ASSESSMENT OF EXPERIENCE WITH HIGH YIELDING COCONUT VARIETIES IN INDONESIA

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ABSTRACT

Study on an assesment of experience with new varieties of coconut in Indonesia was carried out in 1988. The objective of the study is to ascertain and assess the suitability and the experience of smallholders with new coconut varieties especially hybrids in new planting programmes in the country. The new coconut hybrid (MYD X WAT, MRD X WAT and NYD X WAT) were introduced to the farmers through Smallholder Coconut Development Project (SCDP) under monoculture farming system. During the early stages of growth, palms are maintained fully by the project and hand over the maintenance responsibility to farmers under control and quidance of the project when palms reach productive stage. The rate of adoption of hybrids compared with the total coconut area in the country accounts for 6 %. However, in areas outside the government sponsored projects, the cultivation of hybrids varieties are found to be insignificant. It was obtained that the investment cost per hectare of each type of coconut hybrid was the same and amounted to Rp. 914,583.00. The results of the study indicated that 78 % of the farmers was satisfied while the rest (22%) was unsatisfied with coconut hybrids. Early bearing character and high yields were reported to be reasons for favoring hybrids. While, too small nuts, low price for nuts, yields less than expected, high expenditure required for fertilizers and chemicals and immature nut fall were reported to be reasons for the dissatisfaction with hybrids by the farmers.

INTRODUCTION

Coconut is very important in the Indonesian daily life, hence it is the second social commodity after rice. In 1986, there was 3,14 million hectares of coconut, of which 98% belongs to smallholders.

As a crop, it provides livelihood to at least three million smallholders families and to hundreds of thousands of workers employed in plantations, in copra processing and trading and in coconut oil milling (Badrun and Hadi, 1989).

The major problem the country is facing at present is low growth rate in coconut production (3.9%) compared to that of domestic consumption (5.8%).

To overcome the shortage of vegetable oil by increasing coconut production as early as possible, in 1974 the government decided to import coconut hybrid seed from Ivory Coast of Africa and Malaysia and to establish locally coconut hybrid seed gardens. Since 1975/1976 genetical trial of local coconut hybrid have been undertaken in two

location i.e. in Mapanget in North Sulawesi and Pakuwon, West Java. Based on the results of these trials, three local coconut hybrids have been selected and released for adoption.

The objective of the introduction of different coconut cultivars and trials of different hybrids is to select cultivars and hybrids which are most suitable to Indonesian conditions.

The development programmes of hybrids has been investigated to fulfill national requirements in vegetable oil and if possible to restore Indonesians' position of biggest exporter of copra in the world again. To support this programme the government has stimulated the state plantation companies, private plantation companies and the coconut research institute to establish seed gardens in the producing areas of the country. Hybrids from these seed gardens are distributed continuously in association with programmes and projects specially designed to promote coconut development.

In 1988, a study has been done to ascertain and assess the suitability and the experience of snallholders with new coconut varieties especially hybrids in new planting programme. This is the first study of this nature since the introduction of coconut hybrids in Indonesia.

LOCAL AND EXOTIC VARIETIES AVAILABLE FOR COCONUT IMPROVEMENT

The crop improvement programme in Indonesia was started with the commencement of the first germplasm survey in 1926 - 1927 in Noth Sulawesi and Maluku provinces.

From 1930, PML Tammes was active in the collection and studying of coconut germplasm particularly suited for breeders interest. Open-pollinated seed from palms that showed economic characters were collected and planted at the 48.5 ha farm at Mapanget. In addition, TAMMES affected crosses between selected palms and the seedlings of their progeny were planted in 1940 in the same farm. Some of these progenies are excellent bearers but during the war of independence, the data relating to these palms were destroyed.

Further, the FAO expert Ihne could not verify the parents of these promising palms and he decided to work back once again through the open-pollinated progeny of the 43 palms planted by Tammes between 1957 and 1959. Among them, strain numbers 32 and 83 are outstanding performers. These strains as well as a few others that yield over 36 kg copra per palm/year have been included in the breeding program in the country.

