FIELD-NOTES ON AN UPDATE OF COCONUT FERTILIZER USE EFFICIENCY AND PRODUCTIVITY OF SCFDP FARMS

Severino S. Magat

The 5-yr Small Coconut Farms Development Project or SCFDP was launched in early 1990 to support and assure the sustained development of the coconut industry by improving national coconut production and farm productivity; increasing annual income of farmers and making them self-reliant in the long run.

Of the 3 million hectares of coconut, 348,000 ha of nutritionally-deficient palms are targeted to be rehabilitated with the application of appropriate fertilizers during the five project years. From the annual copra yield of only 0.85 t/ha, the project aims to at least increase this to 1.80 t/ha/yr. with a projected increase of 75% in terms of farmer's income per hectare per year compared to farms without fertilizer application.

After, three annual fertilizer applications, an update of the current productivity of SCFDP farms and the fertilizer use efficiency was made covering 5 regions and 8 provinces, representing 74 SCFDP participating farms during the period 15 March to 19 April 1995. Also in this field assessment, yield response of palms to previous fertilizer application was noted as a basis in coming up with refinements in the Project 5 fertilizer recommendations.

At the national level (represented by 5 regions), results showed the following: (1) annual average nut yield (per tree) of 35 nuts increased to 83 nuts or a 142% increase in nuts after 3 fertilizer applications (Project Years 1-3); (2) annual average copra yield (per hectare) of 1.02 t increased to 2.79 t or a 179% increase in copra yield (Project Years 1-3); (3) higher average nut yields (tree/year) were observed in: Region IV-B (Quezon, Batangas, Laguna areas) with 75-170 nuts (102 nuts average); Cavite with 77-135 nuts (102 nuts average); Region XI (Davao City and Davao Norte) with 62-130 nuts (94 nuts average); (4) higher average copra yield (hectare/year) were observed in: Region IV-B (Quezon, Batangas and Laguna) with 2.25-6.29 t (3.87 t copra average; Region XI (Davao City and Davao Norte) with 1.81-3.68 t (3.22 t average) and Cavite with 1.73-3.51 t (2.60 t average).

Translated in terms of income, at 2.79 t/ha/yr (national average yield after 3 fertilizer application years), a net income of ₱18,000/ha/yr (₱9.00/kg copra) or 241% increase in farm income was obtained compared to only ₱5,300 /ha net income without fertilizer application.

The impressive positive yield response in almost all farms to specific fertilizers applied based on leaf analysis used by PCA indicates that the fertilizers used [Ammonium Sulfate (21-0-0), KCl (0-0-60), NaCl (common table salt), Superphosphate (0-20-0) and Dolomite ($CaMgCO_3$)] have been effective fertilizer sources to supply Nitrogen, Potassium, Chloride, Sulfur, Phosphorus and Magnesium in the different provinces. More cost-effective and crop efficient fertilizer combinations will be used in future fertilization needs in the SCFDP farms to reduce fertilizer costs and further increase net incomes of farmers.

Key words: Coconut fertilization, coconut mineral nutrition, coconut rehabilitation, coconut fertilizers, coconut productivity, chloride fertilizers, copra

1. *The author is a Career Scientist IV at the Agricultural R&D Branch, Philippine Coconut Authority, Quezon Circle, Diliman, Quezon City 1101 PHILIPPINES.*

2. *The project is an ARDB-initiative in cooperation with FOB and Regional Offices, Philippine Coconut Authority; reported in May 1995 by the author who is a Department Manager.*

INTRODUCTION

The 5-yr Small Coconut Farms Development Project or SCFDP was financially supported by a Government Loan of US$126.6M from World Bank (SCFDP 1989). With such large investment, it is expected to benefit most sectors of the coconut industry directly and indirectly, and projected to improve production and productivity of coconut, substantially. Thereby, in the long run if sustained, it will make the country a stable supplier of coconut and its products, locally and globally, a comparative advantage of the Philippine economy.

