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Sago Production in Tebing Tinggi Sub-district, Riau, Indonesia

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Abstract A social economic survey on sago palm related activities was carried out at Tebing Tinggi Island of the Riau Province, Indonesia. The area of sago palm cultivation and the number of sago processing factories increased steadily from 1990 to 1998, to 27,715 hectares and 60,342 tons/yr respectively. The average size of each smallholder garden is about 11 hectares. Sago palms in these gardens take 12 years to attain maturity and about 26 palms are harvested per hectare per year. In eighty-six percent of the surveyed gardens, sago palms were sold a few years prior to palm maturity, under a unique system known locally as the 'pajak' or 'advancing selling'. Harvesting is normally carried out by contract, with all the harvesting costs borne by the buyers or the owners of processing factories. On average, the costs of harvesting and transportation to factory are about 21,000 Rupiah (US$ 2.8) per palm. In almost all the processing factories, untreated water is used for processing. Sago piths are rasped with nail studded rotating drum driven by diesel engine. The rasped pith is collected in a water-containing tank equipped with a mechanised stirrer. Starch is released by vigorous stirring and the extracted starch is recovered by filtration and sedimentation. The monthly starch production capacity of each factory range from 56 to 350 tons and the starch is sun-dried before exporting to Cirebon in Java.

Key words: *Metroxylon sagu*, sago starch, starch processing

インドネシア，リアウ州，トゥビンティンギ島における サゴヤシ生産

フォー・ショーン・ジョン

要約 サゴヤシに関する社会経済的調査をインドネシア，リアウ州，トゥビンティンギ島において行った．サゴヤシの栽培面積およびサゴデンプン工場は，1990年から1998年にかけて増加し，1998年には栽培面積27,715 ha，デンプンの年間生産量60,342 tonに達した．農家サゴヤシ園の平均面積は11 haであり，これらの園では収穫までに12年を要し，年間約26本/haのサゴヤシを収穫していた．調査園の86%で，サゴヤシは収穫前2～3年に前売り（'pajak' システム）されていた．収穫は通常，請負によって行われるが，その経費は買い取り人またはサゴデンプン工場主によって支払われる．収穫と工場までの運搬賃は，1本当たり平均Rp. 21,000 (US$ 2.8) である．ほとんど全てのサゴデンプン工場では，デンプン抽出に現地の水をそのまま使用していた．サゴヤシの髄部は，ディーゼルエンジンによるロータリ・ラスパーで粉砕される．そして，粉砕髄を撹拌機付きの水槽に入れ，激しく撹拌してデンプンを抽出し，ろ過・静置して回収される．個々のサゴデンプン工場の月産デンプン生産量は56～350 tonで，天日乾燥後，ジャワ島のチレボンに出荷される．

キーワード サゴデンプン，サゴヤシ，デンプン抽出

Introduction

Sago palm cultivation provides an important source of income for many inhabitants in the Riau Islands, especially in the Tebing Tinggi Sub-District. Although the Riau Province has 31,872 hectares (Ketropermono 1996) or about 2.5% of the total sago palm areas in Indonesia, it is regarded as the center of

sago starch processing, supplying most of the domestic requirements of sago starch in the country. Apart from Indonesia's first commercial sago plantation, the town which is famous for sago production and export, Selatpanjang, is also located at the Tebing Tinggi Island.

Despite the popularity and importance of the sago palms in Riau, details of sago production in the vicinity are relatively unreported. A survey on various sago related activities in the Tebing Tinggi Sub-District is thus conducted.

Data collection

Social economic surveys were carried out in twelve sago processing factories and thirty smallholder sago farmers in August 1999. Five groups of sago harvesting workers were interviewed. Questionnaires were prepared beforehand and these were filled in during their interviews. To further understand the methods of raw material transportation and storage, starch processing, drying and packaging, special observations in sago gardens and processing factories were made and recorded.

Data on the sizes of sago gardens, numbers of factories and total starch production were gathered from Agricultural Department and the Sago Association in Selat Panjang.