During 1973-1974, a survey of coconut germplasm in selected areas of 11 provinces in Indonesia was carried out. The main objectives of the survey were to identify suitable cultivars of coconut palms to be planted in the seed gardens and to select desirable types to be included in the breeding programme. Twenty five random samples representing a wide spectrum of population, some exposed to selection

pressure were studied. These revealed the presence of four varieties/cultivars with desirable characters for breeding. They are as follows (Anonymous, 1984).

1. Nias Yellow Dwarf (NYD) form growing in Toyolawa Estate, Nias Island, North Sumatera. The population is homogeneous, first generation progenies are early bearing.

2. Tenga Tall (TT) cultivar growing in Tawaang and Radey Village in North Sulawesi.

3. Bali Tall (BT) form growing in Beji Estate, Central Java and Pulukan Estate, Bali.

4. Palu Tall (PT) cultivar growing in Bangga Village, Central Sulawesi.

The characteristics of the above cultivars are presented in Table 1, as follow :

Table 1. The characteistics of 4 selected cultivars as a result of coconut germplasm survey during 1973-1974 in Indonesia

Cultivar	Wt.of fresh meat/nut (gr.) *	Thicknes of fresh meat (m.m) *	Copra content per nut (gr.) **	C.V.* (%)	Copra production (Kg.) per ha/yrs ***			
					yrs 6	yrs 7	yrs 8	yrs 9
NYD	342	11.3	188	9.8	-		NA	-
TT	538	12.8	296	13.5	59	280	2,132	2,521
BT	619	13.3	340	12.17	59	309	1,850	2,630
PT	644	12.2	354	14.1	162	397	1,999	3,123

Source : * Azis, H and H.T. Luntungan, 1979
** Anonymous, 1984
*** Mahmud, Z, and T. Rompas, 1989

TT, BT and PT population were homogeneously, high-yielding giving about 3,500 kg copra/ha/yrs with low inputs and at farmers level of management (Anonymous, 1984). Davis, et al, (1985) reported that Tenga Tall (TT) strain is not only ideal for breeding, but also it has a high degree of combining ability when crossed with Nias Yellow Dwarf.

Further more, during 1982-1983, two surveys were carried out in the chronically droughtprone Nusa Tenggara Timur Province (NTT) as well as some tidal swampy regions of Central and South Kalimantan Provinces to obtain drought-resistant and water logging resistant seeds. A total of 15 collections from NTT and 12 collections from Kalimantan were made

and the seeds have been planted at the 1,000 ha Central Farm near Bone-Bone (South Sulawesi) developed for the study of coconut germplasm materials (Davis, et al, 1985).

The exotic varieties which have been introduced to the country are Malayan Yellow Dwarf, Malayan Red Dwarf and Cameron Red Dwarf which have been used to develop hybrid as the female parents.

CROP IMPROVEMENT FOR COCONUT DEVELOPMENT

Improvement to local talls

Work on hybridization commenced around 1930's with crosses affected between selected palms from the first germplasm survey (1926-1927) in the country.

The first generation coconut palms of Tall x Tall have been planted between 1957 and 59 at Kima Atas, North Sulawesi, Indonesia. There are 986 palms which grow under good environment for coconut cultivation. Yield data collected during 1975-1979 showed that it is a very valuable coconut gene pool. The average yield was 31.6 kg copra per palm/year equivalent to 3,800 kg per ha/year under low inputs.

It was found that selected selfed progenies of 32 and 83 showed low inbreeding depression and a high general combining ability with high production giving 36 kg copra per year (Liyanage, 1978). These identified cultivars were included in breeding programme which gave rise to 4 Kelapa Baru (KB) varieties of improved tall coconut.

The characteristics of the 4 KB varieties released for mass adoption in early 1980's are given in Table 2.

