APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

STUDY NO. 30
THE VEGETABLE OILS INDUSTRY OF THAILAND

REPORT NO. 1
A BRIEF SURVEY OF THE VEGETABLE OILS INDUSTRY IN THAILAND

BY
SOROT SANGSAN-ANAN
METZ TUNGKHASARANI
SACHEE PIYAPONGSE
ECONOMIC STUDIES GROUP

ASRCT, BANGKOK 1973
not for publication

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

STUDY NO. 30
THE VEGETABLE OILS INDUSTRY OF THAILAND

REPORT NO. 1
A BRIEF SURVEY OF THE VEGETABLE OILS INDUSTRY IN THAILAND

BY
SOROT SANGSAN-ANAN
METZ TUNGKHASARANI
SACHEE PIYAPONGSE
ECONOMIC STUDIES GROUP

ASRCT, BANGKOK 1973
not for publication

CONTENTS

Page

APPENDICES

F O R E W O R D

The purpose of this study is to revise the first draft report which had as its primary aim the provision of the more readily available information to the FAO/UNIDO SIS Mission which came in 1971 to examine the feasibility of establishing an integrated soybean processing industry in Thailand.

The present study aims to provide information on the recent situation of oil-bearing materials, various kinds of vegetable oil and cake production and consumption. It also includes an examination of the structure of the industry and current national policies toward vegetable oil production.

The report is based mainly on the latest available crop statistics (1970) and, since there are no official statistics of vegetable oil production, on the results of ASRCT's own survey.

A BRIEF SURVEY OF THE VEGETABLE OILS INDUSTRY IN THAILAND

By Sorot Sangsan-anan*, Metz Tungkhasarani*, and Sachee Piyapongse*

SUMMARY

Thailand retains from 75 to 100% of each oil-bearing material produced, a highly variable proportion of which is used for oil production. Nevertheless, despite this high domestic retention, 90,000-100,000 tonnes of oilseeds have been exported annually in recent years.

Export of oils is small compared with export of oilseeds. Export of oils in 1970 was 1,958 tonnes and was increasing. Imported oils are chiefly those not produced here, e.g. olive and linseed oils, together with oxidized and hydrogenated oils. Total import of oils in 1970 was 1,679 tonnes.

Export of oil cakes in 1970 was over 43,000 tonnes.

There is no unified overall policy aimed at developing the Thai vegetable oil industry. Certain firms have, however, received promotional privileges; targets have been set for increasing selected oilseed production during the Third National Economic and Social Development Plan, with particular emphasis on soybean production for export.

Government research programmes, often with international support, have been and are being carried out on oil-bearing seeds production and utilization.

Domestic demand for vegetable oils and hence for oilseeds will doubtless increase with population growth and income (combined, at about 4.4% p.a.), but supply and price of lard is a controlling factor.

Achievement of increased oilseed export, especially of soybean, looks brighter than formerly (Japan is buying virtually no Thai soybean currently) as higher-oil-yielding, more-pest-resistant strains are grown by farmers utilizing improved cultivation methods.

Outlook for much increased oil export appears dubious, although world demand for oil cakes will, reportedly, be sustained.

---

*Economic Studies Group, Institute for Development Studies, ASRCT.

RAW MATERIALS: PRESENT POSITION AND FUTURE PLANS

Present position

While Table 1 indicates that Thailand has been exporting between 90,000 and 100,000 tonnes of oilseeds annually over the past five years, Table 2 shows that, except in the case of castor seed, between 75 and 100% of oilseeds produced in the country are used domestically. Table 3 shows that of the oilseeds retained, a highly variable proportion is used for oil production.

Future plans

Chapter 8 of the Third National Economic and Social Development Plan (1972-1976) sets out the targets for increased production of oil-bearing materials during the current Third National Economic and Social Development Plan (1972-1976).

Increase in the most important of these, coconut, is unlikely to suffice the growing demand until about 1975, whereafter the effect of new plantings, replantings, and varietal improvement is expected to lessent gradually the need for supplemental copra imports from Malaya.

Probability of achievement of targets for annual oil crops is much more complex. The fall-off in rice demand is a distinct incentive to crop diversification, but nevertheless agronomists and agricultural economists report that it is still the most popular crop in the northern regions—"at least you can feed the family with it."

Much depends on the success or otherwise of the current implementation of irrigation schemes in the Chao Phraya River basin. These are expected to give 400,000 rai of irrigated land in five years time and 1,350,000 rai eventually.

How will farmers use this land? Agronomists and market economists see a conflict between lucrative, locally marketable crops which require fertilizers, i.e. second-crop rice, string beans, cucumbers, and maize on the one hand, and legumes which require virtually no fertilizer but the market for which is more precarious on the other. Farmer preference seems to be for groundnut, soya, mung, and sesame, in that order.

TABLE 2. THAILAND PRODUCTION AND EXPORT OF MAJOR OILSEEDS

1	2	3	4	5
Oilseed	Production (kilotonnes)	Export (kilotonnes)	Difference (kilotonnes)	Percentage (4) of (2)
Groundnut				
1966	132	18	114	86.4
1967	79	8	71	89.9
1968	95	4	91	95.8
1969	74	6	68	91.9
1970	75	6	69	92.0
Soybean				
1966	38	6	32	84.2
1967	53	5	48	90.6
1968	45	3	42	93.3
1969	48	5	43	89.6
1970	50	6	44	88.0
Sesame				
1966	20	5	15	75.0
1967	23	3	20	86.9
1968	22	4	18	81.8
1969	19	4	15	78.9
1970	20	5	15	75.0
Castor seed				
1966	42	43	-1	(-2)
1967	38	33	5	13
1968	39	27	16	37
1969	37	30	4	12
1970	43	35	16	31
Cottonseed				
1966	59	18	41	69.4
1967	54	31	23	42.6
1968	78	47	-31	39.7
1969	29	54	-25	-86.2
1970	18	24	-6	-33.3
Kapok				
1966	56	28	28	50
1967	57	8	49	86
1968	58	14	44	75.9
1969	53	4	49	92.4
1970	57	11	46	80.7

Sources. Exports: Dept. of Customs.
Production: Ministry of Agriculture.

TABLE 3. THAILAND: PRODUCTION, EXPORT, AND UTILIZATION OF OIL-BEARING MATERIALS, 1970

1	2			3			4	5	6
	Total production			Raw material used in local processing					
	1970 Production (tonnes)	Planned by NEDB 1972 (tonnes)	Planned by NEDB 1976 (tonnes)	Oil (tonnes)	Cake (tonnes)	Total (tonnes)	Export (tonnes)	Raw material retained in country (tonnes)	Internal consumption (tonnes)
Soybean	50,400	100,000	300,000	3,640	24,360	28,000	6,290	16,110	Seeding 2,520 Direct consumption, stock, etc. 11,750 Loss 1,840
Groundnut									
- in shell	124,900	210,000	400,000						
- without shell (60% of total weight)	74,940	126,000	240,000	6,080	9,120	15,200	6,445	53,295	Seeding 13,040 Direct consumption, stock, etc. 36,505 Loss 3,750
Copra	20,840	na.	na.	14,000	10,000	24,000	-	Raw material insufficient	-
Cotton	26,800	90,000	200,000						
Cottonseed	17,958	60,300	134,000	1,500	7,900	9,400	23,720	-16,642 (Raw material drawn from stock last year for export)	Seeding 580 Loss 898
Kapok seed	56,650		500,000	2,650	12,070	14,720	11,268	30,662	Seeding 954 Stock, etc. 26,878 Loss 2,830
Castor seed	42,700	44,000	55,000	3,100	4,650	7,750	35,680	3,010 (Raw material drawn from stock previous year for export)	Seeding 145 Loss 2,135

TABLE 3 - continued

1	2			3			4	5	6
Sesame seed	20,200	26,000	48,000	unaccounted			5,420	14,780	Seeding 100 Direct consumption, stock, etc. 13,670 Loss 1,010
Rice bran	1,170,400	-	-	6,480	31,640	38,120	-	1,132,280	Animal feeding, loss 1,132,280
Kenaf seed	unaccounted	-	-	35	150	185	-	unaccounted	-
"Tung" (Parinarium)	unaccounted	-	-	90	105	195	-	unaccounted	-

Sources. 2 - Production : Division of Agricultural Economics, Ministry of Agriculture.

- Planned production : Third National Economic and Social Development Plan 1972-1976, NEDB.
- Rice bran production : Calculated by using rate 8.8% of paddy production (paddy production in 1970 was 13.3 million tonnes)

3 : ESG survey; 4 : Department of Customs; 5 : ESG calculation; 6: ESG calculation based on the following facts:

Seeding rates:

Soybean	=	5	kg/rai
Ground nut	=	20	kg/rai
Cottonseed	=	3	"
Kapok seed	=	3	"
Castor seed	=	.5	"
Sesame seed	=	.5	"

- Loss calculated as 5% of total production.

MAJOR OILSEED SITUATION

a) Soybean—a favoured crop

A series of maps is appended showing the major growing areas of oilseeds in Thailand.

Of the oilseeds, soybean has received more attention than other oilseeds. Recently there was an FAO/UNIDO SIS Mission which examined the feasibility of establishing an integrated vegetable oil industry in Thailand. There are also study and research now being conducted by many government agencies to improve yield of soybean and to increase production.

Production

The latest official figures (for 1970) show that Thailand produced 50,400 tonnes of soybeans from 368,000 rai. Table 4 shows that up to 1970, at least, there had been a decline in yield over the past 10 years.

TABLE 4. SOYBEAN: PRODUCTION OIL MARKET VALUE 1960-1970

Year	Area planted (1000 rai)	Area harvested (1000 rai)	Average yield (kg/rai)	Production (k tonnes)	Wholesale price[1] (baht/kg)	Market value (10^6 baht)
1960	139	135	190	25.6	1.89	48.4
1961	149	143	169	24.2	2.58	62.4
1962	174	170	176	30.0	2.42	72.6
1963	210	200	165	33.0	1.93	63.7
1964	213	213	147	31.3	1.98	62.0
1965	117	115	166	19.1	2.68	51.2
1966	285	276	137	37.9	2.50	94.8
1967	399	365	145	52.8	2.37	125.1
1968	329	288	155	44.8	2.42	108.4
1969	299	293	164	48.2	2.41	116.2
1970[2]	368	360	140	50.4	2.35	118.4

[1] Bangkok, soybean, Chiang Mai (good)

[2] Preliminary estimate by Division of Agricultural Economics

Source. Agricultural Statistics of Thailand 1970. (Division of Agricultural Economics, Office of the Under-Secretary of State, Ministry of Agriculture.)

Disposal

It can be seen from Table 3 that in 1970, 11,750 tonnes or 23% of total production was used domestically for bean curd, bean sprout, and as additions stock; 56% was used for oil production; 12% for export; and the remaining 9% was for seeding and loss.

Exports

Export of soybean from Thailand varied from 1,600 tonnes in 1965 to 6,077 tonnes in 1971 as shown in Table 5. Although Japanese imports of soybeans are of the order of 3.2 million tonnes p.a., Thailand's share of that market has been declining, and in 1970 Japan took only 30 tonnes of Thailand soybeans. Japanese imports are forecast to reach 4 million tonnes by 1975/77.

Japan prefers US soybeans because:

1) US soybeans have 18-21% oil content compared with 15% or less for Thai beans.

2) The Japanese want shipments of 5,000-tonnes lots whereas Thailand can generally offer only 500 tonnes at a time.

3) US soybeans average about 5 baht per picul cheaper than Thai.

TABLE 5. THAILAND: SOYBEAN EXPORT & IMPORT 1965-1971

Year	Export		Import	
	Quantity (tonnes)	C.I.F. value (1000 baht)	Quantity (tonnes)	C.I.F. value (1000 baht)
1965	1,610	4,515	0.5	2
1966	5,608	14,625	-	-
1967	5,897	15,127	1.5	8.3
1868	3,552	9,467	-	-
1969	5,017	13,156	1.2	6.2
1970	6,289	16,198	-	-
1971	6,077	17,023	0.8	7.5

Source. Department of Customs, Bangkok.

Thailand's major export markets are Malaysia and Singapore where it is used, as in Thailand, mainly for bean curd and bean sprouts (i.e. non-oil uses) (Table 6). Of Malaysia's suppliers, Red China is the largest, with Thailand second.

Future prospects

In a qualitative sense, at least, future prospects for Thai soybeans appear brighter than formerly. Much of this optimism springs from the work of a recent Japanese expert team for soybean development.

Thailand's potential soybean production is put at 245,000 tonnes p.a. if one-tenth of the total rice area were turned over to soybeans during the dry season (but under irrigation).

Returns to the farmer

Seeds capable of yielding 13-16% oil have been distributed to most farmers in northern and central provinces.

Factors militating against the higher oil-yielding types in Thailand seem to be:

1) A greater proneness to pests than the native type (23 pests are listed as operative locally).

2) Large tracts of unsuitable land.

3) Inability of farmers to afford fertilizers and pesticides (see "Cotton").

4) The usual lack of adequate transportation and agricultural machinery.

5) Absence of any government-backed price-guarantee system.

6) The shortage of agricultural extension officers.

Perhaps the most subtle, yet cogent, antagonistic factor is the apparent reluctance of the Department of Agriculture fully to endorse soybean promotion on the grounds that it "may let the farmers down".

There are, nevertheless, indications that soybean production could "take off" on its own account. These include:

TABLE 6. THAILAND: SOYBEAN EXPORT BY COUNTRIES OF DESTINATION

Country	1966		1967		1968		1969		1970	
	Quantity (tonnes)	C.I.F. value (10^3 baht)	Quantity (tonnes)	C.I.F. value (10^3 baht)	Quantity (tonnes)	C.I.F. value (10^3 baht)	Quantity (tonnes)	C.I.F. value (10^3 baht)	Quantity (tonnes)	C.I.F. value (10^3 baht)
North Borneo	13	25	40	85	46	98	41	91	21	58
Hong Kong	212	566	1,303	3,648	375	942	335	840	412	1,072
Malaysia	2,786	2,454	3,039	7,309	2,203	6,019	2,933	7,668	3,789	9,640
Singapore	1,668	4,337	851	2,286	897	2,319	1,690	4,503	1,643	4,294
Laos	-	-	-	-	0.2	0.8	-	-	-	-
Japan	-	-	-	-	30	86	12	35	61	153
France	-	-	-	-	0.5	2	6	19	-	-
Penang	254	664	74	204	-	-	-	-	-	-
Philippines	-	-	-	-	-	-	-	-	360	974
Taiwan	675	1,579	100	254	-	-	-	-	-	-
Mauritius	-	-	-	-	-	-	-	-	3	7
Total	5,608	9,625	5,407	13,786	3,552	9,467	5,017	13,156	6,289	16,198

Source. Department of Customs, Bangkok.