In SCFDP, coconut rehabilitation by fertilization is one of the major components. It aims to: (1) increase annual average yield of 0.85 t copra per hectare to at least 1.9 t copra for a period of 4 yr (in participating farms); (2) provide farmers and farm workers the technologies in fertilizer application; (3) increase the farm income and develop farmers' self-reliance.

The very low farm productivity (0.85 t copra/ha) and declining coconut production is not only due to the 20% senile and unproductive palms (nationwide) but more strongly attributed to poor nutrition and absence or lack of balanced fertilization of at least 1.5 million ha out of the roughly 3 million ha of coconut lands (PCA Survey 1979). Magat et al. (1981) revealed nationwide widespread nutrient deficiencies in *nitrogen*, *chlorine* and *sulfur* in major coconut areas; and correction of these deficiencies resulted in significant increase in yield (50%-150%) in 3-4 yr time as reported in several PCA research studies (Magat 1978; Magat 1990; Magat et al. 1992). Lately, nutrient deficiencies in potassium, phosphorus, and boron in increasing number of provinces have been identified based from foliar diagnosis of SCFDP participating farms.

As judicious fertilization is needed to maximize the yield and income derived from fertilizer application, fertilizer use efficiency should be evaluated as applicable. Basically, this involves relating pre-fertilization yields, current yields and fertilizer applications, and with this field evaluation of the yield response to fertilization, adjustments or refinements of fertilizer recommendations are made possible.

Hence, these field notes attempt to provide an update on the extent or degree of the response to regular fertilization of palms for the past 3-4 yr in selected SCFDP farms in some provinces and regions. They also

discussed the implications of the results or findings in relation to the SCFDP objectives and the long-term development of the industry.

METHODOLOGY

Selection of Farms

For the purpose of this field evaluation (done 15 March - 19 April/95), it was limited to 5 regions and 8 provinces and cities with distinct growing zones with projected yields (see upper table on the right).

Relevant details of the 74 randomly selected SCFDP farms are shown in Tables 1-5. At the time of this field assessment, all farms have palms at full-bearing stage; and the age ranges 15-45 yr.

Fertilizers Applied

Primarily, leaf analysis was used to formulate the fertilizer recommendations, following the methods developed by the PCA in the Philippines (Magat 1976; Magat 1978; Magat et al. 1989 and Magat 1991). Based on the available leaf analysis results, the grades and rates of fertilizers applied are shown on the lower table on the right.

Estimation of Productivity (Yield)

The method described below was followed to estimate the benchmark or pre-fertilizer application yield of nuts (per tree) and copra (per hectare).

1. At least 15 palms per farm were randomly selected as sample palms. Those with abnormally low yields were avoided. The 3 oldest bunches of the sample palms were identified, total nut count of the bunches was taken. The mean nut count per tree was computed. To convert mean nut yield per tree per three months (NPT/3 mos to mean nut yield per tree per year (NPT/year), NPT/3 mos was multiplied by a factor of 4 (obtained by dividing 12 mos by 3 mos).

2. The nuts to kg copra conversion factor or NCCF was estimated by examining the split-nuts (at least 3

REGION	PROVINCE	GROWING ZONE#	NUMBER OF FARMS
IV-A	Cavite	Dry	14
IV-B	Quezon	Wet	10
	Batangas	Intermediate	2
	Laguna	Intermediate	3
VII	Leyte	Wet	16
IX	Zamboanga City	Intermediate	14
XI	Davao City	Wet	4
	Davao Norte	Wet	11
	T O T A L		74

Dry - less than 1.5 t copra/ha/yr projected
Intermediate - 1.5-2.5 t copra/ha/yr
Wet - more than 2.5 t copra/ha/yr

