32	44205	62[illegible]	01715	4[illegible]734	44533	49306	50641	66255	03716
Norway	110[illegible]7	13102	14537	165[illegible]	14711	17730	1325[illegible]	14[illegible]19	17[illegible]47	1[illegible]345	15020	1[illegible]251
Poland	10[illegible]6	604	2[illegible]70	4034	33[illegible]2	11293	1105	6645	2040	517[illegible]	3532	10[illegible]25
Portugal	-	-	-	2	-	1[illegible]04	-	-	-	2	1	1[illegible]
Romania	1*	-	99*	-	-	-	1*	-	112*	-	-	-
Spain	5032	339[illegible]	63[illegible]37	[illegible]131	92304	102[illegible]	[illegible]434	3956[illegible]	79210	96033	103259	11141[illegible]
Sweden	5	510	20	3[illegible]	5[illegible]	125	10	590	35	56	91	22[illegible]
Switzerland	[illegible]4	-	-	2[illegible]	21	323	111	-	-	52	30	370
UK	20439	2[illegible]703	2[illegible]61[illegible]	252[illegible]0	2400[illegible]	32435	33067	33[illegible]35	3507[illegible]	29221	25051	3454
Total	34[illegible]302	371243	440493	4[illegible]7490	4[illegible]064[illegible]	540230	37700[illegible]	4253[illegible]9	525[illegible]1	503940	51[illegible]3	505532
USSR	-	0340	-	-	-	-	-	10011	-	-	-	-
NTH CTR AM												
Canada	40744	43250	43111	43[illegible]44	2[illegible]2	4045[illegible]	49037	42[illegible]01	4[illegible]02	4454	2[illegible]44	3[illegible]040
Cuba	2550	2000*	2000*	2000*	...	...	2[illegible]74	2300*	2300*	2200*	...	...
Mexico	104	2[illegible]7	503	534	1214	155[illegible]	311	472	[illegible]1	944	10[illegible]	25[illegible]5
Others	20	11	9	57	25	[illegible]	31	10	24	7	35	14
Total	52514	45503	45022	40434	33124	44045	52253	45770	51[illegible]04	47779	33070	42[illegible]
SOUTH AMERICA												
Venezuela	2477	2200	3[illegible]50	2211	4700	3000	2[illegible]70	2600	4142	2542	4055	3[illegible]02
Others	3	1	210	1	10	-	9	3	193	2	20	-
Total	24[illegible]	2575	420	2212	4775	3075	2[illegible]70	29[illegible]7	4490	2544	4[illegible]1	3[illegible]14
ASIA												
Brunei	4	...	5	7	7	...	11	...	1[illegible]	13	15	...
China Taiwan	1[illegible]1[illegible]3	10140	10450	35114	3[illegible]492	47221	20452	19217	19701	432[illegible]4	44315	524[illegible]4
Hong Kong	1249	327	2033	2201	1[illegible]72	1[illegible]11	1379	375	2139	264[illegible]	21[illegible]	2135
India	4[illegible]	-	-	-	-	-	76	-	-	-	-	-
Israel	23740	23707	25927	25350	25245	20703	253[illegible]4	27190	30350	30433	27790	22450
Japan	160715	1[illegible]4747	210[illegible]47	2169[illegible]0	242077	259000	1[illegible]4524	225774	272007	272030	274142	2[illegible]1034
Korea Rep	17	19	15	2570	3[illegible]40*	1700	1055	40	12	3231	4[illegible]*	3[illegible]
Lebanon	-	-	-	553	1390	...	-	-	-	590	1471	...
Malaysia												
Sabah	14	...	22	31	31	3	20	...	30	44	47	57
Sarawak	105	122	152	130	100	10[illegible]	131	174	206	1[illegible]3	205	21[illegible]
W Malaysia	1704	1091	1[illegible]33	1769	1[illegible]13	1742	2151	229	2170	2279	22[illegible]1	21[illegible]
Philippine	227	1982	2265	73	20[illegible]	72	241	2315	2207	137	337	102
Ryukyu Island	1173	1072	977	1321	1430	1323	2100	2251	1237	1[illegible]24	1[illegible]73	1720
Singapore	1553	1990	1200	1430	1265	1049	1695	2403	1653	1930	1672	2120
Vietnam Rp	-	137	29	-	-	20	-	10[illegible]	43	-	-	2[illegible]
Total	209507	232571	267021	237550	317914	336030	23922[illegible]	2[illegible]2344	332391	350045	361234	3[illegible]9[illegible]1
AFRICA												
Ghana	-	-	-	-	-	14[illegible]	-	-	-	-	-	320
Kenya	1[illegible]	12	12	64	[illegible]4	104	7	11	12	64	73	[illegible]4
Morocco	114[illegible]	930	[illegible]0*	-	-	-	1297	1124	750*	-	-	-
S Africa	2	23	25	-	-	-	3	27	33	-	-	-
Total	11[illegible]	965	717	[illegible]4	[illegible]5	252	1307	11[illegible]2	795	[illegible]4	74	[illegible]
OCEANIA												
Australia	1[illegible]	[illegible]4	12[illegible]	3[illegible]	3[illegible]	4[illegible]	203	752	157	4[illegible]	4	[illegible]
Fr Polynesia	-	1	1	1	1	...	1	2	2	2	4	..
New Zealand	2	-	1	2	2	-.	3	-	3	5		-
Total	2[illegible]1	[illegible]	12	42	4[illegible]	47	2[illegible]7	754	1[illegible]2	[illegible]	[illegible]	[illegible]

basis which is usually 18% with a maximum of 2% foreign material.

11.15 The annual average price of soya beans in the United Kingdom has dropped from £33 9s. in 1960 per ton to £ .27.. .10. s. per ton in 1970. Supplies of soya beans have become more plentiful in recent years primarily as a result of increased production and greater productivity in the United States and therefore the price has eased accordingly.

11.16 Though the main importers of soya beans appear also to be importers of soya bean oil, the quantities they take are extremely small compared with their imports of beans. This serves to underline the emphasis which most markets place on oilseeds in preference to oil.

11.17 The largest single market for soya bean oil is Spain where in recent years it has to be acceptable as an alternative to the highly priced olive oil for edible purposes. It is now being sold to Spanish consumers without first being blended with olive oil and this new development has resulted in increased purchase of soya bean oil from the United States, the Principal supplier.

11.18 Apart from Spain, the other large markets for soya bean oil are Canada, Dominican Republic, Ecuador, Italy, etc.

11.19 United States not only dominate in the export of soya beans to the world and oil to Spain but also to other countries, though the volume of soya bean oil entering the international market is very much limited. In the European Community, the other exporting countries of soya bean oil are West Germany, Netherlands, Denmark, Sweden, Belgium and Luxembourg. Denmark is the largest of all European exporters of soya bean oil though all the beans crushed in this country are imported. The export from Finland has considerably reduced in recent years.

Market Trends

11.20 An important factor in considering the market for edible oilseeds and their oil is the influence which substitution has upon the market. With the advancement in processing techniques, substitution of one oil for another has become easier to effect. Price has therefore become the ultimate factor which governs the usage. For example, margarine contains a blend of oils and fats and depending on the quality of margarine required to be produced, manufacturers will use the cheapest raw materials available. The principal vegetable oils used are groundnut oil, cottonseed oil, palm oil, palm kernel oil, coconut oil and soya bean oil. Soya bean oil will continue to occupy its place as long as the price remains competitive as at present.

Prospects

11.21 It would be difficult for any country to enter the international market with its production of soya beans and soya bean oil in the face of competition from USA and China. Particularly in the case of oil, there is unlikely to be any scope largely in view of the western countries' highly capitalized oil processing industries which would continue to show interest only in buying beans.

11.22 The scope of soya bean production has been discussed at length in the report of the Regional Planning Study Group for the First Division and any further discussion on this would only be duplication. It is, however, recommended that Sarawak should work out a plan for the production of soya beans to meet the increasing requirement of its own food industry, and also for the food industries in the neighbouring countries, such as the Philippines, Singapore and Indonesia. It can cater also to the Sabah market which is at present a substantial importer of soya beans.

Sarawak Situation

11.23 Soya bean is grown in Sarawak at present by smallholders, generally as an off-season crop in wet paddy areas. In a few places, it is also grown as a sole crop in alluvial-type soil. Most of the total estimated annual production of 200 tons of soya bean is from the Nonok area of the First Division. The Chinese farmers of this area growing soya beans have migrated to Serian after the 1967 security operations and have taken to pepper cultivation. Some quantities of soya beans are also grown in areas like Maludam in the Second Division, Paloh in the Third Division and Matapak in the Fifth Division. Based on an estimated per acre average yield of 13 piculs (1 picul = 133 lbs.), the total estimated area under soya beans in the State is estimated to be 260 acres.

11.24 Trials carried out in the experimental stations established that soya bean is a crop suitable for Sarawak conditions and it should be possible to make land available for the crop in the Sundar area of the Fifth Division and also in the Lambir-Subis area of the Fourth Division.

11.25 The volume and value of soya bean and its products (almost entirely sauce) imported into Sarawak during the period 1966-1970 are shown in Tables 11.4 and 11.5. While most of the soya beans are imported from Mainland China, Indonesia and Thailand, the sauce supplies largely came from Mainland China and Singapore.

[illegible]

[illegible]

[illegible] of Origin/ [illegible]nation	[illegible]		[illegible]		1968		[illegible]		[illegible]	
	Ton	[illegible]	Ton	[illegible]	Ton	[illegible]	Ton	[illegible]	Ton	[illegible]
[illegible]										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-
[illegible]	15.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],591	-	-	-	-
[illegible]	[illegible]	16,[illegible]	-	-	-	-	[illegible]	[illegible]	-	-
[illegible]land	[illegible]	[illegible],360	[illegible]	[illegible],765	[illegible]	[illegible]	[illegible]	127,357	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.43	169	0.10	[illegible]	[illegible]	138	0.09	[illegible]
[illegible]	71.82	[illegible],207	407.37	[illegible],312	704.32	249,906	592.[illegible]	135,5[illegible]	434.[illegible]	[illegible]
[illegible]	-	-	[illegible].64	1,239	-	-	-	-	-	-
[illegible]	0.04	[illegible]	-	-	-	-	-	-	-	-
[illegible]	0.45	351	-	-	-	-	-	-	-	-
[illegible]	665.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible],559	[illegible]	596,[illegible]	[illegible].68	[illegible]
[illegible] Republic	[illegible]	[illegible]	[illegible]	[illegible]	3.09	[illegible],341	-	-	-	-
[illegible] Countries in Central [illegible] South America	1.[illegible]	[illegible]	-	-	-	-	-	-	-	-
[illegible]	-	-	-	-	[illegible]	[illegible]	-	-	-	-
[illegible], West	-	-	-	-	-	-	[illegible]	75	-	-
[illegible]	-	-	-	-	-	-	[illegible]	40	-	-
Total	1,[illegible]8.95	[illegible]	1,340.00	[illegible]	1,573.6[illegible]	[illegible]	[illegible]	660,558	1,716.[illegible]	[illegible]
Export										
[illegible]	-	-	-	-	[illegible]	100	[illegible]	125	1.90	[illegible]

[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
	Val.	[illegible]	Val.	[illegible]	Val.	[illegible]	Val.	[illegible]	Val.	[illegible]
Imports?										
[illegible]	114,[illegible]	[illegible]	70,[illegible]	[illegible]	[illegible]	[illegible]	165,6[illegible]	[illegible]6,7[illegible]	[illegible]	[illegible]
[illegible]	7,[illegible]54.5[illegible]	[illegible]	4,[illegible]	[illegible],501	10,[illegible]	40,229	[illegible]	50,[illegible]	[illegible].94	[illegible]
[illegible]	[illegible].00		–	–	66.[illegible]	[illegible]	[illegible]	[illegible]	[illegible].50	[illegible]
[illegible]	[illegible],25[illegible].00	4,6[illegible]	13.[illegible]	48	40.20	[illegible]	[illegible]	17	[illegible].50	[illegible]
[illegible]	–	–	20.00	[illegible]	–	–	–	–	–	–
[illegible]	86,55[illegible].92	164,[illegible]	78,[illegible]	147,[illegible]	1[illegible],410.4[illegible]	[illegible]	[illegible]	197,[illegible]	107,[illegible].62	[illegible]
[illegible]	–	–	[illegible]	54	36.00	[illegible]	–	–	–	–
[illegible]	–	–	10.[illegible]	[illegible]	–	–	–	–	–	–
[illegible]	–	–	–	–		–	[illegible]	[illegible]	–	–
[illegible]	–	–	–	–	–	–	–	–	137.00	[illegible]
Total	210,742.[illegible]	426,396	153,[illegible]	[illegible],292	[illegible],707.72	403,195	376,[illegible]	555,[illegible]	220,[illegible]	47[illegible]
Exports										
[illegible]	40.00	[illegible]	791.00	[illegible],165	[illegible],071.00	[illegible],770	[illegible].00	420	180.00	[illegible]
[illegible] Labuan	–	–	[illegible]	770	60.[illegible]	150	–	–	–	–
[illegible]	–	–	–	–	1[illegible].00	40	–	–	–	–
Total	40.00	[illegible]	[illegible].00	[illegible]	[illegible],144.00	[illegible]	[illegible].00	420	180.00	[illegible]

11.26 The percentage increase (average) in the volume and value of soya beans imported into the State were 3% and 31/8% respectively. With the rise in the per capita income, population (particularly amongst the Chinese) and also expansion in the sauce making industry (suggested in the Chapter on Existing Industries), the domestic demand of soya beans is expected to rise at the rate of 6% per annum. (Based on arguments offered in the case of the sugar industry).

11.27 Assuming the recovery of 70%, the quantity of beans used overseas for producing the volume of sauce imported into Sarawak in 1970 was around 1,400 tons. If the total requirement of soya bean sauce of the State were to be produced locally, the quantity of bean required in 1970 was, therefore, 3,100 tons. With an yield of 13 piculs per acre, the total area required to be brought under soya bean was 3,900 acres. This acreage has to be increased annually by 6% to maintain the level of production for meeting the domestic demand of soya bean sauce in [illegible].

11.28 The price of imported soya beans at factory gate was $520 per ton (as against c.i.f. price of $428). The locally produced soya beans were sold at $420 per ton. It has been estimated by the Dutch Team on Regional Study of the First Division that even with a per ton price of $310, soya beans growing in Sarawak could be remunerative as the crop is proposed to be raised as an off season one. As production of this crop will result in import substitution to a considerable extent the Agriculture Department should encourage growing of this crop, if necessary, by providing incentives to the farmers as in the case of coconut and rubber.

CHAPTER XII

RUBBER

Rubber Cultivation in Sarawak

12.1 In spite of dwindling prices in the International market, except for a short spell during 1968 and 1969, rubber still remains an important cash crop for a large section of Sarawak farmers; particularly those belonging to the native communities. The estimated total crop of rubber in Sarawak including both high yielding and local unselected clones, amounted to 461,345 acres in 1970. The high yielding clone accounted for 185,489 acres and the balance were under ordinary unselected clones (planted before World War II). In places, these old holdings have reverted into jungle,

12.2 Unlike West Malaysia, rubber is predominantly a smallholder crop in Sarawak. The Government developmental efforts are also directed towards improvement and expansion in this sector. This has resulted in increase in the smallholders acreage by way of new planting and replanting.

12.3 There are three types of subsidy schemes for smallholders under implementation by the State Government. These are "Schemes A" - New Planting and replanting of high yielding rubber on smallholdings, Scheme B' - plantings of high yielding rubber on Land Settlement Schemes for the landless farmers. The acreage of newly planted and replanted under Scheme A over the period 1956 - 1970 was 170,930 acres; and under Scheme B, it was 10,642 acres, since inception of the programme in 1964 until the end of 1970.

12.4 It would be seen from the table 12.1 that there has been a continuous rise in the acreage of newly planted and replanted with high yielding material over the years.

