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Coconut productivity and profitability of two important Philippine PCA hybrids: A critical review

Severino S. Magat, PhD[1], Liberty H. Canja, MSc[2], and Susan M. Rivera, MSc[3]

Abstract

To generate indicative information and knowledge on productivity and production economics in growing coconuts, two known hybrids of coconuts in the country are considered in this review. These are: Catigan dwarf x LAGT (PCA 15-1) hybrid; and Malayan red dwarf x BAYT (PCA 15-3) hybrid, tested earlier at the genetic and performance blocks of Zamboanga Research Center of Philippine Coconut Authority (PCA-ZRC), an intermediate growing zone of coconut, coastal-flat area of Western Mindanao. Relevant data from field establishment, maintenance and yields of palms for first 15 years from field-planting (FP) are used in this ex-ante enterprise budgeting and net present value or NPV analyses, considered as practical tools for decision-making in coconut farming and agribusiness.

Depending on the planting material used and farm gate copra price levels (Php 10–24/kg), initial harvest year (4 – 5 years), average annual nut and copra yields at early full-bearing and full-bearing stages, the following profitability indices all differed between the two hybrids: annual gross returns and net returns, net present value (NPV), benefit-cost ratio or BCR, and internal rate of return (IRR %). At mature full-bearing stage, annual yields ranged 2.5 – 4.3 tons copra/ha (135 trees). Using a copra price level of Php 16/kg: the average annual net returns at full bearing stage (10-`15 years) reached PhP23,900 – 44,100 (PCA 15-1) and PhP18,500 – 72,200 (PCA 15-3) and NPV (18% interest) at PhP 20-24/kg copra of PhP 26,340 – 41,641(PCA 15-1) and PhP34,288 - 58,304 (PCA 15-3); and BCR of 1.24 and 1.48 and 1.40 – 1.68, for PCA 15-1 and PCA 15-3, respectively. Overall, varietal productivity, long-term sustainability and profitability or economic indices indicate that the logical selection option identified follows: PCA 15-3 > PCA 15-1. (PhP 48.70 = US$1)

Implications on coconut planting/replanting, palm productivity and profitability as influenced by the different planting materials are discussed with respect to policies in coconut industry development.

Keywords: coconut production, coconut palms, hybrids, tall variety, replanting, coconut productivity, economic profitability, nuts, copra yield.

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[1]Scientist IV and Manager III, Agricultural Research Management Department and
[2]Science Research Specialist II, Agronomy and Soils Division, Davao Research Center,
[3]Sr. Science Research Specialist, Breeding and Genetics, Zamboanga Research Center, R & D, and Extension Branch, Philippine Coconut Authority, Elliptical Rd, Diliman, Quezon City 1101
Emails: sev_magat@yahoo.com; lhcanja@yahoo.com; pca_zrc@pldtdsl.net

Introduction

In coconut farming, the profitability and return to investment are influenced by the growth and yield performance of the planting materials under field conditions. As well known, the yield of coconut palms is the resultant of the interaction of the variety, the growing environment, in particular soil conditions and climate, and cultural practices as fertilizer application, pest and disease management, and farming systems followed, among many others.

Over the past decades, tall varieties of coconut have dominated (90-95%) the coconut plantings in the country. In recent years, aside from the Laguna Tall variety (LAGT), farmers have been planting other identified and studied tall varieties. To name some: Baybay Tall (BAYT), Tagnanan Tall (TAGT), Bago-Ohiro Tall (BAOT) and San Ramon Tall (SRNT). Research works and advances in the country, in particular that of the Philippine Coconut Authority (PCA) had produced to date at least 15 coconut hybrids (usually of the dwarf x tall crosses).

Two popular dwarf x tall hybrids are among those grown by farmers across locations in the country, namely: PCA 15-1 (Catigan x Laguna) and PCA 15-3 (Malayan Red Dwarf x Baybay Tall). In the next section, a summary description of the four parental materials: Laguna Tall; Baybay Tall; Catigan Green Dwarf; and Malayan Red Dwarf, and the two developed dwarf x tall hybrids (PCA 15-1 and PCA 15-3) is presented. In addition, Figures 1 and 2 present pictorial information of these known hybrids developed by the PCA research efforts.

Materials and methods

Characteristics of Selected Commercial Planting (Genetic) Materials in the Country (Santos et al 1996)

1. **Laguna Tall (LAGT)** - The most widely planted local tall in the country, first known to be identified in the province of Laguna (Luzon Islands, Southern Tagalog Region), hence endemic to Luzon. Laguna Tall variety introduced in Davao City in the 1960's, particularly at the Bureau of Plant Industry Experimental Station (later became the PCA-Davao Research Center, Bago-Ohiro) demonstrated good genetic potential as a pure population or open-pollinated variety (OPV) and as the male parent of the first PCA local hybrid (PCA 15-1 or CATD x LAGT, a.k.a CATLAG. Except for its good combining ability (GCA) with Catigan green dwarf, there are no specific traits which can help distinguish this tall from other local talls. At green stage (immature fruits), fruit color can either be green or brown (buff). Details of significant basic features of the Laguna variety in shown in Table 1.

2. **Baybay Tall (BAYT)** - This cultivated variety (cultivar) is believed to be an advanced generation of the LAGT, found and first identified by PCA researchers in 1973 at Baybay, Leyte (Eastern Visayas, Central Philippines). It has a highly desirable and powerful growth habit and bears large roundish-flat nuts with 320 g of copra/nut and shows good uniformity. Having selected for early bearing, high copra/nut and uniformity, the resultant second generation of BAYT grown at the PCA's Zamboanga Research Center (San Ramon, Zamboanga City, Western Mindanao) can be considered an outstanding tall variety. Seednuts usually start germinating quickly (in 6 weeks time from nursery-sowing), and with a potential production of 4.0 t copra/ha per year. As a male parent, its cross with Malayan Red dwarf (MRD) produced MRD x BAYT or PCA 15-3 which has demonstrated very satisfactory field performance. It has gained its position as one of the best PCA 15 series hybrids. Table 1 indicates this hybrid's important traits.

Table 1. Average basic Traits of Some Parental Palms (Breeding and Genetics Division, ZRC, PCA)

Indicative Yield and Traits	Tall Varieties		Dwarf Varieties	
	Laguna (LAGT)	Baybay (BAYT)	Catigan (CATG)	Malayan Red (MRD)
Age at 1st flowering (years)	3 - 5	3 – 4.5	2 – 3	2 – 2.5
Age at 1st nut harvest (years)	6	5	3	3
Nut size	medium to large	medium to large	Medium	Small to medium
Nut color (immature)	green/brown	green/brown	Green	Golden yellow
Nuts/kg copra (no)	3.5 - 4	3 – 3.5	4.5 – 5	5 – 6
Nuts/palm/yr (no)	70	105	75	110
Nuts/ha/yr (no)	12,700	16,400	15,700	26,600
Copra/nut (g)	250	295	210	190
Copra/palm/yr (kg)	20	30	15	20
Copra/ha/yr (tons)	3.5	5	3.3	4.5
Wt of whole nut (kg)	1.440	1.550	1.485	1.000
Wt of husk (kg)	0.520	0.390	0.540	0.285
Wt of shell (kg)	0.220	0.250	0.215	0.135
Wt of fresh meat (kg)	0.425	0.530	0.427	0.370
Wt of water (kg)	0.270	0.380	0.300	0.216
Fruit Quality Value (FQV)[1]	0.37	0.45	0.37	0.47
Fruit length (cm)	16.30	18.80	18.90	20.37
Fruit width (cm)	16.33	18.83	18.66	17.80
Husk thickness (cm)	2.22	2.80	3.84	2.74
Meat Thickness (cm)	1.32	1.36	1.27	1.27
Fatty Acid Profile (%)				
MCFA (C6:0 –12:0)[2]	63.80	67.88	62.47	66.39
Lauric (C12:0)	50.07	50.80	50.77	51.34
Oleic (C18:1)	6.28	3.99	5.61	3.84
Linoleic (C18:2)	1.06	0.73	0.70	0.46