Note. Thai customs statistics specify "Malaysia" and "Penang" as seperate destinations.

1) According to the Bank of Thailand, middlemen now play only a minor role in soybean trading because prices have risen sufficiently to allow farmers to sell directly to merchants without liens to middlemen constraining sales.

2) The native type of soybean gives the following profit:

Yield	=	145	kg/rai
Selling price	=	2.00	baht/kg
Revenue from sale	=	290	baht/rai
<u>Less</u> cost of production 1.02 baht/kg	=	150	baht/rai
Profit	=	140	baht/rai

The newer type gives the following profit:

Yield	=	300	kg/rai
Selling price	=	2.00	baht/kg
Revenue from sale	=	600	baht/rai
<u>Less</u> cost of production (including fertilizers and pesticides cost)	=	350	baht/rai
Profit	=	250	baht/rai

This is 110 baht/rai profit greater than by the old method.

<u>Source</u>. Division of Agricultural Economics, Ministry of Agriculture, Bangkok.

3) Oil producers prefer soybeans as a raw-material particularly, for even if they have to pay 2 baht/kg, the cake, representing 85% of raw-materials input, sells at 2.50 baht/kg, compared with 1.00 baht/kg for other cakes.

Even if farmers receive only 1.50 baht/kg for the higher yielding strains, they still make 100 baht per rai. However, farmers appear to be dissatisfied with their profit of 140 baht per rai for native types, even though the 1.50 baht/kg is a price guaranteed by oil producers.

It should be noted, here, that accent is being put on <u>high-oil yielding varieties</u> of soybean. If the bean were grown for its <u>protein content</u> rather than its oil yield, production and marketing problems would be considerably altered.

Oddly enough, soybean occupies an ambivalent position: grown as a seed crop it returns 400-500 baht/rai but grown and marketed as a vegetable (with seed still unripe) it returns 1500 baht/rai, but demand as a vegetable is probably small.

Doubtless, some intermediate, fluctuating compromise between the two crop types will result. Amongst factors determining this will be:

i) Normal market equilibria

There will obviously be demand/supply/price relationships between the two crop types marketed in their traditional forms.

ii) Supply innovations

1) The success or otherwise of the current Japanese soybean team in introducing/developing more appropriate seed types.

2) More effective promotion of improved seed types to farmers.

3) A more effective farmer-credit system in which the farmer is assured of an intermediate-term positive return and in which he cannot "welch" on credit given.

iii) Demand innovations

Demand prospects for soybean oil would result from:

1) A rapid increase in the domestic popularity of vegetable oils vis-a-vis lard. (This seems unlikely in view of the traditional preference for lard and distrust of vegetable oils---a distrust reinforced by derogatory press notices concerning adulteration of vegetable oils and their high fatty-acid contents.) For a fuller discussion, see Section 4.

2) A trade agreement with Japan allowing access into that market for Thai vegetable oils.

3) Other external outlets for vegetable oils.

b) Groundnut

The latest official statistics (1970) showed that groundnut production in shell was 124,900 tonnes. In this report, a kernel yield of 60% is used, giving a kernel production of 74,900 tonnes. In 1970 (Table 3), 15,200 tonnes or 20% of total groundnut production was utilized in the oil processing industry, 6,445 tonnes or 8.6% was exported, 16,790 tonnes or 22% was used as seeding and loss, and the remaining 36,505 tonnes or 49.4% was used for direct consumption and kept in stock.

Thus, direct consumption of groundnuts is 1 kg per head, which is high compared with other oil seeds and this is the basis of complaint by oil processors.

Average price of groundnut in 1970 was 3.72 baht/kg. Groundnut price was high during March to May and low during September and October as can be seen in Table 7. This is typical of groundnut price fluctuations since the crop is harvested in September-October.

TABLE 7. PRICE OF SHELLED GROUNDNUTS (ORDINARY), 1966-1971

	1966	1967	1968	1969	1970	1971
January	3.85	3.70	4.33	4.14	3.77	3.41
February	3.32	3.84	4.50	4.04	3.95	3.46
March	3.70	4.24	5.31	4.37	4.18	3.50
April	3.68	4.44	5.00	4.21	4.55	3.33
May	3.25	4.19	3.77	4.15	4.58	3.46
June	3.11	3.95	3.71	4.12	3.59	3.21
July	3.07	4.21	3.43	3.97	3.59	3.75
August	3.22	4.23	3.59	3.85	3.36	4.00
September	3.08	4.48	3.52	3.89	3.24	4.50
October	3.23	4.44	3.56	3.81	3.22	3.75
November	3.23	4.36	3.73	3.68	3.46	3.87
December	3.56	4.12	4.16	3.83	3.40	4.04
Average	3.35	4.18	4.13	4.00	3.72	3.69

Source. Department of Commercial Intelligence.

c) Copra

Copra production in Thailand is a cottage industry and no official statistics exist for production and the extent of copra use.

However FAO survey data indicates that only a limited amount of copra, about 20,000 tonnes p.a., is produced in Thailand. Copra shortage has generally been a problem with coconut oil producers and frequently some copra has to be imported; e.g. in 1970 just over 3,000 tonnes was imported for oil processing.

Why should Thailand be short of copra when about 600 million coconuts are produced annually? The answer stems largely from the fact that there is a large demand for coconuts in the fresh state, the milk of which is used in Thai curries and "khanom". Thus, only reject nuts or those available from temporary surpluses reach the copra producers.

Moreover, the profit margin in Thai copra production appears "thin". In 1970, for example, small-sized coconuts, weighing 1.3 kg, sold for 1.04 baht each. It requires 3.3 such nuts to make 1 kg of copra, the average price of which was 3.80 baht/kg. Thus, with raw material costing 3.40 baht/kg, the copra producer is left with only 0.40 baht per kg of copra to cover the labour-intensive process of copra production and his profit.

VEGETABLE OIL AND CAKE SUPPLY AND DEMAND

i) The general picture

In 1970, Thailand produced about 38,000 tonnes of vegetable oils and 70,000 tonnes of vegetable oil cakes (Table 3). Import of oils of similar type (Table 8) in 1971 (the latest figures) was 2,123 tonnes, but of this, 157 tonnes were as crude soybean oil, an import which, it is understood, is unlikely to be repeated.

Thus, Thailand is virtually self-sufficient in untransformed edible vegetable oils although there are significant imports of industrial oils particularly in oxidized or hydrogenated forms (Table 9). Thailand, as yet, has no blowing or hardening facilities.

TABLE 8. OIL AND CAKE PRODUCTION OF SURVEYED VEGETABLE OIL INDUSTRIES IN 1969, 1970

Oil	Number of producers up to 1970	Oil production 1969 (tonnes)	Oil production 1970 (tonnes)	Average yield Oil (%)	Average yield Cake (%)	Raw material usage 1969 (tonnes)	Raw material usage 1970 (tonnes)	Cake production 1969 (tonnes)	Cake production 1970 (tonnes)
Soybean	15	3,300	3,640	13	87	25,400	28,000	22,100	24,360
Groundnut	17	4,300	6,080	40	60	11,000	15,200	6,700	9,120
Copra	25	14,000	14,000	58	42	24,000	24,000	10,000	10,000
Cotton seed		1,500	1,500	16	84	9,400	9,400	7,900	7,900
Kapok seed	12	1,200	2,650	18	82	6,700	14,720	5,500	12,070
Castor seed	6	3,200	3,100	40	60	8,000	7,750	4,800	4,650
Rice bran	5	4,000	6,480	17	83	23,500	38,120	19,500	31,640
Kenaf	1	30	35	19	81	160	185	130	150
Tung	3	80	90	45	55	180	195	100	105
Total		31,610	37,575			108,340	137,570	76,730	99,995

Source. Economic Studies Group survey.

TABLE 9. THAILAND: IMPORTS OF VEGETABLE OIL

Description	1967 Qty. (kilo-litres)	1967 Value (1000 baht)	1968 Qty. (kilo-litres)	1968 Value (1000 baht)	1969 Qty. (kilo-litres)	1969 Value (1000 baht)	1970 Qty. (kilo-litres)	1970 Value (1000 baht)	1971 Qty. (kilo-litres)	1971 Value (1000 baht)
1. Crude, refined, or purified oils										
Oil, linseed	189	1,444	206	1,363	264	1,952	80	593	149	7,891
Oil, soybean	91	759	174	1,153	2,831	12,423	142	1,198	157	1,443
Oil, groundnut	4	37	10	138	2	20	3	29	-	-
Oil, olive	33	609	48	956	21	442	39	694	52	624
Oil, palm	72	472	202	884	101	546	70	406	109	623
Oil, coconut	602	3,067	-	-	-	-	-	-	-	-
Oil, castor	31	340	60	759	147	1,624	13	143	-	-
Oil, tung	58	435	34	196	21	143	23	226	5	48
Oil, sesame	15	290	24	538	24	436	20	391	22	457
Oil, maize	2	18	16	177	35	512	3	407	37	564
Oil, bean, n.e.s.	10	81	8	71	4	28	2	23	-	-
Oil, mustard	2	5	5	7	7	-	-	-	-	-
Oil from seeds, nuts, and kernels, n.e.s.	79	842	107	1,132	66	729	8	101	73	887
Oil, sunflower									51	476
Total crude, refined, or purified oil imported	1,186	8,399	889	7,374	3,516	18,855	404	4,211	655	13,013

TABLE 9 - continued

Description	1967		1968		1969		1970		1971	
	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)
2. Modified oils										
Olive oil, oxidized, blown or boiled	6	99	10	140	3	73	1	53	2	75
Linseed oil, oxidized, blown or boiled	558	4,646	663	5,520	614	5,057	613	5,288	920	6,650
Soybean oils oxidized, blown or boiled	6	52	6	48	667	2,674	-	-	-	-
Castor oil modified, inedible	-	-	-	-	-	-	12	119	87	934
Palm oil oxidized, blown or boiled	48	364	105	559	43	284	-	-	-	-
Tung oil modified	-	-	-	-	-	-	2	2	4	38
Coconut oils oxidized, blown or boiled	112	513	-	-	113	782	-	-	-	-
Salad oil	21	170	14	169	21	182	-	-	-	-
Edible oils, n.e.s. oxidized, blown or boiled	7	95	4	62	49	464	1	15	35	280
Oils, n.e.s. oxidized, blown or boiled	17	150	29	260	39	396	7	66	7	59
Total modified oils imported	775	6,085	831	6,758	1,549	9,912	634	5,543	1,055	8,036

TABLE 9 - continued

Description	1967		1968		1969		1970		1971	
	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)	Qty. (kilo-litres)	Value (1000 baht)
3. Hydrogenated oils										
Olive oils hydrogenated	4	75	2	68	5	122	1	24	-	-
Linseed oils hydrogenated	20	177	50	546	57	480	24	179	3	32
Groundnut oils hydrogenated	13	106	-	-	4	5	-	-	-	-
Soybean oils hydrogenated	9	68	4	34	8	61	-	-	-	-
Palm oils hydrogenated	244	1,886	385	2,429	515	3,008	393	3,095	369	2,794
Coconut oil hydrogenated	1	9	3	4	1	2	6	10	-	-
Oils, n.e.s. hydrogenated	38	339	154	1,590	248	2,185	20	156	-	-
Edible, oils n.e.s. hydrogenated	148	1,521	249	2,437	329	2,966	198	1,826	39	334
Sesame oil hydrogenated edible	-	-	-	-	-	-	5	116	2	57
Salad oil hydrogenated	-	-	-	-	-	-	3	4	1	2
Total hydrogenated oils imported	477	4,181	844	7,108	1,163	8,829	642	5,410	413	3,219
Grand total (1+2+3) vegetable oils imported	2,438	18,665	2,564	21,240	6,228	37,596	1,679	15,164	2,123	24,268

Source. Department of Customs, Bangkok.

Thailand's only significant export of vegetable oil is that of groundnut, and even this has increased from 1,700 tonnes in 1968 to 2,401 tonnes in 1971 (Table 10).

The small export of vegetable oils contrasts markedly with the large exports of oilseeds which have ranged from 60,000 to 100,000 tonnes p.a. over the past five years.

Thailand exports a significant proportion of its oil cake production (Table 11). Import statistics show that there was only a small quantity of oil cake import during 1967-1969 and this continued to increase during 1970-1971 as shown in Table 12. But there is said to be some import (possibly a re-import "feed concentrate".

ii) Oil types

Of the 38,000 tonnes of vegetable oils produced in 1970, some 60% was coconut oil, with peanut at 14% the next highest.

iii) Future demand

There appears to be comparatively little difficulty in disposing of vegetable oil cakes either domestically or abroad, so that the limitation in the vegeta~~b~~le oil industry is principally that of disposing of the oil.

Domestic demand

Present demand for edible vegetable oils in Thailand, as shown above was 37,000 tonnes p.a. in 1970.

If it is assumed that population growth in Thailand over the next ten years will be 3.3% and that income elasticity of demand for oils and fats will remain, as predicted by FAO, at 1.1, then domestic demand for edible vegetable oils will be 46,000 tonnes p.a. by 1975 and 57,000 tonnes p.a. by 1980.

This doctrinaire approach probably gives a minimum value. Demand could increase due to the gradual adoption by Thai farmers of leaner types of pigs, slaughtered at an earlier age so that lard production decreases.

Present production of lard is difficult to estimate as much pig-slaughter seems to be done illegally and hence official statistics are misleading (Table 13).

TABLE 10. THAILAND: EXPORTS OF VEGETABLE OILS

Description	1967		1968		1969		1970		1971	
	Qty. (kilo-litres)	Value f.o.b. (1000 baht)	Qty. (kilo-litres)	Value f.o.b. (1000 baht)	Qty. (kilo-litres)	Value f.o.b. (1000 baht)	Qty. (kilo-litres)	Value f.o.b. (1000 baht)	Qty. (kilo-litres)	Value f.o.b. (1000 baht)
Groundnut oil crude refined or purified	1,044	7,524	7	66	244	1,551	1,650	11,549	2,401	15,737
Soybean oil crude refined or purified	-	-	2	2	2	10	8	48	36	206
Coconut oil	59	620	65	295	-	-	83	252	-	-
Castor oil	34	210	8	60	-	-	2	12	2	14
Tung oil	-	-	2	14	14	83	27	197	-	-
Rice bran oil	240	357	7	25	-	-	85	320	1	9
Beans oil edible	-	-	-	-	52	278	4	1	5	2
Other vegetable oil edible	-	-	1	8	-	-	60	180	11	89
Castor oil inedible	-	-	-	-	-	-	12	38	3	20
Rice bran oil inedible	-	-	-	-	-	-	30	31	2	24
Other vegetable oils inedible	-	-	-	-	-	-	2	82	100	309
Total	1,377	8,711	89	463	312	1,922	1,958	12,698	2,556	16,410

Source. Department of Customs, Bangkok.