12.5 Under the Second Malaysia Plan (1971 - 1975), the State Government has proposed to have a total of:

Replanting 41,000 acres
New Planting 33,000 acres

(Please refer Table 1..2) of which 4,000 acres would be allocated to

DEPARTMENT OF AGRICULTURE - RUBBER PLANTING SCHEME 'A' ACHIEVEMENTS
1956 - 1970

Divisions and Districts	1956 - 1967				1968				1969			
	REPLANTING		NEW PLANTING		REPLANTING		NEW PLANTING		REPLANTING		NEW PLANTI[illegible]	
	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Plant[illegible]
F I R S T												
[illegible]ching	3,124.00	3,344.50	9,926.00	6,[illegible]1[illegible].75	332.00	302.00	560.00	470.00	390.00	361.00	606.00	546.
[illegible]rian	564.00	431.50	11,055.75	[illegible].137.50	99.00	91.00	720.00	446.00	524.00	416.00	500.00	556.
[illegible]	2,115.75	1,695.00	8,347.50	6.747.75	205.00	205.00	920.00	825.00	342.00	342.00	500.00	565.
Simunjan	108.50	133.50	4,071.00	3 952.00	48.00	48.00	118.00	5.00	42.00	42.00	699.00	687.
[illegible]ndu	276.00	121.75	4,323.50	2,332.[illegible]	20.00	20.00	229.[illegible]	208.00	63.50	63.50	579.00	555.
Total Acreages	6,188.50	4,736.25	38,323.75	2[illegible], 3[illegible]	704.00	666.00	2,555.00	1.954.00	1,366.50	1,224.50	3,044.00	2,909.[illegible]
S E C O N D												
[illegible]ang Lupar	173.75	125.00	9,080.75	7.680.25	94.00	66.25	830.00	340.00	202.25	179.73	696.00	696.
[illegible]ribas	1,614.25	1,332.25	4,659.00	3,331.50	433.00	427.00	290.00	327.00	253.50	222.50	365.00	359.
[illegible]bok Antu	39.50	34.00	6,503.50	5,576.50	2.00	2.00	600.00	549.00	50.75	47.75	210.00	210.[illegible]
[illegible]	163.75	138.75	7,063.50	6,391.00	75.50	73.50	590.00	570.00	197.00	169.50	600.00	502.[illegible]
T[illegible] [illegible]eages	1,991.25	1,630.00	28,106.75	23.479.25	654.00	578.75	2,400.00	2 [illegible]86.00	70[illegible].50	619.50	1,871.00	1,347.[illegible]
[illegible] U REJANG												
[illegible]	129.00	69.00	4,107.00	2.053.00	186.00	168.00	400.00	369.00	300.00	274.00	400.00	398.[illegible]
[illegible]nowit	227.00	201.00	10,037.25	[illegible] 53.75	375.00	354.00	300.00	236.00	300.00	2[illegible]3.00	229.00	147.[illegible]
[illegible]pit	51.00	23.00	8,494.50	5.145.50	49.00	49.00	1,197.00	1,183.00	200.00	200.00	900.00	882.[illegible]
[illegible]h	-	-	2,314.00	2,053.00	43.00	43.00	300.00	265.00	200.00	1[illegible]2.00	400.00	400.[illegible]
[illegible]t	-	-	655.00	643.00	..	..	90.00	43.00	..	..	-	-
Total Acreages	407.00	303.00	25,607.75	1[illegible],[illegible]53.25	653.00	614.00	2,287.00	2.1[illegible]1.00	1,[illegible]06.00	914.00	1,929.00	1,[illegible]22.[illegible]
[illegible] L.REJANG												
[illegible]ikei	672.75	599.75	9,023.75	[illegible],[illegible]39.00	175.75	164.75	430.00	400.00	469.00	400.00	551.00	549.[illegible]
[illegible]tang	1,057.50	685.75	2,763.00	2.106.25	100.00	100.00	250.00	250.00	200.00	191.00	280.00	265.[illegible]
[illegible]lau	27.75	25.75	1,109.00	1.[illegible]70.00	..	..	250.00	226.00	50.00	47.00	200.00	194.[illegible]
[illegible]al Acreages	1,758.00	1,491.25	12,895.75	11,265.75	275.75	264.75	930.00	876.00	719.00	736.00	1,031.00	1,008.[illegible]
F O U R T H												
[illegible]i	39.00	35.00	7,115.25	[illegible],482.50	..	-	586.00	473.00	-	-	349.00	313.[illegible]
[illegible]ntu[illegible]	452.25	410.75	14,763.00	11,[illegible]73.00	30.75	29.50	900.00	762.00	69.25	61.75	1,000.00	964.[illegible]
[illegible]	36.50	29.00	16,304.50	11,[illegible]67.00	32.50	26.50	910.00	661.00	88.00	84.00	600.00	555.[illegible]
T[illegible]l Acreages	527.75	474.75	39,002.75	29,027.50	63.25	56.00	2.396.00	1,896.00	157.25	145.75	1,[illegible]9.00	1,832.[illegible]
F I F T H												
[illegible]	569.75	335.75	9,551.00	6.149.75	50.00	50.00	588.75	521.25	103.50	91.25	159.00	159.00
Lawas	276.25	175.50	4,405.50	2,987.50	..	-	192.00	111.00	18.00	15.00	[illegible]	174.[illegible]
[illegible]	244.25	119.50	3,903.50	2,325.25	35.50	29.50	156.00	87.00	7.00	7.00	143.00	143.[illegible]
T[illegible]l Acreages	1,090.25	630.75	17,860.00	11,[illegible]62.50	85.50	79.50	936.75	719.25	128.50	113.25	[illegible]02.00	476.[illegible]
TOTAL ACREAGES (Smallholders)	11,962.75	9,266.00	162,376.75	121,322.75	2.435.50	2,259.00	11,564.75	[illegible]	4,080.75	3,723.00	10,[illegible]06.00	9,894.[illegible]
E S T A T E S												
[illegible]gal Tengah	357.00	302.00	-	-	..	..	-	-	-	-	.	-
[illegible]	675.00	405.00	-	-	200.00	200.00	-	-	275.00	275.00	.	-
[illegible]	1,140.00	1,140.00	-	-	100.00	100.00	-	-	200.00	200.00	.	-
[illegible]	101.00	97.00	-	..	-	-	-	-	-	-	.	-
[illegible] Sungai Mayan	-	-	180.00	50.00	-	-	-	-	-	-	.	-
[illegible]g	10.00	10.00	40.00	40.00	-	-	-	-	-	..	.	-
[illegible] Lapan	200.00	-	..	..	-	-	-	-	..	..	.	-
[illegible] Eng Fui	25.00	15.00	25.[illegible]	25.[illegible]	-	..	-	..	..	-	.	-

SECTION 1

...LTURE - RUBBER PLANTING SCHEME [illegible] ACHIEVEMENTS DURING THE PERIOD
1956 - 1970

	1969				1970				1956 - 1970			
[illegible]	REPLANTING		NEW PLANTING		REPLANTING		NEW PLANTING		REPLANTING		NEW PLANTING	
Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted
[illegible]	390.00	361.00	606.00	546.00	948.00	308.00	350.00	329.00	4,794.00	3,315.50	11,442.00	8,155.75
[illegible]	524.00	416.00	530.00	556.00	503.00	327.00	350.00	323.00	1,770.00	1,315.50	12,705.75	9,462.50
[illegible]	342.00	342.00	500.00	565.00	1,060.00	1,337.00	300.00	300.00	4,323.00	3,579.00	10,655.50	3,437.75
[illegible]	42.00	42.00	699.00	687.00	139.00	90.00	350.00	155.00	337.50	273.50	5,338.00	4,799.00
[illegible]	63.50	63.50	579.00	555.00	88.00	47.00	708.00	468.00	452.50	252.25	5,839.50	3,613.00
[illegible]	1,366.50	1,224.50	3,044.00	2,909.00	3,418.00	2,609.00	2,058.00	1,575.00	11,677.00	9,235.75	46,480.75	34,460.00
[illegible]	[illegible]	179.75	696.00	696.00	152.00	119.25	400.00	397.00	622.00	490.25	11,056.75	9,613.25
327.00	[illegible]	222.60	~~365.00~~	359.00	512.25	457.50	410.00	401.00	2,863.00	2,449.25	5,825.00	4,918.50
[illegible]	[illegible]	47.75	210.00	210.00	199.25	177.50	493.50	454.00	291.50	261.25	7,807.00	6,789.50
[illegible]	197.00	169.50	600.00	502.00	252.50	207.00	399.00	369.00	683.25	500.75	9,452.50	7,912.00
[illegible]	[illegible]	[illegible]	1,871.00	1,847.00	1,116.00	961.25	1,702.50	1,621.00	4,464.75	3,709.50	34,140.25	29,233.25
[illegible]	[illegible]	274.00	400.00	398.00	600.00	537.00	266.00	251.00	1,215.00	1,048.00	5,173.00	3,066.00
[illegible]	[illegible]	[illegible]	229.00	147.00	396.00	354.00	250.00	238.00	1,298.00	1,177.00	10,816.25	8,779.75
[illegible]	[illegible]	[illegible]	900.00	882.00	600.00	505.00	800.00	768.00	900.00	887.00	11,391.50	7,983.50
[illegible]	[illegible]	[illegible]	408.00	400.00	164.00	129.00	211.00	211.00	413.00	344.00	3,225.00	2,954.00
[illegible]	..	..	-	-	28.00	28.00	189.00	186.00	28.00	28.00	934.00	872.00
[illegible]	[illegible]	914.00	1,929.00	1,822.00	1,788.00	1,633.00	1,716.00	1,654.00	3,854.00	3,464.00	31,539.75	23,655.25
[illegible]	[illegible]	[illegible]	551.00	549.00	720.00	566.00	270.00	243.00	2,037.50	1,798.50	10,274.75	9,286.00
[illegible]	[illegible]	[illegible]	[illegible]	265.00	471.50	466.50	110.00	92.00	1,829.00	1,623.25	3,403.00	2,713.25
[illegible]	[illegible]	47.00	[illegible]	194.00	150.00	114.00	220.00	166.00	227.75	186.75	1,779.00	1,656.00
[illegible]	719.00	[illegible]	1,031.00	1,008.00	1,341.50	1,146.50	600.00	506.00	4,094.25	3,608.50	15,456.75	13,655.25
[illegible]	-	-	[illegible]	313.00	41.00	-	500.00	472.00	60.00	35.00	9,450.25	6,740.50
[illegible]	[illegible]	61.75	[illegible]	964.00	835.75	743.50	699.00	588.00	1,388.00	1,245.50	17,362.00	14,192.00
[illegible]	[illegible]	84.00	600.00	555.00	142.50	99.00	498.00	383.00	299.50	238.50	18,312.50	13,266.00
[illegible]	157.25	145.75	[illegible]	1,832.00	999.25	842.50	1,697.00	1,443.00	1,747.50	1,519.00	45,124.75	34,198.50
[illegible]	[illegible]	91.25	[illegible]	159.00	26.75	26.50	320.00	308.00	750.00	503.50	10,818.75	7,138.00
111.00	[illegible]	15.00	[illegible]	174.00	178.50	36.50	128.00	201.50	464.75	277.00	4,905.50	3,474.00
7.00	7.00	7.00	143.00	143.00	-	-	172.00	-	286.75	156.00	4,374.50	2,555.25
[illegible]	[illegible]	113.25	[illegible]	476.00	197.25	113.00	620.00	509.50	1,501.50	936.50	19,898.75	13,167.25
[illegible]	[illegible]	3,723.00	10,306.00	9,894.00	8,860.00	7,305.25	8,393.50	7,300.50	27,339.00	22,553.25	192,641.00	140,377.50
-	-	-	-	-	-	-	-	-	357.00	302.00	-	-
-	275.00	275.00	-	-	252.00	252.00	-	-	1,402.00	1,132.00	-	-
..	200.00	200.00	-	-	200.00	200.00	-	-	1,640.00	1,640.00	-	-
..	-	..	-	-	-	-	-	-	101.00	97.00	-	-
..	-	..	-	-	-	-	-	-	-	-	100.00	50.00
-	..	..	-	-	-	-	-	-	10.00	10.00	40.00	40.00
..	..	..	-	-	-	-	-	-	200.00	-	-	-
-	-	-	-	-	-	-	-	-	25.00	15.00	25.00	25.00

Divisions and Districts	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved
1-Shaw Kim	[illegible]	2[illegible].00	-	-	-	-	-	-	-	-	-
3-Bukit Lan	3[illegible].00	2[illegible].00	-	-	-	-	-	-	-	-	-
5-Limbang	94.00	94.00	-	-	-	-	-	-	-	-	-
5-Lawas	303.00	296.00	27.00	27.00	2[illegible].00	2[illegible].00	-	-	25.00	25.00	-
5-W. Wong	27.00	10.00	-	-	30.00	30.00	-	-	-	-	-
5-Ban Seng	3[illegible].00	20.00	-	-	-	-	-	-	-	-	-
TOTAL ACREAGES (Estates)	3,072.00	2,445.00	272.00	142.00	35[illegible].00	35[illegible].00	-	-	500.00	500.00	-
TOTAL ACREAGES FOR STATE	15,[illegible]34.75	11,711.00	102,64[illegible].75	121,4[illegible]4.75	2,7[illegible]5.50	2,[illegible].00	11,564.75	[illegible],[illegible]52.25	4,[illegible].75	4,223.00	10,[illegible].00

-nk.

Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted	Approved	Planted
-	-	-	-	-	-	-	-	-	[illegible]	20.00	-	-
-	-	-	-	-	-	-	-	-	30.00	30.00	-	-
-	25.00	25.00	-	-	20.00	-	-	-	134.00	114.00	-	-
-	-	-	-	-	29.00	28.00	-	-	386.00	379.00	27.00	27.00
-	-	-	-	-	-	-	-	-	27.00	16.00	-	-
-	-	-	-	-	-	-	-	-	30.00	20.00	-	-
-	[illegible]	[illegible]	-	-	500.00	430.00	-	-	4,422.00	3,775.00	272.00	1142.00
[illegible]52.25	4,681.75	4,223.00	10,[illegible].00	9,894.00	9,360.00	7,705.25	3,393.50	7,3[illegible].00	31,761.00	26,32[illegible].25	1[illegible],913.00	14[illegible],519.50

SECTION 2

Table 12.2

SECOND MALAYSIA DEVELOPMENT PLAN 1971-1975

Divisional Acreages proposed for Rubber Planting during the Period

DIVISIONS	1971 REPLANT (Acres)	1971 NEWPLANT (Acres)	1972 REPLANT (Acres)	1972 NEWPLANT (Acres)	1973 REPLANT (Acres)	1973 NEWPLANT (Acres)	1974 REPLANT (Acres)	1974 NEWPLANT (Acres)	1975 REPLANT (Acres)	1975 NEWPLANT (Acres)	1976 REPLANT (Acres)	1976 NEWPLANT (Acres)
1st Division	2,400	1,000	1,900	800	1,900	800	1,900	600	1,900	500	10,000	3,700
2nd Division	1,600	1,000	1,600	800	1,600	800	1,	600	1,600	500	8,000	3,700
3rd Division/Upper Rejang	2,400	1,000	1,900	800	1,900	800	1,900	600	1,900	500	10,000	3,700
3rd Division/Lower Rejang	1,200	1,000	1,200	800	1,200	800	1,200	600	1,200	500	6,000	3,700
4th Division/Miri	200	1,500	200	1,000	200	1,000	200	1,000	200	800	1,000	5,300
4th Division/Bintulu	500	1,000	500	800	500	800	500	600	500	500	2,500	3,700
5th Division	200	1,500	200	1,000	200	1,000	200	1,000	200	700	1,000	5,200
Estates	500	-	500	-	500	-	500	-	500	-	2,500	-
Sub-Total	9,000	8,000	8,000	6,000	8,000	6,000	8,000	5,000	8,000	4,000	41,000	29,000
Youth Settlement Schemes	-	-	-	1,000	-	1,000	-	1,000	-	1,000	-	4,000
TOTAL	9,000	8,000	8,000	7,000	8,000	7,000	8,000	6,000	8,000	5,000	41,000	33,000

12.6 Compared to the smallholders, the estate* sector rubber in Sarawak is very insignificant. There are altogether 14 estates in the State, of which 7 are defunct. Of the remaining, only three are operating reasonably well though with a limited labour force. These estates are, Samarahan and Dahan in the First Division and Lawas in the Fifth Division.

12.7 Government has a subsidy to encourage replanting in the Estates also. Under this Scheme, the estates have, till the end of 1970, replanted 3,917 acres and under the Second Malaysia Plan, an additional area of 2,500 acres is likely to be replanted. Thus at the end of 1975, the total area under newly planted and replanted of high yielding rubber would be 259,489 acres, as shown in Table 12.3.

Table 12.3

	Cumulative total acreage under high yielding rubber					
	1956-1970	1971	1972	1973	1974	1975
Smallholder	170,930	187,430	200,930	214,430	226,930	238,430
Land Settlement Scheme	10,642	10,642	11,642	12,642	13,642	14,642
Estates	3,917	4,417	4,917	5,417	5,917	6,417
Total	185,489	202,489	217,489	232,498	246,489	259,498

Rubber Yield

12.8 With reasonable and adequate management, tapping of rubber should be possible at the end of the sixth year after planting. On this basis, the tappable acreage under rubber, districtwise, from the newly planted and replanted areas alone in the State are calculated and shown in Table 12.4.

* above 100 acres.

Table 12.4 Tappable Acreage Under Rubber

Division	District	Cumulative total of estimated tappable acreage - 1972-1985 (high yielding)										Remarks
		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	
First	Kuching	9,085	9,608	10,680	11,447	12,835	13,915	14,855	15,795	16,695	17,575	
	Serian	8,407	9,343	9,880	10,992	11,843	12,523	13,063	13,603	14,103	14,583	
	Bau	7,403	8,442	9,472	10,379	12,016	12,696	13,236	13,776	14,276	14,756	
	Lundu	2,217	2,503	2,731	3,349	3,864	4,544	5,084	5,624	6,124	6,604	
	Simunjan	3,832	4,045	4,211	4,940	5,185	5,865	6,405	6,945	7,445	7,925	Inaccessible by r[oad]
Second	Simanggang	8,596	9,610	10,660	11,848	12,364	13,014	13,614	14,214	14,514	15,034	
	Saribas	8,393	7,104	8,245	8,821	9,679	10,329	10,929	11,529	11,829	12,349	
	Lubok Antu	5,045	5,610	6,161	6,371	7,002	7,652	8,252	8,852	9,152	9,672	
	Kalaka	5,984	6,525	6,272	7,023	7,599	8,249	8,849	9,449	9,749	10,269	
Third	Sibu	3,460	3,788	4,750	6,102	6,890	7,590	8,177	8,764	9,310	9,822	
	Sarikei	10,550	11,664	12,228	13,245	13,493	14,193	14,780	15,367	15,904	16,416	
	Binatang	2,579	2,971	3,321	3,777	4,335	5,935	5,622	6,209	6,746	7,258	
	Julau	934	1,095	1,321	1,562	1,842	2,542	3,129	3,716	4,253	4,765	
	Kanowit	7,976	8,359	8,949	9,364	9,956	10,656	11,243	11,821	12,358	12,870	Inaccessible by r[oad]
	Kapit	4,009	5,178	6,415	7,497	8,847	9,547	10,134	10,721	11,258	11,770	- do -
	Mukah	1,827	2,058	2,386	2,958	3,298	3,998	4,585	5,172	5,709	6,221	- do -
	Dalat	499	643	685	685	899	1,599	2,186	2,773	3,310	3,822	- do -
Fourth	Miri	6,806	7,247	7,936	8,249	8,721	9,789	10,620	11,453	12,211	12,885	
	Bintulu	11,450	12,288	13,079	14,104	15,435	16,501	17,334	18,167	18,933	19,599	
	Baram	10,948	11,696	12,383	13,022	13,504	14,570	15,403	16,236	17,002	17,668	Inaccessible by r[oad]
Fifth	Limbang	5,691	6,485	7,456	8,306	8,640	9,206	9,606	10,006	10,406	10,706	
	Lawas	3,115	3,162	3,273	3,461	3,595	4,261	4,661	5,061	5,461	5,761	Inaccessible by r[oad]
	Sundar	2,184	2,444	2,560	2,710	2,864	3,430	3,830	4,230	4,630	4,930	- do -

12.9 The productivity of rubber varies with the age of the trees and with quality of management. Once tapping has started at the end of the sixth year, this can continue for thirty years, after which the trees become uneconomical. The prime period for the rubber trees, when yield is best, begins at the end of the tenth year and starts tapering off from the 15th to 20th year.

12.10 In Sarawak, it is common practice for the smallholders to manage their rubber plantations, along with many other food crops, of which rice is the most important. It is thus understandable that they tend to pay more attention to the rice crop, which results in periods when the rubber is neither tapped nor maintained. This state of affair has resulted in very low average production of rubber per acre. Furthermore, with the large number of days when it rains, the number of working days are also reduced considerably.