[1] FQV = meat wt/fruit wt minus water wt [2] medium chain fatty acids

Figure 1. Features of PCA 15-1 (Catigan Dwarf x Laguna Tall)
Photos courtesy of Breeding and Genetics Division (PCA-ZRC)

Figure 2. Features of PCA 15-3 (Malayan Red Dwarf x Baybay Tall)
Photos courtesy of Breeding and Genetics Division (PCA-ZRC)

3. **Catigan Green Dwarf (CATD) –** This dwarf variety is claimed to be indigenous to the Philippines, named after the place it was first identified in early 70s (Rabara farm, Catigan, Davao City). In fact, local people earlier called it Rabara dwarf variety. This green dwarf is early bearing (precocious) and prolific, flowering in 2 – 3 years from field-planting under very suitable growing conditions. Its hybrids with local talls like Laguna and Tagnanan (TAGT) showed high performance over some local talls and hybrids. It has long peduncle with round nuts with distinct stigmatic point. Relative to other dwarf varieties, it has bigger nuts with average copra per nut of 210 g and about 93% self-pollinating (male and female phases overlapping).

4. **Malayan Red Dwarf (MRD) -** This dwarf variety is believed to be indigenous to many Southeast Asian countries including the Philippines where it is popularly called "Golden King" or Orange dwarf. Genetic field studies in the country and elsewhere showed that its general combining ability with many tall varieties is highly acceptable. MRD is a prolific (average of 100 nuts/tree per year) and precocious (starts flowering in less than 20 months from field-planting), with about 160 g copra/nut. Its young nuts and leaf petiole is usually bright orange.

Results

Yield Profiles of Selected two PCA Hybrids

Yield profiles of two hybrids were extracted from Annual Report of Breeding and Genetics Division (PCA-Zamboanga Research Center, 1999). The coconut area is a coastal-flat, intermediate climate and suitable coconut growing zone in Western Mindanao, Philippines, located at San Ramon, Zamboanga City.

The palms, talls and hybrids were grown in the nursery of the center following proper seednut and seedling selections and cultural practices prior to field-planting. In general, average to sub-optimal levels of fertilization was guided by foliar diagnostic techniques (leaf analysis) in most years.

In this productivity and production economics analysis, data gathered during the period 1–15 years was considered. Usually, palms, either tall varieties or hybrids reached the full-bearing stage within 12–15 years. This means that after full-bearing age, the ensuing productivity (annual yield/tree or yield/ha), the yearly variation or fluctuation is mainly affected by the growing conditions, in particular, soils, rainfall, crop nutrition and fertilization management, and pest and disease control measures. It should be considered that the growth and the productivity or yield of palms can only be optimized, regardless of planting material, if there are no growth or yield-limiting factors, e.g., mentioned earlier.

1. Catigan green dwarf x Laguna Tall Hybrid (PCA 15-1)

Initial harvest hybrid of PCA 15-1 starts at 4 years from FP, with the early full-bearing stage of this hybrid likely reached at 7 years from FP and a trend of yield fluctuation of nuts and copra follow (Table 3.1). The full-bearing year of this hybrid is likely achieved at 11 years from FP, and with productivity in 11 – 15 years from FP of 80 – 108 nuts/tree or 2.7 – 4.05 tons copra reached. At 15 years from FP, an accumulated copra yield of 28.33 tons could be reached.

2. Malayan Red Dwarf x Baybay Tall hybrid (PCA 15-3)

Table 3.2 indicates that initial harvest starts 5 years from FP and the full bearing stage of PCA 15-3 reached at 7 years from FP. The ensuing annual variation in yield (nuts and copra) is highly attributed to growing conditions and farming practices following.

Table 2. Average basic traits of two PCA local hybrids: PCA15-1 and PCA 15-3 (Breeding and Genetics, ZRC, PCA)

Indicative Yield and Traits	PCA Hybrid	
	PCA 15-1 (Catigan dwarf x Laguna Tall	PCA 15-3 (MRD x Baybay Tall)
Age at 1st flowering (years)	3 - 4	3 – 4
Age at 1st nut harvest (years)	4 - 5	4 – 5

Nut size	Medium	Medium
Nut color (immature)	Brown/green	Brown
Nuts/kg copra (no.)	4	4
Nuts per palm (no.)[1]	117	144
Nuts per ha (no)	17,900	21,950
Copra per nut (g)	250	271
Copra per palm/yr (kg)	30	40
Copra per ha/yr (tons)	4	6
Wt of whole nut (kg)	1.320	1.195
Wt of husk (kg)	0.375	0.310
Wt of shell (kg)	0.205	0.180
Wt of meat (kg)	0.435	0.445
Wt of water (kg)	0.310	0.260
Fruit Quality value (FQV)	0.43	0.48
Fatty acid profile (%):		
MCFA (C6:0 – C12:0)[2]	68.38	63.17
Lauric (C12:0)	52.20	52.05
Oleic (C18:1)	4.03	5.43
Linoleic (C18:2)	0.39	0.72

[1] at full-bearing stage [2] medium chain fatty acids

Table 3.1 Yield Profiles in nuts and copra terms of PCA 15-1 Hybrid

Year from Planting	NUT YIELD (no.)		COPRA YIELD (kg)		
	Per tree	Per ha	Per tree	Per ha	Accum./ha
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	9	1,258	2.2	297	297
5	39	5,211	8.2	1,890	2,187
6	23	3,159	6.2	837	3,027
7	80	10,712	20.2	2,727	5,754
8	63	8,505	15.4	2,079	7,833
9	73	9,855	17.1	1,755	9,588
10	64	8,640	14.8	1,994	11,582
11	105	14,175	30	4,055	15,637
12	108	14,580	27.1	3,655	19,292
13	95	12,838	24.7	3,339	22,631
14	97	13,117	22	2,971	25,602
15	80	10,811	20.2	2,729	28,331

Source: Magat and Canja (2060) from Santos et al (1995), Philippine Coconut Authority

Table 3.2 Yield Profiles in nuts and copra terms of PCA 15-3 Hybrid

Year from Planting	NUT YIELD (no)		COPRA YIELD (kg)		
	Per tree	Per ha	Per tree	Per ha	Accum./ha
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	57	7,752	10	1,360	1.36
6	10	1,368	3	310	1,670
7	111	15,048	33	4,388	6,058
8	81	10,944	20	2,689	8,747
9	74	9,948	18	2,433	11,180
10	77	10,423	17	2,277	13,457
11	43	5,768	10	1,374	14,831
12	163	21,968	44	5,663	20,494
13	97	13,174	25	3,350	23,844
14	109	14,706	23	3,136	26,980
15	149	20,152	38	5,083	32,063

Source: Magat and Canja (2060) from Santos et al (1995), Philippine Coconut Authority

Very high annual yields of 149-163 nuts/tree or 20,150 – 21,960 nuts/ha (135 trees/ha basis) and 5.08 – 5.66 tons copra/ha could be obtained under high suitable cropping years of this Malayan red Dwarf x Baybay Tall hybrid. At 15 years from FP, compared with Catigan Green Dwarf x Laguna Tall hybrid (PCA 15-1), this hybrid achieved 13% more accumulated yield in copra terms.