Table 2. The characteristics of the KB coconut strain

Particulars	KB1	KB2	KB3	KB4
Parents	No.32 x No.32	No.32 x No.2	No.32 x No.83	No.32 x No.99
Colour of spadix	Reddish brown	Greenihs yellow	Reddish brown	Greenish yellow
Colour of petiole	Green. yellow	Green. yellow	Green. yellow	Green. yellow
Colour of fruite	Reddish brown	Green. yellow	Reddish brown	Reddish yellow
Shape of fruit	Spherical	Spherical	Spherical	Spherical
Leaves in Crown	27	31	27	27
No. leaf scars	10 in 1 m	11 in 1 m	11 in 1 m	11 in 1 m
First flowering	6 th year	6 th year	6 th year	6 th year
Total bunches	16 per year	16 per year	16 per year	16 per year
Total fruits	96/year	121/year	124/year	118/year
Size of fruit	Medium	Medium	Medium	Medium
Wt.of copra	330 gm/fruit	301 gm/fruit	305 gm/fruit	288 gm/fruit
Oil content	68 %	68 %	71 %	67 %
Copra yield	3,881 kg/ha	4,491 kg/ha	4,657 kg/ha	4,067 kg/ha

Source : Davis et al, (1985).

Local hybrids

In 1973, under a FAO project three local tall varieties and a dwarf variety was selected for hybridization and establishment of seed gardens of 530 hectares. Nias Yellow Dwarf and the Tenga, Palu and Bali Tall were the varieties selected for the programme. The government of Indonesia have approved the release of the 3 new hybrids named as Kelapa Hibrida Indonesia (KHINA) varieties of which characters are given in Table 3.

Meanwhile, a study on varietal resistance to fruit shedding caused by Phytopthora palmivora is presented in Table 4.

Table 3. Details of Indonesia KHINA hybrid variety

Particulars	KHINA 1 (NYD x TT)	KHINA 2 (NYD x BT)	KHINA 3 (NYD x PT)
1. First flowering	4 th year	4 th year	4 th year
2. Spadies/year	13	12	11
3. Colour spadix	green	green	green
4. Colour of petiole	green	green	green
5. Colour of fruit	green	green	green
6. Shape of fruit	spherical	spherical	spherical
7. Size of fruit	small	medium	medium
8. Total fruits	100 per year	105 per year	95 per year
9. Total leaves	34 per year	32 per year	33 per year
10.Leaf scars	11/m stem	11/m stem	11/m stem
11.Wt.of copra	253 gm/fruit	296 gm/fruit	254 gm/fruit
12.Oil content	61.78 %	60.61 %	62.46 %
13.Copra production	over 4.0 ton/ha	over 4.0 ton/ha	over 4.0 ton/h

Source : Davis et al (1985).

Table 4. Spot area which is caused of the attack of P. Palmivora on the nut surface after innoculation

Variety	Size of spot are		
	Length (cm)	Width (cm)	Square (cm^2)
NYD	13.69	20.16	138.00
TT	4.33	4.56	9.91
KHINA-1	9.24	7.62	35.20
KHINA-2	7.47	10.94	40.85
KHINA-3	8.45	10.23	43.20
PB 121 (MAWA)	12.21	11.39	69.54

Source : Mahmud, and Tine (1989).

The data showed that Tenga Tall variety (TT) is relatively resistant to fruit shedding, while NYD is the most susceptible. Besides, coconut hybrid PB 121 is more susceptible compared to KHINA-1, KHINA-2 or KHINA-3. Based on the level of fruit damage, it can be concluded as the following order : TT > KHINA-1> KHINA-2> KHINA-3> PB121> NYD.

On the other farm research on stem-bleeding disease, shows that PB121 variety is more susceptible than KHINA-1, 2 or KHINA-3. The copra production of these hybrids (KHINA-1, KHINA-2 and KHINA-3) is presented in Table 5.

Table 5. Copra production of KHINA hybrids at different ages in Mapanget , North Sulawesi, Indonesia (ton copra/ha/yrs)

Varieties	Age (years)				
	5	6	7	8	9
KHINA - 1	1,999	1,132	3,616	5,145	4,767
KHINA - 2	1,426	0,676	3,146	3,896	4,461
KHINA - 3	1,411	0,897	3,102	3,690	4,703

Source : Mahmud, and Tine (1989).