12.11 The 'Rubber Production Survey' carried out in 1967-68, on a sample of 20 smallholders in the First Division of Sarawak, planted with high yielding rubber (R.R.S. 'A') has revealed an average yield of 680 lb. per acre per annum, whereas the maximum yield amounted to 1,200 lb. per acre. The Survey also indicated that such a wide difference between the maximum yield and the average yield was due to overall low number of tapping days, namely 109 days in 1967. As rubber is a smallholder crop, and it will continue to be so for many more years to come (because the native farmers are most unlikely to change their habits of dividing their attention to the many crops, including rubber and also because of the heavy rainfall), it will be only reasonable to work out the production basis on a lower per acre yield. The calculations shown in table 12.5 on districtwise annual production of rubber from the high yielding alone is, therefore, based on a acre/annum yield of 600 lbs.

Table 12.5 Average Yield for the period - 600 lb./ cr.

Division	District	Production from all types of holding (high yielding only) in '000 tons									
		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
First	Kuching	2.4	2.6	2.9	3.1	3.4	3.72	3.98	4.22	4.46	4.7
	Serian	2.2	2.5	2.6	2.9	3.2	3.3	3.5	3.6	3.8	3.9
	Bau	[illegible]	2.3	2.5	2.8	3.3	3.4	3.5	3.7	3.8	4.0
	Lundu	0.6	0.7	0.7	0.9	1.0	1.2	1.4	1,5	1.7	1.8
	Simunjan	1.0	1.1	1.1	1.3	1.4	1.6	1.7	1.9	2.0	2.1
Second	Batang Lupar	2.3	2.6	2.85	3.2	3.3	3.5	3.65	3.8	3.9	4.0
	Saribas	1.7	1.9	2.2	2.36	2.6	2.76	[illegible]	3.1	3.18	3.3
	Lubok Antu	1.35	1.5	1.65	1.7	1.88	2.05	2.2	2.36	2.45	2.58
	Kalaka	1.6	1.75	1.58	1.88	2.03	2.2	2.36	2.53	2.6	2.75
Third	Sibu	0.93	1.01	1.17	1.64	1.84	2.03	[illegible]	2.35	2.50	2.63
	Sarikei	2.81	3.13	3.28	3.55	3.6	3.8	3.95	4.1	4.25	4.40
	Binatang	0.69	0.8	0.89	1.01	1.16	1.34	1.50	1.66	1.80	1.94
	Julau	0.25	0.29	0.35	0.42	0.49	0.68	0.83	1.0	1.14	1.28
	Kanowit	2.13	2.24	2.4	2.5	2.65	2.85	3.0	3.16	3.30	3.45
	Kapit	1.07	1.38	1.72	2.0	2.36	2.55	2.7	2.86	3.02	3.14
	Mukah	0.49	0.55	0.64	0.79	0.88	1.07	1.22	1.38	1.53	1.67
	Dalat	0.13	0.17	0.18	0.18	0.24	0.43	0.58	0.74	0.89	1.02
Fourth	Miri	1.82	1.94	2.12	2.2	2.34	2.61	[illegible]	3.07	3.27	3.45
	Bintulu	3.07	3.3	3.5	3.78	4.15	4.40	4.63	4.85	5.05	5.22
	Baram	2.93	3.13	3.3	3.5	3.6	3.88	4.12	4.35	4.55	4.73
Fifth	Limbang	1.52	1.73	2.0	2.21	2.30	2.46	2.58	2.7	2.80	2.86
	Lawas	0.84	0.85	0.88	0.93	0.96	1.14	1.24	1.35	1.46	1.54
	Sundar	0.58	0.65	0.69	0.73	0.77	0.92	1.03	1.13	1.24	1.32

Rubber Trade

12.12 Neither the Agriculture Department nor the Statistical Department collected any statistics on actual production of rubber and all figures provided by the Statistics Department were from the actual exports obtained from the Customs Department. The volume and value of rubber exported for the years 1960-70 is shown in Table 12.6. It would be seen that there is a small quantity of import of rubber into Sarawak. It is reported that this import is mainly from Indonesia.

12.13 The export of rubber from Sarawak dropped continuously from 1960 until 1968 and then it suddenly increased considerably in 1969 (38,729 tons). In 1970, the export dropped again to 21,460 tons. Such a trend in export is more indicative of market situation rather than of productivity.

Table 12.6

NET EXTERNAL TRADE IN RUBBER BY VOLUME AND VALUE

1960 - 1970

VALUE IN M$'000

Year	Exports		Imports*		Net Export
	Tons	$	Tons	$	
1960	49,949	122,440	4,995	6,480	115,960
1961	46,904	83,257	3,135	2,964	77,329
1962	43,796	72,597	1,017	4,797	63,003
1963	44,834	69,575	1,276	1,137	67,301
1964	42,959	60,133	20	18	60,097
1965	40,034	59,453	+	0.130	59,452
1966	33,589	46,192	97	71	46,050
1967	28,445	32,363	674	408	31,547
1968	23,794	26,314	73	304	26,010
1969	38,729	49,866	86	72	49,794
1970	21,460	23,976	143	64	23,912

Source: Department of Statistics

* Includes sheet, crepe and scrap

+ Less than 1 ton

12.14 The quality of Sarawak rubber is stated to be low. According to the Agriculture Department, the quality distribution of exported Sarawak rubber for the years 1962 - 67 was as shown in the Table 12.7.

Table 12.7

Grade	Quality Description
RSS 1	1%
RSS 2	6%
RSS 3	65%
RSS 4	18%
RSS 5	7%
RSS 6	3%

It is gathered that the price of rubber paid to farmers is most often determined on the assumed quality of RSS 5.

12.15 The normal marketing system includes smallholders selling their rubber to local rubber dealers, who, in turn sells to the wholesaler, who is also the exporter. The rubber sold to the local dealer is partly sun dried and unsmoked (U.S.S.) and the local dealer will smoke the rubber purchased and re-sell to the wholesaler.

12.16 Statistical data on marketing margins under rubber are not available, however, certain figures obtained by the Dutch Study Team from the farmers, dealers and exporters are shown in Table 12.8

12.17 It would be seen that the prices of natural rubber had declined sharply between 1961 - 68. In 1969 however, the price improved considerably, due mainly to the increased demand from China, Russia and other East European countries and also due to the suspension of U.S. stockpile sale. There has been a steady fall in the rubber price since 1970.

Table 12.8

Producer prices of rubber (R.S.S. 1) 1961 - 1969;
Projections 1970 - 1990 (M$ per picul)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1975	1980	1985	1990
Price f.o.b. Kuching	108.-	102.-	95.22	87.62	90.70	84.05	68.01	67.42	92.-	80.-	73.-	67.-	60.-	53.-
Export duty	16.66	16.16	13.47	11.57	12.34	10.67	7.36	7.27	12.66	9.66	8.26	7.21	6.16	5.46
Loading charges transport cost from wholesaler to exporter and exporter's margin	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30					
Wholesale price	89.04	84.54	79.45	73.75	76.06	71.08	58.35	57.85	77.04					
Wholesaler's margin transport cost and shopkeeper's margin	2.-	2.-	2.-	2.-	2.-	2.-	2.-	2.-	2.-					
Producer's price	87.04	82.54	77.45	71.95	74.06	69.08	55.85	55.35	74.54	65.50	60.-	57.-	51.-	45.-

12.18 The International Rubber Study Group predicted a change long ago, from the situation of short supply of natural rubber to a situation of surplus from 1970 onwards. Therefore, the present trend of falling might well continue till 1975, and for that year, the price of 45 M cents per lb. f.o.b. Kuching for RSS 1 rubber has been forecasted.

12.19 In the Provisional Indicative World Plan of the F.A.O., the price of natural rubber (RSS1) c.i.f. New York of 16 - 20 U.S. cents per lb. for 1985 has been calculated, this would be equivalent to a price f.o.b. Kuching of 41 M cents per lb., a price which is still in line with the projection in Table 12.6.

<u>Proposal for Rubber Processing</u>

12.20 As various social, economical and political conditions would not permit Sarawak or even Malaysia as a whole to dispense with rubber plantation, (in fact it has to be encouraged and is being encouraged); and as the lower qualities of rubber will suffer more from the general fall in prices, up-grading of Sarawak rubber is urgently required. The present marketing system is totally inadequate to stimulate readjustment. Many farmers are acting in the belief that improvement of the quality of rubber does not pay at all as they are paid by the determination of the price of RSS 5, irrespective of actual quality of rubber presented. As such, the best solution would be the establishment of factories to produce Standard Malaysian Rubber (hevea-crumb) at various places, along with establishment of collection centres by the factories at smallholders concentration.

12.21 The establishment of hevea-crumb factory would relieve the smallholders from all the processing functions, which, when not done properly, result in low quality grades of rubber. At present, for coagulating the latex from the plantation, the farmers are to do the following operations before delivering them to the shopkeepers:-

1. Dilution of latex with diluted formic acid without sieving and skimming of bubbles.
2. Coagulation in tin pans.
3. Mangling of coagulum into assorted sizes of sheets.
4. Drip drying of sheets over "dapor" (kitchen fire place).

The sheet is then ready for delivery to the shopkeeper.

12.22 To produce quality rubber, sieving and skimming of bubbles are very essential. It is also necessary to regulate the quality of water used in coagulation and washing. The farmers use for coagulation, any water that is available in the vicinity, and sieving and skimming are hardly practised.

12.23 For the International market in order to obtain a good premium, the sheets should be such as not to weigh more than a pound, be of uniform thickness and must be cured properly by smoking. The method of curing over the fire place caused uneven coagulum and the collection of ash and dust thus resulting in low quality rubber. There is also danger of fire hazard in this method of kitchen drying.

12.24 With the establishment of a few hevea-crumb factories at selected places within the State the present problem of poor quality rubber production could be overcome and this would directly result in higher cash return to the farmers.

12.25 It has been the experience in West Malaysia and in the only factory in Sarikei in the Third Division, that rubber factories cannot successfully operate by depending entirely on smallholders' supply of latex. This is especially true in the case of Sarawak where the smallholders are generally irregular in their tapping. The solution, lies in locating a hevea-crumb factory either in or around the rubber estates or a

Land Settlement Scheme. These are the places in Sarawak where better management and administration is practised and, where at least a certain quantity of latex can be guaranteed all round the year. It has been estimated that if a supply of 40% of the total requirement of latex can be assured, the factory can run efficiently depending for the remaining 60% from the individual smallholders.

12.26 The total number of heve crumb factories required to be established, over the period of years, should be a matter of detailed study. It is recommended that in 1972, two heve crumb factories each with a capacity of 10 tons a day should be established at the following places:-

1. Samarahan Estate in Serian District of the First Division.
2. Lambir Land Settlement Scheme along the Miri/Bintulu Road in Fourth Division.

12.27 The Samarahan Estate is located 44 miles from Kuching. The last 12 miles, which is a feeder road at 32nd mile of the Kuching/Serian Road, though motorable, would have to be improved once the factory is decided to be located in this estate.

12.28 The "Pati" Canal which is passing through the estate and is fed from the Samarahan River, could be a source of sufficient water for the proposed factory (Please see map 12.1).

12.29 The estate's present electrical capacity would not be sufficient for the requirement of the factory. Electricity would have to be provided for the factory either by drawing lines from Serian, which is 19 miles away by road (much shorter as the crow flies); or by adding one more generator set to the existing one. The decision of choice would depend on the comparative costs of the two alternatives.

12.30 Samarahan Estate has an acreage of 4,035 of which 730 acres are already in tapping. Under scheme A, of the State Government for helping the estates in replanting, they have been presently planting new areas and the area to come in tapping from 1972 - 1980 are as below:-

Table 12.9

Year	Acreage under tapping
1972	830
1973	1,030
1974	1,130
1975	1,230
1976	1,330
1977	1,530
1978	1,730
1979	1,930
1980	2,230

12.31 In the Serian District, there is also a Land Settlement Scheme (Triboh) of 512 acres of rubber. 436 acres of this area are already in tapping and the remaining is expected to come into tapping by 1972. Another small area of about 500 acres of rubber also exists in this district.

12.32 The Land Settlement Scheme at Melugu in the 2nd Division with an acreage of 1,888 would also be an assured source for latex supply. Assuming that 40% of the yield of these smallholders would be available for processing in the factory, the total acreage from which latex supply would be obtained would amount to about 2,000 acres. Latex supply is likely to be available from the smallholders in the 2nd Division, also, as all these areas are connected to the proposed factory's location by road.

12.33 One of the reasons for the continued failure to attain success in the FLDA run heveacrumb factory in Seremban in West Malaysia and the S.D.P.C. run factory at Beriki, is the expectation to deal direct with smallholders for collection of latex. Of the most obvious reasons, administrative shortcomings and irregular payments to the farmers are predominant. To some extent, West Malaysia has solved this problem by way of appointing collection agents on commissioned basis. These agents have been selected from amongst the villagers themselves. Under this system, it is to be ensured that after assessment of the DRC for the latex, the farmers are paid right on the spot, and it is the responsibility of the collection agent to deliver the latex to the tankers operated by the factory for the purpose.

12.34 For the proposed factory in Samarahan, the probable collection centres would be as below:

1. Baki Bazaar : 22nd Mile Kuching/Simanggang Road.
2. Village : 29th Mile Kuching/Simanggang Road,
3. Pancher : 27th Mile Kuching/Simanggang Road.
4. Tapah : 24th Mile Kuching/Simanggang Road.
5. Village : 35th Mile Kuching/Simanggang Road.
6. Kampong Riih : 8th Mile feeder road to Tebakong from 37th mile in the Kuching/Simanggang Road.
7. Triboh Land Settlement Scheme: 45th Mile Kuching/Simanggang Road.
8. Melugu Land Settlement Scheme in 2nd Division.

12.35 The location for the 2nd factory can either be at Lambir Settlement Scheme or somewhere along the Miri/Bintulu Road. The total planted acreage at Lambir is 1,600 and the Sibiyiu Foochow Settlement Scheme outside Bintulu is approximately 5,000 acres of matured rubber. The Foochow Settlement Scheme is entirely Chinese plantation and negotiations have to be carried out with the farmers in the area for an assured supply of latex. The assurance or otherwise of this community would be the most important factor as to the location of the 2nd factory. The Bintulu District has also other sources of rubber. A large acreage of rubber is under smallholders and this acreage would be increasing during the coming years. In Bakam and Sepraya areas, which are about 12 miles along the Miri/Bintulu Road, the Hakka Community has also planted approximately 500 acres of matured rubber.

12.36 Whichever be the finally selected site, it would be quite away from either Miri or Bintulu, rendering supply of electricity through H.T. lines uneconomical. Therefore, provision has to be made for own generation by the factory. Water supply can be obtained by the numerous rivers crossing the Miri/Bintulu Road, depending upon the site.

CHAPTER XIII

PEPPER

World Trade (Export & Import)

13.1 Indonesia, India and Malaysia in addition to Madagascar and Brazil are the three chief pepper producing countries in the world. Their combined total export in 1970 is estimated at 1,063,000 cwts., a short fall of 17% over 1969 export. The world trade in pepper for the period 1968 - 1971 is shown in Table 13.1. From 1969 to 1970, shipments from India rose by 12%, but those from Malaysia were 16% lower. As calculated from the returns of the principal importers, the Indonesian exports are estimated to have fallen by 45% over the same period. Shipments from Madagascar totalled 43,800 cwt. in 1970, a short fall of 38% from the previous year, while, due to a poor crop, exports from Brazil are believed to have fallen considerably below the 1969 record level of 285,700 cwts. This cannot, however, be confirmed as official figures are not available.

Table 13.1

Trade in Pepper

(thousand cwt)

	1968	1969					1970					1971
		1st qtr	2nd qtr	3rd qtr	4th qtr	Total	1st qtr	2nd qtr	3rd qtr	4th qtr	Total	1st qtr
Exports												
Malaysia d	456.1	[illegible]0.6	132.7	276.7	[illegible]2.6	572.6	67.0	133.2	159.6	120.6	4[illegible]0.4	
India	490.5	104.9	[illegible]1.7	71.[illegible]	[illegible]5.[illegible]	344.2	190.6	44.0	53.1	7.3e	3[illegible]4.0e	
Ceylon	16.2	5.7	3.9	4.0	4.3	17.9						
Cambodia	55.0											
Malagasy Republic	60.9	1[illegible].9	12.6	12.1	25.2	6[illegible].[illegible]	7.5	12.2	5.[illegible]	1[illegible].3f	43.[illegible]f	
Brazil	191.5	-	-	73.4	-	2[illegible]5.7	-	-	-	-	-	
Indonesia	4[illegible].9a	-	-	-	-	304.1a	-	-	-	-	19[illegible].6a	
Re-exports												
Singapore	[illegible]16.3	150.[illegible]	157.[illegible]	175.1	175.4	659.1	1[illegible]5.9	171.4	197.3	1[illegible]7.7	742.3	
Imports												
Singapore	3[illegible].2	[illegible]4.5	125.7	219.7	134.6	564.5	73.[illegible]	10[illegible].3	1[illegible].6	11[illegible].5	4[illegible]2.2	
United Kingdom	53.[illegible]	17.5	14.2	13.[illegible]	24.6	70.1	27.0	11.0	10.6	13.1	[illegible]1.7	13.5
Canada	45.6	9.5	11.1	5.6	[illegible].1	34.3	12.3	13.0	6.3	11.5	43.1	5.2c
Australia	14.9	4.2	4.6	5.[illegible]	3.5	1[illegible].1	4.3	6.3	5.5	5.1	21.2	3.3
United States	473.[illegible]	114.1	140.[illegible]	96.0	131.2	4[illegible]2.1	124.4	[illegible].0	77.3	144.7	431.4	99.4c
West Germany	117.5	32.4	2[illegible].1	34.[illegible]	3[illegible].[illegible]	127.1	21.[illegible]	25.6	35.3	36.4	1[illegible].2	11.1b
France	99.1	22.6	20.9	2[illegible].[illegible]	21.2	[illegible]5.5	1[illegible].0	16.5	16.2	24.9	75.6	
Italy	51.6	12.9	14.1	1[illegible].[illegible]	11.9	57.7	9.9	9.0	11.9	1[illegible].[illegible]	49.6	4.[illegible]b
Belgium	14.0	2.[illegible]	3.9	4.2	3.6	14.5	3.7	3.6	3.0	2.6c		
Netherlands	21.2	4.6	6.4	4.0	4.4	19.4	4.2	3.9	4.2	6.2	1[illegible].5	
Soviet Union	20[illegible].7	-	-	-	-	216.5						

a From data recorded in the returns of principal importers (excluding Singapore); official return gave exports of 449.1 for 196[illegible] and 3[illegible].9 for 1969.

b One month only. c Two months only. d Sarawak only. e Partly estimated.

f [illegible]

13.2 The Indian export in 1970 was largely due to a considerable increase in the shipment to the United States and the Soviet Union, the two largest markets. This outweighed the stiff declines in shipment to Italy, Egypt and Yugoslavia. The increased export to the United States was particularly impressive in so far as it took place in the context of lower American imports, India having benefitted from the poor Indonesian and Brazilian crops. Apart from exports to the Soviet Union, those to other countries in Eastern Europe were mixed; the highest shipments to East Germany, Hungary and Rumania were more than offset by smaller consignments to Yugoslavia, Czechoslovakia, Poland and Bulgaria.