Results

Total sago areas and sago production in Tebing Tinggi Sub-District (Table 1)

The acreage of sago cultivation in Tebing Tinggi increased steadily from 14,863 ha in 1990 to 27,715 ha in 1998. The number of factories processing dry starch also increased steadily from 29 in 1990 to 43 in 1997. Total number of factories producing wet and dry starch in 1998 totaled to 76. The annual dry starch production increased from 24,640 tons in 1990 to 74,985 tons in 1996. In 1997 and 1998, the annual production decreased to about 60,342 tons.

The "pajak" or advance selling system

This is the system practiced by most smallholder farmers in Tebing Tinggi. In some cases, the term 'mortgage' or 'pawn' is used. When cash advance is required such as during festive seasons, building houses, wedding or other needs, farmers sell their sago palms to factory owners or buyers before the palms are mature.

In most cases, the 'pajak' is administered in written form, witnessed by the village headman or some prominent figures in the area. In some regions, it is just based on verbal agreement and mutual trust. Such system appeared to run smoothly and farmers abide rather strictly to this practice.

The price of the sago palms sold under the 'pajak' system depends on the palm age (physiological maturity), location (some locations are known to produce high yielding palms), trunk size and distance from the seaside. Normally, 'Pajak' palms approaching maturity (2–3 years before harvesting) may fetch about 50% to 60% of the selling price of a mature palm that is not in 'pajak'. However, in most cases, the 'pajak' price is much lower than the market price of 'non-pajak' palms.

Once the palms are sold in advance, the farm owners have no more rights to sell or harvest these palms. However, it is the farmers' responsibility to main-

Table 1 The development of sago gardens, processing factories and starch production in Tebing Tinggi Sub-District, Riau, Indonesia

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total area of sago gardens (ha)	14,863	15,717	15,093	16,210	16,710	17,927	26,392	27,112	27,715
No. of processing factory	29	33	33	34	43	42	43	43	76**
Total dry starch production (ton)	24,640	24,916	39,471	41,781	54,716	61,640	74,985	59,751	60,342

Source of data: Agric. Dept., Tebing Tinggi Sub-District, Riau, Indonesia. **From 1990–1997, only factories producing dry starch were recorded. In 1998, factories producing wet starch were included.

tain the gardens to make sure that sufficient palms are harvested to fulfill the number of palms sold under 'pajak'. Upon completing the supply of the palms sold under 'pajak', these restrictions are lifted.

When the 'pajak' palms are harvested, additional money is not paid to the farm owners in normal cases. However, some buyers may offer an additional amount of money for each palm sold under 'pajak' at early ages. Yet a few others may adjust the final purchase price of 'pajak' palms to about 50% of the free market price of 'non-pajak' palms.

Social economic survey on planting, harvesting and selling of sago palms by smallholder farmers (Table 2)

The average size of each garden is 11.09 hectares, with a range of 0.6 ha to 62 ha. In 80% of the gardens, two suckers are planted in each planting point. 13.3% of the gardens planted 3 suckers in each point. The remainder planted only 1 sucker or a combination of 1 to 3 suckers. On average, 87 palm clusters (or planting points) are planted per hectare. The average time to reach maturity is 12.03 years, with a range from 11 to 15 years.

Palms are mostly harvested once in every two to three years. An average of 26 palms are harvested per hectare per year. The range is from 5.6 to 53. In 86% of the surveyed smallholder farms, the palms are sold in advance under the "pajak" system. Of these, 61% have all the palms in their gardens sold under "pajak". The remaining 39% have only part of their palms sold in advance. Of the palms sold under the "pajak" system, 66.7 % are sold at the age of 8 years or above, some palms are sold in advance as early as 3 years old. The price of the 'pajak' palms ranged from 2,000 Rupiah[1] per palm (3 years old in 1967) to 50,000 Rupiah per palm (mature palm in 1999).