TABLE 11. THAILAND: EXPORTS OF OIL CAKE

Description	1967		1968		1969		1970		1971	
	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)
Groundnut cake	5,380	10,776	4,358	8,642	3,067	6,429	4,847	10,716	3,828	8,673
Bean cakes, n.e.s.	930	1,721	857	1,858	2,040	4,570	2,091	2,900	810	2,036
Copra cake	7,368	7,635	10,466	10,379	8,808	9,430	8,104	8,218	9,610	9,046
Soybean cake	2,348	4,319	2,833	5,866	8,580	18,608	4,724	10,660	1,207	2,784
Cotton seed cake	-	-	-	-	-	-	5,082	7,062	-	-
Kapok seed cake	-	-	-	-	-	-	17,157	20,230	-	-
Other oil cakes & residues from the extraction of vegetable oils	-	-	-	-	-	-	1,828	1,820	14,030	10,788
Total	16,026	24,451	18,514	26,745	22,495	39,037	43,833	61,606	29,485	33,327

Source. Department of Customs, Bangkok.

TABLE 12. THAILAND: IMPORTS OF OIL CAKE

Description	1967		1968		1969		1970		1971	
	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)	Qty. (tonnes)	Value (1000 baht)
Groundnut cake	-	-	-	-	-	-	-	-	969	1,910
Soybean cake	-	-	-	-	-	-	1,016	2,226	310	1,282
Other bean cake	-	-	-	-	-	-	-	-	5	5
Other oil cake and residue from the extraction of vegetable oils	3	9	6	30	3,013	6,774	1,016	2,163	23	4
Total	3	9	6	30	3,013	6,774	2,032	4,389	1,307	3,201

Source. Department of Customs, Bangkok.

TABLE 13. THAILAND: LARD IMPORTS AND EXPORTS 1965-1971

Year	Import		Export	
	Quantity (kg)	Value, c.i.f. (baht)	Quantity (kg)	Value, c.i.f. (baht)
1965	-	-	360	4,080
1966	-	-	120	1,006
1967	1,650	10,010	1,820	12,051
1968	14,891	69,880	-	-
1969	40,331	218,105	-	-
1970	2,135	15,415	1,700	17,100
1971	700	5,549	-	-

Source. Department of Customs, Bangkok.

The Household Consumer Survey of 1963 showed a per capita lard oil consumption in Thailand of 800 g annually. If this still holds, then present lard oil consumption is about 28,000 tonnes p.a. for the total population, i.e. roughly of the same order as vegetable oil production.

However, Sprinks (personal communication, 1971), threw doubt on the Household Consumer Survey as a basis for present estimates (because of risen per capita income and failure to include meals purchased outside) and considered per capita consumption for 1968-1970 as:

Lard	2.50	kg
Vegetable oils	0.88	kg
Total	3.38	kg

Thus, a relatively small change in lard price could have a relatively large influence on vegetable oil consumption.

Spinks, while admitting the deficiencies in data, foresees a rise in per capita lard consumption from the 2.80 kg of the 1968-70 period to about 3.95 kg in 1976 and 5.37 in 1980, while for vegetable oils, he foresees a rise from the 1968-70 base period of 0.88 kg to 1.93 kg in 1976 and 3.26 kg in 1980. Spinks also foresees some considerable increases in soybean consumption but these may be spurious because of a double counting of imported crude soybean and the same oil when refined. To summarize Spinks's figures:

THAILAND: DEMAND FOR LARD, VEGETABLE OILS AND SOYBEAN OIL
(per capita kg)

Year	Lard	Vegetable oil	Soybean oil
1968-70	2.50	0.88	0.100
1976	3.95	1.93	0.22
1980	5.32	3.26	0.37

The Manderstam report (1970), however, suggested a rather reverse ratio for lard: vegetable oil consumption by 1980.

Overseas demand

The FAO Study Group on Oilseeds, Oils, and Fats has made a fairly recent assessment of world market for oil cakes and meals which shows a generally rising trend. In short, however, the term "world market" is meaningless and the total market is sectorized, with Thailand very much dependent on Japan as the major buyer.

For oilseeds, Japan is certainly Thailand's major market. In castor seed, Thailand is the biggest supplier to Japan, with Indonesia second. Japan imports no castor seed oil at present. In kapok seed, Japan was the only destination in 1970. In cottonseed, 98% of the total seed exported went to Japan. The Thai Government could theoretically ask the Japanese Government to grant greater access for Thai oils rather than oilseeds, but Japan's strict import regulations seem to militate against success.

Japan's total vegetable oil consumption is over 800,000 tonnes p.a., and tariffs are relatively low. Japan can produce about 15% of oil from domestic seeds. The rest is imported both as oil and oilseeds. Of the 30,000 tonnes of oil imported nearly 70% is palm oil. Japan relies little on tariffs but a great deal on devices which are difficult to negotiate such as quota restrictions on sensitive items, the withholding of import permits and foreign exchange as well as deposit levies.

PRODUCTION CAPACITY IN USE

Our survey covering 45 factories revealed that annual productive capacity of the vegetable oil industry in Thailand based on a one-shift, 300-day-per-year basis, is about 100,000 tonnes. (The Ministry of Industry in 1970 quoted a capacity of 103,000 tonnes p.a. covering 91 factories.)

Our survey of vegetable oil production for 1970 was 38,000 tonnes, so that capacity in use overall was 38%. The figure varies widely, however, from firm to firm and depends on the availability of raw material. In the coconut oil industry, for example, production was originally centred around Bangkok where the larger firms still exist. With decreasing availability of copra, however, a number of small to medium-size mills have been set up in southern Thailand adjacent to centres of copra production and most are working at 60-80% capacity, occasionally eking out copra supplies with local rubber seed.

Of course, if capacity is reckoned on the basis of two or three shift operation (as it often is for this industry in other countries), then plant capacity in Thailand is, overall, very much under-utilized.

Details of production of oils and cakes, capacity in use, and consumption of each kind of oil are given separately so that the overall position of each kind of oil can be seen.

a) Soybean oil

Production of soybean oil

According to our survey there were 9 factories processing soybean oil in 1962 and 11 factories in 1970, of which 4 could be classified as large by local standards. These 4 mills use solvent extraction. The remaining 7 mills are of medium and small size and use expeller presses. The average working year of the oil mills was 300 days. The mills produced 3,300-3,600 tonnes of soybean oil, which was only about 30% total capacity (in terms of raw material). This was caused by the shortage of soybeans since they could be bought only in the rainy and the cool seasons. Some producers claimed that the market price of soybean oil was quite low, but raw material and production costs were very high.

So some factories had to cease producing soybean oil production although they still produced other oils.

Year	Full capacity (raw material) (tonnes/year)	Production: Oil prod. (tonnes)	Production: Equivalent raw material usage (tonnes)	% of raw material usage to full capacity	% of excess capacity
1969	85,500	3,300	25,400	30.00	70.00
1970	98,400	3,640	28,000	28.45	71.55

Source. ESG survey.

Consumption of soybean oil

In 1969 local consumption of soybean oil was derived from 50% import, and 50% local production, and total local consumption was about 6,800 tonnes. In 1970 the local consumption declined to some 3,800 tonnes, of which 96% was derived from local production.

Since Thailand had to import hydrogenated soybean oil, some producers considered that hydrogenation in Thailand should soon be feasible if supplies of soybean were to increase and if Thai taste were swinging toward it. Hydrogenation eliminates the characteristic "beany" flavour of soybean oil. Details of production, import, export, and local consumption are given below.

1	2		3		4		5	
Year	Oil production		Import 1/		Export		Local consumption	
	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value c.i.f. (10^6 baht)	Qty. (tonnes)	Value f.o.b. (10^6 baht)	Qty. (tonnes)	Value (10^6 baht)
1969	3,300	17.00	3,506	15.20	2	.01	6,804	32.19
1970	3,640	18.25	142	1.20	8	.05	3,774	19.40

1/ Includes refined oil, oxidized oil and hydrogenation oil

Sources. 2: ESG survey; 3, 4: Dept. of Customs; 5 = 2 + 3 - 4.

Soybean cake and meal production, export, and local consumption

Local consumption of soybean cake and meal was between 13,500 and 21,000 tonnes per year derived wholly from local peoduction. Total production of soybean cake during 1969 and 1970 was 22,100 and 24,360 tonnes, of which 19-39% was exported. In Singapore and Malaysia, soybean cake from Thailand had a higher price than that from some other countries. In the local market, soybean cake was sold to animal feed factories. It should be noted that soybean cake has a premium over other oilseeds. Local consumption, import, and export are given below.

1	2		3		4		5	
	Cake production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	22,100	50.83	-	-	8,580	18.60	13,520	32.23
1970	24,360	55.30	1,016	2.20	4,724	10.70	20,652	46.80

Sources. 2 : ESG survey; 3, 4 : Department of Customs; 5 : 2 + 3 - 4.

Soybean oil & cake prices

Average wholesale price of soybean oil was around 5 baht/kg in 1969 and 1970. Even though the price of soybean oil was not as high as those of other kinds of oil, it was balanced by the relatively high price of soybean oil cake, which was over 2.00 baht/kg and in some years was as high as 2.50 baht/kg compared with 1.00 baht/kg for other oilseed cakes. The price of imported soybean oil was different for each category of oil as shown in the following table:

1	2	3			4
	Local oil wholesale price	Imported oil price, c.i.f.			Local cake
Year	(baht/kg)	Refined oil (baht/kg)	Oxidized oil (baht/kg)	Hydrogenated oil (baht/kg)	(baht/kg)
1969	5.15	4.35	4.00	7.63	2.30
1970	5.07	8.44	-	-	2.27

Sources. 2, 4: ESG survey; 3: Dept. of Customs, Bangkok.

Average revenue and return from soybean oil and cake

The average revenue in real terms according to the ESG survey ranged from 68 million baht to 74 million baht. The return before deducting expenses (other than raw material) per factory was 397,780 baht in 1969 and 468,180 baht in 1970 based on the assumption that every factory had the same production capacity and the same level of production during the survey period. Details are given below.

1	2	3	4	5	6	7	8
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)	Return before expenses (baht/factory)
1969	9	17.00	50.83	67.83	64.25	3.58	397,780
1970	11	18.45	55.30	73.75	68.60	5.15	468,180

Sources. 2, 3, 4, 5, 6: ESG survey; 7 = 5 - 6; 8 = 7 ÷ 2.

b) Groundnut oil

Production of groundnut oil

According to the ESG survey, there were 15 oil processing factories producing groundnut oil in 1969, and in 1970 there were 19 factories which formerly processed this kind of oil but some of them had stopped their operations due to market competition and shortage of raw material. Out of the total factories producing groundnut oil, only 2 of them extracted oil by solvent extraction, the rest using expeller presses. In the solvent extraction process, some factories used an expeller to reduce oil content prior to extraction.

In 1969, production of groundnut oil was 4,300 tonnes and increased to 6,000 tonnes by 1970. The average working year of the factories was about 300 days. The peak period of groundnut oil production was during May and June. The present production was only 17-25% of capacity in terms of raw material, due to substitution of other oilseeds. Details are shown in following table.

Year	Full capacity, raw material (tonnes/year)	Production		% of raw material usage to full capacity	% of excess capacity
		Groundnut oil (tonnes)	Equivalent raw material usage (tonnes)		
1969	89,400	4,300	11,000	25.60	74.40
1970	91,200	6,080	15,200	16.67	83.33

Source. ESG survey.

Consumption of groundnut oil

The local consumption of groundnut oil was mostly derived from local production, which was around 4,000-6,000 tonnes/year. There was a small amount of groundnut oil imported. Groundnut oil is suitable for human consumption. There is an increase in the number of local consumers as well as in the demand from Hong Kong and Singapore because of its taste. Some consumers considered that pressed groundnut oil is superior in taste to refined groundnut because refining had deprived the better of aroma and flavour.

Details of production and consumption are shown below.

1	2		3		4		5	
Year	Production		Import		Export		Local consumption	
	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value (10^6 baht)
1969	4,300	36.07	2	.02	244	1.60	4,058	34.49
1970	6,080	46.15	8	.07	1,650	11.50	4,438	34.72

Sources. 2 : ESG survey; 3, 4 : Department of Customs, Bangkok; 5 = 2 + 3 - 4.

Groundnut cake production, export, and local consumption

Local consumption of groundnut cake was around 3,600 to 4,300 tonnes derived wholly from local production. Almost 50% of local groundnut cake was exported. Local consumption of groundnut cake was for animal feed. Local production, export, and local consumption of groundnut cake are shown in the following table.

1	2		3		4		5	
	Production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	6,700	15.61	-	-	3,067	6.40	3,633	9.21
1970	9,120	17.97	-	-	4,847	10.70	4,273	7.27

Sources. 2 : ESG survey; 3, 4 : Department of Customs, Bangkok; 5 = 2 - 4.

Groundnut oil & cake prices

Wholesale average price of groundnut oil cake varied each year depending on the supply of groundnuts and demand for oil and cake. During the time of the ESG survey (1969 and 1970) the price was between 7-8.39 baht/kg for local oil, and 8.00 to 9.00 baht/kg for imported oil. The price of cake was between 2.25 and 2.33 baht/kg.

There are 3 grades of groundnut oil sold in the local market.

Grade A. Best quality edible oil produced from good quality groundnuts, priced at 8 baht/kg or over.

Grade B. Second quality edible oil produced from mixed good grade and ordinary grade nuts, priced at about 7 baht/kg.

Grade C. Oil of this quality is produced from a poor grade of groundnuts, and is priced at above 5 baht/kg or a little over.

The table below shows only the average local wholesale price of oil and cake, and does not give details of oil price according to grade.

1	2	3	4
Year	Local oil wholesale price (baht/kg)	Imported oil price, c.i.f. (baht/kg)	Local cake price (baht/kg)
1969	8.39	9.00	2.33
1970	7.59	8.05	1.97

Sources. 2, 4 : ESG survey; 3 : Department of Customs, Bangkok.