PROVINCE/ CITY	PROJECT YEAR (PY)	FERTILIZERS (kg/tree/yr) AS	KCl	NaCl	SP	DOL
Cavite	PY1	1.5	2.0	-	-	-
	PY2	1.5	2.0	-	-	-
	PY3	1.5	2.0	-	-	1.5
Quezon	PY1	1.5	2.0	-	-	-
	PY2	1.5	2.0	-	-	-
	PY3	1.5	2.0	-	1.0	-
Batangas	PY1	1.5	2.0	-	-	-
	PY2	1.5	2.0	-	-	-
	PY3	1.5	2.0	-	-	1.5
Laguna	PY1	1.5	2.0	-	-	-
	PY2	1.5	2.0	-	-	-
	PY3	1.5	2.0	-	-	-
Leyte	PY1	1.5	2.0	-	-	-
	PY2	1.5	2.0	-	-	-
	PY3	1.5	2.0	-	1.0	-
Zamboanga City	PY1	1.5	2.0	-	-	-
	PY2	1.5	2.0	-	-	-
	PY3	1.5	2.0	-	1.0	-
Davao City	PY1	1.5	2.0	-	-	-
	PY2	1.5	-	2.0	-	-
	PY3	1.5	2.0	-	-	-
Davao Norte	PY1	1.5	2.0	-	-	-
	PY2	1.5	-	2.0	-	-
	PY3	1.5	2.0	-	1.0	-

AS (21-0-0); KCl(0-0-60); NaCl (common table salt); SP (0-20-0); DOL (Dolomite limestone, $CaMgCO_3$)

sample nuts) and using the field guide on NCCF estimation (refer to Annex).

3. To estimate the copra yield/ha, the adjusted planting density (palms/ha) was determined by reducing the calculated planting density by 5% or 95% of the theoretical density. The reason for such adjustment is that under actual field conditions, missing hills occur due to dead palms caused by pests and diseases, lightning damages, and other natural and abiotic factors.

4. Simply, therefore, we may use the formula to calculate *nut/tree/yr (A)* and tons copra *yield/ha/yr (B)*:

$$(A) = \text{mean NPT/3 mos} \times 4$$

$$(B) = \frac{(\text{NPT/3 mos} \times 4) \times \text{adjusted planting density (palms/ha)}}{\text{NCCF}}$$

Example: *with a mean of 25 nuts (NPT/3 mos at 9x9m spacing, A and B are calculated) -

(A) NPT/yr = 25 nuts x 4 = 100 nuts

(B) Copra/ha/yr =

$$\frac{25 \text{ nuts} \times 4}{3.5 \text{ nuts/kg copra}} \times 117 \text{ palms/ha (at 9x9m spacing adjusted to 95\%)}$$

$$= \frac{100 \text{ nuts/tree/yr}}{3.5 \text{ nuts/kg copra}} \times 117 \text{ palms/ha} = 3{,}342 \text{kg or } 3.34 \text{t/ha/yr}$$

RESULTS, OBSERVATIONS, AND DISCUSSION

Significant information on yield (nut and copra) of pre-fertilizer application (benchmark) and after 3-4 yr of regular fertilization on selected farms are indicated in Tables 1-5 and Figure 1.

Nut Productivity of Farms

Region IV-A (represented by Cavite province)

The benchmark annual nut yield ranged 26-58 nuts/tree or an average of only 37 nuts (Table 6). With fertilization, it increased to 77-135 nuts/tree or an average of 94 nuts/tree/yr, corresponding to an average increase of 163% (84%-335% range).

For an area like Cavite (representing Region IV-A), considered as a dry growing zone, this nut productivity (94 nuts/tree) and increase of 163% appear impressive and suggest strongly that applied fertilizers improved the drought tolerance or resistance of palms in the province, which contributed to the yield improvement. Generally, fertilized field crops yield higher during dry periods compared to unfertilized crops; and this result indicates same is applicable to coconuts.

Region IV-B (provinces of Quezon, Batangas and Laguna)

In Southern Tagalog (Region IV-B) represented by the QBL provinces (Quezon, Batangas, and Laguna, the average nut yield increased from 41 nuts/tree/yr to 102 nuts/tree/yr (after 3-4 yr of regular fertilization) or an average increase of 192% over benchmark nut yield (Table 6).