13.3 In Malaysia, pepper is mainly produced in the State of Sarawak, The total export of pepper from Sarawak for the period 1960 - 1970 is shown in Table 13.2. The Malaysian dependence on exports to Singapore continued to decline in 1970, when only 82% of its pepper were shipped through that port compared to 92% in 1969. Export of Malaysian pepper direct to EEC countries more than doubled to 35,400 cwt., while increased shipments were also made direct to Australia, Norway and Sweden. Nevertheless, the exports of Malaysian and Indonesian pepper from Singapore during 1970 rose by 13% to 742,300 cwts. as higher shipments were made to major destinations except to the United States, which took 17% less than in 1969. Shipments to the United Kingdom at 124,900 cwts. were 15% higher than in the previous year, while those to the EEC at 109,200 cwwt. were 79% higher. Significant increases also occurred in exports to Canada, Hungary and especially to America.

Table 13.2

Net External Trade in Pepper by Volume and Value

1960 - 1970

Value in M $ '000

Year	EXPORTS			
	WHITE		BLACK	
	Tons	$	Tons	$
1960	3,393	15,180	705	2,020
1961	7,051	19,635	3,902	9,011
1962	7,082	16,100	4,496	7,787
1963	8,326	17,664	3,115	4,726
1964	7,732	16,288	4,382	7,376
1965	7,119	19.193	10,495	22,539
1966	7,094	20,422	5,960	12,574
1967	10,777	22,488	8,724	12,980
1968	10,826	19,089	11,978	15,575
1969	11,879	27,604	16,753	25,283
1970	9,230	25,102	14,791	31,103

Source: Department of Statistics

13.4 Exports of pepper from Sarawak for the period 1966 to 1970 to various destination are shown in Table 13.3 and 13.4

Table 13.3

Exports of Pepper (Black) by Destination 1966 - 1970

Year / Destination	1966		1967		1968		1969		1970	
	Tons	$	Tons	$	Tons	$	Tons	$	Tons	$
Australia	-	-	-	-	2.00	2	26	44	41.5	87
Canada incl. Newfoundland	-	-	-	-	-	-	-	-	-	-
Countries of [illegible]Europe	47	88.1	29	40	175.5	290	421	556	860	1,733
Hong Kong	38	79	16	24	43	56	23	30	15	24
Korea	2.7	5.3	-	-	-	-	-	-	-	-
Malaysia [illegible]est	-	-	-	-	0.12	0.153	-	0.004	0.06	0.139
Morocco	250	516	690	1,020	1,156	1597	525	888	452.5	989
New Zealand	1.5	3.2	4	6	11.5	16	12	29	5.3	14
Other Countries	4	8	-	-	-	-	-	-	10	23
Sabah	-	-	0.14	206	-	-	-	-	-	-
Singapore	5,620	11,859	7,974	11,876	10,579	13,654	15,738	23,724	13,402	28,218
United Kingdom	2.5	4.8	10	13	10	27	8	11	5	15

Source: Department of Statistics

Table 11.4

Exports of Pepper (White) by Destination 1966 - 1970

Value in M$'000

Year / Destination	1966		1967		1968		1969		1970	
	Tons	$	Tons	$	Tons	$	Tons	$	Tons	$
Australia	-	-	57.5	110	103	180	144	291	239.3	671
Brunei	-	-	-	-	-	-	-	-	0.03	0.092
Canada incl. Newfoundland	29	84.5	20.5	46	-	-	-	-	-	-
China Mainland	1.7	5	-	-	0.4	0.6	-	-	-	-
Countries of Western Europe	414.5	3,567.3	1,216.5	2,545.6	2,056.0	3,684.0	908	1,794	2,253	6,057
Formosa	-	-	-	-	-	-	-	-	-	0.016
Hong Kong	58.6	164	59	123.8	56.7	101	6	11	53	137
Japan	107	321	90	190	112	208	177	392	195	565
Korea	0.5	1	-	-	-	-	-	-	-	-
Malaysia West	-	-	-	-	-	-	-	-	0.06	0.173
New Zealand	117	347	97.5	209.9	114.5	223	67	178	80.2	239
Other African Countries	-	-	-	-	-	-	-	-	5	12
Sabah	-	-	1	2	-	-	0.09	0.2	-	-
Singapore	5,296	15,264	9,121	19,020	8,201.1	14,338	10,522	24,824	6,390	17,378
Union of S. Africa	120	325	37.5	77	162	314	56	114	-	-
United Kingdom	119.5	342	75.5	161.7	20.0	40	-	-	15	43

Source: Department of Statistics

13.5 Imports into the United Kingdom during the first quarter of 1971, at 13,500 cwts. were only half of those during the corresponding period of the previous year, with substantial reductions in arrivals from Malaysia and Singapore. Consignments from Indonesia were also almost halved, and those from Brazil 25% smaller.

13.6 Imports into the United States during 1970 were 11% lower than in the previous year; the fall would have been greater but for substantial increases in supplies from Malaysia and India. During the first two months of 1971, however, there was some recovery compared with the corresponding period of the previous year, and continued increase in imports from India and a revival in those from Brazil, outweighed a further decline in consignments from Indonesia.

13.7 The Canadian imports of pepper during 1970 were around a quarter more than those in the previous year, with increased imports from Malaysia and India more than offsetting declines from other sources. Clearance during the first two months of 1971, however, was rather lower than that in the corresponding period of 1970.

13.8 During 1970, imports into West Germany, the chief pepper market in EEC, were 6% lower than in the previous year, as reduction in consignments from Indonesia and Brazil together were higher than the 51% increase in those from Malaysia together with the modest rise in import from Singapore. French imports during 1970 fell by 12% compared with 1969, with supplies from Madagascar and Brazil lower by 66% and 52% respectively; consignments from Malaysia on the other hand showed a substantial increase. During 1970, Italy imported some 14% less than in the previous year, following a fall of 45% in purchases from India, which was her chief source. Reflecting smaller supplies from Indonesia, imports into Netherlands during 1970 were 5% lower than in 1969. Those into Belgium, by contrast, were offset by a rise in those arriving via Singapore.

Prices

13.9 The price of Sarawak pepper started declining in July 1970, and continued through January 1971, when the commodity was quoted at 370 shillings per cwt. for black pepper special and 397 shillings six pence for white pepper. By the end of February, however, quotations had recovered by 30 shillings and 25 shillings respectively. Malabar black pepper which had closed the year 1970 at 500 shillings per cwt. rose to 535 shillings by the end of February.

13.10 The recovery of Sarawak pepper prices, which took place at the end of February 1971, was short-lived. With consumer demand generally remaining unimpressive, quotations drifted to low levels during the first three weeks of March 1971. Subsequently, however, reports that stock in Singapore market were tight and that the situation was not expected to improve before the arrival of the crop around July-August, caused prices to maintain a steadier trend for a while. These go to indicate the uncertainty of the prices in the pepper market.

13.11 The uncertainty of the pepper market has compelled the major pepper growing countries to sign an agreement at the 27th session of the ECAFE, held in Manila in April 1971, to establish an Asian Pepper Community. The major objectives of the organization are as follows:-

(i) To co-ordinate and stimulate research on technical and economic aspects of production;

(ii) To develop programmes for increasing consumption in traditional and new markets, including programmes of co-operation in promotional activities;

(iii) To intensify and co-ordinate research on new uses of pepper;

(iv) To further joint action for the relaxation of tariff and non-tariff barriers and for the removel of other obstacles to trade;

(v) To co-ordinate standards of quality so as to facilitate international marketing;

(vi) To keep under constant review developments relating to supply, demand and prices of pepper;

(vii) To co-ordinate investigations into the causes and consequences of fluctuations in the prices of pepper and to suggest proper solutions;

(viii) To improve statistical and other information on pepper production, consumption, trade and prices including techniques of forecasting.

13.12 While the formation of the community is a step in the right direction in the cause of joint co-operation, the effectiveness of the organization will be considerably undermined if other important producers, such as Brazil, do not join the community. They might impair the sales position of prices, in markets like the United States, which absorb nearly a quarter of total world trade in the commodity.

Demand Forecast

13.13 As a crop exposed to the hazards of weather and plant diseases, pepper is characterised by heavy year-to-year fluctuations in output. Such fluctuations will affect prices significantly, since overall demand is inelastic with respect to price. Apart from the minimum effect on producers' income and a country's export earnings, short-term supply and price fluctuations will affect production in the longer term, with a lag of roughly seven years. The yield of the plant is generally abundant in the sixth to the tenth year after planting, a deep decline substantially after the 15th year. Thus, the cyclical movement of production is generated. Such a situation was observed in the post-war years, particularly during the 1950s. Projection on production is made difficult by the gaps in current data and particularly by the lack of consistent long-term historical seeds.

13.14 A number of problems exist in analysing world consumption and hence in attempting its projections (i.e. inadequate statistical data on production, export, imports and stocks). Present indication supports the view that the import demand for pepper may be expected to continue to rise since consumption is determined by food habits (which change slowly over time) and by the increase in population. However, the annual rate of increase is most likely to be very small. No large expansion in world production could thus out-run demand and lead, as in some past years.

Sarawak Situation

13.15 Pepper cultivation in Sarawak, and for that matter, in almost all the producing countries, is a small industry. The acreage is limited by the necessity of hand-picking of the green berries. The average farm size varies from 0.5 to 1 acre. Pepper acreages in Sarawak are distributed in all the Divisions, though the largest concentrations are in the First, Second and Third Division. The estimated acreage in the First Division was 5,600 productive acres and 1,700 acres of young pepper. In the Third Division, there are at present an estimated 3,000 acres in the upper Rejang area and 6,000 acres in the lower Rejang area. Almost equal acreages are stated to be planted with pepper in the Second Division. The pepper areas in the Fourth and Fifth Division are still small, though increasing, particularly in the Fourth Division along the Miri-Bintulu Road in the Lambir-Subis area.

13.16 Pepper cultivation in the State is almost exclusively Chinese enterprise, though during the last few years, native farmers are increasingly taking up pepper cultivation. Their productivity, however, still remains poor compared to those of the Chinese farmers.

13.17 The lower productivity in the native gardens is attributed to the lack of capital for investment in fertilizer, especially for the first three years. Moreover, the land tenure system of Sarawak, which benefitted the natives with large land areas at their disposal, discourages intensive cultivation. Their Chinese counterparts on the other hand, who have very small land holdings, are compelled to intensify their cultivation.

13.18 Pepper cultivation is a capital-intensive enterprise, as would be evident from Table 13.5 worked out by the Federal Agricultural Marketing Authority.

Table 13.5

Establishment Cost/Acre*1 of Pepper

Year 1			
a)	Land clearance *2	$ 165.00	
b)	1 round ploughing and 1 round rotavating*2	60.00	
c)	Planting materials. 700 cuttings at $0.25 each*3	175.00	
d)	Fertilizer	32.00	
e)	Posts : 700 @ $1.20 each *4	840.00	
f)	Pesticides	9.00	
g)	Labour *5	1,050.00	
h)	Interest charge @ 8% on above expenditure for 3 years	559.50	2,890.50
Year 2			
a)	Fertilizer	$ 93.00	
b)	Pesticides	9.00	
c)	Labour	1,050.00	
d)	Interest charge @ 8% on above expenditure for 3 years	184.30	$1,336.30
Year 3			
a)	Fertilizer	180.00	
b)	Pesticides	18.00	
c)	Labour	1,200.00	
d)	Interest charge @ 8% on above expenditure for 1 year.	112.00	$1,510.00

*1 Pepper vines start economic production after the third year.

*2 Contract rates

*3 Although 700 cuttings are planted, final density at bearing will be around 600 to 650 vines/acre.

*4 Posts are of hardwood, able to last the economic lifespan

*5 Labour rates charged at $5 per manday.

Total establishment cost/acre up to first harvest	=	$5,736.80
Yield/acre of black pepper at first harvest	=	15 piculs
∴ Gross income : 15 piculs *6 $108.50/picul *7	=	1,627.50
∴ Remaining establishment cost to be apportioned to successive harvests	=	4,109.30
Vines can bear economically for the next 10 years *8		
∴ Establishment cost/acre/year for the next 10 years	=	$ 410.90

Recurrent cost/acre/year (after 1st harvest)

a)	Fertilizer	$ 181.00	
b)	Pesticides	18.00	
c)	Labour	1,500.00	
d)	Establishment cost	410.90	
e)	Interest share @ 8% on above expenditure per year	168.80	$2,278.70

13.19 It would be seen from the table that the cost of establishing an acre of pepper garden is about $5,750 in a period of three years, i.e. before harvesting could be undertaken. During the next 10 years (i.e. the economic yielding life of the vines) another $2,380 are required to be invested annually. Such capital investment from the farmers' own resources is very difficult to come by and therefore, a chain system of credit from the exporter to middlemen to farmer have developed over decades.

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*6 Yield at first harvest is very low.

*7 It is assumed that ex-farm price is 70% of Singapore F.O.B. prices. Average weekly price in December for Singapore F.O.B. was $155/- per picul of Sarawak Special Black Pepper, 96% N.L.W.

*8 After the 12th to 13th year, yields start to drop drastically.

13.20 The pepper trade in the State is characterized by the socio-economic aspects of the relationship between the farmer and the shop-keeper (third rank dealers), the second rank dealers, exporters, graders in Singapore, speculation in pepper shortage and sources of credit. The credit to the farmers is supplied by the rural shop-keeper, subject to the condition that the produce would be sold to him. On receipt of the produce, he sells it to the second rank dealer. The exporter provides credit to the second rank dealer who finally sells the produce to the exporter. Hence, the credit system follows a sort of chain connection. In fact, the entire production and trade of pepper in Sarawak is controlled through this credit system by the exporters and the second rank dealers. Sometimes, the second rank dealers are also the exporter.

13.21 Though pepper grown in Sarawak is of premium quality, the State Government has no control in ensuring this quality to the consuming markets, as Sarawak produced pepper is graded in Singapore and re-exported from there. The Singapore business houses are at liberty to grade it according to their convenience. Indonesian pepper, which is stated to be of inferior quality, is also exported through Singapore, and complaints are often received that the inferior Indonesian pepper is mixed with Sarawak pepper and exported under the brand "Sarawak Pepper". This results in Sarawak pepper obtaining a price which is lower than what is due. With a view to ensuring quality and also to reduce dependence on Singapore, the Government of Malaysia has lately announced the establishment of a Pepper Quality Control and Marketing Promotion Council, with the following objectives:-

(1) To ensure fair and equitable returns to the producers.

(2) To establish and prescribe a schedule of grades to enhance the saleability of the commodity "pepper" in overseas markets.

(3) To promote and expand the sale of pepper to consuming markets.

(4) To provide assistance and facilities to promote direct export to consuming markets.

(5) To assist production and processing by undertaking research and extension work.

13.22 The Council will operate in the States of Sarawak, Sabah and Johore where almost all the Malaysian pepper is grown.

13.23 While the establishment of the Board is timely and is a step in the right direction, its success in regard to item (1) above, would depend primarily on the supply of credit to the primary growers on easy terms. In this aspect, however, there does not appear to have been any provision made in the scheme.

Recommendations

13.24 During the course of field study, it was gathered that the State Government intended to introduce a subsidy scheme in pepper farming from next year. The size and content of the scheme has still not been worked out. As pepper plantation requires heavy fertilizing, the cost of plantation is sufficiently high, and unless the farmers, middlemen and exporters are adequately financed on easy terms, the implementation of the scheme is likely to be difficult. One exporter in Sibu stated that with the introduction of grading in Sarawak, he would have to pay extra interest on money borrowed from the bank, for the period his consignments are held up for grading. Unless the gain in price due to grading is commensurate with the combined loss, in terms of extra interest paid and the net loss of 3% due to grading, it is not profitable for anyone to grade the pepper before export. It would, therefore, be necessary to simultaneously take the industry out of this debt, if the quality control sch [illegible]

13.25 Based on the cost structure at Table 13.2, it is estimated that the credit requirement of the indus[illegible]uld be around $40 million annually on 75:25 basis for the next 5 years. As the Board would concern itself primarily with quality control, grading and sales promotion, the State Development Finance Corporation should undertake financing the pepper plantation industry. Though the corporation has, in the past, provided loans for pepper cultivation, the loans to individual farmers are inadequate and should be increased considerably. The requirement of finance and operation of the system would require a detailed study, and if necessary, assistance might be requested from UNIDO.

13.26 Further, there is no regular shipping services between Sarawak and the ports in the consuming countries, a situation which places Sarawak in a disadvantageous position, not only for pepper, but for almost all trading matters. On the other hand, the shipping services between Singapore and other countries are regular and freight rates are also cheaper at least by $30.00 to a ton. This difficulty also has to be overcome if Sarawak is to make a foothold in the overseas market, without going through Singapore.

13.27 Many studies have already been carried out in regard to the production, processing and marketing aspect of pepper in Sarawak during the last 30 years. Therefore, any discussion here would be a repetition of those that have already been recommended and therefore no attempt is made at that.

CHAPTER XIV

OTHER MINOR AGRICULTURAL CROPS

NIPAH

14.1 Nipah, a semi-wild plant grown in the swamps of Sarawak, is mostly concentrated in the Sarawak mangrove forest reserves in the First Division, Loba Pulau area (Rejang), Kenalian forest reserve (Lawas) and Awat-Awat (Lawas) unreserved forest. Nipah plantations also occur in small, but varying sizes, all over the State.

14.2 The Nipah plant is about a foot high with long stems (15-20 feet), and leaves (3-4 feet), similar in shape to those of the coconut tree. The plants are vegetatively propagated. Flowering takes place once a year from the fourth year of plantation, and the economic life of the plant is about 30 years from then.

14.3 The flowering takes place at the end of a central stem. The flower, when mature drops off and the stem is ready for yielding a kind of juice, from which the natives of Sarawak produce sugar.