Survey on the harvesting and transportation of sago palms (Table 3)

All the harvesting is arranged and borne by factory owners. Three to seven people are working as a group in log harvesting. Palms are harvested at around flowering time and each trunk is cut into log sections of 1 m in length to facilitate transportation. A normal trunk can be cut into 8 to 9 sections. The log sections are steered and rolled on temporary rails (made from sago palm fronds or small tree trunks), by a wooden steering device, to the nearest waterway.

The average distance for log transport from felling site to the sea, river or waterway is about 500 m. Upon arrival at the nearest navigable waterway, the log sections are tied into rafts for towing, by motor launches, to the processing factory. Harvesting is undertaken by contract workers. Excluding felling and sectioning, about 30 sections are land transported per man-day. On average, 2,100 Rupiah is paid for each 1 m section (19,000 Rupiah per palm), including harvesting, transporting to seaside and rafting. An additional 2,000–3,000 Rupiah may be required to transport each log section to the factory.

Economic and production surveys on processing factories (Table 4)

All the factories were of the cottage or 'traditional' type, owned by individual family or relatives. Rotating raspers are used to extract starch. Recovery of starch is by sedimentation. The starch production capacity of traditional factories ranged from 56 to 350 tons per month. Many factories also refine wet starch purchased from yet smaller mills in the nearby villages. The number of palms required to process into 1 ton of sun-dried starch (18% moisture) ranged from 4 to 11, with an average of 7.2.

The purchase price of each palm varies greatly, from a few thousand Rupiah (palms 'pajak' at an early age) to the current market price of about 100,000 Rupiah for 'non-pajak' palms. In 50% of the factories, starch production is reduced during the rainy season. The other 50% reported that production was maintained throughout. All the factories used untreated water from canals for starch processing. Most factory owners have their own gardens. The sizes of their gardens are roughly from a few hectares to 160 hectares. An average of 45 palms are harvested per hectare per year from these gardens.

1) US$ 1 = 7,500 Rupiah Indonesia

Table 2 Social economic surveys on planting, harvesting

Item	Surveyed												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Size of garden (ha)	15	12	15	6	4.3	4.3	3.1	3.1	0.6	11	6.2	31	9.3
Year of planting	1985	1985	1975	1985	1975	1969	1982	1984	1983	1974	1945	1968	1972
No. of suckers planted per point	2	2	2	2	2	2	2	3	2	2	2	2	3
No. of palm clusters in garden	1140	912	1150	456	340	350	260	250	60	900	500	2600	680
Commencement of harvesting	1996	1996	1986	1996	1987	1981	1994	1996	1995	1986	N.A.	1980	1984
Time to 1st harvest fr. planting (yrs)	11	11	11	11	12	12	12	12	12	12	12	12	12
Intervals between each harvest (months)	24	24	36	36	36	36	24	36	24	24	24	36	24
No. of harvest since planting	2	2	4	2	4	6	2	2	2	6	?	6	7
Av. no. of palms harvested/ha/year	10	5.6	12	11	18	16	29	27	50	32	31.6	34.7	9.7
Are the palms sold in advance (pajak)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of palms sold in advance	300	500	500	500	340	350	500	250	100	900	500	4000	680
Age of palm when sold (years)	3	5	8	8	4	5	10	3	12	8	10	10	5

N.A.: Not Available

Table 3 Surveys on sago palm harvesting system in Tebing Tinggi Island, Riau, Indonesia

Item	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Average
Harvesting by farmer or factory owner	Factory owner	Factory owner	Factory owner	Factory owner	Factory owner	Factory owner
No. of persons per group	3	5	5	7	5	5
Wages (Rp/log section)	3,000	2,000	1,500	2,000	2,000	2100
Av. transporting dist. to collection site (m)	1000	300	500	540	200	508
Method of harvesting (axe/chainsaw)	Axe	Axe	Axe	Axe	Axe	Axe
Average trunk length of palm (m)	10	10	10	9	9.5	9.7
Harvesting stage	flowering	flowering	flowering	flowering	flowering	flowering
Averagr no. of sections per trunk	9	9	9	8	8.5	8.7
No. of log sections transported per day	30	20	50	20	30	30
Method of log transport	wooden steering device	wooden steering device	wooden steering device	wooden steering device	wooden steering device	wooden steering device
Transportation delay from log harvesting to arrival at factory log pond (days)	N.A.	N.A.	8	2	16	9