2. Malayan Red Dwarf x Baybay Tall hybrid (PCA 15-3)

Table 3.2 indicates that initial harvest starts 5 years from FP and the full bearing stage of PCA 15-3 reached at 7 years from FP. The ensuing annual variation in yield (nuts and copra) is highly attributed to growing conditions and farming practices followed. Very high annual yields of 149–163 nuts/tree or 20,150 – 21,960 nuts/ha (135 trees/ha basis) and 5.08 – 5.66 tons copra/ha could be obtained under high suitable cropping years of this Malayan red Dwarf x Baybay Tall hybrid. At 15 years from FP, compared with Catigan Green Dwarf x Laguna Tall hybrid (PCA 15-1), this hybrid achieved 13% more accumulated yield in copra terms.

Total Returns of Two Coconut Hybrids under Four Copra Prices (135 palms/ha)

In all the computerization of data to generate the required tables of desired parameters and indices in this paper, the MicroSoft Word and Excel program softwares were used. Brown and Librero (1991) stressed that the cost and returns analysis and the NPV analysis are production economics applicable to perennial crops like coconut. The cost of inputs, including the "cost of money" based on the % interest rate (usually based on savings account), and depreciation cost of tools, equipment and other fixtures are covered. In addition, annexes 2 and 3 are presented to understand the cost details of the yearly production from field-planting up to year 15.

Catigan Green Dwarf x Laguna Tall (PCA 15-1)

For this hybrid, at year 4, the first initial harvest year, the total returns of PhP 4,752 per ha is obtained (at Php 16.00 kg copra farm gate price) and increased to PhP43,632 per ha/year at 15 years from FP (or 11 years from initial harvest), as shown in Table 4.1. The accumulated total returns reached PhP 447,496 per ha from years 4 to 15.

When farm gate copra price reached higher levels of PhP 20 and 24/kg, total returns achieved impressive values of PhP 81,000 and 97,700, respectively. From lower returns of only PhP 48,600 at PhP 12/kg copra.

Malayan Red Dwarf x Baybay Tall Hybrid (PCA 15-3)

Table 4.2 below shows a total returns of PhP21,600 per ha (farm gate copra price of Php16.00/kg at the initial harvest year or 5 years from FP. At 15 years from FP or 10 years after initial production year, total returns generated at same farm gate copra price (PhP 16/kg) is PhP 82,080 per ha and an accumulated returns of PhP 520,560 per ha (10 years). Accumulated returns of PCA 15-3 increased by 16% over the PCA 15-1, Php 73,064 higher. Moreover, from Php 12.00 per kg copra price to Php 24.00 per kg, total returns at full–bearing stage (12 years from FP) reached PhP 71,280 to 118,800/ha per year, clearly indicating that farm gate copra price strongly determines the profitability in growing coconuts.

Also, total returns of the MRD x Baybay Tall hybrid increases linearly with increasing price levels, indicating that both high productivity (yield) and farm gate copra price contribute to high economic benefits derived from planting of hybrids.

Table 4.1 Total Returns of PCA 15-1 Hybrid, years 1 – 15 under four copra prices

Year from	NUT YIELD		COPRA YIELD		TOTAL RETURNS @				
Planting	per tree	per ha	per tree	per ha	P10/kg	P12/kg	P16/kg	P20/kg	P24/kg
	(no.)		(kg)	(kg)					
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	9	1,215	2.2	297	2,970	3,564	4,752	5,940	7,128
5	39	5,265	8.2	1,107	11,070	13,284	17,712	22,140	26,568
6	23	3,105	6.2	837	8,370	10,044	13,392	16,740	20,088
7	80	10,800	20.2	2,727	27,270	32,724	43,632	54,540	65,448
8	63	8,505	15.4	2,079	20,790	24,948	33,264	41,580	49,896
9	73	9,855	17.1	2,309	23,085	27,702	36,936	46,170	55,404
10	64	8,640	14.8	1,998	19,980	23,976	31,968	39,960	47,952
11	105	14,175	30	4,050	40,500	48,600	64,800	81,000	97,200
12	108	14,580	27.1	3,659	36,585	43,902	58,536	73,170	87,804
13	95	12,825	24.7	3,335	33,345	40,014	53,352	66,690	80,028
14	97	13,095	22	2,970	29,700	35,640	47,520	59,400	71,280
15	80	10,800	20.2	2,727	27,270	32,724	43,632	54,540	65,448

*95% of the total palms/ha (143 palms/ha @ 9x9 m triangular) to allow 5% nut loss due to uncontrollable factors.
Source: Magat and Canja (2006), Philippine Coconut Authority

PhP48.70=$1

Table 4.2 Total Returns of PCA 15-3, years 1 – 15, under five copra prices

Year from	NUT YIELD		COPRA YIELD		TOTAL RETURNS @				
Planting	per tree	per ha	per tree	per ha	P10/kg	P12/kg	P16/kg	P20/kg	P24/kg
	(no.)		(kg)	(kg)					
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	57	7,695	10	1,350	13,500	16,200	21,600	27,000	32,400
6	10	1,350	3	405	4,050	4,860	6,480	8,100	9,720
7	111	14,985	33	4,455	44,550	53,460	71,280	89,100	106,920
8	81	10,935	20	2,700	27,000	32,400	43,200	54,000	64,800
9	74	9,990	18	2,430	24,300	29,160	38,880	48,600	58,320
10	77	10,395	17	2,295	22,950	27,540	36,720	45,900	55,080
11	43	5,805	10	1,350	13,500	16,200	21,600	27,000	32,400
12	163	22,005	44	5,940	59,400	71,280	95,040	118,800	142,560
13	97	13,095	25	3,375	33,750	40,500	54,000	67,500	81,000
14	109	14,715	23	3,105	31,050	37,260	49,680	62,100	74,520
15	149	20,115	38	5,130	51,300	61,560	82,080	102,600	123,120

*95% of the total palms/ha (143 palms/ha @ 9x9 m triangular) to allow 5% nut loss due to uncontrollable factors.
Source: Magat and Canja (2006), Philippine Coconut Authority

PhP48.70=$1

It should be recalled that an earlier study (Santos et al 1995) indicated that local hybrids which included PCA 15-1 and PCA 15-3, and the very impressive Baybay Tall variety reached the break-even point (BEP) much earlier (7 – 9 years) than other local talls (as Laguna, Tagnanan, Bago-Oshiro) at 14 – 16 years, clearly suggesting that earlier return to investment is very likely achieved in the former over the latter.