14.4 When the flower drops off, the stem is cut at the top at about an inch, and an earthen pot is fixed to it into which the juice is collected. Every morning, one person would empty the pot and again placed it back on the stem, after cutting another inch or two of the stem. The process continues till the entire stem is exhausted and this occurs during a period of about 3 months, usually starting from August.*

14.5 The collected juice is boiled for about 4 hours and the final product is a brown colour solid which, in properties, is comparable to jaggery. This product is either consumed by the poorer section of the population as a substitute for sugar, or sold to the two distilleries in Kuching, who produce inferior quality alcoholic drinks from it.

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* Though some of the farmers do not agree with this and they claim that Nipah plantations can be worked all the year round.

The sale to the latter has lately reduced considerably, as the distilleries are operating only 50 - 60 days a year, due to their inability to compete in the local market. This has resulted from the high excise duty on alcoholic drinks.

14.6 There is practically no information available on nipah acreage and production of nipah products in Sarawak. However, field enquiry revealed that about 24 gallons of juice are collected per day, from an acre of nipah plantation, and the jaggery yield is about one-sixth of this or 40 lbs. With the current market price of 15 cents per pound, and assuming possible collection for 80 days, the total return per acre is $480 per annum. As no input is necessary, except labour (one man can operate 3 acres), this return per acre is quite good, particularly from swampy lands which otherwise have no use.

14.7 Not much work has been done on the possibility of improved utilization of nipah sugar. It has, however, been found that the sugar content of the sap varies between wide limits; in some samples it was found to be as much as 23% while in others it was only 8%. An analysis of brown jaggery indicated that it contained 64% maltose. However, these results are too scanty for any conclusion to be drawn and it is suggested that UNIDO depute one of their experts on this subject for working out the feasibility of utilizing nipah sugar for the production of industrial alcohol or other usuable products.

14.8 The nipah leaves are used by the natives for thatching. The stems of the leaves are used as fuel for boiling the juice thus saving the cost on it.

14.9 The exact acreage under nipah palm in the State is not known. Various agencies have made their own guesses and most of these estimates place the nipah palm acreage around 40,000 in the whole State, and 16,000 in the First Division. Some even place it at as low as 10,000 - 12,000 acres. It would be futile to comment on these estimates in the absence of adequate information.

14.10 It has been recommended in Chapter V, that a sugar factory be established in the State. This factory will yield a substantial quantity of jaggery which might be processed into alcohol. The jaggery from nipah could be an addition to the input for such a plant. However, before venturing into such an alcohol manufacturing project, it would be necessary to ascertain the quantity likely to be available continuously.

14.11 The UNIDO study suggested earlier could look into this possibility and in the meantime, the State government should carry out a survey to assess the acreage under nipah palm, their locations, present system of disposal, price, employment, etc. which the UNIDO expert would need for his study. Further, a detailed chemical analysis of the nipah jaggery should also be carried out, either in the Agriculture Department laboratory, or in the Science Laboratory of the University of Malaya.

WHEAT

14.12 Wheat, in the form of wheat flour, is an essential food item all over the world. The flour is consumed in various forms, such as bread, chapatti, nan, noodles, meehoon etc. In biscuit and confectionery also, wheat flour is the main ingredient.

14.13 Wheat is not grown in any part of Malaysia and the country's total requirement of this commodity is met by imports. At one time, both the wings of Malaysia were importing wheat flour. Today, with the establishment of two large flour mills, West Malaysia is importing only wheat, and grinding is done locally. The East Malaysian States however, still import wheat flour.

14.14 Though the total grinding capacity in West Malaysia is sufficient to meet both the West and East Malaysian demand, very little supply in East Malaysia is obtained from this source. In 1970, against a total import of 11,577 tons of wheat flour into Sarawak, the West Malaysian share was only 37.36 tons. The performance of West Malaysian wheat flour in Sabah was no better. This state of affair is mainly due to the reluctance of West Malaysian millers due to expensive and irregular shipping facilities, just to supply a small market. The shipping facilities between the two wings of Malaysia is not likely to improve considerably in the foreseeable future. Hence, the import of wheat flour into the two East Malaysian States from West Malaysia is not expected to increase by any extent.

14.15 Both Sarawak and Sabah import more than 90% of their total requirement from Singapore. Some supplies are also obtained from Australia and Hong Kong; these quantities however, are very small. The import of wheat flour into Sabah and Sarawak is shown in Table 14.1, and the Sarawak imports from various sources is shown in Table 14.2.

14.16 The total import of wheat flour in East Malaysia has increased from 16,735 tons, valued at $5.47 million in 1966, to 21,426 tons, valued at $6.395 million in 1970. This works out to an annual average rate of increase, in volume, during the period, at 5½% and the corresponding increase in value at 4½%.

14.17 Consumption of wheat flour is dependent directly on the increase of population and indirectly on the rise in the standard of living, which enhance, to a certain extent, the consumption of items like biscuit, confectionery, etc. With the rise in the standard of living, changes also take place in food habits, which are likely to result in increased consumption of flour, especially in the case of Asian countries where rice is still the main staple food.

14.18 In the Chapter on Existing Industries, it has been suggested that the existing biscuit factories and confectioneries should expand their production with the view to replacing that part of the import which is not affected by consumer preference. If this recommendation is given effect to, increased quantity of flour would be required for the additional production and it is estimated that this would amount to about 2% of the current volume of wheat imported. The total average increase in flour consumption in the State would therefore be 7½% annually up to 1980. Based on this average increase, the combined estimated requirement of wheat flour for East Malaysia would be around 37,000 tons by 1980.

Table 14.1

Import of Wheat Flour into Sabah and Sarawak 1966-1970

Value - '000 M$

State \ Year	1966 Vol. (Tons)	1966 Value (M$)	1967 Vol. (Tons)	1967 Value (M$)	1968 Vol. (Tons)	1968 Value (M$)	1969 Vol. (Tons)	1969 Value (M$)	1970 Vol. (Tons)	1970 Value (M$)
Sarawak	9006	2897	10167	3244	10810	3450	11394	3550	11577	3558
Sabah	7727	2573	8245	2659	8031	2730	7802	2575	9849	2837
Total	16735	5470	18412	5903	18841	6180	19196	6125	21426	6395

Sabah

Rate of increase (average)
Vol. - 7%
Value - 5½%

Sarawak

Rate of increase (average)
Vol. - 6½%
Value - 2½%

Total

Rate of increase (average)
Vol. - 5½%
Value - 4¼%

Table 14.2

Sarawak Imports of Wheat Flour for the Year 1966 - 1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Ton	$	Ton	$	Ton	$	Ton	$	Ton	$
Australia	1,411.30	485,421	916.07	525,032	1,185.69	412,981	831.02	287,832	597.05	210,543
France	159.91	48,167	239.68	72,231	60.09	15,771	-	-	-	-
Germany, West	-	-	122.32	32,301	32.32	9,557	15.62	4,400	-	-
Hong Kong	320.52	99,422	224.64	69,073	140.16	42,809	111.33	32,199	317.28	90,842
India	5.64	2,113	3.36	1,243	2.62	957	2.59	968	3.50	1,212
Japan	10.00	2,876	10.00	2,946	5.00	1,431	-	-	40.00	10,707
Malaysia, West	239.45	85,487	2.12	779	-	-	14.05	6,907	87.35	35,433
Singapore	6,704.87	2123,796	8,614.17	2723,096	9,575.91	2960,406	10413.42	3210,870	10,530.12	3205,802
Thailand	-	-	-	-	5.00	1,546	-	-	-	-
United Kingdom	4.99	6,409	5.72	7,890	3.65	4,439	5.75	6,531	2.30	2,093
U.S.A.	40.44	8,493	29.21	9,141	-	-	-	-	0.02	23
Canada	51.87	22,257	-	-	-	-	-	-	-	-
China Mainland	48.58	9,933	-	-	-	-	-	-	-	-
Formosa	8.92	2,862	-	-		-	-	-	-	-
Total	9,006.49	2,897,236	10,167.29	3,243,735	10,810.44	3449,907	11393.78	3549,707	11,577.64	3,557,755

In addition, the demand of wheat flour in Brunei, which is at present 2,500 tons, is also likely to increase to 5,000 tons by the end of 1980. Hence, by 1980, the total demand of wheat flour in the region would be well over 40,000 tons per annum.

14.19 Such a demand would justify establishment of milling facilities in the region both in view of the importance of wheat flour as a food item, and also for replacing imports of wheat flour from other countries.

14.20 There could either be two plants, each with an annual capacity of about 20,000 tons, one in each State, or, there could be only one plant of 40,000 tons annual capacity located either in Kuching or in Kota Kinabalu. The former suggestion would be preferable if the present transport facility is not improved, as in that case, the cost of distribution would be reduced. The second proposal, though economically more profitable, would entail higher consumer price because of the difficult transport system in the region.

14.21 For a plant with a capacity to mill 20,000 tons of wheat flour, working 250 days a year, on two shifts, the fixed investment required would be of the order of $1 million and the working capital $½ million. Such a plant would employ around 40 workers of different categories.

14.22 A 40,000 tons plant, on the other hand, would require a capital investment of about $1.8 million in fixed assets and the working capital requirement would be of the order of $800,000. This plant can employ about 63 workers.

14.23 As these units are standard ones and no sophisticated skill is involved, detailed analysis of the process, costs, etc. are considered unnecessary.

Other Crops

14.24 The agriculture research division of the State Government is currently carrying out trials on the prospects of growing mushroom, castor, ginger, essential oil bearing plants, banana etc. While their efforts in this direction are praiseworthy, the available information is still inadequate. A study of the scope of industrial processing of these agricultural produce for both international and home markets, can only be undertaken after it has been established that the crops can be grown profitably in the State. However, the State Government might, at this stage, examine whether assistance in any of these fields could be requested of UNIDO.

CHAPTER XV

LIVESTOCK

General

15.1 Climatological factors generally play an over-whelming part in determining both the supply of, and the demand for, livestock products in developing economies. The tropical plant growth in Malaysia makes it difficult to establish livestock carrying pastures, such as occur naturally in temperate climates. Both climatic and soil conditions do not favour extensive cereal growing, which would provide the raw material for livestock production. Instead, tropical conditions favour the development and spread of animal diseases and parasites.

15.2 The development of a livestock industry in Malaysia in the past, has been hampered by diseases and other limitations of a technical nature. Such limitations are now probably of less significance then limitations of an economic or social nature. There is the generally competitive relationship between crop and animal production; and the lack of complementary relationships between the two. Unlike many other countries, where it is necessary to integrate livestock closely with the overall farm economy, in Malaysia, good profits have been obtained from growing crops without livestock.

15.3 Pig farming, poultry, rearing of cattle, buffaloes and goats for meat purposes are generally carried out in Sarawak by small farmers. There is no large scale enterprises in the State. A few dairy farms are also found in the vicinity of Kuching, and these are also small in nature.

15.4 The estimated livestock population of Sarawak for the period 1960 - 1970 is shown in Table 15.1. The overall livestock population has not varied significantly over the years. Only slight variations in the population are indicated from year to year. Pig farming is by far the most important. Table 15.2 shows the slaughterings of livestock in Sarawak for the period 1962 - 1970. Like the livestock population, there has not been any significant differences in the number of slaughterings over the years.

Table 15.1

Estimated Livestock Population 1960 - 1970

Year \ Species	Cattle	Buffaloes	Pigs	Goats
1960	11,116	9,364	177,586	9,021
1961	7,620	9,982	255,841	8,813
1962	10,151	12,310	287,518	11,371
1963	10,605	6,743	302,982	10,465
1964	9,766	8,463	278,712	10,219
1965	7,082	7,861	218,277	8,224
1966	6,648	7,503	227,931	6,864
1967	8,296	7,768	225,219	7,454
1968	7,978	8,630	206,705	8,136
1969	8,730	7,460	196,380	7,480
1970	8,939	8,441	211,790	7,566

Pig Farming

15.5 Commercial pig keeping in Sarawak is almost an exclusive Chinese enterprise. The natives of the State (Dayaks and others) also rear pigs, but compared to those belongings to the Chinese, the number is small.

15.6 The Chinese farms in the State are managed reasonably well. The pigs are large and healthy, and in littering, an average of 12 pigs per sow per annum are obtained (one litter). Occasionally, as high as 14 pigs are also obtained in some of the best farms in the State.

Table 15.2

Slaughterings of Livestock

1962 - 1970

Species / Year	Cattle	Pigs	Buffaloes	Goats
1962	1,030	44,654	716	816
1963	989	50,375	768	417
1964	231	44,439	1,575	672
1965	353	46,951	1,636	480
1966	867	70,829	1,273	469
1967	1,113	68,685	1,398	686
1968	1,364	60,947	1,066	612
1969	1,115	61,974	1,220	546
1970	1,193	70,784	1,061	493

Note: The figures for Slaughterings of Livestock are collected from various district councils within the State. These data include livestock slaughtered outside the slaughtering house.

The pigs reared by the natives on the other hand, are small in size and almost half the time fed from the leftovers of the household. The output of these pigs is around 3 pigs per sow per annum. Compared to the live weight of the pigs at slaughter in the Chinese farms which is as high as 260 lbs. per pig, the mean live weight at slaughter in the case of pigs reared by natives is only about 130 lbs.

15.7 Though the total livestock population remained somewhat constant during the entire period, the pig population of the State had increased steadily from 177,586 in 1960 to 302,962 in 1963 and then declined to 196,380 in 1969. This fall is attributed to the severe outbreak of swine fever in 1967. Though the disease was put under control by the veterinary services of the State government, the lives of a large number of pigs were lost. The pig farming industry however, recovered considerably in 1970 as illustrated by the population of 211,790 in that year.

15.8 The largest concentration of pig population is found in the Third Division. The native pigs are also concentrated mostly in this Division. The estimated pig population by Divisions for the period 1968 - 1970 is shown in Table 15.3

Table 15.3

Estimated Pig Population by Division 1968 - 1970

Year	First Division	Second Division	Third Division	Fourth Division	Fifth Division	Total for State
1968	22,923	22,968	126,654	28,943	5,217	206,705
1969	28,526	22,082	115,571	20,571	9,631	196,381
1970	35,030	18,587	134,031	14,475	9,667	211,790

15.9 With the decline in pig population, slaughter also declined considerably. As against 68,685 pigs slaughtered in 1967, only 60,947 pigs were slaughtered in 1968 and 61,974 were slaughtered in 1969. In 1970, there was considerable improvement and the slaughter figure increased to 70,784 (Please see Table 15.2). Based on a live weight of 220 lbs. per pig at slaughter, and assuming that the slaughter weight is 80% of the live weight, the quantity of pork produced in the slaughter houses amounted to 5,560 tons in 1970.

15.10 Only a part of the native pigs is slaughtered for domestic consumption and the rest is marketed. The number of pigs slaughtered from the native sources in 1970 was 10,920. Based on a live weight of 130 lbs. per pig, and a recovery of 80% of consumable meat, another 505 tons of pork was thus available for consumption.

15.11 For the improvement of the native pig keeping, the government initiated a subsidy scheme called "Ulu Pig Subsidy Scheme" under which trainees from the farmers training centres are provided with good weaners, high protein feed and materials for pig-sty construction. The issue of units from 1967 - 1970, by Divisions, under the scheme is shown in Table 15.4. The scheme has however, not been able to make much headway, perhaps, due to the market, being far away from the native long houses. In addition, the government also supplies pure bred boars to commercial pig farmers, at a subsidized rate, to maintain good quality herd.

15.12 The exact import of pork and pork preparations into Sarawak is difficult to obtain as some of the preparations are mixtures of pork, beef and veal. However, the Dutch Team on Regional Planning Study of the First Division of Sarawak estimated that in 1967, the quantity of pork and pork preparation imported into the State approximated to 11,675 tons. Assuming that there was no substantial rise in import in 1970, the total pork consumed in the State in 1970 was about 17,740 tons or roughly 4 lbs. per head. As the population belonging to the Muslim faith and some others, do not consume pork at all, the per capita consumption of pork of the pork consuming population, mainly Chinese, was perhaps much higher.

Table 15.4

Ulu Pig Subsidy Scheme - Issue of Units 1967 - 1970

Division	1967		1968		1969		1970		TOTAL	
	No. of Units	Weaners	No. of Units	Weaners	No. of Units	Weaners	No. of Units	Weaners	No. of Units	Weaners
First	48	148	57	111	59	177	30	78	194	514
Second	15	45	17	42	32	96	30	90	94	273
Third	39	117	23	67	38	114	34	102	134	400
Fourth	15	34	21	38	11	33	26	77	73	182
Fifth	24	40	14	42	40	119	21	63	99	264
Total	141	384	132	300	180	539	141	410	594	1,633

Note: Figures for 1970 are subject to alterations. A unit of ulu pig subsidy is worth 3 crossbred weaners plus $200/- worth for feeds and housing.

15.13 The current price structure in the market for pork in Sarawak is as below:-

Retail Prices in Kuching, Sibu and Miri

Pork (lean)	-	$3.40 per lb.
Pork (lean and fat)	-	$1.20 per lb.
Producers price (liveweight)	-	90 cents to $1 per lb.

15.14 In view of the high demand and good price of pork in Sarawak, large scale pig farming should be encouraged in the state. In particular, the Sarawak natives should be urged to venture into pig farming, and assistance with regards to farm management and finance should be provided to them. Supplementary income derived from this industry would certainly help to raise their standard of living.

Beef and Veal

15.15 The cattle and buffaloe population of Sarawak is very small and in both cases, varied from 6,000 to 9,000 during the years 1966-70, as would be seen from Table 15.1. There is no cattle farm as such and the cattle are maintained by farmers in the backyards. In 1970, a total of 2,254 cattle and buffaloes were slaughtered. Based on an estimated slaughter weight of 70% on an average live weight of 800 lbs., the total production of beef and veal was 1,262,240 lbs. In addition, the import of beef and veal was about 1,120,000 lbs. The per head consumption of beef and beef preparation, 1970 therefore, was 2.38 lbs. which is quite low compared with other countries in the region including West Malaysia.

15.16 The retail price of beef per lb. in Kuching and other important centres in 1970 was around $2.50 per lb. and the producers receive a live weight price of 85 cents per lb. and slaughter weight price of $1.10 per lb. These prices compare well with those in West Malaysia.

15.17 The rearing of cattle in Sarawak has never been a full-time occupation. This is because of the poor return from such an undertaking. Unless something is done to place livestock farmers on a sound economic footing, it is feared that cattle rearing would receive little attention, thus resulting in marked decline in the animal population. If this trend is allowed unchecked, it would mean that in time to come, the entire demand of beef would have to be met from import.