Average revenue and return of groundnut oil & cake

The average revenue in real terms according to the ESG survey ranged from 52 million baht to 64 million baht. Revenue before deducting other expenses (except raw material) per factory was between 512,000 baht and 445,290 baht as shown below:

1	2	3	4	5	6	7	8
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Revenue before expenses (10^6 baht)	Revenue before expenses (baht/factory)
1969	15	36.07	15.61	51.68	44.00	7.68	512,000
1970	17	46.15	17.97	64.12	56.54	7.57	445,290

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6; 8 = 7 ÷ 2.

c) Coconut oil

Production of coconut oil

There were 25 factories in Thailand with facilities for producing crude coconut oil in 1970; some of them produced other oils when copra was in shortage. Six of the factories, including the largest are metropolitan; the remainder are in southern Thailand.

There is no solvent extraction of coconut oil in Thailand and virtually all production is by expellers. Copra is mechanically chopped and then fed continuously from a hopper into each expeller. Only in the larger factories is copra precooked before feeding into the expeller, and a final pressing of cake is also made to express residual oil.

Production of coconut oil in 1969 and 1970 was about 14,000 tonnes. Total installed capacity was about 70,000 tonnes of raw material, equivalent to about 40,000 tonnes of oil per year. Overall capacity in use for copra was about 34% of full capacity, due to insufficiency of copra. Details are shown in the following table.

Year	Full capacity (raw material) (tonnes/year)	Production: Coconut oil (tonnes)	Production: Equivalent raw material (tonnes)	% of raw material usage to full capacity	% of excess capacity
1967	70,000	14,000	24,000	34.28	65.72
1970	70,000	14,000	24,000	34.28	65.72

Source. ESG survey.

Consumption of coconut oil

In 1969 and 1970 consumption of coconut oil was 13,000-14,000 tonnes, of which 99% was derived from local production. The remaining 1% was derived from import in the form of oxidized and hydrogenated oils. Export of coconut oil was very small. Coconut oil is produced in only one grade, and it must be refined before consumption. Unrefined coconut oil is use for soap and for lubrication. Details are given below.

1	2		3		4		5	
	Oil production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	14,000	106.40	113	0.78	-	-	14,113	107.18
1970	14,000	119.14	0.6	0.01	83	0.25	13,917	118.90

Sources. 2 : ESG survey; 3, 4 : Department of Customs; 5 : 2 + 3 - 4.

Copra cake production, import, export, and local consumption

Copra cake production in 1969 and 1970 was 10,000 tonnes. Of the total production, 81-88% was exported especially to Singapore. Local use of copra cake was either directly for pig raising or sold to animal feed factories. Local feed factories, however, used very little copra cake, since there was an abundance of other oilseed cakes, rice bran, and corn which can be bought at lower prices. Details are given in the table below.

1	2		3		4		5	
	Cake production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value,c.i.f. (10^6 baht)	Qty. (tonnes)	Value,f.o.b. (10^6 baht)	Qty. (tonnes)	value,approx. (10^6 baht)
1969	10,000	11.5	-	-	8,808	9.43	1,192	2.07
1970	10,000	12.0	-	-	8,104	8.22	1,896	3.78

Sources. 2 : ESG survey; 3, 4 : Department of Customs; 5 = 2 - 4.

Coconut oil and cake prices

Average wholesale price of coconut oil and cake varied from year to year largely depending on the price of copra. During 1969-1970, the local price of oil was between 7.60 and 8.51 baht/kg compared with the price of imported oxidized and hydrogenated at 7 and 16.67 baht/kg respectively. The cake price in the same period was around 1.15-1.20 baht/kg as shown below.

1	2	3		4
		Average import price, c.i.f.		
Year	Wholesale price of local coconut oil (baht/kg)	Oil oxidized (baht/kg)	Oil hydrogenated (baht/kg)	Local copra cake price (baht/kg)
1969	7.60	6.92	-	1.15
1970	8.51	-	16.67	1.20

Sources. 2 : Division of Agricultural Economics, Ministry of Agriculture;
3 : Department of Customs; 4 : ESG survey.

The average revenue and return of coconut oil and cake

The average revenue in real terms according to the ESG survey ranged from 118 million baht to 131 million baht. The return before deducting other expenses (except raw material) per factory was between 812,500 baht and 1,357,600 baht during 1969 and 1970 as shown in the following table:

1	2	3	4	5	6	7	8
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)	Return before expenses (baht/factory)
1969	24	106.40	11.50	117.90	98.40	19.50	812,500
1970	25	119.14	12.0	131.14	97.20	33.94	1,357,600

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6; 8 = 7 ÷ 2.

d) Cottonseed oil

Production of cottonseed oil

According to ESG survey 1969 and 1970 there was only one factory producing cottonseed oil with modern solvent extraction equipment. This factory is located in the metropolitan area and has an installed capacity of 150 tonnes of raw material per day. The other factories found that there was difficulty in finding cottonseed to feed their factories. Besides, cottonseed, unlike other oilseed, need special decorticating and delintering equipment to prepare it prior to oil extraction. Cottonseed oil needs refining before it becomes suitable for human consumption because of its peculiar taste and colour. Consequently, there was only one modern plant processing this oil during the survey period.

The production of cottonseed oil in 1969 and 1970 was at the same level of about 1,500 tonnes, which was about 20% of full capacity in term of raw material usage. Details are given below.

Year	Full capacity (tonnes/year)	Production: Cotton-seed oil (tonnes)	Production: Equivalent raw material usage (tonnes)	% of raw material usage to full capacity	% of excess capacity
1969	45,000	1,500	9,400	20.89	79.11
1970	45,000	1,500	9,400	20.89	79.11

Source. ESG survey.

Consumption of cottonseed oil

Local consumption of cottonseed oil was wholly derived from local production which was around 1,500 tonnes per year. Cottonseed oil is frequently mixed with more expensive vegetable oil like groundnut oil for purpose of reducing cost of production and sell price.

Year	Oil production Qty. (tonnes)	Oil production Value (10^6 baht)	Import Qty. (tonnes)	Import Value, c.i.f. (10^6 baht)	Export Qty. (tonnes)	Export Value, f.o.b. (10^6 baht)	Local consumption Qty. (tonnes)	Local consumption Value, approx. (10^6 baht)
1969	1,500	8.86	-	-	-	-	1,500	8.86
1970	1,500	9.00	-	-	-	-	1,500	9.00

Source. ESG survey.

Production, import, export, and local consumption of cottonseed meal

Production of meal in 1969 and 1970 was 7,900 tonnes. In 1970 Thailand could export 64% of total production. Local consumption was for animal feeding. Meal from solvent have only 1% residual oil (while pressed cake from small screw press may have up to 8% oil). Some producer complained that cottonseed meal was difficult to sell if it has over 0.02% gosapol (only ruminants can handle) although Japanese can by 0.04%.

Detail of meal production, export, and local consumption are given in the table below.

1	2		3		4		5	
	Cake production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	7,900	6.30	-	-	-	-	7,900	6.30
1970	7,900	7.90	-	-	5,082	7.06	2,818	2.82

Sources. 2 : ESG survey; 3, 4 : Department of Customs; 5 = 2 - 4.

Cottonseed oil and cake prices

Cottonseed oil price during 1969 and 1970 was about 6 baht/kg and the price did not vary much during the year. Price of cake increased from 0.63 to 1.00 baht/kg due to the increasing demand from foreign countries.

Year	Wholesale price of local cottonseed oil (baht/kg)	Local cottonseed cake price (baht/kg)
1969	5.91	0.67
1970	6.00	1.00

Source. ESG survey.

Average revenue and return of cottonseed oil and cake

The average revenue in real term according to ESG survey ranged from 15 million baht to 17 million baht. The return before deducting other expenses (except raw material) per factory was between 3.2 million baht to 4.1 million baht in 1969 and 1970 as shown in the following table:

1	2	3	4	5	6	7
Year	No. of factory	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)
1969	1	8.86	6.30	15.16	11.94	3.22
1970	1	9.00	7.90	16.90	12.78	4.12

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6.

e) Castor oil

Production of castor oil

According to ESG survey, there were 5 factories processing castor oil in 1969, and only 4 factories processing this oil in 1970 since one factory had to stop its operation due to decrease in demand for this kind of oil. These factories also produce other kinds of oil. Only one of these factories has solvent extraction equipment, the others used expeller pressing machine.

Production of castor oil in 1969 was 3,200 tonnes and production declined to 3,100 tonnes by 1970. The present production (in term of raw material) was only 29% of full capacity if it is assumed that these factories produced only castor oil. Some factories claimed that castor extraction need high technique and modern machine. Details of production and capacity are tabulated below.

Year	Full capacity (tonnes/year)	Production: Castor oil (tonnes)	Production: Equivalent raw material usage (tonnes)	% of raw material usage to full capacity	% of excess capacity
1969	27,300	3,200	8,000	29.30	70.70
1970	26,100	3,100	7,750	29.70	70.30

Source. ESG survey.

Consumption of castor oil

In 1969 and 1970 consumption of castor oil was about 3,200-3,300 tonnes, of which 95% was derived from local production. The oil is the typical industrial oil mainly used as lubricant or processed in the pharmaceutical and chemical industries. It is suitable for used with high temperature machine, i.e. use as jet oil and in hydraulic machinery. The oil cannot be used for human consumption. The local producer of castor oil claimed that even though Thailand has plenty of factories which can used castor oil as their raw material for the production of soap, cosmetic, paint, and pharmaceutical products, the producer of these products are not interested in local castor oil and most of them preferred imported castor oil. The local market of Thai castor oil is then to small, and only a small quantity was exported so most of these factories produced castor oil whenever there was demand or order from customer. The other factor that limited demand for local castor oil was that the price of local castor oil was as high as the import price; so there is a great competition and the producer has to sell the local product at a lower price. Details are shown below.

1	2		3		4		5	
	Oil production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value,c.i.f. (10^6 baht)	Qty. (tonnes)	Value,f.o.b. (10^6 baht)	Qty. (tonnes)	Value (10^6 baht)
1969	3,200	32.80	147	1.62	-	-	3,347	34.42
1970	3,100	30.22	25	0.26	12	.04	3,113	30.44

Sources. 2 : ESG survey; 3, 4 : Department of Customs; 5 = 2 + 3 - 4.

Castor oil cake production, and local consumption

Castor oil cake production cannot be used as feed for livestock. There was no import and export of castor oil cake. The local consumption is for fertilizer which was about 4,600-4,800 tonnes as shown below:-

	Cake production		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value,approx. (10^6 baht)
1969	4,800	3.98	4,800	3.98
1970	4,650	4.65	4,650	4.65

Source. ESC survey.

Castor oil and cake prices

Average wholesale prices of castor oil and cake varied from year to year, largely depending on price of raw material. Price of raw material increased every year; thus cost of production was also high. During the time of ESG survey (1969-1970), the local price was between 9 and 10 baht/kg, compared with imported price of 10-11 baht/kg in the same period, which showed that there was a little variation among local and imported price. Price of cake was between 0.83 and 1.00 baht as shown in the table below.

1	2	3		4
Year	Local oil wholesale price (baht/kg)	Import price, c.i.f.		Local cake price (baht/kg)
		Refined oil (baht/kg)	Modified oil (baht/kg)	
1969	10.25	11.02	-	0.83
1970	9.75	10.80	9.92	1.00

Sources. 2 : Division of Agricultural Economics, Ministry of Agriculture; 3 : Department of Customs; 4 : ESG survey.

Average revenue and return of castor bean oil and cake

The average revenue in real term according to ESG survey ranged from 34 to 36 million baht, and the return before deducting other expenses (except raw material) per factory was between 3 and 4 million baht as shown in the following table.

1	2	3	4	5	6	7	8
Year	No. of firms	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)	Return before expenses (baht/factory)
1969	5	32.80	3.98	36.78	20.80	15.98	3,196,000
1970	4	30.22	4.65	34.87	18.21	16.66	4,165,000

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6; 8 = 7 ÷ 2.

f) Rice bran oil

Production of rice bran oil

According to ESG survey there were 4 factories producing rice bran oil in 1969, and 5 factories processing rice bran oil in 1970. Four of them are in the metropolitan area, and these are the big producers of rice bran oil as well as other kinds of oils using solvent extraction. The remaining factory is situated in Nakhon Pathom province and uses mechanically operated expeller.

Four or five years ago there were 7 rice bran oil factories in Thailand since rice bran oil business was born during that time; after that rice bran oil was competed by other vegetable oils which have better quality and taste. Some factories have to cease producing rice bran oil and turned to other oils. It was complained by some producers that rice bran oil extraction will be profitable if the plant could throw away extracted bran. Even though the government agrees to give quota to export extracted rice bran at present, but demand did not increase much due to competition among various vegetable oils.

Production of rice bran oil in 1969 was about 4,000 tonnes and increased to 6,480 tonnes by 1970. Total full capacity was about 88,500 to 96,000 tonnes of raw material, but the capacity in use was about 26% to 40% of full capacity due to raw material shortage. Rice bran oil can be produced only 3 to 4 months in the year.

Details of full capacity and capacity in used are given in table below.

Year	Full capacity, raw material (tonnes/year)	Production: Rice bran oil (tonnes)	Production: Equivalent raw material usage (tonnes)	% of raw material usage to full capacity	% of excess capacity
1969	88,500	4,000	23,500	26.55	73.50
1970	96,000	6,480	38,120	39.70	60.30

Source. ESG survey.

Consumption of rice bran oil

In 1969 and 1970 consumption of rice bran oil was 4,000 to 6,300 tonnes, derived wholly from local production. Export of rice bran oil was very little and there was no import as shown in the table below.

1	2		3		4	
	Oil production		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	4,000	27.60	-	-	4,000	27.60
1970	6,480	44.91	115	.35	6,365	44.56

Sources. 2 : ESG survey; 3 : Department of Customs; 4 = 2 - 3.

Rice bran cake production, export, and local consumption

Rice bran cake production in 1969 and 1970 was 19,500 tonnes and 31,640 tonnes. Before 1970 extracted rice bran was not permitted to be exported. In 1970 the government agreed to give quota to export extracted rice bran, so 6% of rice bran cake was exported that year. There was no import in either 1969 or 1970. Local consumption of rice bran cake was 23,500 tonnes in 1969 and 30,712 tonnes in 1970. Local consumption was in animal feed factories. Details are given in the following table.

1	2		3		4	
Year	Cake production		Export		Local consumption	
	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	19,500	13.45	-	-	23,500	16.22
1970	31,640	18.07	1,828	1.82	30,712	16.25

Sources. 2 : ESG survey; 3 : Department of Customs, Bangkok; 4 = 2 - 3.