Sensitivity Analysis in Net Returns of Two Coconut hybrids, under increasing copra prices

Catigan Green Dwarf x Laguna Tall Hybrid

Significant net returns or gains (Table 5.1) from growing coconut hybrid PCA 15-1 starts at year 5 from FP, ranging PhP 4,438 to 13,924/ha per year (copra price of Php 16 – 24/kg), while at the early full-bearing stage of 7 years from FP, this increases from PhP 10,387 to a high of PhP48,565/ha per year. At full bearing stage of this hybrid reached in the 11ath year from FP, net returns ranged from PhP 19,914 – 76,614/ha per year, as a result of the increased productivity level and product farm gate copra price.

At an average farm gate copra price of PhP16.00/kg, the net return is PhP 27,107/ha per year. This could be used as a profitability index under monocropping with the growing of PCA 15-1, also popularly known as *CATLAG*

Malayan Red Dwarf x Baybay Tall Hybrid

Initial net return (gain) from growing the PCA 15-3 hybrid is obtained starting year 5 from FP, increasing from Php1,763 – 17,963/ha per year based from copra farm gate price Php 12–24/kg. However, at early full-bearing at the 7th year from FP, net return even at PhP 10 -24 kg copra considerably increases from PhP 26,762 – 46,576, and at peak yields of the full-bearing stage (15th year), the very high yield (120 nuts or 4.50 t copra/ha per year), reached net returns from PhP 28,976 – 100,796. At copra price of P12.00/kg (i.e., double the production cost of a kg of copra), net returns could reach Php 39,236 with PCA 15-3 hybrid.

This indicates clearly that if the genetic potential of coconut hybrids as PCA 15-3 is achieved by optimizing yields by ensuring adequate and balanced crop nutrition and fertilization management and other farming practices, even monocropping of coconut could still be encouraging to farmers, especially under highly profitable prices of nuts or copra.

Net Present Value Analysis (NPV)

Coconut is grown over a long period (50 years or more), hence production expenses are incurred annually and the crop generates annual benefits during its production cycle. Thus, determining the NPV of benefits and costs is important in assessing crop production profitability. Moreover, in simple terms, NPV (stream of benefits and costs) is the cost/value at certain % interest or discount rate of a certain monetary value that would be obtained from the investment for a certain period of years.

Catigan Green Dwarf x Laguna Tall Hybrid

In the 15 year cropping period (Table 6.1), the NPV (@18% interest) is negative at copra price levels PhP 10 – 16/kg, but turns positive or gains at copra price levels of PhP 20 and 24/kg, respectively, NPV reached PhP 20,343 and PhP 41,641/ha. The BCR (gross benefits/gross cost) likewise reached satisfactory/acceptable levels of BCRs 1.24 and 1.48 only at copra farm gate prices of PhP 20 and 24/kg), respectively.

Malayan Red Dwarf x Baybay Tall Hybrid

Table 6.2, in contrast to PCA 15-1 (Table 6.1), indicates that PCA 15-3 hybrid had positive NPV, starting with a lower copra price

Table 5.1 Sensitivity analysis of annual net returns per ha of PCA 15-3 coconut hybrid, under five copra price levels

	Total Production	Gross Return @					Net Return @[a]				
Year	Cost (P/ha)	P10	P12	P16	P20	P24	P10	P12	P16	P20	P24
1	29,192	0	0	0	0	0	(29,192)	(29,192)	(29,192)	(29,192)	(29,192)
2	6,445	0	0	0	0	0	(6,445)	(6,445)	(6,445)	(6,445)	(6,445)
3	8,136	0	0	0	0	0	(8,136)	(8,136)	(8,136)	(8,136)	(8,136)
4	17,879	0	0	0	0	0	(17,879)	(17,879)	(17,879)	(17,879)	(17,879)
5	14,437	13500	16200	21600	27000	32400	(937)	1,763	7,163	12,563	17,963
6	14,821	4050	4860	6480	8100	9720	(10,771)	(9,961)	(8,341)	(6,721)	(5,101)
7	17,798	44550	53460	71280	89100	106920	26,752	35,662	53,482	71,302	89,122
8	18,224	27000	32400	43200	54000	64800	8,776	14,176	24,976	35,776	46,576
9	17,959	24300	29160	38880	48600	58320	6,341	11,201	20,921	30,641	40,361
10	18,123	22950	27540	36720	45900	55080	4,827	9,417	18,597	27,777	36,957
11	18,967	13500	16200	21600	27000	32400	(5,467)	(2,767)	2,633	8,033	13,433
12	22,775	59400	71280	95040	118800	142560	36,625	48,505	72,265	96,025	119,785
13	20,438	33750	40500	54000	67500	81000	13,312	20,062	33,562	47,062	60,562
14	20,935	31050	37260	49680	62100	74520	10,115	16,325	28,745	41,165	53,585
15	22,324	51300	61560	82080	102600	123120	28,976	39,236	59,756	80,276	100,796

[a]values in ( ) are negative returns

Source: Magat and Canja (2006), Philippine Coconut Authority

PhP48.70=$1

Table 5.2 Sensitivity analysis of annual net returns per ha of PCA 15-3 coconut hybrid, under five copra price levels

	Total Production	Gross Return @					Net Return @[a]				
Year	Cost (P/ha)	P10	P12	P16	P20	P24	P10	P12	P16	P20	P24
1	29,192	0	0	0	0	0	(29,192)	(29,192)	(29,192)	(29,192)	(29,192)
2	6,445	0	0	0	0	0	(6,445)	(6,445)	(6,445)	(6,445)	(6,445)
3	8,136	0	0	0	0	0	(8,136)	(8,136)	(8,136)	(8,136)	(8,136)
4	17,879	0	0	0	0	0	(17,879)	(17,879)	(17,879)	(17,879)	(17,879)
5	14,437	13500	16200	21600	27000	32400	(937)	1,763	7,163	12,563	17,963
6	14,821	4050	4860	6480	8100	9720	(10,771)	(9,961)	(8,341)	(6,721)	(5,101)
7	17,798	44550	53460	71280	89100	106920	26,752	35,662	53,482	71,302	89,122
8	18,224	27000	32400	43200	54000	64800	8,776	14,176	24,976	35,776	46,576
9	17,959	24300	29160	38880	48600	58320	6,341	11,201	20,921	30,641	40,361
10	18,123	22950	27540	36720	45900	55080	4,827	9,417	18,597	27,777	36,957
11	18,967	13500	16200	21600	27000	32400	(5,467)	(2,767)	2,633	8,033	13,433
12	22,775	59400	71280	95040	118800	142560	36,625	48,505	72,265	96,025	119,785
13	20,438	33750	40500	54000	67500	81000	13,312	20,062	33,562	47,062	60,562
14	20,935	31050	37260	49680	62100	74520	10,115	16,325	28,745	41,165	53,585
15	22,324	51300	61560	82080	102600	123120	28,976	39,236	59,756	80,276	100,796

[a]values in ( ) are negative returns

Source: Magat and Canja (2006), Philippine Coconut Authority

PhP48.70=$1

Table 6.1 Other profitability indices of coconut hybrid PCA15-1 under varying copra prices (PhP 10-24), @ 18%interest to capital, per ha