15.18 In the light of this, it is recommended that cattle rearing for beef be undertaken in the state. However, as a lot of information gap still exists for large-scale cattle rearing in the state, and large-scale cattle rearing would entail heavy capital outlay and know-how, only modest-scale cattle rearing should be undertaken initially.

Fresh Milk

15.19 Fresh milk is produced in a few dairy farms in the surroundings of Kuching and the milk is sold at about 80 cents per pint. The total annual production may be estimated at 25 tons of fresh milk. The State's import of milk and milk products is around 4,600 tons valued at $7.88 million. This is a substantial consumption and calls for a separate study to look into the possibility of establishing a dairy farm on modern lines. UNIDO might consider providing assistance for such a study.

Mutton

15.20 In 1970, some 493 goats were slaughtered while about 400 tons of mutton and lamb were imported. The per capita consumption of meat was much less than one-tenth of a pound. Demand for mutton and lamb in Sarawak is not expected to increase considerably as there is not a large potential mutton consuming population.

Poultry

15.21 The production of broilers in Sarawak is very negligible and slaughter consists mostly of culled laying birds. It is estimated that there are about 360,000 commercial laying birds in the State. Assuming a laying period of 18 months, around 200,000 old birds are slaughtered annually. With a total weight of around 178.5 tons, the total production of commercial poultry might have amounted to 143 tons based on a recovery of 80%. The number of fowls and chickens slaughtered from the native stock is not known. The Dutch Team, however, has estimated this slaughter at 96,000 birds, each having a live weight of 1.3 lbs. The total production from this source, on this basis, works out to 420 tons.

15.22 In addition, around 120 tons of poultry are imported into Sarawak annually. Considering the consumption of ducks and geese, the average per capita consumption of poultry in the State may amount to 2 lbs. The producer's price of old birds was around $1.00 to $1.20 per lb. of live weight as against a retail price of $1.40 to $1.80 per lb. of live weight.

15.23 In regard to egg production, Sarawak is considered to be self-sufficient with a total consumption of 79 million eggs per annum and against a total production of 74 million eggs in 1967.

15.24 Table 15.5 below shows the consumption of meat in Sarawak for the period 1967 - 1990, as worked out by the Dutch Study Team.

Table 15.5

Consumption of Meat in Sarawak, 1967 - 1990

	Units	1967	1975	1980	1985	1990
Population	thousands	930	1,220	1,450	1,730	2,040
Per caput consumption of;						
- beef and veal 1)	kg. per year	1.25	1.50	1.75	1.95	2.20
- mutton, lamb and goat	- do -	0.05	0.06	1.06	0.07	0.08
- pork	- do -	12.70	13.70	14.50	15.20	16.00
- poultry 1)	- do -	1.50	1.90	2.15	2.15	2.85
- total meat	- do -	15.50	17.16	18.46	19.67	21.13
Total demand for :						
- beef and veal	tons	1,125	1,800	2,500	3,300	4,400
- mutton etc.	- do -	46	72	86	119	161
- pork	- do -	11,675	16,440	20,700	25,900	32,100
- poultry	- do -	1,200	2,280	2,070	4,170	5,720
- total meat	- do -	14,846	20,600	26,300	33,500	42,500

1 Assumed income elasticities of demand: 1.2, 1.0, 0.5 and 1.4 respectively, which seems to be a reasonable assumption according to the F.A.O. Agricultural

Commodities Projections 1975 and 1985. Furthermore a growth of the per caput income of 2% annually has been assumed. The price level is supposed to remain at the 1967 level.

15.25 It would be seen that there is likely to be a great increase in the demand for meat and meat products in Sarawak and it would be necessary for the State Government to work out the programme of establishing large pig farms and cattle farms in the State to meet the increased demand. For the economics of establishing such farms, the State Government might refer to the industrial potentiality study of Sabah conducted by FIDA, wherein the cost estimates for such farms have been provided. These estimates with necessary adjustments can be applied for Sarawak.

EXISTING AGRO-INDUSTRIES AND FOOD PROCESSING INDUSTRIES

General Performance

16.1 The Statistics Department of the Government conducts annual survey of the manufacturing industries in the State. The latest survey report available relates to the year 1969. According to this survey, there were 1,943 industrial establishments in the State in 1969 as against 1,591 in 1966, 1,674 in 1967 and 1,739 in 1968. The corresponding percentage rises were 4, 5 and 11 respectively. The higher rate of increase in 1969 was perhaps due, among other reasons, to the growing awareness in the local business community of the necessity of local production, in view of the progressive withdrawal of preferential import duty enjoyed previously by the East Malaysian State. Moreover, the demonstrative effect of massive industrialisation taking place in Singapore and West Malaysia is also reflected in this. Some basic information on the manufacturing industries for the period 1966 - 1969 is shown in Table 16.1.

16.2 The number of agro-processing and food manufacturing industries did not increase substantially as would be evident from the table. This is due to various reasons. In the case of agro-processing industries i.e. rubber remilling, sago factory, etc. which depend largely on international market, there was in fact a drop due to the declining prices of the commodities. In the case of industries like coconut oil mills, the drop in the number of establishments was mainly due to the short supply of raw materials. Though the decline in the number is not appreciable, these factories often worked much below capacity as and when the prices dropped.

Table 16.1

Manufacturing Industries Survey 1966 - 1969

INDUSTRY	1966 No. of Est.	1966 Value of Output	1966 Value of Materials	1966 Value Added	1967 No. of Est.	1967 Value of Output	1967 Value of Materials	1967 Value Added	No. of Est
[illegible] of Estate Type Agriculture Products in Factories off Estate	[illegible]8	11,523,942	9,577,366	1,945,676	80	11,138,148	9,722,218	1,415,930	83
Rubber Remilling off Estates	25				24				[illegible]
[illegible] of Estates	4				45				[illegible]
[illegible] Oil Mills	7				3				
[illegible]	[illegible]7	12,51[illegible],335	[illegible],173,964	3,[illegible],931	510	14,652,209	10,461,362	4,190,847	55[illegible]
Manufacture [illegible]	[illegible]				1[illegible]				[illegible]
Manufacture [illegible]					5				
[illegible]	[illegible]				3				[illegible]
[illegible]	2[illegible]				63				[illegible]
[illegible] M[illegible]	[illegible]91				313				34[illegible]
[illegible]	[illegible]				23				2
[illegible]	[illegible]5				41				4[illegible]
Manufacture [illegible] [illegible] Dessicated [illegible] Products	[illegible]2				14				1
[illegible]	[illegible]				5				
Manufacture of Coffee					9				
Ice Factories	[illegible]				11				11
Manufacture of S[illegible] Po[illegible]					1				1
Manufacture of Prepared Animal Feeds					2				2
Manufacture of Y[illegible]t	[illegible]				2				[illegible]
[illegible] Manufacturing Industries	1[illegible]	[illegible]	[illegible]	[illegible],[illegible]6,136	18	6,734,[illegible]37	2,[illegible]	3,[illegible]7,339	1[illegible]
Distilling, Rectifying & Blending of Spirits	3				3				3
Manufacture of Soft Drinks & Carbonated Beverages	1[illegible]				15				1[illegible]
Manufacture of Tobacco Products	3	[illegible],743	[illegible]47,759	232,934	1	497,243	112,[illegible]	385,181	5
Manufacture of Wood and Rattan Products Except Furniture; Manufacture of Furniture & Fixtures	1[illegible]9	55,[illegible],134	31,553,[illegible]71	24,096,223	21[illegible]	70,318,767	[illegible],466,969	31,[illegible]51,793	1[illegible]7
Sawmills	[illegible]7				69				[illegible]
Planing Mills, Window & Door Mills & Joinery [illegible]	7				11				1[illegible]
Manufacture of Coffins	6				6				-
Plywood and Particle Board Mill	[illegible]				1				[illegible]
Manufacture of Furniture & Carpentry	1[illegible]3				123				102
Manufacture of Household Furniture of Rattan [illegible]	4				6				
[illegible] Refineries	1	155,4[illegible]2,937	131,497,301	23,945,636	1	161,522,906	[illegible]	21,550,7[illegible]0	1
Manufacture of Transport Equipment	13[illegible]	4,566,903	2,023,225	2,543,653	180	6,123,245	[illegible],830,327	3,297,91[illegible]	212
Ship Building & Repairing	[illegible]				9				11
Marine Engine Repairs	25				17				1[illegible]
Motor Vehicle Repairs	40				54				61
[illegible]	75				100				11
Repairing of Motor Cycles & Scooters					-				[illegible]

SECTION 1

Table 16.1

Manufacturing Industries Survey, [illegible] - 1969

[illegible]	1967				196[illegible]				1969			
	No. of Est.	Value of Output	Value of Materials	Value Added	No. of Est.	Value of Output	Value of Materials	Value Added	No. of Est.	Value of Output	Value of Materials	Net
[illegible]	30	11,138,148	9,722,218	1,415,930	83	13,881,731	11,958,178	1,923,553	82	15,336,340	13,386,854	1,949,486
	24				20				22			
	45				54				51			
	[illegible]				9				9			
[illegible]	[illegible]	14,652,209	10,461,362	4,190,847	550	14,001,077	9,927,487	4,073,590	568	18,835,652	13,541,398	5,294,254
	[illegible]				20				24			
	[illegible]				5				6			
	[illegible]				3				4			
	[illegible]				60				62			
	413				345				352			
	[illegible]				28				27			
	[illegible]				42				45			
	[illegible]				16				17			
	[illegible]				6				7			
	[illegible]				9				8			
	11				11				10			
	1				1				2			
	[illegible]				2				2			
	[illegible]				2				2			
[illegible]	[illegible]	[illegible]	[illegible]	3,387,339	13	8,011,914	3,570,415	4,441,499	18	7,170,306	3,273,802	3,896,504
	[illegible]				3				3			
	[illegible]				15				15			
[illegible]	1	497,243	112,462	385,181	5	1,155,796	627,516	528,260	3	623,976	359,036	264,940
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	187	76,070,577	45,450,900	30,619,677	217	83,838,392	43,577,598	35,261,294
	[illegible]				65				67			
	11				11				13			
	[illegible]				-				5			
	1				1				1			
	[illegible]				102				123			
	[illegible]				3				3			
[illegible]	1	161,522,966	[illegible]	21,550,730	1	171,402,557	149,494,220	21,908,330	1	172,378,432	147,169,642	25,208,790
[illegible]	[illegible]	6,123,245	[illegible]	3,297,918	212	7,209,484	3,744,495	3,464,989	229	7,936,642	4,148,007	3,788,635
	9				11				13			
	17				19				21			
	54				61				77			
	[illegible]				[illegible]				114			
	[illegible]				3				4			

2/...

SECTION 2

INDUSTRY	1966				1967				
	No. of Est.	Value of output	Value of Materials	Value Added	No. of Est.	Value of Output	Value of Materials	Value Added	No. of Est.
Other Industries	640	24,201,518	14,720,079	9,481,440	666	27,476,[illegible]	17,510,332	9,966,[illegible]	[illegible]
Manufacture of Footwear (Except Rubber Footwear) Other Wearing Apparel & Make-up Textile [illegible]	[illegible]				250				[illegible]
Printing, Publishing & Allied Industries	19				17				1[illegible]
Manufacture of Rubber Products	[illegible]				8				1[illegible]
Manufacture of Chemical Products	[illegible]				3				[illegible]
Manufacture of Non-Metallic Mineral Products Except Petroleum Products	24				26				[illegible]
Manufacture of Metal Products Except Machinery and Transport Equipment	32				39				104
Manufacture of Machinery Except Electrical Machinery	32				34				41
Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies	50				51				57
Manufacture Jewellery, Gold & Silverware	1[illegible]				112				117
Manufacture of Signs & Advertising Displays	[illegible]				7				[illegible]
Repair of Watch & Clocks	44				49				54
Manufacture of Paper Boxes, Bags & Other Containers	-				1				1
Manufacture of Chemical Fertilizers	-				1				1
Manufacture of Matches	1				1				1
Metal Coating, Stamping, Polishing, etc.	-				-				1
Spray Painting Shops	-				1				1
Manufacture of Plastic Products	2				2				[illegible]
Manufacture of Metal Smallware, Stamps & [illegible]	2				2				[illegible]
Repair to Office, Commerce & Household Machinery	-				2				-
Manufacture of Wooden Boxes, Cases & Crates	-				-				1
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	1,674	298,469,[illegible]	221,922,654	76,546,752	1,73[illegible]

SECTION 1

	[illegible]				1 9 [illegible]				1 9 6 9			
	No. of Est.	Value of Output	Value of Materials	Value Added	No. of Est.	Value of Output	Value of Materials	Value Added	No. of Est.	Value of Output	Value of Materials	Net
[illegible]	[illegible]	27,476,[illegible]	17,[illegible]	9,966,959	683	27,[illegible]5,779	17,519,331	1[illegible],135,[illegible]	875	31,672,572	19,535,965	12,136,607
	[illegible]				23[illegible]				292			
	17				16				21			
					10				11			
	[illegible]				3				3			
	[illegible]				20				32			
	[illegible]				104				114			
	44				41				61			
	51				57				68			
	11[illegible]				117				124			
	[illegible]				9				12			
	[illegible]				54				72			
	1				1				1			
	1				1				1			
	[illegible]				1				1			
	-				1				1			
	[illegible]				1				1			
					2				3			
	[illegible]				2				3			
					-				2			
	-				1				2			
	[illegible]1,7[illegible]	[illegible],459,[illegible]	221,[illegible]	76,546,752	1,739	319,338,915	242,292,562	77,096,353	1,943	337,792,812	249,992,302	87,800,510

SECTION 2

16.3 The number of food manufacturing units has increased from 497 in 1966 to 568 in 1969 representing an average increase of around 14% during the period; the higher increase of 8% was during 1968. These food industries consisted of ice-cream manufacture, manufacture of pickles and sauce, other fish preparation and preserving, sago mills, rice mills, biscuit factories, etc. (See Table 16.1, column 1).

16.4 The number of beverage manufacturing industries in 1966 were 17. In 1967 one more was added and during the next two years it remained the same. This group of industries included distilling, rectifying and blending of spirits from locally grown nipah "sugar" and manufacturing of soft drinks and carbonated beverages.

16.5 In terms of value of output, the agro-processing industries accounted for something between 4½% to 5½% annually of the total output in the manufacturing sector during the period under review. The food processing industries performed somewhat better where the value of output increased from about 6% in 1966 to around 8% in 1969.

16.6 In terms of value added, the performance of these two sectors remained around 3% - 4% of the value added by all types of industries.

16.7 Figures on employment for 1969 are not available yet. However, in 1968 the agro-base industries employed 389 full-time workers and 86 part-time paid workers. The corresponding number of unpaid workers or family workers during the year were 74 and 44 respectively. As against this, the food industries employed 1,147 full-time paid workers and 166 part-time paid workers. The number of unpaid workers were 324 full-time and 307 part-time. There were no part-time paid workers in the beverage manufacturing industry and the number of full-time unpaid workers were only 12. The tobacco manufacturing industry employed 63 full-time workers. The rubber industry which also includes the manufacture of rubber footwear in three establishments employed 79 full-time and 4 part-time paid workers. The manufacturing of soap, washing and cleaning compounds in 3 existing establishments employed 22 full-time paid workers and 3 full-time unpaid workers. The combined percentage share of the agro-processing, food and beverage industries in the industrial employment of the State is shown in Table 16.2.

Table 16.2

Full-time Unpaid	Part-time Unpaid
33%	67%
Full-time Paid	**Part-time Paid**
16%	58%

The high percentages of unpaid workers, both full-time and part-time and also paid part-time, clearly indicate that a large section of the total industrial establishments in the food and agro-industry sector are family enterprises, where apart from the head of the family and the mother, school-going children also work either on wage or with a small allowance.

16.8 Though the per unit value of output in agro-industries was as high as $167,000 in 1968, these units are really small as the bulk of this value is made up of the cost of raw materials which are rubber in the case of rubber remilling and rubber smokehouses, and copra in the case of oil mills. In the food manufacturing industries, the average value of output is around $22,500, illustrating the small size of the factories. In fact, except for one fish processing factory, 3 biscuit factories and a few sago and rice mills, all other food processing units are insignificantly small. In the beverage manufacturing sector, the bulk of the value of output is made up by the bottling plant of Fraser & Neave, the internationally known beverage manufacturer.

16.9 The present position of the various industries are discussed below:

Rubber-Base Industries

16.10 Rubber remilling off-estates and rubber smokehouses off-estates are maintained and run by the rubber exporters and few individuals. As the export of rubber over the period of years has dwindled considerably, the value of output in the individual unit dropped considerably. The three rubber footwear units, all located in Kuching, are very small in size, their combined output being only $214,242 in 1968. Vulcanizing and retreading of tyres and repair of tubes are actually undertaken by roadside service units catering to the localized markets. These units have their importance in their own way.

Food and Beverage Industries

16.11 The food and beverage industries in Sarawak include the following:-

(i) Manufacture of ice-cream
(ii) Manufacture of pickles and sauces
(iii) Other fish preparation and preserving
(iv) Sago mills
(v) Rice mills
(vi) Biscuit factories
(vii) Bakeries
(viii) Manufacture of confectionery
(ix) Manufacture of meehoon, noodles and related vermicelli products

(x) Manufacture of coffee powder

(xi) Ice factory

(xii) Distilling, rectifying and blending of spirits

(xiii) Manufacture of soft drinks and carbonated beverages

(xiv) Manufacture of spices and curry powder

Manufacture of Ice-Cream

16.12 The ine-cream units in Sarawak are really deep freeze refrigerator units, maintained by coffee shops catering to the needs of the customers visiting these shops. These are located in town centres and bazaars and are more or less well distributed.

Pickles and Sauce Factories

16.13 Pickles and sauce are two important food items in the Asian countries, particularly where the Chinese population is predominant. In Sarawak, there are five small units producing only soya bean sauce. These units are distributed as below:-

First Division	-	3
Second Division	-	Nil
Third Division	-	1
Fourth Division	-	1
Fifth Division	-	Nil

All these units are cottage-type establishments run by the Chinese. These units are working in rather unhygienic conditions, mainly due to lack of space and also capital. The process employed is crude. The beans are first washed and then boiled in water for about 8 hours. The soft beans are then put in a room for humidification in trays for 3 - 4 days, after which the beans are taken out and washed again. The washed beans are mixed with brine water in the ratio of 1:2 and put in jars kept in open yard. Depending on the sunshine, the jars are kept there for 5 - 7 weeks before the liquid is decanted.