N.A. = Not Available / Not Applicable

Rp: Indonesian Rupiah; US$ 1 = Rp 7,500

and selling of sago palms by smallholder farmers

garden No.																
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
13.3	13.9	20	5	4.1	8.3	9.3	4.7	10	3.1	5	2	1.54	16	27	62	6.5
1987	1971	1964	1976	1976	1972	1979	1985	1988	1988	1980	1980	1970	1976	1977	1980	1980
2	2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	1 to 3
200	800	1100	400	294	1000	700	450	1160	300+	550	230	200	1500	3600	5400	630
1999	1983	N.A.	1988	1988	1984	1991	N.A.	1999	1999	1992	1992	1985	N.A.	1989	1992	1995
12	12	12	12	12	12	12	15	11	11	12	12	15	10	12	12	15
N.A.	24	36	36	34	24	36	N.A.	24	24	24	24	N.A.	24	24	30	48
1	4	N.A.	4	3	3	3	N.A.	1	1	3	3	2	5	4	2	2
29	25.8	13	21.2	18	45	11	N.A.	35	32.3	48.9	33	N.A.	N.A.	53	12	38
no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes
N.A.	580	1024	750	500	1000	700	200	200	100	200	N.A.	N.A.	700	N.A.	1000	630
N.A.	5	3	8	10	8	6	mature	9	8	8	N.A.	N.A.	N.A.	N.A.	mature	8

Marketing

Over 80% of the starch is marketed to Cirebon through 'Koperasi Harmonis' in Selatpanjang. Some factories sell their starch directly to buyers in Cirebon. The charges borne by the seller include transportation; administration and handling (totaling about 75,000 Rupiah per ton); commission (4%) as well as weight deduction due to high moisture content and weight loss in handling. The total charges borne by the seller amount to about 185,000 Rupiah per ton of starch sold. Payment is normally received after the goods are distributed to retailers in Cirebon. This may sometimes take a few months.

Discussion

The sago palms in smallholder farms are cultivated in a 'traditional' or semi-wild manner. Little or no maintenance is carried out after planting. The planting of 2 to 3 suckers is to insure against mortality, hoping that at least one of them will survival and develop into mature palm. Most of these gardens are located near to the seaside, within about 1 km from the shore. New plantings are located further inland but are rarely more than 3 km from the shore.

Although an average of 87 points are planted per hectare, many gardens contain much few palms upon maturity as the dead palms are not replaced. This is also reflected in the low number of palms harvested (26 palms/ha/yr) as contrasted with better maintained gardens (45 palms/ha/yr) belonging to sago factory owners.

The huge difference in the price of 'pajak' palms (e.g., 2000 Rupiah in 1967 to 50,000 Rupiah in 1999) is mainly attributed to the multifold devaluation of the Rupiah to other currencies and inflation over the years. Currently, a "pajak" palm is sold at between US$ 3 to 7.

The decline in the total starch production in Tebing Tinggi from 74,985 tons in 1996 to 60,342 tons in 1998 is mainly due to the regional economic crisis. Today, more factories have been set up and the pro-