Index	Copra Price (PhP)				
	P10	P12	P16	P20	P24
Net present value (NPV @18%,PhP) [a]	(32,901)	(22,252)	(954)	20,343	41,641
Sum of discounted gross benefits, PhP	53,244	63,893	85,191	106,489	127,787
Sum of discounted gross costs, PhP	86,145	86,145	86,145	30,681	86,154
Benefits-cost ratio (BCR, @18%)	0.62	0.74	0.99	1.24	1.48
Internal rate of return (IRR, @18%), %	3.00	9.05	17.68	23.95	29.02

[a] values in ( ) are negative PhP 48.70=US$ 1

Source: Magat and Canja (2006), Philippine Coconut Authority

Table 6.2 Other profitability indices of coconut hybrid, PCA 15-3 under varying copra prices (PhP 10-24), @18% interest to capital, per ha

Index	Copra Price (PhP)				
	P10	P12	P16	P20	P24
Net present value (NPV @18%,PhP) [a]	(27,750)	(13,742)	10,272	34,288	58,304
Sum of discounted gross benefits, PhP	60,038	72,046	96,062	120,077	144,093
Sum of discounted gross costs, PhP	85,789	85,789	85,789	85,789	85,789
Benefits-cost ratio (BCR, @18%)	0.70	0.84	1.12	1.40	1.68
Internal rate of return (IRR, @18%), %	7.05	12.85	21.22	27.44	32.50

[a] values in ( ) are negative PhP48.70=$1

Source: Magat and Canja (2006), Philippine Coconut Authority

(PhP 16.00/kg), increasing considerably to PhP 34,288 and PhP 58,304 with copra price levels of PhP 20.00 and 24.00/kg, respectively.

Moreover, the BCRs are higher than 1.0 from PhP 16, 20 and 24/kg copra; while the the

IRR@ 18% interest showed acceptable levels even at PhP16/kg copra, which increases to 27.4% and 32.5%, at PhP 20 and 24/kg copra, respectively.

Covercrop Establishment

In areas where intercropping is not intended or coconut monocropping system of farming is selected, covercropping with leguminous plants (creeping legumes, bush legumes and nitrogen-fixing trees) should be followed as practical. This practice as multiple benefits as: 1) control of unwanted weeds which retard normal growth of young palms; 2) supplies additional nitrogen nutrient and increase the humus and fertility content of the soil; and 3) minimizes soil erosion and degradation of soil productivity, among many others (Magat 1999).

In the covercrop establishment in coconut farms, the combination of animal-manual method is the most effective and efficient. At current economic conditions, with component labor and planting material (covercrop seeds), the estimated cost of Php14,000 each hectare is required (annex 4). It usually covers almost one year period to achieve a full, vigorous legume cover and practical cultural control against unwanted weeds.

Discussion

During the period 1986 – 1995, a regional testing of promising coconut hybrids and cultivars (Project MULTILOC) was conducted covering 9 project sites with different agro-climatic conditions in the country (4 in Luzon, 2 in the Visayas and 3 in Mindanao). Among the selected cultivars and hybrids tested was PCA 15-3 (MRD x Baybay Tall), but not PCA 15-1 (CATD x Laguna Tall), for reasons not indicated. Using nut and copra yield gathered at 9 years from FP, the field performance of the planting materials was evaluated (Santos, 1996). In 7 out of 9 locations, researchers reported that the hybrid PCA 15-3 was consistently in the top 5 rank in terms of nut and copra yields, indicating its high suitability in the intermediate to wet growing zones of the country.

Moreover, in this long-term study, the clear significant positive influence of fertilizer application on the growth and early yield of palms was shown, emphasizing the critical role of adequate and balance nutrition in increased or optimized productivity of palms (Santos, 1996). He also mentioned that fertilizer application considerably resulted in more uniform growth and development of palms and minimized the effects of soil variability, soil fertility in particular.

In the same work, a crop fertilizer use efficiency analysis (CFE) was applied as tool in identifying appropriate planting materials for different agro-climatic conditions (Magat 1996). CFE is expressed either as nut yield or copra yield/tree per kg of fertilizer applied (e.g., in 1995 in all cultivar/hybrid entries at study site of Mambuaya, Cagayan de Oro City: CFE of PCA 15-3 = 121 nuts/4 kg fertilizer= 30.30 or 30.30 kg copra/4 kg fertilizer= 8.36). In this area, PCA 15-3 hybrid ranked no. 2.

An action program on adoption of suitable technologies with emphasis on coconut varieties and hybrids from the earlier MULTILOC Research Project followed in June 1996. This time with acronym MULTILOC ACTPRO, it was piloted in an aggregate of 1000 ha in 19 study sites or 18 provinces, 447 farmer-cooperators, in 6 coastal areas and 13 inland areas under the dry, intermediate and wet growing zones and varied soil conditions (Magat et al 2004).

Of the 13 planting materials (8 hybrids, 4 talls and 1 dwarf), PCA 15-1 (8.8%) and PCA 15-3 (12.7%) were included and grown in a total of 368 ha of coconut lands, as selected by farmers. At termination date (Year 7, May 2003) of project most pilot farms/areas had been suffering from multiple nutrient deficiencies (N, P, K, Cl, B and other micronutrients) based of foliar diagnosis done by the PCA. Of the total 24,772 flowering palms, PCA 15-1 had 7,708, and PCA 15-3 with 5,131. In 1996–2003, nationwide, the government thru PCA and PCARRD/DOST collaboration selected promising coconut variety and locally-

developed hybrids, PCA 15-1 and PCA 15-3 were included. Out of the 1000 ha aggregate area in different wet, intermediate and dry coconut growing zones, 145 ha was planted to the following: PCA 15-1 with 91 ha (13,000 palms); and PCA 15-3 with 131 ha (18,200 palms) as reported by Magat, Santos and Calub (2004).

Over the full-bearing stage, the higher NPVs achieved by PCA 15-3 hybrid over the PCA 15-1 even at lower copra price level of PhP 16/kg as well as the higher BCRs and IRRs of the former over the latter provides clear indication of the higher profitability of growing PCA 15-3 in coconut lands of the country.

Santos et al (1995) reported under a replanting scheme, an enhanced profitability in coconut planting mainly as a result of the following: 1) lower total labor cost at early years of field maintenance; and **2) initial income from the sale of coconut logs from cut senile palms (more than enough to cover costs during the non-productive years of the plantation).** Under this condition, both tall varieties and hybrids have positive net returns from year one and onwards; hybrids and the local tall Baybay generate over the years an average BCR of 3.00 – 3.44 (return per peso invested) and achieved internal rate of return of higher than 100%.

Implications and conclusions

Of the two selected planting materials evaluated, MRD x Baybay Tall hybrid (PCA 15-3) generates higher yield (productivity) levels and economic viability or profitability indices in terms of: annual gross returns, annual net returns, net present value (NPV) and benefit-cost ratio (BCR) over Catigan green dwarf x Laguna Tall hybrid (PCA 15-1). This recent evaluation which extended copra price levels at PhP 20 and 24/kg from PHP 10/kg and yield performance up to 15 years from field-planting instead of 13 years (Santos et al 1995), showed almost similar trends in productivity and profitability indices.