The liquid is then boiled and poured back into the jars in the open yard. It is considered that the longer the sauce is kept in the open yard, the better is the sauce.

16.14 The beans from the first concentration can be used again and again in up to 3 - 4 times. The final residue is a cake used as pig food or fertilizer. The sauce is filled in bottles by hand pouring and sold in the market.

16.15 In view of the fact that all the operations are carried out in open space, large quantities of dust, leaves, insects, etc. accumulate on the boiling pans and also in the jars. Hair, droppings, etc. of the domestic animals are not uncommon items which get mixed during the process.

16.16 During field enquiries, it was gathered that the factory owners were aware of the need of maintaining hygenic condition in their factories, but they were unable to do it at the present premises - which is their household. Their requests for land in the industrial areas, it is reported, have been turned down by the Government in consideration of the small size of their operation.

16.17 Sarawak imported 201,207 gallons of soya bean sauce valued at $403,195 in 1968. This works out to a value of $2 per gallon. The price of soya bean sauce in the local market for both locally produced, as well as the imported item is the same. Based on the value of $2 per gallon, the local production of soya bean sauce is estimated at 179,525 gallons in 1968. It is thus noted that the total local production was around 40% of the State's total consumption of 380,732 gallons in that year.

16.18 The State's import of soya bean sauce between 1967 - 1969 rose at an average rate of 35%, with total production remaining static at the level of the 1967 production during the period. The rate of increase is not likely to remain at this level. However, with the rising standard of living and also increased population, particularly among the Chinese, and also due to effective tourist promotion drive undertaken by the government, the average annual rate of increase on sauce concumption, could be assumed at 10%. Such a rate of increase calls for priority attention to the industry for its modernisation and efficient functioning.

16.19 The sauce manufacturers are aware of this market and prospects. Accordingly, some of them even negotiated for import of machinery and equipment from Australia. Unfortunately, however, their efforts so far have not been successful due to lack of proper accommodation.

16.20 The soya bean manufacturers of Sarawak, who are all Chinese, have the technical capability to run the factories on modern lines. Given the proper opportunity, they are capable of replacing the entire import by local production. It is, therefore, recommended that their application for land in the industrial estate at Pending(near Kuching) should be given sympathetic consideration.

16.21 Like the other industries, the small sauce factories in the State have also their financial problems. Though there are government-sponsored institutions and commercial banks in the State whose rules provide for financing the industries, these are often so rigid that it is almost impossible for the small units to obtain assistance. Firstly, they are incapable of offering adequate securities as required by the financing bodies. For example, the normal belongings of a small sauce maker are his small homestead, a few pans, jars, etc. the total value of which would be so insignificant to be either offered or accepted as security for any sizeable loan. It is, therefore, recommended that the government should either set up an institution with liberalized rules to finance the small industries or liberalize the rules of the existing institutions, particularly, in the case of a request for financial assistance from small industrial units.

16.22 As security would be the main issue in such financing, the State government might consider including the granting of loans to Malaysian citizens of Sarawak origin for establishment or expansion of small-scale industries to the extent of $10,000 on personal surety, $25,000 on two colateral sureties and up to $100,000 to be covered to the extent of $75,000 by the assets created out of the loan and the balance on two colateral sureties. To ensure proper utilization of the loan, either joint account with the financing agency administering the loan or payment of the amount in instalment according to the progress of implementation of a previously approved plant, could be tried. These are simple guidelines and a detailed study of the financial requirement by the small industries would be required, if the suggestion is agreed to,

16.23 As sauce is a food item, conformity to certain regulations with minimum of hygienic conditions is required. It is suggested that the State government's Health Department should be activised to undertake this.

Other Fish Preparation and Preserving

16.24 In 1969, there were four fish preparation and preserving units of which one was a fish canning unit established on a joint venture with a Japanese firm. This is a modern unit. Though the unit is still running at a loss, it is expected that with the change in the management and organization which took place recently, the situation would improve in the near future. The other units are engaged in drying and salting of fish by crude process.

Sago Mills

16.25 The position of the existing sago milling industry has been discussed in Chapter VIII on Sago.

Rice Milling

16.26 There were 245 rice mills in Sarawak in 1968, scattered all over the State. The largest concentration, however, were in the First and Second Division. Most of the rice mills were small in size and some were even mobile mills. These mills work on custom basis. There is very little scope for any improvement in the rice milling industry as paddy in Sarawak is grown in mostly scattered areas and transportation from the field to the mills and again from mills to consumer centres is very difficult. The majority of the urban population is fed with imported rice; Sarawak being a net importer of rice.

Biscuit Factories

16.27 All but 3 of the 27 biscuit factories in the State are really cottage-type units scattered all over the State. The three large factories are in Kuching, of which two are family enterprises and one is run by a public limited company. The biscuits produced from these factories are well accepted in the local market. Biscuits produced particularly from the factory owned by the public limited company are comparable in quality to biscuits imported from West Malaysia and Singapore.

16.28 The total value of biscuits, both sweetened and unsweetened, imported into the State is around $2.75 million (please see Tables 16.3 and 16.4). While some import would always be there due to

Table 1.3 Sarawak im[illegible] and exports of biscuits unsweet[illegible] for the year 1966-1970

Country of Origin/ Destination	1966		1967		1968		1969		1970	
	Cwt	$	Cwt	$	Cwt	$	Cwt	$	Cwt	$
Imports										
Australia	5.63	862	2.99	414	9.90	1,192	7.34	1,520	9.46	1,476
Brunei	-	-	6.00	410	-	-	-	-	-	-
China Mainland	17.41	913	41.98	1,977	127.51	17,290	13.47	4,142	56.06	5,335
Denmark	0.21	78	0.75	264	2.25	142	0.97	358	7.70	2,086
Hong Kong	45.66	5,331	22.14	2,745	23.07	2,656	9.46	945	17.65	2,059
Japan	0.59	175	-	-	53.31	8,200	2.19	350	297.34	27,217
West Malaysia	17,092.41	310,994	17,987.67	805,676	17,574.92	829,422	24,661.46	1,146,047	21,495.49	1,302,249
Netherlands	0.56	123	0.78	205	1.31	507	0.49	113	11.07	2,959
Singapore	1,547.50	93,203	453.38	39,871	329.86	28,113	174.85	15,591	143.57	11,1[illegible]
United Kingdom	459.54	95,351	396.78	84,613	367.76	76,104	328.81	66,543	107.22	19,663
U.S.A. etc.	1.53	123	0.89	467	0.52	200	2.28	796	1.03	411
India	-	-	-	-	-	-	15.19	2,580	0.46	8[illegible]
New Zealand	-	-	-	-	-	-	-	-	8.66	1,116
Total:	19.171.04	1,007,153	18,913.36	936,642	18,490.41	964,502	2[illegible].51	1,238,985	22,155.71	1,373,765
Exports										
Brunei	17.01	1,878	11.44	1,634	22.90	1,810	7.29	1,220	4.02	270
Indonesia	-	-	16.43	805	19.55	977	-	-	25.35	1,112
Sabah	-	-	-	-	-	-	359.92	23,960	273.71	15,735
Total:	17.01	1,878	27.87	2,439	42.45	2,787	367.21	25,180	303.08	17,117

Table 1.4 Sarawak Imports and Exports of Biscuits sweetened for the year 1966 - 1970

Countries of Origin/ Destination	1966		1967		1968		1969		1970	
	Cwt.	$	Cwt.	$	Cwt.	$	Cwt.	$	Cwt.	$
Imports										
Australia	103.17	16,225	29.95	4,370	58.45	9,741	58.21	5,939	2.89	656
China Mainland	4,012.39	278,356	5,541.04	439,841	4,155.20	321,846	5,514.36	279,725	0.90	53
Denmark	22.33	6,997	13.58	4,666	42.71	14,404	38.17	11,519	-	-
France	0.42	166	-	-	-	-	-	-	-	-
Hong Kong	1,202.58	113,072	809.73	96,945	942.37	87,721	704.53	65,930	-	-
Japan	100.62	11,425	89.24	11,464	612.52	73,308	127.26	15,023	7.25	-
West Malaysia	9,142.40	574,791	14,705.82	814,546	14,424.99	807,402	1[illegible],[illegible]95.49	992,749	23,598.70	1,146,477
Netherlands	14.19	3,859	13.32	3,732	11.83	2,957	8.43	2,005	-	6
Singapore	1,916.09	128,888	1,307.33	92,820	1,289.51	98,975	310.02	60,276	90.36	7,335
United Kingdom	592.59	128,221	351.03	73,565	371.09	76,192	362.16	75,718	65.57	12,059
U.S.A. etc.	5.78	1,267	2.79	1,009	7.76	2,735	2.57	891	3.82	1,660
Eire	-	-	-	-	-	-	3.70	869	-	-
India	-	-	-	-	-	-	4.81	900	10.60	1,728
New Zealand	-	-	-	-	-	-	0.09	10	1.03	167
Brunei	-	-	-	-	0.64	36	-	-	-	-
Total:	17,110.62	1,263,747	22,863.83	1,542,958	21,917.07	1,485,423	22,[illegible]09.80	1,511,554	23,781.12	1,171,001
Exports										
Brunei	682.09	43,247	486.69	37,530	322.31	29,150	130.58	9,631	65.29	3,078
West Malaysia	-	-	0.01	3	0.40	30	-	-	0.40	25
Hong Kong	-	-	-	-	-	-	0.04	5	-	-
Indonesia	-	-	-	-	-	-	1.00	70	23.45	1,100
[illegible]	-	-	-	-	-	-	375.30	24,374	272.35	15,940
Singapore	-	-	-	-	-	-	-	-	0.10	15
Total:	682.09	43,247	486.70	37,533	322.71	29,180	506.92	34,080	361.59	20,058

consumer preference, [illegible]. For the bulk consumers such as hotels and restaurants which cater to tourists, it should be possible to substitute the large portion of the total import by increased local production. The problem of the industry again is space and finance and recommendations made in the case of the sauce industry would therefore apply to this industry as well.

Bakery Industry

16.29 The bakery units are also cottage units operating in unhygienic conditions. In many cases, these are part activities of coffee shops. However, the units are distributed somewhat uniformly on the basis of population to meet the local requirements.

Confectionery Industry

16.30 The confectionery industry also consists mainly of cottage units which make sweet drops and cater to the local market. The prospect of developing this industry has been discussed in the Chapter on Cocoa.

Manufacture of Meehoon Noodles and Related Products

16.31 Meehoon, noodles etc. are among the most important items in the Chinese food preparation. The seven meehoon manufacturing units in the State are all very small family units having total disregard for sanitation in their working premises. There is great scope for improvement in this industry as the State imports around $1.5 million worth of meehoon and similar products annually. This import is mostly from China and Hong Kong.

16.32 The problem here again is of finance and accommodation. Once the problem is solved, it should be possible for the industry to replace the entire import with local production.

Manufacture of Coffee

16.33 Field study revealed that these are really not coffee-making units. The coffee shops maintain small household coffee grinders for service to their customers. The possibility of establishing a coffee factory in the State have been discussed in the Chapter on Coffee.

Ice Factories

16.34 Of the ten ice factories in Sarawak, only two are of any magnitude. All these ice factories, cater mainly to the fishing industry. The present installed capacity is not only sufficient to meet the needs of the fishing industry but also capable of catering additional requirement to the extent of 50% of their present production.

Distilling, Rectifying, Blending of Spirits

16.35 There are two distilleries in the State distilling alcoholic beverages. Both the factories are located in Kuching. The quality of the products is inferior when compared to the imported equivalence. The basic raw material used is nipah "sugar".

16.36 Before the increase of excise duty to $28/-per gallon, these distilleries were working to full capacity. At present however, they are experiencing difficulty in marketing the spirit. Their customers are mostly the rural section of the community. These people are slowly changing their drinking habits, with the increase in their incomes and also due to the reduced difference between the price of locally produced spirit and the imported ones resulting from enhanced excise duty.

16.37 There is, perhaps, not much of a scope for these two distilleries to expand or improve as the equipment used are all outdated. As mentioned, in the Chapter on nipah and sugar cane, it might be desirable to replace the existing distilleries by a modern one to produce rum and industrial alcohol provided studies suggested therein justify.

Oil Milling Industry

16.38 The oil milling industry has been discussed at length in the Chapter on Coconut.

Feedmeal Industry

16.39 The livestock industry in Sarawak is fast gaining momentum in view of the rising standard of living and also increase in the population. As a result, the demand for feedmeals had also been increasing very fast. This demand in the earlier years had fully been met by imports. With the establishment of two feedmeal units in Kuching since the last two years, part of the total demand is now met by supplies from these factories.

16.40 The import of various ingredients of feedmeal and also prepared feedmeal for the period 1960 - 1970 is shown in the Table 16.5. It would be observed that the annual import of mixed feedmeal declined from [illegible] pikuls valued at $8.9 million in 1969 to 353,[illegible]90 pikuls valued at $6.9 in 1970. The imports of ingredients such as meat and fish meal, maize, rice bran, etc. have increased, in contrast, considerably.

16.41 Though the two factories in Kuching are capable of producing compound feedmeals to the extent of 80% of its total state consumption, the factories are reported to be operating at much lower capacity; - one is operating to the extent of 65% and the other to 40%. This is due to competition from traditional sources of supply, i.e. Singapore. The feedmeals imported from Singapore are cheaper by about $1.20 per pikul, except when [illegible] in Kuching. This is due to the following reasons:-

TABLE 16.5 IMPORTS OF [illegible] BY YEAR 1960-1970

Year	Rice Bran		Cereal Veg. Bran Pollard Sharps etc.		Copra Cake		Other Oilseed Cake	
	Pkls.	Value $	Pkls.	Value $	Pkls.	Value $	Pkls.	Value $
1960	43,263	504,380	7,023	100,090	1,938	29,359	25,035	510,859
1961	40,296	541,242	7,974	106,520	1,315	17,482	30,820	617,875
1962	37,409	533,390	5,963	93,549	3,568	55,213	38,479	702,339
1963	39,703	484,132	9,832	149,804	480	73,267	30,253	590,975
1964	45,122	559,984	22,824	327,422	1,910	30,107	35,822	675,175
1965	58,552	850,874	35,450	576,608	2,522	43,050	39,090	759,124
1966	34,657	513,375	46,962	721,474	3,912	61,083	39,073	821,189
1967	36,580	481,978	65,342	901,448	8,457	109,151	17,048	343,160
1968	35,246	417,732	65,489	865,730	2,669	36,890	13,559	282,797
1969	35,638	433,830	69,196	888,273	3,658	49,325	249	4,004
1970	97,694	1,074,882	93,997	1,297,969	17,283	227,826	2,434	49,796

Continued on next page

IMPORTS OF ANIMAL FEED BY TYPES 1960 - 1970

Year	Maize		Meat & Fish Meal		Sweetened Forage & other preps. for animal feeding		Animal feeds n.e.s.	
	Pkls.	$	Pkls	$	Pkls.	$	Pkls.	$
1960	279,470	3,091,373	16,357	330,079	18,620	399,273	933	18,661
1961	252,649	3,148,265	16,247	328,063	42,236	803,768	338	10,099
1962	228,413	3,453,018	39,649	591,091	81,486	1,528,330	563	10,255
1963	222,990	2,835,925	19,372	276,082	110,265	2,011,985	571	10,243
Change of Classification								
1964	250,609	3,233,452	25,369	525,081	170,696	3,162,496	10,093	176,113
1965	245,410	3,529,130	35,025	692,397	158,538	3,022,497	9,931	172,468
1966	283,257	3,737,963	6,084	198,830	337,401	6,401,330	2,492	46,906
1967	311,919	4,419,046	9,794	283,185	314,633	5,818,376	10,291	185,137
1968	293,258	3,576,018	9,368	231,668	368,151	6,726,531	11,448	168,456
1969	329,247	4,270,929	20,968	297,505	492,408	8,911,467	3,869	51,505
1970	412,317	5,638,126	26,968	890,521	353,290	6,918,492	5,638	99,353

Note : Under Animal Feed n.e.s. for 1969 there is a change of classification

N.E.S.: Not elsewhere specified

Source: Department of Statistics, Sarawak.

16.42 Firstly, 30 different items of ingredients are required for mixing to produce various brands of feedmeal and Sarawak producers have to import these from Singapore or other places. The feedmeals are then required to be transported to the consuming centres thus incurring extra transport and handling costs. The Singapore producers on the other hand ship their products directly to the various consuming points in Sarawak. For the purpose of comparison, a Kuching producer, besides incurring $17 transport per ton for the raw material from Singapore to Kuching, has again to ship it from Kuching to Sibu, a consuming centre, by spending another $11 per ton towards transport charge. In addition, he has also to pay two extra handling charges in Kuching. The Singapore producers who ship their product direct to Sibu need only to incur a transport charge per ton of around $18. This not only saves cost in freight but also in the handling charges.

16.43 Secondly, consumer preferences are also in favour of Singapore producers. In the course of field investigations, when a pig farmer was asked if he would be prepared to buy locally produced feedmeal once the price is equalized or reduced, he replied with a categorically 'no' and stated that the pigs fed with locally produced feedmeal tend to lose their appetite as the local produce has no odour. The Singapore feedmeal is free from this defect. This reason was however rejected by the veterinary officer accompanying the team. The problem is that the farmers are prejudiced against local mixed feed.

16.44 Thirdly, complaints are often made that the locally mixed feedmeal gets mouldy on arrival at destinations. The feed millers considered this fact and reportedly have made some improvements lately.

16.45 Though the local feed millers first went into commercial production in 196[illegible], and their installed capacity was capable of meeting 20% of the local demand, the Government has still been issuing licence for import of feeding stuff from Singapore to the extent of 75%, based on 1968 imports of individual licence holders. It is gathered that the Government is reluctant to totally ban import lest the local feed millers raise their prices. While this fear could be genuine, the Government, by exercising its powers under price control ordinance, can regulate the prices once import is banned. This would be in the interest of industrial development of the state.

16.46 Sarawak feed millers cannot, perhaps, reduce their price very much in view of the state's dependence on imported ingredients. While some of the imported items would be difficult to replace, raw materials like maize, tapioca, fishmeal etc. could be produced locally, which in the long term, could effect a substantial reduction in price.

16.47 Cost of transportation to the consuming centres and handling charges at various ports, would continue to be a disadvantage. This would however, [illegible] substantial as the transport system in the state gradually improves.