From Table 5, showns that the highest copra production was observed from KHINA-1, followed by KHINA-3 and KHINA-2 with an average production of 4,767 ; 4,703 and 4,461 ton per hectare/year, respectively.

Exotic hybrids

Simultaneously with the local coconut improvement/hybridization programme, with the aim of increasing the coconut production as fast as possible, in 1974 the government decided to introduce exotic hybrid to the country. The coconut hybrids which have been introduced to the farmers through government project are progenies of materials imported (MYD x WAT and MRD x WAT).One of the local material which has been used to develop hybrid is NYD as the female and the male, however,is WAT.

Thus, the exotic hybrid which have been recommended for coconut smallholders and private plantations are MYD x WAT, MRD x WAT and NYD x WAT. These hybrids are produced in seed gardens owned by state plantation companies and private plantations.

To assure supply of hybrid seedlings, seedgardens were established in strategic areas around the country. About 1890 has of seedgardens have been established, production capasity of about 18.9 million seednuts over year (Table 6).

Table 6. Distribution of coconut seed garden in Indonesia

Operator	Location	Province	Year	Total Area (ha)	Total Palms (bt)	2) Parents	Production (nut)
PIP VI	Adolina	Sumut	1987	190	32,413	MYD,MRD	1,900,000
	Sukabumi	Sumbar	1982	97	15,579	NYD,CRD	970,000
	Rimbo. B	Jambi	1982	200	24,185	NYD,MYD,MRD	2,000,000
	M Marah	Kaltim	1981	85	9,201	NYD	850,000
	Bone-Bone	Sulsel	1976	137	26,488	NYD	1,370,000
PIP VII	Sei Dekan	Kalbar	1982	120	22,437	NYD	1,200,000
PIP X	Rejosari	Lampung	1974	160	27,515	NYD,MYD,MRD	1,600,000
PIP XI	Serpong	Jawa Barat	1980	150	30,454	NYF,CRD	1,500,000
PIP XXVIII	Tiniawangko	Sulut	1983	200	40,142	NYD	2,000,000
	Awaya	Maluku	1983	92	18,316	NYD	920,000
PT. Patratani	Serdang	Sumsel	1983	133	27,219	NYD	1,330,000
PT.Multi Agro	G. Batin	Lampung	1981	150	26,320	NYD,MRD	1,500,000
PT.PP.Londsum	Bah Lias	Sumut	1979	20	4,018	NYD	200,000
Balitka	Paniki	Sulut	1976	60	8,159	NYD	600,000
	Pakuwon	Jabar	1976	54	11,000	NYD	540,000
	Paya Gajah	Aceh	1977	41	8,095	NYD	410,000
	Total			1,890	332,114		18,900,000

Source : Badrun and Hadi, 1989.

Note : 1) MYD : Malaysian Yellow Dwarf
NYD : Nias Yellow Dwarf
MRD : Malaysian Red Dwarf
CRD : Camerun Red Dwarf

2) Assume 10.000 nuts/ha

NEW COCONUT VARIETIES DEVELOPMENT

Performance of new varieties

The sample selected for the Indonesian country study is being confined to hybrid varieties particularly in the area covered under the Smallholder Coconut Development Project (SCDP).

In Indonesia, the hybrid cultivars which have been introduced to the farmers through government project of SCDP, NES, transmigration schemes and through family planning programme is largely confined to exotic varieties, consisting of MYD x WAT, MRD x WAT and NYD x WAT. The local hybrid varieties of KHINA's and improved varieties of KB's are still in small quantities.

The extent of above varieties included in the sample of the country study have been carried out is given in Table 7.