Thus, if seednuts or seedlings of these planting materials are easily available to farmers/growers, under suitable growing zones of coconut, the order of preference should be: PCA 15-3 > PCA 15-1.

The high productivity in farms are only obtained when adequate and balanced crop nutrition (with strong emphasis on nutrients N, K, Cl, P, Ca, Mg, S, and B) is achieved by farms thru judicious fertilization. If not, either tall varieties or hybrids will perform dismally in terms of nut productivity and socio-economic benefits. As such, several opportunities are caused to be lost by coconut stakeholders, farmers (basically the raw material producers), in particular.

Moreover, comparing coconut two hybrids at increasing copra price levels: PhP 10 – 24/kg, the selection of option based on the productivity and profitability indces follows: PCA 15-3 > PCA 15-1. Earlier report of Santos et al (1995) mentioned that local hybrids (covering PCA 15-1 and PCA 15-3 and the impressive Baybay Tall variety achieved higher economic indicators than the traditional tall varieties like Laguna, Tagnanan and Bago-Oshiro Talls.

This critical review, utilized an *ex-ante* enterprise budgeting and NPV analysis which are considered an appropriate for long-term perennial crops like coconut, fruit crops and industrial tree crops. The basic yield data and profitability indices was based on the actual field performance in the first 15 years from field-planting of two hybrids: PCA 15-1 and PCA 15-3) as examples of widely-grown planting materials in the Philippines, since the advent and promotion of coconut hybrids few decades ago.

To date, the PCA had conserved, managed and utilized important genetic resources: 107 talls; 53 dwarfs; and 102 hybrid crosses. These efforts yielded enormous valuable data and the corresponding profitability or economic indices. In current and future coconut productivity efforts to secure and increase field and market supplies of coconuts of the industry, supportive development policies and decision-making should be based on sound results of R & D and efficient operational extension services.

Better still, albeit the inherent difficulty in projecting or forecasting positive outcomes of agricultural commodities, even of national importance like the coconut crop, development programs (with sustained commitments of main stakeholders) as that of increasing coconut productivity and production levels could be more effective and efficient cum minimal risks of delays in expected outputs and development impacts if reliable local agricultural and statistical information, and knowledge and technologies are available, better still location-specific.

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References

Brown, E.O. and Librero, A.R. 1991. Measuring the economic viability of agricultural technologies. Los Baños, Laguna: Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, 34 p. (Book Series No. 118).

Magat, S.S. 1999. Production Management of Coconut (*Cocos nucifera*, Lin.) Diliman, Quezon City. Metro Manila: PCA-ARDB. 67p.

Magat, S.S. 1996. Crop Fertilizer Use Efficiency Analysis (CFE). A tool in Identifying appropriate planting materials of coconut in different agro-climatic conditions. *Intl. J. Coconut Res.Dev.* 12 (2): 1-33.

Magat, S.S., Santos, G.A. and Calub, D.J. 2004. Action Program on Adoption of Suitable Technologies with emphasis on Coconut Varieties and Hybrids from earlier MULTILOC Research Project (June 1996 – May 2003). Terminal Report: Philippine Coconut Authority; PCARRD/DOST. Diliman, Quezon City. 174 P.

Santos, G.A., Rivera S.M. and R.L. Rivera. 1995. Coconut Variety Hybrid Farming: Investment Analysis at 22. Breeding and Genetics Division, Zamboanga Research Center, Philippine Coconut Authority. 55p.

Santos, G.A., Rivera, S.M. and Rivera, R.L., Baylon, G.B. and de la Cruz, B.V. 1995. Comparative investment analysis of recommended coconut hybrid/cultivars for the national planting and replanting programme in the Philippines. Int'l J. Coconut R & D 9(2):1-38.

Santos, G.A. 1996. Regional Testing of Promising Coconut Hybrids and Cultivars (MULTILOC). Terminal report: Philippine Coconut Authority; Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, DOST; Agricultural Investors, Inc 78p.

Annex 1

Assumptions used in the cost and returns;
Profitability analysis of two local PCA hybrids (PhP 48.70=US$ 1)

			PhP		
1	Coconut seedlings	LOCAL TALL	20	/pc	
2	Coconut seedlings	HYBRIDS	26	/pc	
3	Ammosul		16	/kg	(800/bag)
4	NaCl		4	/kg	(120/bag (@ 30kg/bag)
5	Labor		90	/day	
6	Man-animal Labor		200	/day	
7	Cover crop seeds		200	/kg	
8	Cocopugon		8000		
		Depreciation Cost			
		(10 % p.a.)	720		
	Residual Value	(after 10 years)	800		
	Value				

15-1			**15-3**	
Year 3	7280			
4	6560		Year 4	7280
5	5840		5	6560
6	5120		6	5840
7	4400		7	5120
8	3680		8	4400
9	2960		9	3680
10	2240		10	2960
11	1520		11	2240
12	800		12	1520
13	800		13	800
14	800		14	800
15	800		15	800

9	Land rental (opportunity Cost)	2000	/ha	
10	Farm tools	2000		

Annex 2

Yearly production cost for the establishment & production of local "PCA 15-1 (Catigan green dwarf x Laguna Tall) Hybrid' variety

Year	Particular	Cost (P)
	1. Land rental	2,000
1	2. Land preparation & covercrop establishment	13,490
	3. Farm tools	2,000
	4. Seedlings - 143 pcs + 15% for replanting @ P26/seedling	4,276
	*Transportation cost (P3/seedling)	495
	5. Fertilizers:	
	Ammonium sulfate (AS) -150g/hill (21.45kg/ha) @ P16/kg	343
	NaCl - 160 g/hill (22.88kg/ha, @ P4.00/kg)	92
	6. Field planting	
	*Lay-outing and staking -4m.d. @P90/day	360
	*Holing (0.5 cubic meter) - 7 m.d.	630
	*Fertilizer application & planting 4 m.d.	360
	7. Field maintenance	
	*Ring-weeding 3 m.d., 6x a yr	1,620
	8. Fertilizers, 6 mos. after	
	AS - 200g/hill, 28.6 kg/ha @ P16/kg	458
	NaCl - 200 g/hill, 28.6 kg/ha @P4.00/kg	114
	9. Labor for fert. application, 13 min/tree, P90/day	349
	10. Pesticides	1,000
	*Pesticide application 3x a yr	270
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	1,079
	Total	29,192
2	1. Land rental	2,000
	2. Field maintenance	
	*Ring-weeding 3 m.d. 6x/yr	1,620
	3. Fertilizer	
	AS- 0.5 kg/tree, 71.5 kg/ha @ P16/kg	307
	NaCl - 0.48 kg/tree, 68.6 kg/ha @ P4.00/kg	206
	4. Fertilizer application 13 min/tree, P90/day	349
	5. Pesticides	1,000
	*Pesticide application 3x a yr	270
	6. Other labor (uprooting weeds)	225
	7. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	199
	Total	6,432
3	1. Land rental	2,000
	2. Cocopugon Copra Dryer	8,000
	3. Ring-weeding, 3 m.d. 6x/yr	1,620
	4. Fertilizer - AS - 0.75 kg/tree. 107 kg/ha @ P) 16/kg	1,712
	NaCl - 0.72 kg/tree - 103 kg/ha @ P4.00/kg	412
	5. Fertilizer application - 13 min/tree P90/day	349
	6. Pesticides	1,000
	*Pesticide application 3x a yr	270
	7. Other labor (uprooting weeds)	225
	8. Interest	
	*Capital Investment (6%)	737
	*Operating Capital (5%)	279
	Total	16,603