16.48 In any case, it is essential that the import of feedmeal is totally banned in the interest of the healthy development of feedmeal industry in the state.

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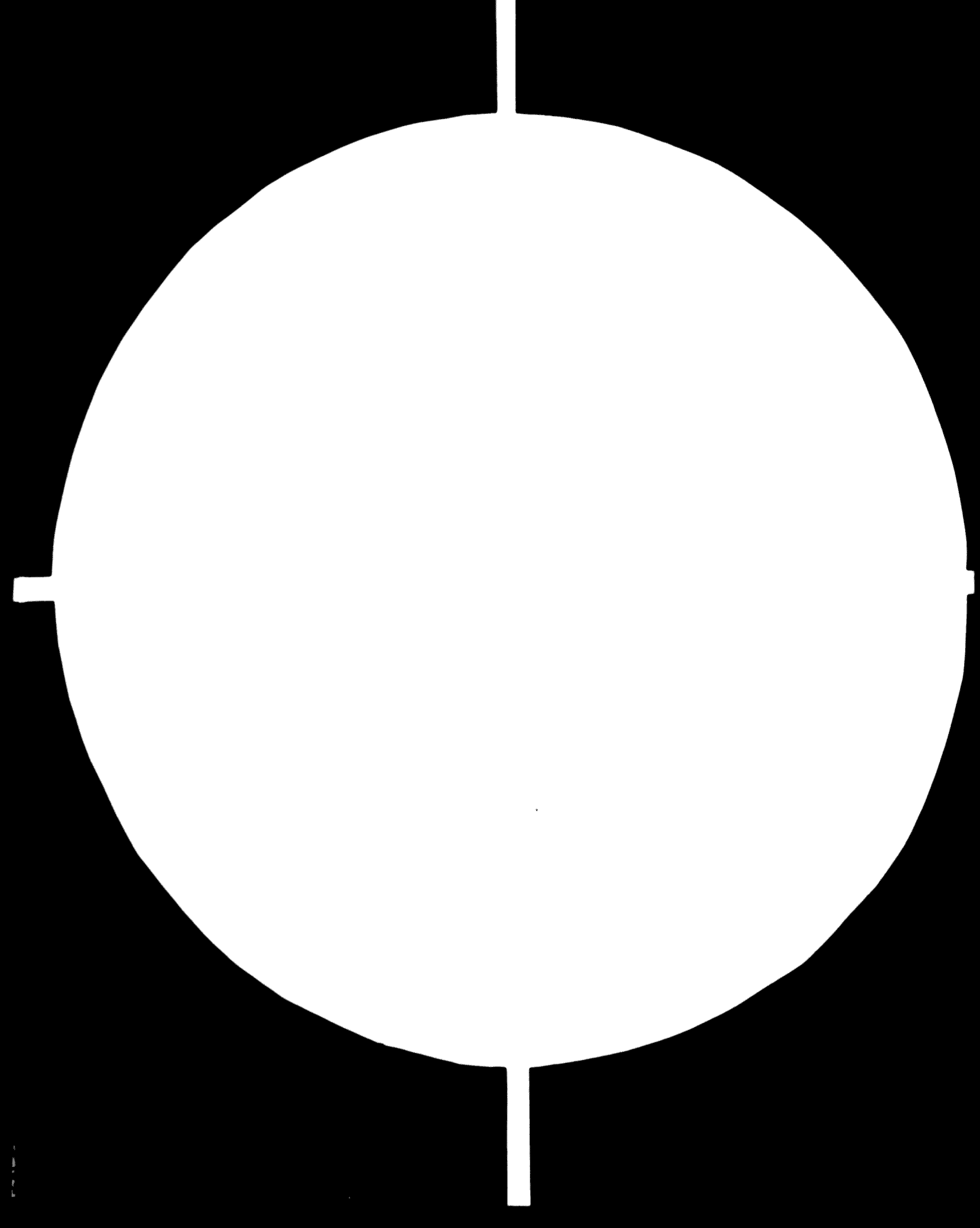

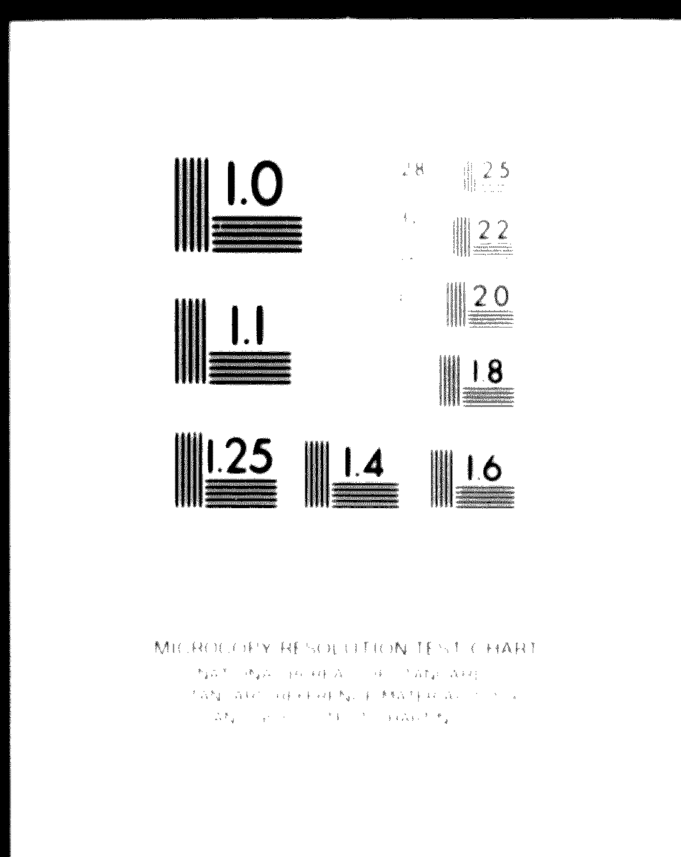

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CHAPTER XVII

SUMMARY OF RECOMMENDATIONS

CHAPTER II - TAPIOCA

In view of the rising world demand as well as domestic demand the State Government should encourage two tapioca plantations in the State; one for feeding a factory to produce tapioca pellets and the other for manufacturing starch. The State's climate, soil etc. are considered suitable for tapioca plantations as has been established by the trials in the agricultural research stations of the State Government.

The proposed plantations could be located either in the (i) Stenggang-Stungkor area in the Bau district of the First Division or, (ii) Pengulu-Lingoh area of the Second Division. The pellet factory with a capacity of 36,000 tons per annum would require a productive acreage of 6,000. Allowing an area of 50% for crop rotation the total area required would be 9,000 acres.

The plantation would require a fixed investment of $3.4 million and a working capital of $460,000. While the plantation would employ a considerable number of contract labour in addition to 26 persons of all categories in the plantation management, the employment in the pellet factory would be 56 persons of all categories.

The pellet factory would require an investment of $1.84 million in fixed assets, in addition to a working capital requirement of $1.74 million.

For the starch factory to produce 7,200 tons of starch and 3,600 tons of refuse annually, the total yielding area required per year would be 2,400 acres. Allowing for 50% crop rotation, the total land required would be of the order of 3,600 acres. In the plantation, an investment of $1,369 million in fixed assets would be needed. In addition, an amount of $180,000 would be required for working capital. The plantation would employ 14 persons of all categories in addition to a considerable number of contract labour.

The starch plant would require a fixed investment of $1.9 million and a working capital investment of $428,000. The factory would employ 80 persons of all categories.

Effective marketing promotion would have to be undertaken at the international level to create, maintain and expand the market for produced tapioca products from Sarawak.

CHAPTER III - COCONUT

With vast potential existing, the programme of rehabilitating and replanting of 35,000 acres with coconut is too small and it is suggested that the State Government should consider increasing it considerably and also expanding the smallholder acreages to make 100 acres or more per holding, so that the holdings are economically viable. The proposed plantations could be undertaken in the 270 sq. miles of coastal area suitable for coconut, which is still under no use.

The copra produced by Sarawak farmers is inferior in quality and, therefore, results in poor yield of oil. It is suggested that modern copra processing centres be established to produce quality copra in the concentration of coconut plantations.

Such processing centres with an output of 1,500 tons of quality copra per annum would require a capital investment of $161,700. The working capital requirement would be of the order of $178,000, each centre employing 21 persons of all categories.

The locations suggested for these centres are Nonok, Mid-Sadong, Santubong, Kabong and Simanggang. Other likely centres would include Sebangang, Pajong, Lingga, Maludam, Seribas and Sesah.

Extension in coconut acreage and improvement in the quality of copra would result in fuller utilisation of the milling capacity already obtaining in the States.

It is also suggested that a factory for producing desiccated coconut should be established in Sarawak in consideration of the good prospect of this product in the international market. The plant should be located at Serikei where fresh coconuts could be obtained in large quantities from the adjoining areas. Also, Serikei offers reasonably good port facilities for export of the product to the international market.

The desiccated coconut plant would require an investment of $1.17 million in fixed capital and about $1 million for working capital. The plant would employ 40 workers of all categories.

CHAPTER IV - COCOA

Cocoa has been grown successfully in Sarawak for many years as a sole crop and since recently inter-cropped with coconut. In view of the favourable world demand and also the rising domestic demand (which is currently met by imports), a large-scale cocoa plantation is suggested for the State.

An estate-type plantation of [illegible],000 acres is suggested for Lambir-Bubis area in the Fourth Division. It should be possible for a plantation of this size to meet the requirements of a factory producing 3 tons of cocoa liquor per day of 8 hours shift. The plant would require a capital investment of $1.52 million, in addition to a working capital of $565,000. This factory would employ 34 people of all categories.

A chocolate plant could be added to the unit at a later stage which would require a capital investment of $2 million in fixed assets and a little over $1½ million in working capital. The plant would employ 40 people.

CHAPTER V - SUGAR

Subject to further detailed study, either (1) a sugar factory along with a plantation under the same management should be set up in the Lambir-Bubis area of the Fourth Division. The capacity of the mill should be 3,000 tons of cane per day operating 200 days; or (2) two mills should be established; one in Sabah and the other in Sarawak. Each mill should have a crushing capacity of 1,500 tons of cane per day operating 200 days.

The 3,000 tons crushing capacity per day plant would require an investment of $15 million and employ around 500 persons, plantation labour included.

CHAPTER VI - COFFEE

In view of the substantial local demand and also demand in the international market, it is suggested that two estate type coffee plantations be undertaken: one in the Baram District of the Fourth Division and the other in the Fifth Division. These plantations should have an area of 5,000 acres each.

Processing facilities should also be created in the estates to produce coffee powder and instant coffee. Part of the production would be traded in the international market and the rest would be consumed locally.

A detailed feasibility study is required to be undertaken, both for the plantations and also for the factory. Roughly, however, a factory to produce 110 lbs. of instant coffee powder per hour or 264,000 lbs. per year, working single shift would require an investment of around $2.5 million in fixed assets. This plant would be capable of operating three shifts to produce 800,000 lbs. of instant coffee per annum. The plant would employ around 60 people only as this is an automatic one.

CHAPTER VII - PINEAPPLE

Though there is a rising demand for canned pineapple in the world market, it is highly competitive and established importers are finding it increasingly difficult to enjoy a steady position in the consuming countries due to price undercutting.

Sarawak's soil and climate are suitable for growing pineapples. But the production cost of 1.9¢ per lb. is estimated to be higher when compared with West Malaysia. In view of this, a careful study would be necessary before venturing into such a project.

The Malaysian Pineapple Board which have considerable experience in marketing and production of canned pineapple should be invited to make this detailed study and if feasible, only then it should be desirable to undertake the project.

Gedong, about 42 miles from Kuching should be the most suitable location for the plantation and cannery. A cannery to process 4,680 tons of fruit would require roughly $3/4 million in fixed investment and would employ around 120 workers of all categories.

CHAPTER VIII - SAGO

It is suggested that UNIDO should assist the State Authorities in carrying out research on (i) development of better methods and techniques in the cultivation of sago plants, (ii) the production of better variety of plants giving higher yields and (iii) improvement and modernisation of the present processing methods to reduce processing losses and improve the quality of the flour produced.

As sago has to compete in the international market with other flour, it is urgently necessary that the quality of sago produced in the State be improved. This would necessitate the establishment of refineries. It is suggested that two refineries be immediately established: one in Sibu and the other in Tanjong Mani which should have a capacity of 1 ton of dried refined sago per hour having a moistured content of 12% with little or no fibre content in the finished product. A refinery of such a capacity would require $455,000 in fixed investment and would employ about 70 workers of all categories.

Marketing promotion efforts, particularly in Japan would have to be undertaken to regain the position for sago starch. European markets have also to be explored.

CHAPTER IX - OIL PALM

The State Development Finance Corporation should consider entering into joint venture with a West Malaysian company for its oil palm plantation and processing plant. FIDA and MIDF could assist in selecting such a company. Once such a collaboration is identified and accepted, the SDFC should establish only one processing plant for both its plantations. Two small processing plants - one for each plantation as planned would result in higher production cost, which would be dangerous in a highly competitive market.

The State should encourage establishment of 5/6 more estates on oil palm in the Lambir-Subis area. Each estate could have plantation of 5,000 acres. In addition, smallholders in this area could also be encouraged to grow oil palm.

It is suggested that at a later stage a palm oil refinery and hydrogenation plant be established in Miri. The plant should have a capacity of 40 tons of hard fat per day. Such a plant would require an investment of $6.5 million and employ 45 workers of all categories working three shifts.

The UNIDO should consider providing assistance for a detailed feasibility study for the project.

CHAPTER X - CASHEW NUTS

In view of the rising world demand, cashew nut has good prospect in the international market. From the trials carried out so far, Sarawak has been found to be suitable for growing this crop. It is, therefore, suggested that an area of 2,000 acres per year for 5 years in the Lambir-Subis area of the Fourth Division should be brought under cashew nut and a mechanised processing plant be established in 1974. Such a plant would require an investment of $2.1 million in fixed assets and would employ 276 persons of all categories.

CHAPTER XI - SOYA BEAN

In consideration of the suggested expansion in the soya bean sauce making industry in Sarawak, the Agriculture Department of the State Government should encourage soya bean growing in the State. To meet the entire demand of the industry, it is suggested that an area of around 5,000 acres be brought under soya bean (off-season crop) in the Fourth and Fifth Division of the State. The acreage has to be increased annually by at least 6% to cope with the rising demand of the industry.

From the farmers point of view, growing of soya bean as an off-season crop in Sarawak is considered to be renumerative.

CHAPTER XII - RUBBER

Inspite of the uncertain and discouraging world prices, the social, economic and political conditions would not permit Sarawak or even Malaysia as a whole to dispense with rubber plantation in the foreseeable future. The alternative, therefore, is to improve the industry where-ever possible. In the case of Sarawak, sufficient scope exists for improving the quality of rubber. It is, therefore, suggested that a few hevea-crumb factories along with collection centres be established at Samarahan Estate in Serian District of the First Division. For the second factory, any suitable location near the Lambir Land Settlement Scheme along Miri-Bintulu Road should be selected.

The capacity of a hevea-crumb plant would depend on the availability of latex in adequate quantities. However, a 10-ton per day plant is considered to be the minimum economic unit. Such a unit would require an investment of a million dollars in fixed assets and would employ 20 people of all categories. In addition, there would be some employment in the collection centres.

CHAPTER XIII - PEPPER

With a view to ensuring quality and also to reducing dependence on Singapore, the Government of Malaysia has lately announced the establishment of a Pepper Control & Marketing Promotion Council. The Council is expected to ensure fair and equitable return to the producers, establish and prescribe a schedule of grades to enhance the saleability of the commodity, to promote and expand the sales of pepper to consuming markets, provide assistance and facilities to promote direct export and assist production and processing by undertaking research and extension work.

While the establishment of the Council is a timely step in the right direction, fair and equitable return to producers is unlikely to be achieved unless the present system of supply of credit to the primary growers can be affectively taken over by the Council from the middlemen. The credit requirement for the industry is estimated at $40 million annually for the next 5 years. It is recommended that the State Development Finance Corporation which has been providing some finance to the pepper growers should allocate similar funds to this sector.

CHAPTER XIV - OTHER MINOR AGRICULTURAL CROP

NIPAH

It is suggested that UNIDO provide assistance to the State Government for carrying out a detailed study on the prospect of utilising nipah jaggery economically. Prima facie, there appears to be good scope for producing power alcohol and rum from nipah jaggery.

WHEAT

Though wheat is not grown in Sarawak and there is no prospect of developing this crop in the State, the rising demand of wheat flour in the two East Malaysian states justifies establishment of flour mill. There could either be two plants, each with an annual capacity of 20,000 tons - one in each state or, there could be one plant of 40,000 tons capacity located either in Kuching or in Kota Kinabalu. The former suggestion would be preferable, if the present transport facilities are not improved, as in that case, the cost of distribution would be substantially lower. The second proposal, though economically more desirable, would entail a higher consumer price because of the difficult transport system in the region.

For establishment of a plant with a capacity to mill 20,000 tons of wheat flour, working 250 days a year, on two shifts, the fixed capital investment required would be of the order of $1 million and the working capital required would be around $500,000. Such a plant would employ around 40 workers of different categories.

The 40,000 tons plant, on the other hand, would require a capital investment of about $1.8 million in fixed assets and a working capital requirement would be in the order of $800,000. This plant can employ 63 workers.

CHAPTER XV - LIVESTOCK

In view of the rising demand and good price of pork in Sarawak large-scale pig farming should be encouraged in the State. In particular, the natives of Sarawak should be asked to take up pig farming and assistance in regard to farm management and finance should be provided to them. Supplementary income derived from the industry would help raise their standard of living considerably.

There appears to be scope of establishing cattle rearing farms for production of beef. The size of the farm should be small as there is still a lot of gap in available information for large scale cattle rearing in the State.

The State's imports of milk and milk products workout to around [illegible] million annually and this import is rising. This is a substantial consumption and calls for a separate study to look into the possibility of establishment of a dairy farm on modern lines. UNIDO might consider providing assistance for such a study.

CHAPTER XVI - EXISTING AGRO INDUSTRIES AND FOOD PROCESSING INDUSTRIES

In Sarawak, food processing and agro industries are very insiginificant except in the cases of sago milling, oil milling and rice milling. Generally all these industries suffer from lack of adequate finance. In many cases, the factories cannot expand and/or modernise because of inadequacy of land in the existing premises. The State Government is developing an industrial estates in Kuching and also has plans for developing estates in other areas. It is suggested that the application of the existing industries for land in these estates should be treated with priority. There should not be any discrimination against proprietory small ventures.

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