Table 4 Economic and production surveys of some traditional

Item	Surveyed				
	1	2	3	4	5
Year started	1940's	1986	N.A.	1964	1942
Av. no. of people employed in factory	20	14	15	25	30
Production capacity (tons/month)	150	200	130	350	300
No. of palms/ton starch	6	8	5	9	8.5
Cost of 1 log section (1 m) at factory gate (Rp)	8,000	15,000	N.A.	15,000	15,000
Transport cost per log section to factory (Rp)	250	275	N.A.	250	210
Av. no. of log sections processed per day	275	200	200	300	300
Av. log storage in pond before processing	< 1 month	< 1 month	4 weeks	< 1 month	< 1 month
Peak production (dry season) ton/mon.	270	200	150	350	300
Lowest production (wet season) ton/mon.	270	70	35	80	75
Source of water for processing	canal	canal	canal	canal	canal
Any traetment of water (yes/no)	no	no	no	no	no
Starch drying method (equipment/sun drying)	sun drying	sun drying	sun drying	sun drying	sun drying
Log transport from pond to factory (log/man-day)	N.A.	50	N.A.	50	50
Debarking (log/man-day)	120	22	N.A.	20	20
Type of starch sold (wet/sun-dried)	sun-dried	sun-dried	sun-dried	sun-dried	sun-dried
Selling price of sun-dried atarch (Rp/ton)	1,350,000	N.A.	N.A.	N.A.	N.A.
System of payment (C.O.D/credit)	credit	credit	credit	credit	credit
Area of sago garden owned by owner (ha)	80	50	160	100	50
No. of palms harvested per ha per year	49	40	45	45	40
Interval between each harvest (months)	24	24	24	N.A.	3

N.A.: Not Available; Rp = Indonesian Rupiah; US$ 1 = Rp 7,500

duction for export to local markets is estimated at about 75,000 to 80,000 tons per annum.

In the social economic survey, some factories consumed 8 to 11 palms for the production of one ton of sun-dried starch. The truth of these reports is questionable as 50% of the factories were able to produce 1 ton of starch from 4 to 6 palms. Nonetheless, losses of starch are commonly observed. Significant starch loss is attributed to deterioration at the exposed end of the log sections, caused by prolonged storage in the log pond. Other starch losses are caused by inefficient sedimentation during processing, wind action and spilling during drying and handling.

The weather condition does not seem to affect the starch production in 50% of the factories. Wet starch is sun-dried over water-proof drying sheets measuring about 3 m by 3 m. On the onset of intermittent showers, the starch is gathered at the center of the drying sheet, with the sides folded over the starch to keep off the rain. The sheets are re-opened and the starch spread out during sunny intervals. In extremely dry season, saline water is used for processing in some factories. The starch produced needs to be refined as it is grayish and salty.

In general, the sago starch produced at Tebing Tinggi is of inferior quality. The slightly reddish coloration, acidic odor, partially deteriorated starch granules, high moisture and crude fiber contents make it unattractive in the international market. However, with increased sago palm cultivation and interests in the sago industry, it is anticipated that modernized processing factories will be set up in the near future to increase the efficiency of processing and the quality of finished product.

sago factories in Tebing Tinggi, Riau, Indonesia

factory No.							
6	7	8	9	10	11	12	Mean/median
1955	1949	1993	1994	1994	1989	1969	
21	43	6	18	22	18	26	21.5
130	90	60	120	182	300	56	172
11	6.4	10	5.5	5.5	4	8	7.2
10,000	10,000	10,000	10,000	10,000	10,000	8,000	11
300	250	190	450	225	250	200	260
200	200	100	200	300	350	150	208
1 week	< 1 month	3 weeks	< 1 month	1–2 weeks	3 weeks	2 weeks	< 1 month
130	200	60	120	150	300	40	189
130	200	60	120	50	300	20	118
both	canal	canal	canal	canal	canal	canal	canal
no	no	no	no	no	no	no	no
sun drying	sun drying	sun drying	sun drying	sun drying	sun drying	sun drying s	un drying
20	45	20	40	50	60	100	48.5
35	65	65	40	100	70	50	55.2
sun-dried	sun-dried	sun-dried	sun-dried	sun-dried	sun-dried	sun-dried	sun-dried
1,000,000	N.A.	1,300,000	1,300,000	N.A.	1,300,000	N.A.	1,300,000
credit	credit	credit	credit	N.A.	credit	credit	credit
62	N.A.	2	16	31	16	160	66
N.A.	N.A.	N.A.	50	N.A.	N.A.	N.A.	45
12	N.A.	N.A.	12	N.A.	N.A.	N.A.	16.5

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