Table 7. Extent of different varieties of hybrid coconuts planted by size of holding

Coconut	Extent (ha) under different varieties						TOTAL	
	NYD x WAT		MYD x WAT		MRD x WAT			
	Ha.	%	Ha.	%	Ha.	%	Ha.	%
0 - 5	0.90	6.16	5.25	8.89	5.75	50.88	11.90	14.01
5 - 1	5.35	36.65	15.80	26.76	5.55	49.12	26.70	31.43
2 - 2	3.18	21.78	27.90	47.25	-	-	31.08	36.59
2 - 3	-	-	5.10	8.63	-	-	5.10	6.00
3 - 5	-	-	5.00	8.47	-	-	5.00	5.89
5 - 7	5.17	35.41	-	-	-	-	5.17	6.09
7 - 10	-	-	-	-	-	-	-	-
Above 10	-	-	-	-	-	-	-	-
Total	14.60	100.0	59.05	100.0	11.30	100.0	84.95	100.0

Source : Tarigans et al (1988).

Nearly half of the farmers operated holdings of 1-2 ha which accounted for 37% of the area in the sample. Another third of sample farmers operated holdings of 0.5-1.0 ha and accounted for 31% of the total area. The number of farmers declined with the increase of the holding size.

The 84.95 ha surveyed 17.19% was planted to NYD x WAT, 69.51% to MYD x WAT and 13.30% to MRD x WAT. Plant densities of each hybrid variety is 143 palms per hectare with triangle planting pattern of 9 x 9 m. This plant population density is the standard and had been introduced to smallholders through government projects.

Meanwhile, coconut hybrids developed are not allowed to be intercropped with other cash crops except cover crops. This condition should be maintained by the farmer until palms reach the productive stage. The area planted under the government coconut development schemes by smallholders during the period 1980-1986 is given in Table 8

Another 90,000 ha reported to have been planted with hybrids by the private and public sector estates over the same period. In addition to the direct planting of about 183,306 ha of coconut hybrids the government programmes such as Family Planning Program had been responsible for distributing hybrid seedlings adequate to cultivate about 7,000 ha by 1986. This amounts to about 190,000 ha of hybrid coconut cultivations in the country by 1986. This area comapred with the total coconut area in the coountry account for 6.0%. However, in areas outside the government sponsored projects, the cultivation of hybrid varieties are reported to be insignificant.

Table 8. Extent of hybrid coconut planted by smallfarmers in Indonesia (1980-1986)

Year	Area Planted (ha)	Cumulative Area (ha)
1980	3,809	3,809
1981	4,849	8,658
1982	11,573	20,231
1983	16,235	36,466
1984	17,500	53,966
1985	18,402	72,368
1986	20,938	93,306

Source : Badrun and Hadi (1989)

The duration of vegetative growth of hybrid based on the country studied, ranged from 2.5 to 5.5 years. In general hybrids took about 3-4 years from planting to produce nuts. The average yield of nuts for different hybrid varieties in succesive years after reaching the bearing stage is given in Table 9.

Though MRD x WAT produced more nuts in the first year of bearing, MYD x WAT had continues high yields since the second year. In the third year MYD x WAT had the highest copra production with an average of 1,189 kg/ha/yrs, followed by NYD x WAT, and MRD x WAT with average of 1,176 and 1,050 kg/ha/yrs, respectively.

The incidence of pests and diseases in sample holdings found that the major pests were Oryctes sp., Brontispa sp., Hidari irava, Sexava sp., and Perasa sp. The hybrids are not free from pests attacks nor resistant to diseases. The results of the study suggested that bud-rot disease was dominant followed by Helminthosporium, Pestalotia and stem bleeding. Hybrid NYD x WAT, and MRD x WAT, however, are more susceptible to bud-rot and stem bleeding than MYD x WAT hybrid.

Table 9. Average yield during the initial stages of bearing by varieties

Coconut Variety	Yield (No. of nuts) Year 1	Year 2	Year 3	No. of nuts per ton copra
NYD x WAT	2,229	4,800	7,250	6,167
MYD x WAT	2,026	5,024	7,581	6,323
MRD x WAT	2,620	3,570	7,125	6,783
Average	2,292	4,465	7,319	

Source : Tarigans, et al (1988).

Meanwhile, from the data obtained from cooperator farmers it was found that the investment cost per hectare of each type of coconut hybrid was the same and amounted to Rp. 914,583.00 (Tarigans, et al, 1988), see Table 10. Of this, cost of seedlings and fertilizer and chemicals accounted for nearly a half.