It was observed that the number of palms per hectare in the QBL area, particularly Quezon SCFDP farms are higher than in Cavite and other coconut areas. Existing stands of 148-194 trees/ha are common in Quezon province (Table 2).

Even in a Laguna farm (D. Cueto, Paliparan, Calauan), with initial nut productivity of 86 nuts/tree/yr, with 3 yr fertilization, nut yield increased to 139 nuts/tree/yr (or 62% increase) (Table 2). But, clearly, farms with low yields (50 nuts and lower) and were nutritionally deficient showed higher response to fertilization (average of 192%).

Region VIII (represented by Leyte province)

Average initial yield was only 31 nuts/tree/yr, but this increased to 47-71 nuts/tree or an average of 55 nuts/tree (Table 6). Despite the strong typhoon in December 1994 that likely reduced nut yield by at least 25% in many areas of the province, an average increase of 118% (range: 10%-650%) was still noted in the sampled SCFDP farms (16). This nut improvement may be strongly attributed to the fertilizer application in these farms for the past 3 yr.

Region IX (Western Mindanao represented by Zamboanga City)

This region is largely characterized as an intermediate growing zone with expected yields of 1.5-2.5 t copra/ha/yr. The SCFDP sampled farms have a very low benchmark nut yield of 20-29 nuts/tree (average of 24 nuts).

With fertilization (3 yr), nut yield increased to 50-80 nuts/tree/yr (or 69 nuts/tree average), corresponding to an increase (over benchmark nut yield) of 117%-280% (or average of 188%) in terms of nuts (Table 6). Compared to QBL, existing planting density of palms is lower, i.e., average of 117 trees/ha.

Region XI (Southern Mindanao represented by Davao City and Davao Norte)

Nationwide, the region is considered as one of the best coconut growing zones (wet); with expected yields of more than 2.50 t copra/ha/yr, favored by well-distributed very adequate rainfall year-round.

With regular fertilization for the past 3 yr, the nut initial yield of 43 nuts/tree increased to 94/tree/yr or an average of 140% increase (Table 6). The SCFDP farm evaluated had nut yield range of 62-130 nuts or 111%-203% increase in nut productivity at 3-4 yr from initial fertilization.

Yield In Terms of Copra

Coconut productivity in terms of copra (the dry coconut meat with 60%-65% oil content) may be expressed on a per tree basis or per hectare basis. The latter is a function of nuts/tree, NCCF and number of trees/hectare (planting density).

Tables 1-5 show that NCCF diffe among farms as result of fertilizatior Studies reported earlier indicated tha fertilizer application particularly chlorine bearing fertilizers as KCl, NaCl, an NH_4Cl increased weight of copra an thickness of fresh meat (Mendoza an

Prudente 1972; Magat et al. 1975; Margate et al. 1975; Magat et al. 1987). In fact, Magat (1986) revealed that nut production is associated with leaf-N, while copra (per nut and per tree) is significantly correlated with leaf-Cl nutrient level (Fig. 2).

Lower NCCF or higher copra weight per nut (annex) improved yield of copra/tree, while higher copra/nut and higher planting density improved copra yield/hectare per year. Thus, in regions or provinces where fertilization increased, nuts and NCCF, and with higher number of tree/hectare, higher level of copra productivity per hectare were observed. This relationship is demonstrated in Cavite, QBL and Leyte areas (Table 1, 2, and 3).

As of the period March-April 1995 (3 yr of fertilization), the average annual copra yields per tree were estimated as follows:

Region IV-A (Cavite) - 23.4 kg/tree
Region IV-B (Quezon, Batangas, Laguna) - 25.5 kg.
Region VIII (Leyte) - 15.7 kg
Region IX (Zamboanga City) - 17.2 kg
Region XI (Davao City, Davao Norte) - 26.8 kg

Translating copra yield on a per hectare basis, more specific conditions are noted (Table 7). The results of SCFDP fertilization of existing nutritionally deficient palms are presented in the following:

Region IV-A

In Cavite, average copra yield per hectare per year increased from 0.88 t to 2.60 t (or an average increase of 210%) in 3 yr time of fertilizer application (Table 7). The copra yields of farms improved 1.73-3.51 t (99%-387% increase over the benchmark 0.88 t copra/ha/yr.).