Year	Particular	Cost (P)
4	1. Land rental	2,000
	3. Ring-weeding, 3 m.d. 6x/yr	1,620
	4. Fertilizer - AS - 1.0 kg/tree. 143 kg/ha @)P16.00/kg	2,288
	NaCl - 1.25 kg/tree - 179 kg/ha @ P4.00/kg	716
	5. Fertilizer application - 13 min/tree P90/day	349
	6. Pesticides	1,000
	*Pesticide application 2x a yr	270
	7. Harvesting P3.00/tree 6x/yr (10% of trees =65 trees)	1,287
	8. Dehusking, P80/1000 nuts	97
	9. Copra making (spliting, scooping, drying, sacking) P120/1000 nuts	146
	10. Other labor (uprooting weeds)	225
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	420
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	11,794
5	1. Land rental	2,000
	2. Ring-weeding, 3 m.d. 6x/yr	1,620
	3. Fertilizer - AS - 1.25 kg/tree, 179 kg/ha @)P16.00/kg	2,864
	NaCl - 1.35 kg/tree - 193 kg/ha @ P4.00/kg	772
	4. Fertilizer application - 13 min/tree P90/day	349
	5. Pesticides	1,000
	*Pesticide application 3x a yr	270
	6. Harvesting P3.00/tree 6x/yr (10% of trees =65 trees)	1,170
	7. Dehusking, P80/1000 nuts	421
	8. Copra making (spliting, scooping, drying, sacking) P120/1000 nuts	632
	9. Other labor (uprooting weeds)	225
	10. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	575
	11. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	13,274
6	(Assuming 10% increase)	
	1. Land rental	2,200
	2. Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr (10% of trees =65 trees)	1,287
	7. Dehusking, P90/1000 nuts	279
	8. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	410
	9. Uprooting weeds	400
	10. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	556
	11. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	14,850

Year	Particular	Cost (P)
7	1. Land rental	2,200
	2. Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & dehusking, 2 m.d., 6x/yr	1,200
	8. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,426
	9. Uprooting weeds	400
	10. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	653
	11. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	16,883
8	1. Land rental	2,200
	2. Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & hauling, 2 m.d., 6x/yr	1,200
	8. Dehusking P90/1000 nuts	765
	9. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,123
	10. Uprooting weeds	400
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	676
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	17,368
9	1. Land rental	2,200
	2. Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & hauling, 2 m.d., 6x/yr	1,200
	8. Dehusking P90/1000 nuts	887
	9. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,301
	10. Uprooting weeds	400
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	691
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	17,683

Year		Particular	Cost (P)
10	1.	Land rental	2,200
	2.	Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3.	Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
		NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4.	Fertilizer application - 13 min/tree P100/day	387
	5.	Pesticides	1,100
		*Pesticide application 2x a yr	200
	6.	Harvesting P3.30/tree 6x/yr	1,287
	7.	Piling & hauling, 2 m.d., 6x/yr	1,200
	8.	Dehusking P90/1000 nuts	778
	9.	Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,140
	10.	Uprooting weeds	400
	11.	Interest	
		*Capital Investment (6%)	257
		*Operating Capital (5%)	677
	12.	Cocopugon Copra Dryer	
		*Depreciation Cost (10% p.a.)	720
		*Repair and maintenace	400
		Total	17,400
11		(Assuming 10% increase)	
	1.	Land rental	2,420
	2.	Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3.	Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
		NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4.	Fertilizer application - 13 min/tree P110/day	426
	5.	Pesticides	1,210
		*Pesticide application 2x a yr	220
	6.	Harvesting P4.00/tree 6x/yr	1,560
	7.	Piling & hualing, 2 m.d., 6x/yr	1,320
	8.	Dehusking, P100/1000 nuts	1,418
	9.	Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	2,055
	10.	Uprooting weeds	444
	11.	Interest	
		*Capital Investment (6%)	257
		*Operating Capital (5%)	819
	12.	Cocopugon Copra Dryer	
		*Depreciation Cost (10% p.a.)	720
		*Repair and maintenace	400
		Total	20,586
12	1.	Land rental	2,420
	2.	Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3.	Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
		NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4.	Fertilizer application - 13 min/tree P110/day	426
	5.	Pesticides	1,210
		*Pesticide application 2x a yr	220
	6.	Harvesting P4.00/tree 6x/yr	1,404
	7.	Piling & hauling, 2 m.d., 6x/yr	1,320
	8.	Dehusking, P100/1000 nuts	1,458
	9.	Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	2,114
	10.	Uprooting weeds	444
	11.	Interest	
		*Capital Investment (6%)	257
		*Operating Capital (5%)	816
	12.	Cocopugon Copra Dryer	
		*Depreciation Cost (10% p.a.)	720
		*Repair and maintenace	400
		*Residual value	800
		Total	21,326

Year	Particular	Cost (P)
13	1. Land rental	2,420
	2. Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,210
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	1,283
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	1,860
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	794
	12. Cocopugon Copra Dryer	
	*Repair and maintenace	400
	*Residual value	800
	Total	19,355
14	1. Land rental	2,420
	2. Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,210
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	1,310
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	1,899
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	797
	12. Cocopugon Copra Dryer	
	*Repair and maintenace	400
	*Residual value	800
	Total	19,425
15	1. Land rental	2,420
	2. Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,210
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	1,080
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	1,566
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	769
	12. Cocopugon Copra Dryer	
	*Repair and maintenace	400
	*Residual value	800
	Total	19,634

Annex 3

Yearly production cost for the establishment & production of local "PCA 15-3 (Malayan Red Dwarf x Baybay Tall) Hybrid' variety

Year	Particular	Cost (P)
1	1. Land rental	2,000
	2. Land preparation & covercrop establishment	13,490
	3. Farm tools	2,000
	4. Seedlings - 143 pcs + 15% for replanting @ P26/seedling	4,276
	*Transportation cost (P3/seedling)	495
	5. Fertilizers:	
	*Ammonium sulfate (AS) -150g/hill (21.45kg/ha) @ P16/kg	343
	*NaCl - 160 g/hill (22.88kg/ha, @ P4.00/kg)	92
	6. Field planting	
	*Lay-outing and staking -4m.d. @P90/day	360
	*Holing (0.5 cubic meter) - 7 m.d.	630
	*Fertilizer application & planting 4 m.d.	360
	7. Field maintenance	
	*Ring-weeding 3 m.d., 6x a yr	1,620
	8. Fertilizers, 6 mos. after	
	*AS - 200g/hill, 28.6 kg/ha @ P16/kg	458
	*NaCl - 200 g/hill, 28.6 kg/ha @P4.00/kg	114
	9. Labor for fert. application, 13 min/tree, P90/day	349
	10. Pesticides	1,000
	*Pesticide application 3x a yr	270
	11. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	1,079
	Total	29,192
2	1. Land rental	2,000
	2. Field maintenance	
	*Ring-weeding 3 m.d. 6x/yr	1,620
	3. Fertilizer	
	*AS- 0.5 kg/tree, 71.5 kg/ha @ P16/kg	307
	*NaCl - 0.48 kg/tree, 68.6 kg/ha @ P4.00/kg	206
	4. Fertilizer application 13 min/tree, P90/day	349
	5. Pesticides	1,000
	*Pesticide application 3x a yr	270
	6. Other labor (uprooting weeds)	225
	7. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	212
	Total	6,445
3	1. Land rental	2,000
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr	1,620
	3. Fertilizer - AS - 0.75 kg/tree. 107 kg/ha @ P) 16/kg	1,712
	NaCl - 0.72 kg/tree - 103 kg/ha @ P4.00/kg	412
	4. Fertilizer application - 13 min/tree P90/day	349
	5. Pesticides	1,000
	*Pesticide application 3x a yr	270
	6. Other labor (uprooting weeds)	225
	7. Interest	
	*Capital Investment (6%)	257
	*Operating Capital (5%)	292
	Total	8,136