Rice bran oil and cake prices

Wholesale prices of rice bran oil and cake did not fluctuate much during the survey period. Even though raw material price increased every year, the producers could not increase selling price of rice bran oil due to the great competition among various kinds of oils sold in Thailand. Wholesale prices of oil and cake are shown in the following table:

Year	Wholesale price of local rice bran oil (baht/kg)	Local rice bran cake price (baht/kg)
1969	6.90	.50
1970	6.93	.50

Source. Daily Trade News.

Average revenue and return of rice bran oil and cake

The average revenue in real term according to ESG survey ranged from 41 to 63 million baht. The return before deducting other expenses (except raw material) per factory was between 5.5 and 7.1 million baht as shown in the following table.

1	2	3	4	5	6	7	8
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)	Return before expenses (baht/factory)
1969	4	27.60	13.45	41.05	19.03	22.02	5,505,000
1970	5	44.91	18.09	62.98	27.45	35.53	7,106,000

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 6 - 5; 8 = 7 ÷ 2.

g) Kenaf seed oil

Production of kenaf seed oil

There was only one factory producing oil from kenaf seed during the ESG survey in 1969 and 1970. The factory producing this oil is quite small factory equipped with an expeller pressing machine, and installed capacity was about 4 tonnes of raw material per day. Production of kenaf seed oil was only 30-35 tonnes in 1969 and 1970 which was only 13-15% of full capacity. The factory produces this kind of oil when seed is available. Kenaf seed supply is uncertain since the production is not on commercial basis at present. Production and capacity are as follow:

Year	Full capacity (tonnes/year)	Production: Kenaf seed oil (tonnes)	Production: Equivalent raw material usage	% of raw material usage to full capacity	% of excess capacity
1969	1,200	30	160	13.30	86.70
1970	1,200	35	185	15.42	84.58

Source. ESG survey.

Consumption of kenaf seed oil

Kenaf seed oil is not popular at present. The oil needs to be refined before it becomes suitable for use as edible oil.

Year	Oil production		Import		Export		Local consumption	
	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	30	0.15	-	-	-	-	30	0.15
1970	35	0.18	-	-	-	-	35	0.18

Source. ESG survey.

Kenaf cake production, and consumption

Cake production was about 130-150 tonnes in 1969 and 1970. All of production is used locally as fertilizer.

Year	Cake production		Import		Export		Local consumption	
	Qty. (tonnes)	Value (baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (baht)
1969	130	60,000	-	-	-	-	130	60,000
1970	150	80,000	-	-	-	-	150	80,000

Source. ESG survey.

Kenaf seed oil and cake prices

Prices of kenaf seed oil and cake did not fluctuate much during 1969-1970 since there was little demand for it. The price of oil was around 5.00 baht/kg and the price of cake was at .50 baht/kg as shown below.

Year	Wholesale price of local kenaf seed oil (baht/kg)	Local kenaf seed cake price (baht/kg)
1969	5.16	0.50
1970	5.00	0.50

Source. ESG survey.

Average revenue and return on kenaf seed oil & cake

Average revenue in real terms according to ESG survey ranged from 0.21 million baht to 0.26 million baht. The return before deducting other expenses (except raw material) was about 100,000-130,000 baht/ factory.

1	2	3	4	5	6	7
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)
1969	1	0.15	0.06	0.21	0.11	0.10
1970	1	0.18	0.08	0.26	0.13	0.13

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6.

h) Kapok seed oil

Production of kapok seed oil

According to ESG survey there were 6 factories producing kapok seed oil in 1969, and 10 factories processing this kind of oil in 1970. Two of the factories which were the largest producer used solvent extraction machine, while the remainders were equipped with expeller pressing machine. All of the factories located in metropolitan area.

Kapok seed oil was produced occasionally when there were order from customer because this kind of oil was not as popular as the other oils. Some producers complained that oil from expeller is of low quality because heat develop in the expeller, and they had now tried to get rid of this problem.

Production of kapok seed oil was 1,200 tonnes in 1969 which was 10% of total capacity, and increased to 2,650 tonnes in 1970 which was 18% of total capacity. The producers confronted with problem of uncertain demand from customers as well as uncertain supply of raw material.

Details of production are shown as follow:

Year	Full capacity (tonnes/year)	Production		% of raw material usage to full capacity	% of excess capacity
		Kapok seed oil (tonnes)	Equivalent raw material usage (tonnes)		
1969	63,300	1,200	6,700	10.58	89.42
1970	83,100	2,650	14,720	17.71	82.29

Source. ESG survey.

Consumption of kapok seed oil

Kapok seed oil is produced only one grade. The oil must be refined before using for human consumption because of its peculiar taste and colour. The kapok seed oil, like cotton seed oil, is frequently mixed with more expensive vegetable oil in order to reduce cost of production and sell price.

Kapok seed oil was exported only a little in 1970, all of the production was consumed in the country at the amount of 1,200 tonnes to 2,600 tonnes as shown in the following table:

1	2		3		4		5	
	Oil production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	1,200	7.08	-	-	-	-	1,200	7.08
1970	2,650	17.17	-	-	60	0.18	2,590	16.99

Sources. 2 : ESG survey; 4 : Department of Customs, Bangkok; 5 = 2 - 4.

Kapok seed oil & cake prices

Kapok oil price increased from 5.90 baht/kg in 1969 to 6.48 baht/kg in 1970. This variation due to the uncertain price and supply of kapok seed.

Kapok seed meal price increased from 0.90 baht/kg in 1969 to 1.07 baht/kg in 1970 due to the increasing demand from foreign countries as shown in the following table.

Year	Wholesale price of local kapok seed oil production (baht/kg)	Local kapok seed cake price (baht/kg)
1969	5.90	0.90
1970	6.48	1.07

Source. ESG survey.

Production, export, and local consumption of kapok seed meal

Local production of kapok seed meal was 5,500 tonnes in 1969 and increased to 12,070 tonnes in 1970. Local expeller cake contains about 6% residual oil; and solvent extraction reduce this to 1% and the cake can be kept longer.

Kapok seed meal was difficult to sell locally because the use of this kind of cake and meal in local mixed feed is not popular; the meal is less known than other oils cake despite the fact that decorticated kapok meal and cake has 44% protein (undecorticated has 30% protein).

Kapok seed meal had increasing demand from foreign countries and about 17,000 tonnes was exported in 1970. This amount of cake had to be drawn from stock of previous year. Details are given in the following table.

1	2		3		4		5	
	Cake production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value,c.i.f. (10^6 baht)	Qty. (tonnes)	Value,f.o.b. (10^6 baht)	Qty. (tonnes)	Value,approx. (10^6 baht)
1969	5,500	4.95	-	-	-	-	5,500	4.95
1970	12,070	12.51	-	-	17,157	20.23	5,080	7.32

Sources. 2 : ESG survey; 4 : Department of Customs, Bangkok; 5 = 2 - 4.

Average revenue and return of kapok seed oil and cake

The average revenue in real term according to ESG survey was between 12 million baht to 30 million baht during the period of the survey. The return before deducting other expenses (except raw material) per factory was between 475,000 baht to 697,000 baht as shown in the following table.

1	2	3	4	5	6	7	8
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)	Return before expenses (baht/factory)
1969	6	7.08	4.95	12.03	9.18	2.85	475,000
1970	10	17.17	12.91	30.08	23.11	6.97	697,000

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6; 8 = 7 ÷ 2.

i) "Tung oil"

The term "tung oil" in Thailand may cover the oils of *Aleurites cordata*, *A. fordii*, and *A. moluccana* together with the oil of *Paranarium anamensis*. In fact, in the ESG survey, *P. anamensis* oil was the only "tung oil" found to be produced. The Royal Forest Department found the oil of *P. anamensis* to have the following properties:-

Iodine value	139-221
Acid value	4.5
Saponification value	194
Refractive index	1.505
Drying time	18-19 hours

The oil is said to have a tendency to crystallize rendering it unsuitable for paint, but in ESG's survey were found to be expressing it. The oil is said to be used as a varnish for lacquerware and is used to water-proof paper umbrellas in northern Thailand.

According to the Royal Forest Department the oil of *A. moluccana* is inferior and its yield poor.

In conjunction with the Department of Science, the Royal Forest Department analysed the oil of *A. montana* in 1958 with the following results:

Specific gravity, 25°C	0.937
Refractive index, 25°C	1.5151
Iodine value (Wijs')	180
Rosemund-Kuhnheim	225

Saponification value	196
Acid value (mg KOH/g)	2.0
Gel time	14.5 minutes
Drying time	18-30 hours

Oil content of the kernel of A. montana is 20-25%. The entire fruit comprises 43% shell, 57% kernel. The relatively fast drying time of the oil is due to its high content of eleostearic acid. The oil, like that of P. ananensis, is used for water-proofing paper umbrellas in northern Thailand.

Production of tung oil

According to ESG survey there was one factory producing tung oil in 1969 and 3 factories processing this oil in 1970. These factories were small-size mills, using expeller pressing machine. Of the factories, two are located in metropolitan area, and the other one located in Nakhon Pathom province.

The production of tung oil was around 80-90 tonnes during 1969 and 1970, and production was 60% of total installed capacity in 1969 and remained only 29% of total capacity in 1970 as shown in the adjacent table.

Tung oil was produced occasionally when there was a demand and raw material was available. The producers complained that there were many problems in producing tung oil. These are:

1. It is very hard to dehusk the tung fruit in order to obtain tung seed for processing oil.

2. When the oil is produced, it cannot be kept long because the oil will crystallize and become unusable.

Year	Full capacity (raw material) (tonnes/year)	Production		% of raw material usage to full capacity	% of excess capacity
		Tung oil (tonnes)	Equivalent raw material usage (tonnes)		
1969	300	80	180	60.00	40.00
1970	6,720	90	195	29.01	70.99

Source. ESG survey.

Consumption of tung oil

Local consumption of tung oil was some 100 tonnes in 1969 and 1970, of which 80% was derived from local production, while 20% were obtained from import. Local consumption of this oil was in paint factories. Local consumption is shown below.

1	2		3		4		5	
	Oil production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	80	0.56	21	0.14	-	-	101	0.70
1970	90	0.79	23	0.23	-	-	113	1.02

Sources. 2 : ESG survey; 3 : Department of Customs; 5 = 2 - 3.

Production and consumption of tung seed cake

Local consumption of tung seed cake was 100 tonnes during 1969 and 1970, derived wholly from local production. Local use of tung seed cake is for fertilizer.

	Production		Import		Export		Local consumption	
Year	Qty. (tonnes)	Value (10^6 baht)	Qty. (tonnes)	Value, c.i.f. (10^6 baht)	Qty. (tonnes)	Value, f.o.b. (10^6 baht)	Qty. (tonnes)	Value, approx. (10^6 baht)
1969	100	.05	-	-	-	-	100	.05
1970	105	.05	-	-	unaccounted		105	.05

Source. ESG survey.

Tung oil price and tung seed cake price

Tung oil has considerable high price which largely due to the fact that supply of tung seed was so scarce and uncertain every year. The wholesale price of tung oil during the period of survey was 7 to 9 baht/kg. The import price in 1969 was only 6 baht and then increased to 10 baht/kg by 1970. Cake price was rather constant since the demand for it was not high. Table of price is as follow.

1	2	3	4
Year	Wholesale price of local tung oil (baht/kg)	Average import price (baht/kg)	Local tung seed cake price (baht/kg)
1969	7.00	6.67	.50
1970	8.75	10.00	.50

Sources. 2, 4 : ESG survey; 3 : Department of Customs, Bangkok.

Average revenue and return of tung oil and tung seed cake

The average revenue in real term according to ESG survey ranged from 0.61 to 0.84 million baht. The return before deducting other expenses (except raw material) per factory was between 140,000 and 220,000 baht as shown below:

1	2	3	4	5	6	7	8
Year	No. of factories	Revenue from oil (10^6 baht)	Revenue from cake (10^6 baht)	Total revenue from oil & cake (10^6 baht)	Raw material cost (10^6 baht)	Return before expenses (10^6 baht)	Return before expenses (baht/factory)
1969	1	0.56	0.05	0.61	0.39	0.22	220,000
1970	3	0.79	0.05	0.84	0.42	0.42	140,000

Sources. 2, 3, 4, 5, 6 : ESG survey; 7 = 5 - 6; 8 = 7 ÷ 2.

i) Sesame oil

There was no factory producing sesame oil during the time of the ESG survey in 1969 and 1970, although some of them processed this oil many years ago. These factories ceased producing sesame oil and turned to producing other kinds of oils because the price of sesame seed was quite high compared to other oilseeds.

Local consumption of sesame oil was derived wholly from import which was 24 tonnes in 1969, 20 tonnes in 1970, and 22 tonnes in 1971 (see Table 9).

Sesame oil import price was quite expensive; the wholesale price in 1969 and 1970 was about 11.57 to 11.67 baht/kg. In some consumers' view sesame seed oil has superior quality and taste compared with other edible oils.

k) Rubber-seed oil

Before the mid 1971 most of the small vegetable oil factories exploited rubber-seed oil by mixing with other edible oils, but the Food and Drug Control Division, Ministry of Public Health, found that rubber-seed oil was dangerous to consumers, and so the mixing of rubber-seed oil in edible oil was prohibited by the Food and Drug Control Division in 1971. Since this prohibition, many small vegetable oil factories have stopped producing rubber-seed oil, because it has no other application.

As a paint oil, rubber-seed oil is slow-drying, for, although it has a relatively high iodine number, its double bonds are not conjugated. Recently, however, ASRCT has shown that by reacting rubber-seed oil with cyclopentadiene, a by-product of petroleum refining, a paint with a high gloss and quick-drying properties can be produced.

l) Palm oil

In 1971 Thailand imported about 478 tonnes of palm oil valued at about 3.4 million baht. The largest palm oil consumer in Thailand is Lever Brothers (Thailand) Limited, who produces soap and edible fats in its factory in Yan Nawa, Bangkok.

Although 478 tonnes of imported palm oil is not a very large amount, the fact remains that Thailand, which has all the pre-conditions for becoming a palm oil exporter, is actually forced to import palm oil.

There is no palm oil processing plant in Thailand at present. But the first private palm oil processing plant will be established at the end of 1972 and will be operated by the Oil Industry and Palm Oil Estate Co. Ltd., in Krabi province. This company also owns oil palm estate covering about 10,000 rai in Krabi. Some of the trees are already in fruit.

Another private oil palm estate is in Ban Bung district in Chon Buri province and has about 4,000 rai of palm tree.

In addition to the two private estates mentioned, the Self-Help Land Settlement Division of the Public Welfare Department, Ministry of Interior started an oil palm pilot scheme in land settlement at Satun province in 1968. The total area planted of oil palm under the administration of the Public Welfare Department was 7,200 rai in 1971. The pilot processing plant of the Public Welfare Department will be installed in 1973 in Satun province.