Region IV-B (Southern Tagalog)

In the QBL areas, average annual copra yield per hectare increased from 1.35 t to 3.87 t or an increase of 192% as a result of fertilization (Table 7). The SCFDP farms starting with range of 0.26-1.92 t improved to 2.25-6.29 t (or a 102%-325% increase after 3-4 yr).

Region VIII (Eastern Visayas)

In Leyte, starting with an annual average yield of 1.09 t copra, at 3-4 yr after initial fertilization, farms yielded an average of 2.17 t copra. An average of 132% increase in copra yield ranging 1.75-3.05 t was obtained, despite the typhoon of December 1994 (4-5 mos earlier).

Region IX (Western Mindanao)

In Zamboanga City, SCFDP farms improved in copra yield from 0.75 t to 2.07 t or an average increase of 144%, mainly as a result of fertilizer application (3 yr). The percent yield increase of copra ranged 118%-284% over the pre-fertilizer application average yield of only 0.60-0.85 t copra/ha/yr.

Region XI (Southern Mindanao)

In the SCFDP farms of Davao City and Davao Norte, priority I growing zone (wet), the average copra yield per hectare significantly increased from 1.05 t to 3.22 t, corresponding to percent average yield increase of 216% which is strongly attributed to SCFDP fertilizer application (Table 7). The benchmark ('91) yield ranged 0.76-1.30 t copra improved by 81-325% ('95); which undoubtedly is a result of the correction of poor nutrition of farms by balanced nutrition through the regular fertilizer application (Project Years 1-3).

IMPLICATIONS OF FINDINGS

On Coconut Production - At the national level, the 3-yr fertilizer applications resulted in average nut yield from 35 nuts/tree/yr to 83 nuts or 142% increase over the pre-fertilization or benchmark condition of unfertilized farms. In terms of annual copra yield, from an average of 1.02 t copra per hectare, this increased to 2.79 t per hectare or a 179% increase or improvement in copra productivity of SCFDP farms. These average production figures (nuts and copra terms) considered as conservative but realistic yield levels obtained under field conditions representing 74 sample farms showed and confirmed large and strong positive response to fertilizer application. They also clearly indicate the low productivity of coconuts in the country is likely attributed to widespread deficiencies in nutrients particularly N, Cl, K, S and P supplied by fertilizers applied based on foliar diagnostic techniques (leaf analysis followed by PCA).

On Coconut Farm Income - Earlier, an appraisal of the fertilization effects (2 applications) showed an annual net income of ₱9,144 per hectare (with 1.8 t @₱8.98/kg copra = ₱16,164/ha; variable cost of ₱7,020 covering weeding, fertilizing, harvesting, processing and marketing) and 73% increase in income compared to farms without fertilizer application. (SCFDP-Philippines 1994). Using the average annual copra price yield of 2.79 t/ha and same costs and copra price/kg as earlier report mentioned, gross copra value had increased to ₱25,100 or an annual net income of ₱18,090 per hectare; an appreciable 241% increase in net income. This indicates strongly that with balanced nutrition by judicious fertilization (reached in 3 annual fertilizer applications), farm income is likely increased by 2-3 times. By now, there is a strong atmosphere indicating that farmers recognize the importance of fertilizer application in profitable coconut farming - eventually developing self-reliance on their part (138,636 farmers covering over 100,000 farms as of 1994).