Year	Particular	Cost (P)
4	1. Land rental	2,000
	2. Cocopugon Copra Dryer	8,000
	3. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr	1,620
	4. Fertilizer - AS - 1.0 kg/tree. 143 kg/ha @)P16.00/kg	2,288
	NaCl - 1.25 kg/tree - 179 kg/ha @ P4.00/kg	716
	5. Fertilizer application - 13 min/tree P90/day	349
	6. Pesticides	1,300
	*Pesticide application 3x a yr	270
	7. Other labor (uprooting weeds)	225
	8. Interest	
	*Capital Investment (6%)	737
	*Operating Capital (5%)	375
	Total	17,879
5	1. Land rental	2,000
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr	1,620
	3. Fertilizer - AS - 1.25 kg/tree, 179 kg/ha @)P16.00/kg	2,864
	NaCl - 1.35 kg/tree - 193 kg/ha @ P4.00/kg	772
	4. Fertilizer application - 13 min/tree P90/day	349
	5. Pesticides	1,300
	*Pesticide application 3x a yr	270
	6. Harvesting P3.00/tree 6x/yr (10% of trees =65 trees)	1,170
	7. Dehusking, P80/1000 nuts	616
	8. Copra making (spliting, scooping, drying, sacking) P120/1000 nuts	923
	9. Other labor (uprooting weeds)	225
	10. Interest	
	*Capital Investment (6%)	650
	*Operating Capital (5%)	558
	11. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	14,437
6	(Assuming 10% increase)	
	1. Land rental	2,200
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr (10% of trees =65 trees)	1,287
	7. Dehusking, P90/1000 nuts	122
	8. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	178
	9. Uprooting weeds	400
	10. Interest	
	*Capital Investment (6%)	607
	*Operating Capital (5%)	567
	11. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	14,821

Year	Particular	Cost (P)
	1. Land rental	2,200
7	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & dehusking, 2 m.d., 6x/yr	1,200
	8. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,978
	9. Uprooting weeds	400
	10. Interest	
	*Capital Investment (6%)	564
	*Operating Capital (5%)	708
	11. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	17,798
8	1. Land rental	2,200
	2. Field maintenance	
	Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & hauling, 2 m.d., 6x/yr	1,200
	8. Dehusking P90/1000 nuts	984
	9. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,443
	10. Uprooting weeds	400
	11. Interest	
	*Capital Investment (6%)	521
	12. *Operating Capital (5%)	729
	Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	18,224
9	1. Land rental	2,200
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,100
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & hauling, 2 m.d., 6x/yr	1,200
	8. Dehusking P90/1000 nuts	899
	9. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,319
	10. Uprooting weeds	400
	11. Interest	
	*Capital Investment (6%)	477
	12. *Operating Capital (5%)	716
	Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	17,959

Year	Particular	Cost (P)
10	1. Land rental	2,200
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P100/day	1,800
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)17.60/kg	3,784
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.40/kg	1,069
	4. Fertilizer application - 13 min/tree P100/day	387
	5. Pesticides	1,210
	*Pesticide application 2x a yr	200
	6. Harvesting P3.30/tree 6x/yr	1,287
	7. Piling & hauling, 2 m.d., 6x/yr	1,200
	8. Dehusking P90/1000 nuts	936
	9. Copra making (spliting, scooping, drying, sacking) P132/1000 nuts	1,372
	10. Uprooting weeds	400
	11. Interest	
	*Capital Investment (6%)	434
	*Operating Capital (5%)	724
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	18,123
11	(Assuming 10% increase)	
	1. Land rental	2,420
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,573
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,560
	7. Piling & hualing, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	581
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	842
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	391
	*Operating Capital (5%)	754
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	18,967
12	1. Land rental	2,420
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,430
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	2,201
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	3,191
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	348
	*Operating Capital (5%)	935
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	Total	22,775

Year	Particular	Cost (P)
13	1. Land rental	2,420
	2. Field maintenance	
	Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,430
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	1,310
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	1,899
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	305
	*Operating Capital (5%)	824
	12. Cocopugon Copra Dryer	
	*Depreciation Cost (10% p.a.)	720
	*Repair and maintenace	400
	*Residual value	800
	Total	20,438
14	1. Land rental	2,420
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,430
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	1,472
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	2,134
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	305
	*Operating Capital (5%)	844
	12. Cocopugon Copra Dryer	
	*Repair and maintenace	400
	*Residual value	800
	Total	20,935
15	1. Land rental	2,420
	2. Field maintenance	
	*Ring-weeding, 3 m.d. 6x/yr, P110/day	1,980
	3. Fertilizer - AS - 1.5 kg/tree, 215 kg/ha @)19.40/kg	4,171
	NaCl - 1.7 kg/tree - 243 kg/ha @ P4.80/kg	1,166
	4. Fertilizer application - 13 min/tree P110/day	426
	5. Pesticides	1,430
	*Pesticide application 2x a yr	220
	6. Harvesting P4.00/tree 6x/yr	1,404
	7. Piling & hauling, 2 m.d., 6x/yr	1,320
	8. Dehusking, P100/1000 nuts	2,012
	9. Copra making (spliting, scooping, drying, sacking) P145/1000 nuts	2,917
	10. Uprooting weeds	444
	11. Interest	
	*Capital Investment (6%)	305
	*Operating Capital (5%)	910
	12. Cocopugon Copra Dryer	
	*Repair and maintenace	400
	*Residual value	800
	Total	22,324

Annex 4

Cost of covercrop establishment per ha.

A. Animal (plowing) - Manual method	
1. Labor	
a) Plowing -2x @ 200, 9-man animal days	3,600
b) Harrowing -3x @ P200, 7 m.a.d.	4,200
c) Furrowing - @ P200, 1.5 m.d.	300
d) Seed treatment (soaking overnight)	50
e) Sowing @ P90/day, 2 m.d.	180
f) General weeding 2x @ P90/day, 12 m.d.	2,160
Subtotal	10,490
2. Planting materials	
a) Covercrop seeds 15 kg @ P200/kg	3,000
Total	**13,490**

PhP48.70=US$1