STRUCTURE OF THE INDUSTRY

Inconsistency of data

According to Ministry of Industry records there were 91 vegetable oil factories in Thailand in 1970 with a combined capacity of 100,000 tonnes p.a. and a total capital of 172 million baht, and an overall employment of 1,700.

In our survey, however, we could locate only 45 factories, 25 of which were mainly producers of coconut oil.

This discrepancy between official registrations and actual survey findings is not unusual, however, because factories which cease to operate rarely advise the ministry of their cessation.

Development of the industry

Historically, the industry comprised both large and small firms, but the passage of the Promotion of Industrial Investment Act (1962) caused an influx into the industry of additional new, larger firms. Promotion certificates in this field were issued by the Board of Investment in two categories, i.e. "Vegetable oil" and "Rice bran oil". In each category, eight firms received promotion certificates, but three firms were common to each category (Tables 14 and 15).

Of the 45 firms in the industry, only 6 were actually producing 1,000 tonnes p.a. or more of oil. Five had solvent extraction equipment and only one (Industrial Enterprises Co. Ltd.) is capable of utilizing cottonseed as it, alone, has delintering equipment.

TABLE 14. FIRMS PROMOTED BY THE BOARD OF INVESTMENT : VEGETABLE OIL PRODUCERS

No.	Name in English	Date of promotion certificate	Products	Capacity (tonnes)	Registered capital (10^6 baht)	Total capital (10^6 baht)
1	Thai Rice Oil Industry	19 Oct. 64	Vegetable oils	6,000-8,000/year	5.000	4.000
2	Tien Yen Industrial Co.	28 May 65	"	14,760/year	10.000	10.000
3	Sutha Thip Co. Ltd.	5 June 63	"	540/year	2.000	3.000
4	East Union Vegetable Oil Co.	30 July 62	"	600/year	0.750	1.250
5	Industrial Enterprise Ltd.	28 May 65	"	5,000-6,000/year	10.000	35.000
6	Chanatip Co. Ltd.	25 Oct. 66	"	3,000-6,000/year	5.000	12.000
7	Rice Bran and Vegetable Oil Co. Ltd.	9 Feb. 67	"	6,000/year	5.000	16.000
8	The Thai Oil Palm Industry and Estate Co. Ltd.	22 May 72	Palm oil	17,600/year	30.000	50.000

Notes

No. 1. Not in production. Reportedly awaiting space in an industrial estate. Future doubtful.

No. 2. In production, but present output very limited, reportedly because of shortage of seeds. Switched to rice bran. Capacity reportedly 100 tonnes of seeds per day.

No. 3. Began production August 1966. Capacity reportedly 540 tonnes of coconut, peanut, and other oils. Reported production figures for 1967, coconut oil 375 tonnes, peanut and other 368 tonnes, plus cake.

No. 4. Began production June 1963. Stopped producing in September 1966, reportedly because of shortage and high cost of raw materials.

No. 5. Began production in 1967. Largest mill in Thailand. Facing various problems, mainly lack of raw materials.

No. 6. Certificate has been withdrawn because of non-activity.

No. 7. Machinery ordered, but no construction as yet.

TABLE 15. FIRMS PROMOTED BY THE BOARD OF INVESTMENT: RICE BRAN OIL PRODUCERS

No.	Name in English	Date of promotion certificate	Product	Capacity (tonnes)	Registered capital (10^6 baht)	Total capital (10^6 baht)
1	Thai Rice Oil Industrial Co. Ltd.	19 Oct. 64	Rice bran oil	8,585/year	1.500	4.000
2	Universal Rice Bran Oil	14 June 61	"	6,579/year	8.500	10.000
3	Industrial Enterprises Ltd.	20 May 65	"	50/day	10.000	35.000
4	General Industrial Co.	3 Dec. 65	"	3,600/year	5.000	22.300
5	Thai Development Rice	22 April 66	"	1,500/year	5.000	7.000
6	Thai Rice Bran & Vegetable Oil Ind. Co.	9 Feb. 67	"	4,000/year	5.000	16.000
7	Tien Yen Industrial Co. Ltd.	4 Sept. 68	"	1,800/year	10.000	10.000

Notes

No. 1. Not in production. Reportedly awaiting space in an industrial estate. Future doubtful.

No. 2. Old firm. Began operations in September 1961. Produces about 1,000 tonnes of oil per year plus wax and other products.

No. 3. Also a vegetable oil producer. Produces relatively little rice bran oil to date, although have a large capacity.

No. 4. Began operations in Jan. 1967. Can process 50 tonnes of rice bran per day. 1967 production was about 1,000 tonnes of oil, 5,300 tonnes of cake, plus wax and other products.

No. 5. In operation already, but no further information is available.

No. 6. Machinery ordered but no construction as yet.

No. 7. Previously a vegetable oil mill, recently given promotion for rice bran because of difficulty of obtaining sufficient vegetable oilseeds. Can process 100 tonnes of rice bran per day. Currently processing 50 tonnes according to the Supervision Division.

Decentralization of the industry

The geographic pattern of production of vegetable oils in Thailand is as follows:

1. Factories producing and refining a variety of oils predominate in Bangkok.

2. Factories specializing in coconut oil production predominate in southern Thailand. Of a total of 25 coconut oil factories in Thailand, only eight are metropolitan and 17 provincial. Nevertheless, 75% of production capacity is in Bangkok and all refining capacity is centred there.

An Israeli IPD/UN Team is examining the feasibility of establishing a solvent extraction plant in Chiang Rai where some 40,000 tonnes of rice bran are said to be available, and if this plant is successful, then a further 6 similar extraction plants would be sited strategically throughout the northern region to process not only rice bran but peanuts, soybeans, kapok seeds, cottonseeds, and sesame seeds. All told, there is estimated to be over 90,000 tonnes of oil-bearing materials throughout the northern region.

The team realizes such inherent problems as that of disposing extracted rice bran (Thai farmers much prefer the unextracted meal) and of oil cakes generally, the relatively low price of which could scarcely withstand transport to Bangkok.

CURRENT NATIONAL POLICIES

According to the Third National Economic and Social Development Plan (1972-1976), vegetable oil is one of the first types of private industry which will be promoted by the Thai Government. There are, however, various government forbearances, plans, and actions aimed at regulating and developing the industry. These include the following:

Forbearances

Although there are over 100 government-owned corporations which engage in manufacture or trading in Thailand, none of these are in the vegetable oil field and government intrusion into that industry seems unlikely in view of the provisions of the Promotion of Industrial Investment Act, 1962 (see below).

Promoted Industries and the Board of Investment (BOI)

Under the Promotion of Industrial Investment Act, certain firms have been "promoted" by the Board of Investment, which is the executive arm, in this connection, of the Ministry for National Development.

The Board of Investment has promoted firms producing "rice-bran oil" and "vegetable oil", (i.e. distinguishing two categories). In each category, eight firms were promoted, three of the firms being common to both categories. Promoted firms receive certificates which entitle them to certain privileges.

The National Economic Development Board

The National Economic Development Board has set the following targets for the Third National Economic and Social Development Plan (1972-1976):

		1972 Production	1976 Production	Average annual growth rate %
Coconuts	(1,000 nuts)	443,000	574,000	5.1
Groundnuts	(tonnes)	210,000	400,000	13.8
Castor seed	"	44,000	55,000	4.6
Soybean	"	100,000	300,000	24.6
Cottonseed	"	60,300	134,000	17.3
Sesame seed	"	26,000	48,000	13.2

Note. In the Third National Economic and Social Development Plan, 1972-1976, cotton production is stated in terms of seed-cotton. Cotton seed in this table is obtained by using a conversion ratio 67% of seed-cotton.

Ministry of Economic Affairs

Even though particular attention is to be given to soybean production for export according to an announcement of 7 January 1971 from the Ministry of Economic Affairs and an export target of 100,000 tonnes p.a. was expected to earn an additional 2,500 million baht, but Thailand could export only 6,077 tonnes at 17 million baht in that year. It is also planned to extend production from northern Thailand (as at also present) to the central plain and to increase productivity from 150 kg of seed per acre to 300 kg.

Government research and development

In addition to the UNIDO-supported Phase II Project of the Technological Research Institute within ASRCT, which includes research on vegetable oil extraction as one of its three main objectives, it is also recommended by a UNIDO consultant that a "Vegetable Oil Unit" should be set up within the Technological Research Institute in order to help solve the problems that may arise in the vegetable oil factories. The Tropical Agricultural Products Institute of ASRCT is also actively working on the production and utilization of grain legumes (ASRCT Research Programme No. 44) and on production and utilization of sunflower (ASRCT Research Programme No. 52).

Additionally, an Israeli IPD/UN team has make a study on Development of the northern region and is examining the feasibility of establishing six or seven solvent oil-extraction plants throughout the northern region to process rice bran, groundnuts, soybeans, kapok seeds, cottonseeds and sesame seeds.

A Japanese team is spending a second term in Thailand specifically on soybean development.

An Australian Colombo Plan team and a Taiwanese team are working in the north central region and their work also covers oilseed agronomy.

All the above projects are carried out in cooperation with the Thai government.

Throughout the past decade, moreover, there have been studies on individual vegetable oil projects, carried out mostly by United States Operations Mission to Thailand (USOM) in cooperation with the Thai government. ASRCT has also carried out earlier studies on some vegetable oils.

A bibliography, listing past reports, appears as Appendix I.

Tariff protection

A significant feature of the vegetable oil economy in Thailand is the high level of tariff protection and, even more so, of effective tariff protection, accorded to local vegetable oil production. Current rates are as follows:

Product	Ad valorem tariff (%)	Specific tariff (baht/litre)	Approx. c.i.f.value (baht/litre)	Effective rate (%)
Groundnut oil	-	2.00	9.20	22
Soybean oil	-	2.00	4.40	46
Coconut oil	-	2.00	6.80	29
Cottonseed oil	-	4.40	5.00	88
Lard	25	4.40	5.40	81

This level of effective protection would make for inefficiency in any industry especially when coupled with the low capacity-in-use in the industry.

Licensing

The Ministry of Industry requires all factories to register which use machines of greater than 2 hp or which employ seven or more workers. Firms producing oils for human consumption must register with the Department of Health otherwise, entry is not restricted.

Controls

Imports of coconut oil, groundnut oil, and palm oil require permits. Imports of other oils and fats are unrestricted.

The industry reports that there are no effective governmental quality or standards controls. Recently, however, the government acted to suppress the use of rubber-seed oil in frying oils.

The economic importance of vegetable oil to the Thai national economy

The contribution to GDP in real terms can be summarized as follows:

The GDP in 1970 was 135,060 million baht and the percentage of value added of vegetable oil to the total of GDP was about 0.1%.

CONTRIBUTION OF THE VEGETABLE OIL INDUSTRY TO THE THAI NATIONAL ECONOMY CALCULATION FOR 1970

1		2	3	4	5	6	7	8	9
Type of product		Oil & cake production (tonnes)	Wholesale price of oil & cake (baht/tonne)	Value of oil (10^6 baht)	Total value of oil & cake (10^6 baht)	Raw material used in oil processing (tonnes)	Wholesale price of raw material (baht/tonne)	Total value of raw material (10^6 baht)	Value added 5-8 (10^6 baht)
Soybean	Oil	3,640	5,070	18.45	73.75	28,000	2,450	68.60	5.15
	Cake	24,360	2,270	55.30					
Groundnut	Oil	6,080	7,590	46.15	64.12	15,200	3,720	56.54	7.58
	Cake	9,120	1,970	17.97					
Copra	Oil	14,000	8,510	119.14	131.14	24,000	4,050	97.20	33.94
	Cake	10,000	1,200	12.00					
Cotton	Oil	1,500	6,000	9.00	16.90	9,400	1,360	12.78	4.12
	Cake	7,900	1,000	7.90					
Kapok	Oil	2,650	6,480	17.17	30.08	14,720	1,570	23.11	6.97
	Cake	12,070	1,070	12.91					
Castor	Oil	3,100	9,750	30.22	34.87	7,750	2,350	18.21	16.66
	Cake	4,650	1,000	4.65					
Rice bran	Oil	6,480	6,930	44.91	62.98	38,120	720	24.45	35.53
	Cake	31,640	500	18.07					
Kenaf	Oil	35	5,000	.18	.26	185	700	.13	.13
	Cake	150	500	.08					
Tung	Oil	90	8,750	.79	.84	195	2,150	.42	.42
	Cake	105	500	.05					
Total oil production		37,535	Total value, oil	286.01	Total raw material production	137,570	Total value of raw material	304.44	
Total cake production		199,995	Total value, cake	128.93					
Total value of oil & cake production				414.94				Total value added	110.50

RECOMMENDATIONS

The raw material procurement proceedings practiced

In Thailand, oilseeds are produced by small-holder farmers. Virtually no industrial large-scale farming exists. A number of small-holders have combined to join cooperatives which are seldom suitably equipped and organized. At present the cooperatives are not able to play their important role as a raw material supplier and partner to the processing industry.

The oilseed producers and the cooperatives normally have no direct contacts with the existing vegetable oil factories, nor do they directly deal with the oilseed exporters. So the oilseed producers have no chance to know exactly how much they should supply to vegetable oil factories or to oilseed exporters. The business transaction in the oilseed trade are made through middlemen who act as an intermediary between the oilseed producers and the vegetable oil processors and the exporters.

The middleman's interest in the oilseed trade is purely commercial and guided only by profit. The tendency is to pay as low a price as possible to the farmer and sell as profitably as possible to the processor or exporter. If the external oilseed price is high, the middleman will sell most of the oilseeds to the exporter, so the existing processing industry will meet difficulties in its raw material supply. This situation may be applicable as long as no modern commercial vegetable oil industry exists, and exports, controlled by the authorities, according to world market prices, take the leading role.

The raw material supply to the industry

A suitable raw material marketing basis for a viable oil industry would be the direct contracting system between oilseed producer and processor on a long-term contract basis. This system does not need any intermediate dealer or middleman and would, therefore, be beneficial to both parties.

Therefore an "Oilseed Marketing Board" should be established to buy oilseeds directly from the producers and also to supply these oilseeds directly to the processors. This board should keep close contact with all vegetable oil processors. The quantity of oilseeds production should be planned by this board according to processors' requirement. The minimum price of oilseed should be guaranteed by long-term contract between Oilseed Marketing Board and oil processors. This board also has the authority to export the oilseeds in the case of domostic oilseed surplus. Establishment of this board would also need encouragement, finance, and legal support from the government and also the cooperation from oil processors.