Table 10. Average capital expenditure per hectare

Items	Cost (Rp.)
Land preparation (including planting)	159,290.00
Seedling	260,411.00
Fertilizer and chemicals	162,008.00
Other Costs	325,874.00
Average Expenditure	914,584.00

Source : Tarigans, et al , (1988).

The annual recurrent expenditure per hectare in the sample holding total to Rp. 254,983.00 (US$150) and consisted of 32% for land upkeep, 28% fertilizer and chemicals, 13% for harvesting, 17% for husking and the balance 10% for collection and transport (Table 11).

Table 11. Average annual upkeep and harvesting expenditure per hectare for the last calender year

Items	Costs (Rp.)
Fertilizer and chemicals	225,711.00
Land Upkeep	259,040.00
Harvesting	104,341.00
Collection of Coconut	77,280.00
Husking	136,874.00
Transport	44,696.00
Total Expenditur	815,946.00
No. of Hectare in bearing	32,000.00
Average Expenditure per Hectare :	254,983.00

Source : Tarigans et al, (1988).

Average annual income for the last calender year by variety is presented in Table 12. Coconut hybrid MYD x WAT had the highest annual income with an average of Rp. 542,041.00, followed by NYD x WAT and MRD x WAT with average of 518,375.00 and 509,437.00 rupiahs (Rp), respectively. These annual income is not too much different with annual income of the farmers Tall Coconut.

Amrizal, (1988) reported that the net returns of the farmers Tall Coconut was about Rp. 499,585.00 per hectare per year or about Rp. 41,600.00 per month. However, their family expenditure per month was more than 3 times that of the net returns. This mean a low return from coconut monocultur. Further, he reported that all surveyed farmers believed that hybrid coconut will not significantly increase their income compared to what they already get now.

Table 12. Average annual income for the last calender year by variety (Rp)

Coconut Variety	Nut production per Hectare/yrs	Average Nut Price	Income
NYD x WAT	7,250	71.50	518,375.00
MYD x WAT	7,581	71.50	542,041.00
MRD x WAT	7,125	71.50	509,437.00

Source : Tarigans et al, (1988).

Farmers views in new varieties

In general, farmers not yet know the difference among three hybrids (NYD x WAT; MYD x WAT and MRD x WAT). They know only coconut hybrids but not the differences in female or male parents among three hybrids.

However, the field survey revealed that 78% of the sample farmers expressed their satisfaction on hybrid varieties mainly due to its early bearing and high yielding characteristics (Table 13) and the balance were not satisfied. The reasons for the dissatisfaction indicated by the farmer are given in Table 14. Too small nuts, low price per nuts, yield less than expected high expenditure required for fertilizers and chemicals and immature nut fall were reported to be reasons for the dissatisfaction with hybrids by the farmers.

Table 13. Reason for satisfaction

Reason for satisfaction	No.satisfied	Percen
1. Early bearing	38	35.17
2. More yield	34	31.48
3. Easy harvesting	21	19.44
4. Good kernel thickness	8	7.41
5. More oil content	7	6.48
Total	108	100.00

Source : Tarigans, et al, (1988).

Table 14. Reason for dissatisfaction

Reason for Dissatisfaction	No.Dissatisfaction	Percent
1. Required large expenditure on fertilizer and chemicals	7	11.86
2. Nuts too small	14	23.72
3. Low price per nut	10	16.95
4. Difficult to process into copra	6	10.17
5. Vunerable to pest and diseases	6	10.17
6. Nut falls	7	11.87
7. Yield less than expected	9	15.25

Source : Tarigans, et al, (1988).

The cost of establisment of hybrid coconut and maintenance appear to be non conducive to its spread. At present hybrids are planted in smallholdings purely under government sponsored programmes. Through these programmes, the government is responsible for land development, planting and maintenance up to the time of bearing. The farmers contribution come in the form of family labour for which a payment is made by the project. However, after the maturity of the plantation, the farmer is obliged to pay back the government expenditure. With the attainment of full production level it can be expected to retain a margin over and above the recurrent cost and repay through accumulation.