Establishment of new vegetable oil plants should not be promoted, but the existing vegetable oil plants should be. Most of these plants are operating below full capacity for shortage of raw material.

The vegetable oil industry in Thailand consists of various small scale factories using different processes and a variety of more or less efficient equipment. Unsuitable equipment will result in low quality of the products produced and subsequent marketing difficulties. The production losses will be high, the production economy very unfavourable, and instead of producing a product with an added value, the raw material value will just be destroyed.

In this connection it may be noted that the application of unsuitable equipment will not necessarily result in financial losses for the owner of a particular factory. It may even be profitable, if the price of a product exceeds its actual value. The product would then be overpaid to the benefit of the producer. However, it will always be a great loss to the national economy of a country.

So quality standard specifications have to be used as a regulator of industrial production for obtaining the confidence of the vegetable oil consumer and protecting the loss of exploiting raw material.

Quality standards should cover the entire process of vegetable oil:

1) Oilseeds

2) Edible vegetable oils

3) Oil cakes

4) Extracted meals.

APPENDIX I

BIBLIOGRAPHY

HATCH, A.U. Outlook for vegetable oil processing industry in Thailand. Bangkok, USOM, 1962.

HERMANS, Wilhemus C.J. Rice bran oil industry in Thailand: Development, problems, and Applied Scientific Research Corporation of Thailand research activities. Mimeographed Bangkok, ASRCT, 1969. (Appraisal Report no. 19.)

HILDITCH, T.P. The Chemical Constitution of Natural Fats. 2nd ed. New York, John Wiley and Sons, 1947.

KOENIG Horst R. Vegetable oil industry in the Kingdom of Thailand. Bangkok, 1972.

L.H. MANDERSTAM AND PARTNERS LTD. The Development of Export Industries in Thailand. Vol. III. London, Ministry of Overseas Development, 1970.

MARSDEN, D.C. Brief analyses of selected industries in Thailand. In: Oils and Fats Industry in Thailand. Sect. VIII. Bangkok, USOM, 1966.

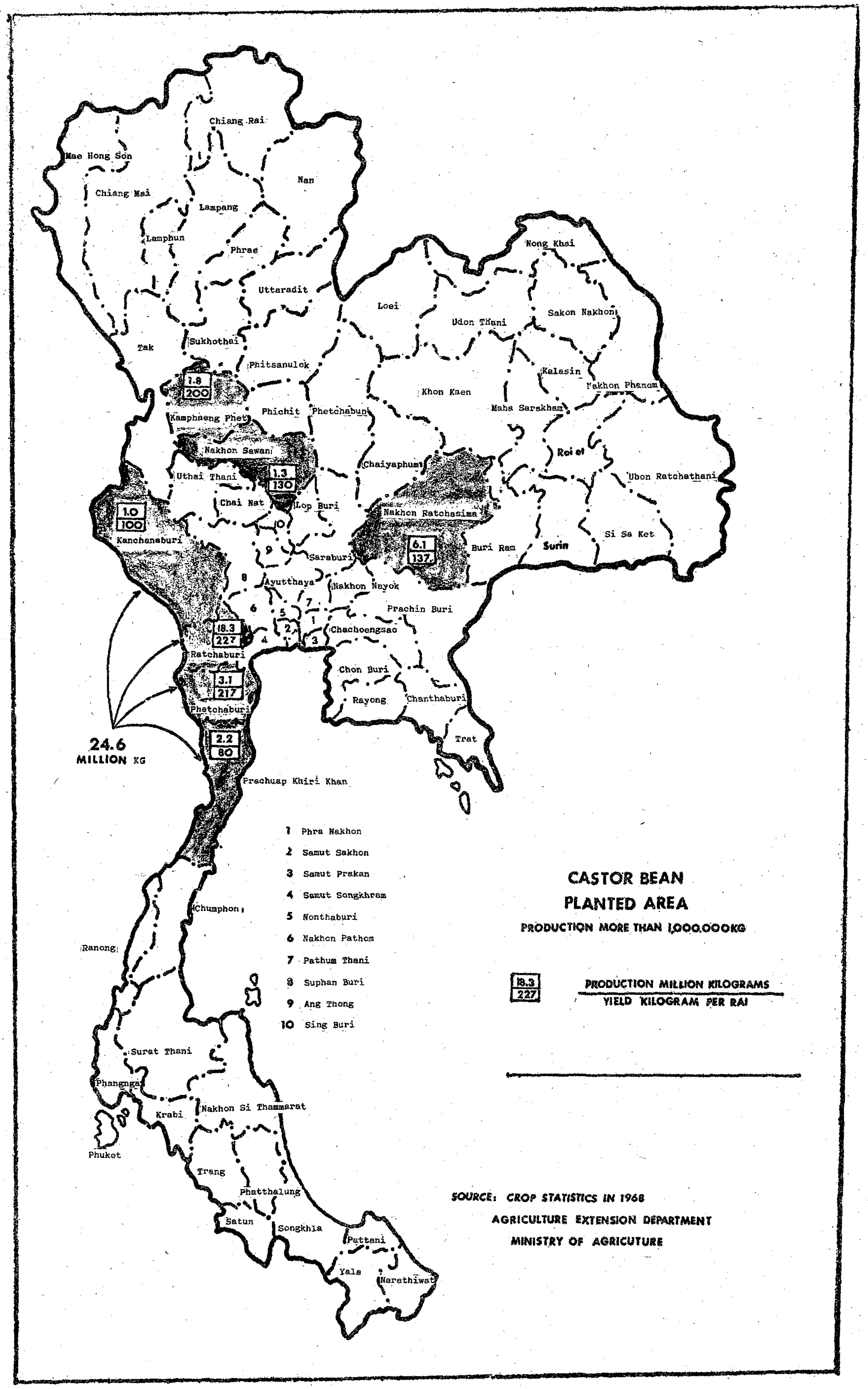
SWERN, D., ed. Bailey's Industrial Oil and Fats Products. 3rd ed. New York, Interscience Publishers, 1964.

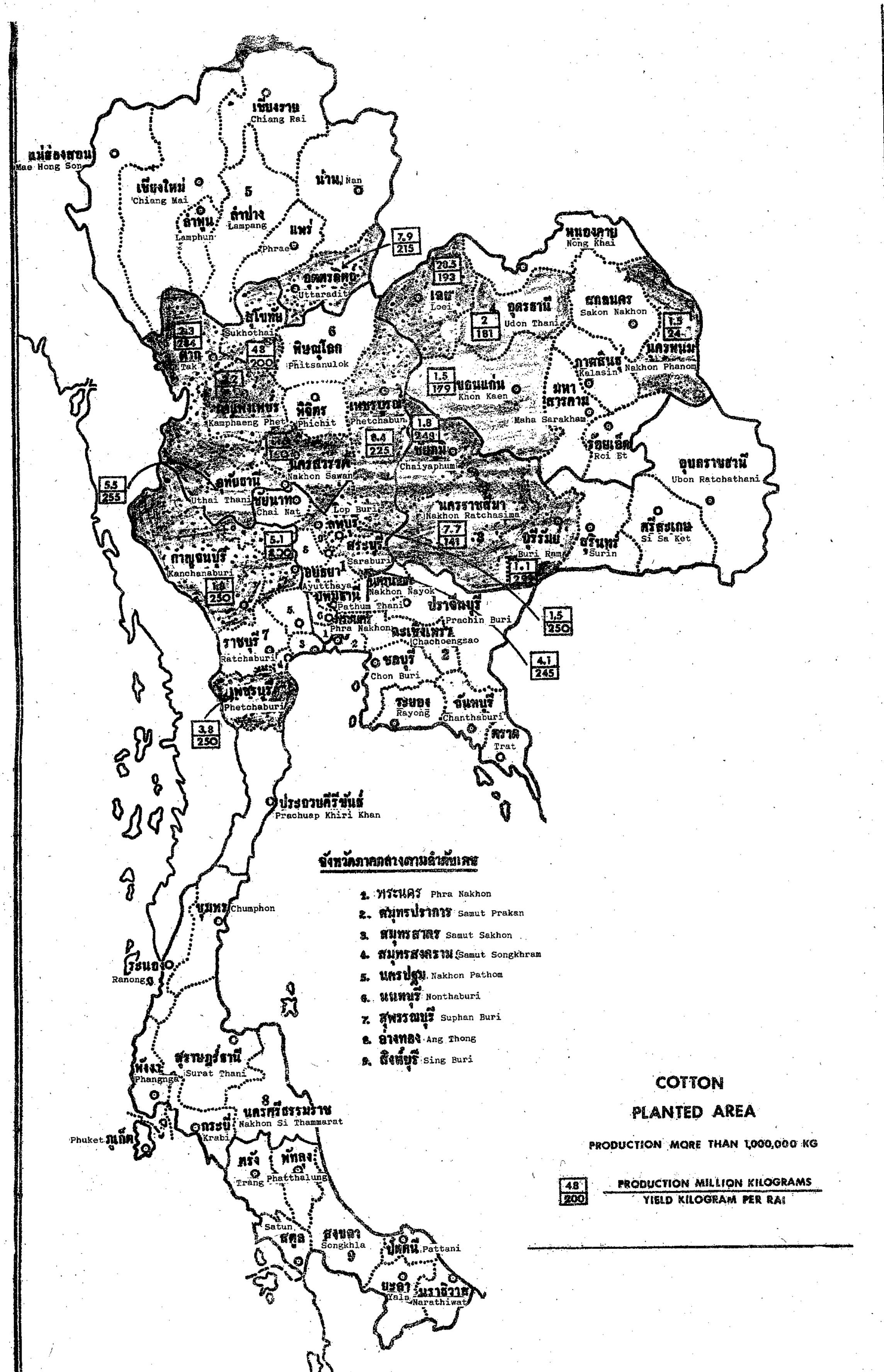
THIEME, I.G. Projects for the development of vegetable oil industry in Thailand. I. Projects for vegetable oil mill in the north-east. Bangkok, Ministry of Industry, 1960.

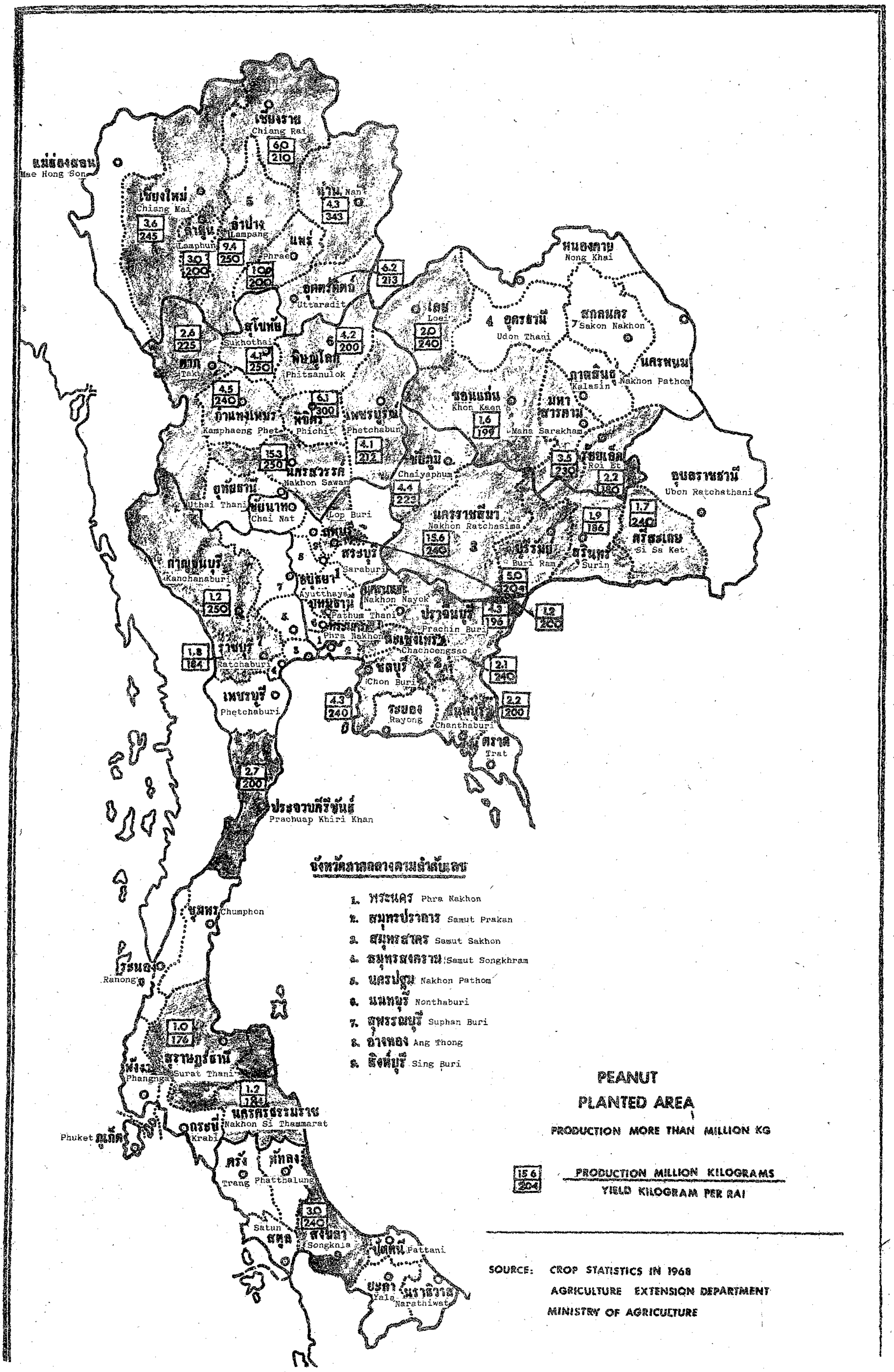
USOM. A summary report on the vegetable oil industry in Thailand. Bangkok, 1962.