The study revealed that the net returns still relatively low would only be sufficient to meet the family subsistence requirements. At this level of income, repayment of government cost would be possible only through reduction of cost of maintenance particularly of purchased inputs. Such a strategy by farmers would result in non apllication of fertilizer and less palms maintenance, thus lower yields. A similar experience in the Philippines and Malaysia are reported to have worst-off small farmers (Anonymous, 1988).

Intercropping in the early stage of coconut plantation is one of the proven methods of generating income during the non-production period of coconut. However, this being prohibitive in government sponsored hybrid schemes, Indonesian farmers have been prevented of that opportunity. According to a Malaysian study the introduction of intercrops in coconut brought a new life to an otherwise dying industry (Anonymous, 1988).

Further, the main reason for the overwhelming acceptance of intercropping by coconut farmers is economic in nature as it brought them higher net returns and productive work for family labour (Tarigans, 1985).

The low level of hybrid planting outside the project areas implies the inability for such an investment by smallholders. The potential for hybrids in Indonesia may be in the two areas currently concentrated, (1) government projects (SCDP, NES, Transmigration scheme and through family planning) and (2) government Estates (PTP and PNP). But with the

increasing budgetary constraint government appears to be giving less priority to such investments and emphasing on projects with low capital cost.

REFERENCES

Amrizal, 1988. Farmers Receptivity to New Technologies in Coconut, APCC. P.O. Box 343 Jakarta, Indonesia.

Anonymous, 1981. Coconut Research Improvement Indonesia. Interim Report. Report Prepared for the Government of Indonesia by the FAO as executing agency for the UNDP. United Nations Development Programme, FAO, Rome 1981.

_____, 1984. Coconut Research Improvement Indonesia. Draft Terminal Report. Report Prepared for the Government of Indonesia by the FAO as executing agency for the UNDP. United Nations Development Programme, FAO, Rome, 1984.

_____, 1988. Report of the Workshop on Farmers Receptivity to New Coconut Technology. August 1988, Bogor, Indonesia. UNDP/FAO Project RAS/80/032-Improved Coconut Production in Asia and The Pasific. APCC. P.O. Box 343, Jakarta, Indonesia.

Azis, H and H.T. Luntungan. 1979. Laporan perkembangan kelapa hibrida di Indonesia. Lembaga Penelitian Tanaman Industri, Badan Penelitian dan Pengembangan Pertanian, Departemen Pertanian. Jl. Cimanggu 1, Bogor.

Badrun, M and Hadi, W. 1989. Strategies for coconut industry development in Indonesia. Paper presented in Workshop on Transfer of Technology Among Coconut Extention and Research Workers, Jakarta, 18-31 Januari 1989. Ministry of Agriculture, Directorate General of Estate, Indonesia, 1989.

Davis, T.A., Sudasrip, H and Darwis, SN. 1985. Coconut Research Institute, Manado, Indonesia. An Overview of Research Activities. Published by the Coconut Research Institute, Manado, Indonesia.

Liyanage, D.V. 1978. Coconut breeding programme Indonesia. Supplement No.1. Departemen Pertanian/UNDP/FAO, Coconut Research Improvement Project INS/72/007. Documnet No.3. September 1978, Lembaga Penelitian Tanaman Industri.

Mahmud, Z and Tine Rompas, 1989. Keragaan kelapa hibrida KHINA-1, KHINA-2, dan KHINA-3 pada beberapa pedoklimat di Indonesia, Balai Penelitian Kelapa, Manado.

Tarigans, D.D. 1985. Effect of cropping patterns on the growth and production of coconut. Pemberitaan Penelitian Tanaman Industri Vol.X (3-4), Januari-Juni 1955.

Tarigans, D.D and Sumith De Silva.1988. Assessment of experience with new varieties of Coconut-Indonesia. Asian and Pacific. Coconut Community P.O. Box 343, Jakarta, Indonesia.