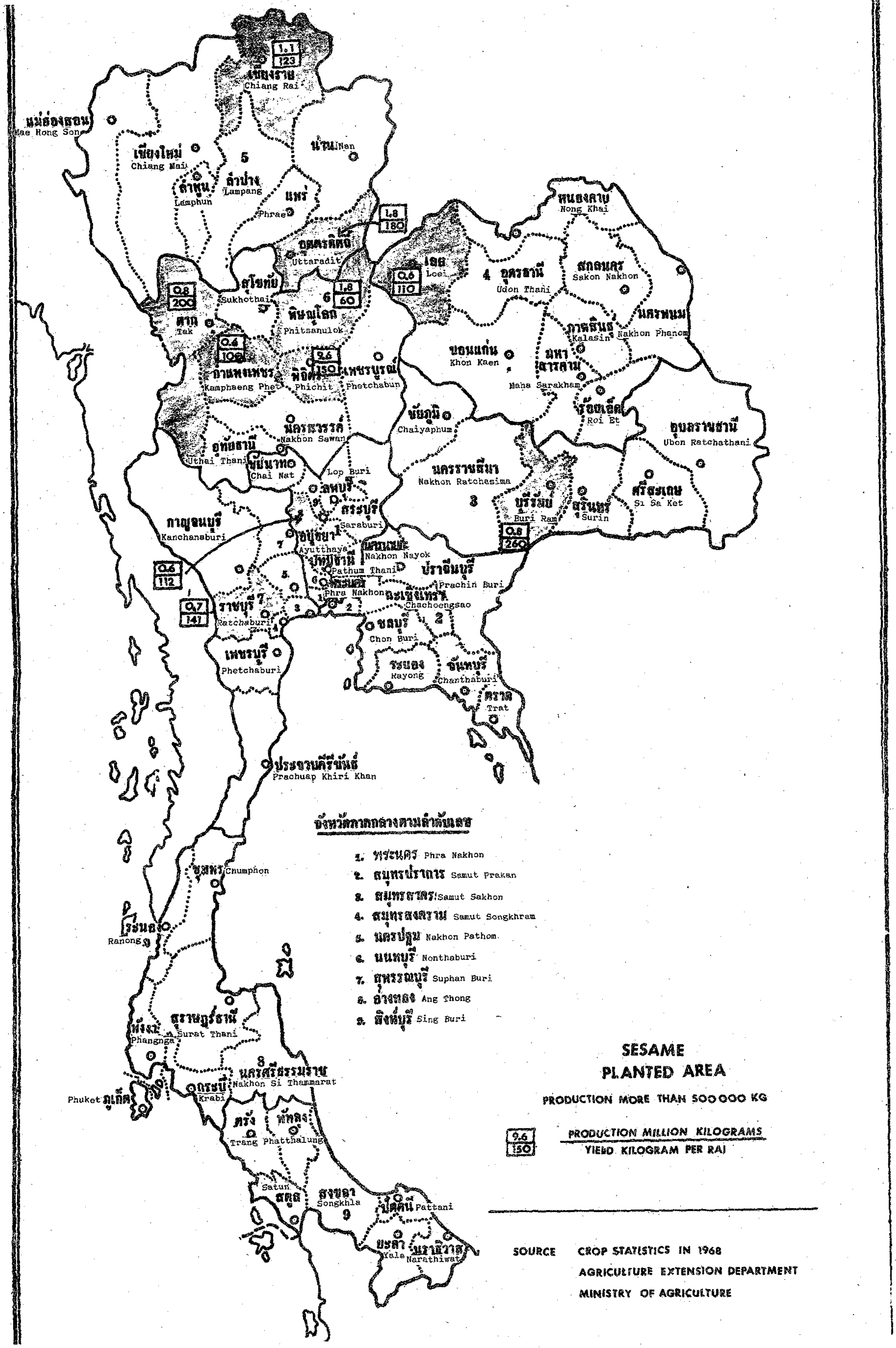
VAN WARMELO, W. Pre-feasibility study on the development prospects of a modern vegetable oil processing industry in north-east Thailand, UNITED NATIONS, 1972.

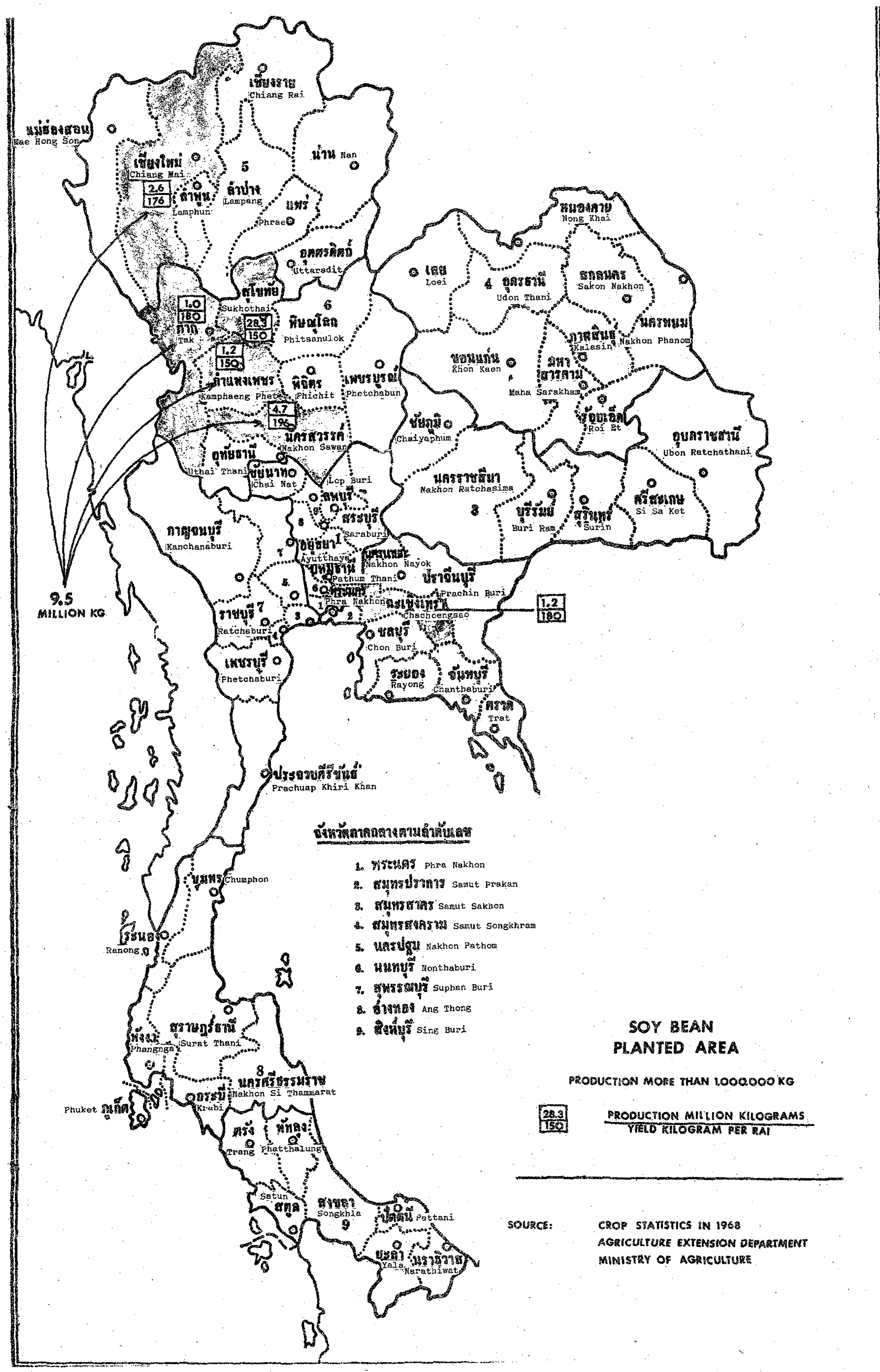
Vegetable oils, search for raw materials. Investor, January 1969.


Chiang Rai
Mae Hong Son
Nan
Chiang Mai
Lampang
Lamphun
Phrae
Nong Khai
Uttaradit
Loei
Sakon Nakhon
Udon Thani
Sukhothai
Tak
Phitsanulok
Kalasin
1.8
200
Khon Kaen
Nakhon Phanom
Phichit
Phetchabun
Maha Sarakham
Kamphaeng Phet
Nakhon Sawan
Roi et
Chaiyaphum
Uthai Thani
1.3
130
Ubon Ratchathani
Chai Nat
Lop Buri
1.0
100
Nakhon Ratchasima
Si Sa Ket
Kanchanaburi
6.1
137
Buri Ram
Surin
Saraburi
Ayutthaya
Nakhon Nayok
Prachin Buri
18.3
227
Chachoengsao
Ratchaburi
Chon Buri
3.1
217
Rayong
Chanthaburi
Phetchaburi
2.2
80
Trat
24.6
MILLION KG
Prachuap Khiri Khan
1 Phra Nakhon
2 Samut Sakhon
3 Samut Prakan
4 Samut Songkhram
5 Nonthaburi
6 Nakhon Pathom
7 Pathum Thani
8 Suphan Buri
9 Ang Thong
10 Sing Buri
CASTOR BEAN
PLANTED AREA
PRODUCTION MORE THAN 1,000,000KG
Chumphon
Ranong
18.3
227
PRODUCTION MILLION KILOGRAMS
YIELD KILOGRAM PER RAI
Surat Thani
Phangnga
Nakhon Si Thammarat
Krabi
Phuket
Trang
Phatthalung
SOURCE: CROP STATISTICS IN 1968
AGRICULTURE EXTENSION DEPARTMENT
MINISTRY OF AGRICUTURE
Satun
Songkhla
Pattani
Yala
Narathiwat


จังหวัดภาคกลางตามลำดับเลข
1. พระนคร Phra Nakhon
2. สมุทรปราการ Samut Prakan
3. สมุทรสาคร Samut Sakhon
4. สมุทรสงคราม Samut Songkhram
5. นครปฐม Nakhon Pathom
6. นนทบุรี Nonthaburi
7. สุพรรณบุรี Suphan Buri
8. อ่างทอง Ang Thong
9. สิงห์บุรี Sing Buri
COTTON
PLANTED AREA
PRODUCTION MORE THAN 1,000,000 KG
PRODUCTION MILLION KILOGRAMS
YIELD KILOGRAM PER RAI


PEANUT
PLANTED AREA
PRODUCTION MORE THAN MILLION KG
PRODUCTION MILLION KILOGRAMS
YIELD KILOGRAM PER RAI
SOURCE: CROP STATISTICS IN 1968
AGRICULTURE EXTENSION DEPARTMENT
MINISTRY OF AGRICULTURE
1. Phra Nakhon
2. Samut Prakan
3. Samut Sakhon
4. Samut Songkhram
5. Nakhon Pathom
6. Nonthaburi
7. Suphan Buri
8. Ang Thong
9. Sing Buri
Chiang Rai
Mae Hong Son
Chiang Mai
Lamphun
Lampang
Nan
Phrae
Uttaradit
Nong Khai
Loei
Udon Thani
Sakon Nakhon
Sukhothai
Tak
Phitsanulok
Kalasin
Khon Kaen
Maha Sarakham
Kamphaeng Phet
Phichit
Phetchabun
Roi Et
Nakhon Sawan
Chaiyaphum
Ubon Ratchathani
Uthai Thani
Chai Nat
Lop Buri
Nakhon Ratchasima
Buri Ram
Surin
Si Sa Ket
Saraburi
Kanchanaburi
Ayutthaya
Nakhon Nayok
Pathum Thani
Prachin Buri
Phra Nakhon
Chachoengsao
Ratchaburi
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Chumphon
Ranong
Surat Thani
Phangnga
Nakhon Si Thammarat
Phuket
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
Yala
Narathiwat


Chiang Rai
Mae Hong Son
Chiang Mai
Nan
Lamphun
Lampang
Phrae
Nong Khai
Uttaradit
Loei
Udon Thani
Sakon Nakhon
Sukhothai
Tak
Phitsanulok
Kalasin
Nakhon Phanom
Khon Kaen
Maha Sarakham
Kamphaeng Phet
Phichit
Phetchabun
Roi Et
Chaiyaphum
Ubon Ratchathani
Nakhon Sawan
Uthai Thani
Chai Nat
Lop Buri
Nakhon Ratchasima
Si Sa Ket
Buri Ram
Surin
Saraburi
Kanchanaburi
Ayutthaya
Nakhon Nayok
Pathum Thani
Prachin Buri
Phra Nakhon
Chachoengsao
Ratchaburi
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Chumphon
Ranong
Phangnga
Surat Thani
Nakhon Si Thammarat
Phuket
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
Yala
Narathiwat
1. Phra Nakhon
2. Samut Prakan
3. Samut Sakhon
4. Samut Songkhram
5. Nakhon Pathom
6. Nonthaburi
7. Suphan Buri
8. Ang Thong
9. Sing Buri
SESAME
PLANTED AREA
PRODUCTION MORE THAN 500 000 KG
9.6 / 150
PRODUCTION MILLION KILOGRAMS
YIELD KILOGRAM PER RAI
SOURCE CROP STATISTICS IN 1968
AGRICULTURE EXTENSION DEPARTMENT
MINISTRY OF AGRICULTURE



Chiang Rai
Mae Hong Son
Chiang Mai
Lamphun
Lampang
Nan
Phrae
Uttaradit
Sukhothai
Tak
Phitsanulok
Kamphaeng Phet
Phichit
Phetchabun
Nakhon Sawan
Uthai Thani
Chai Nat
Lop Buri
Saraburi
Kanchanaburi
Ayutthaya
Nakhon Nayok
Pathum Thani
Prachin Buri
Phra Nakhon
Chachoengsao
Ratchaburi
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Nong Khai
Loei
Udon Thani
Sakon Nakhon
Nakhon Phanom
Kalasin
Khon Kaen
Maha Sarakham
Roi Et
Chaiyaphum
Ubon Ratchathani
Nakhon Ratchasima
Buri Ram
Surin
Si Sa Ket
Prachuap Khiri Khan
Chumphon
Ranong
Surat Thani
Phangnga
Phuket
Krabi
Nakhon Si Thammarat
Trang
Phatthalung
Satun
Songkhla
Pattani
Yala
Narathiwat
2.6 / 176
1.0 / 180
28.3 / 150
1.2 / 150
4.7 / 196
1.2 / 180
9.5 MILLION KG
จังหวัดภาคกลางตามลำดับเลข
1. พระนคร Phra Nakhon
2. สมุทรปราการ Samut Prakan
3. สมุทรสาคร Samut Sakhon
4. สมุทรสงคราม Samut Songkhram
5. นครปฐม Nakhon Pathom
6. นนทบุรี Nonthaburi
7. สุพรรณบุรี Suphan Buri
8. อ่างทอง Ang Thong
9. สิงห์บุรี Sing Buri
SOY BEAN
PLANTED AREA
PRODUCTION MORE THAN 1,000,000 KG
28.3 / 150 PRODUCTION MILLION KILOGRAMS / YIELD KILOGRAM PER RAI
SOURCE: CROP STATISTICS IN 1968
AGRICULTURE EXTENSION DEPARTMENT
MINISTRY OF AGRICULTURE