Confidence on Proper Fertilization to Increase Coconut Production and Productivity - Results obtained provided clear evidence under field conditions that fertilizer application on the project's 348,000 ha target for coconut rehabilitation is likely to generate at least 970,000 t copra in 3-4 yr of fertilization under SCFDP. This translates to about 615,960 t annual incremental coconut production in terms of copra. Earlier PCA finding revealed the positive residual effects of Cl-bearing fertilizers (KCl, NaCl) applied regularly for 3-5 years or high yield level maintained for the next 2 yr after a cut in fertilization (Magat et al. 1991 and 1992). This means, farmer-beneficiaries of the SCFDP practicing fertilization could still have productivity levels of at least 2-2.5 t even during the next 2 yr after they discounted fertilizer application (3-5 yr regular fertilization).

Effect on the Sustainability of Environment and Farm Lands - As increased yields are accompanied by improved growth and development of coconut leaf canopy (tree cover), thus soil erosion and soil nutrient losses would be significantly reduced, increasing soil productivity capable of sustaining agriculture and stabilizing the ecological system. Moreover, increased coconut productivity usually produces more coconut products which are desirable, renewable, and biodegradable (environment-friendly) resources.

Issue of Philippines as a Stable Supplier of Coconut and Coconut Products - Beneficial results from the field as indicated by impressive response of SCFDP farms in the 5 regions and 8 provinces covering 74 representative farms undoubtedly showed coconut rehabilitation by judicious fertilizer application is very practical and economically viable to increase low yields prevailing in at least 1.5 million hectares to at least 2-2.75 t copra/ha/yr nationwide. This fertilization component, a research-based technology (20 years of PCA R&D), clearly deserves to be included in the long-term development of the coconut industry, if an accelerated and expanded one is desired by government to sustain the domestic and global market of coconuts.

Further Improving Fertilizer Use Efficiency - While yields under SCFDP farmers' fields have increased by 2-3 times now compared to the initial low yields of 0.80-1.0 t copra/ha/yr in 3 yr time of fertilization, it is believed that technology users (farmers) could still cut production cost (labor fertilizer inputs) if equally cost effective, practical, efficient fertilizer sources (inorganic or chemical plus organic forms) and grades are available in the market in the years ahead. In this regard, the private investors and the government should have a synergistic tie-up to help the farmers increase their margin of profit in coconut farming.

ACKNOWLEDGMENT

Through the strong cooperation accorded to the ARDB and excellent organization of the involved PCA Regional Administrations (Regions IV-A, IV-B, VII, IX and XI), the sound conduct and successful completion of this vital field work covering five regions, eight provinces/cities and 74 SCFDP representative farms was made possible. It also immensely demonstrated that *teamwork, trust* and *confidence towards a common goal of serving the interest of our coconut farmers* still exist in the Authority.

Sincerely, may we express our appreciation to all PCA Officers and Agriculturists for their great assistance in this endeavor in behalf of the SCFDP. The list below may not be a complete one, hence our apologies.

Region IV-A (Cavite): E. Paloma, J. Astete, J. Illustrisimo, M. Tibayan, E. Atendido, E. Austria, J. Bayan, P. Romero, L. Gatdula

Region IV-B (Quezon, Batangas, Laguna): P. Endaya, N. Bondad, M. Austria, J. Edan, L. Luya, N. Gutierez, A. Dionglay, A. Sahagun, L. Molino, N. Panganiban, C. De Mesa, J. Caldo, A. Tambiloc, T. Flores

Region VIII (Leyte): P. Aquino, E. Nierva, J. Uy, D. Modina, F. Soyosa, Ma. S. Nierva

Region IX (Zamboanga City): L. Orillaneda, E. Castaneda, R. Enriquez, N. Chua, E. Siarez, R. Corsame, E. Cabral

Region XI (Davao City and Davao Norte): L. Cruz, M. Cinco, R. Laburdia, P. Obdinario, S. Minoza, P. Judillo.

Finally, to all *Coconut Farmer Participants of SCFDP* who were around to give their helping hand and apparently interested to see to it that the PY4 fertilizers (available) are properly applied to their palms anytime in the next few days.

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TABLE 1
SCFDP Farms Benchmark Estimated Nut Yield (tree/yr), Nut and Copra Yield after 3-4 yr of Regular Fertilization (Region IV-A, Cavite), Selected Sample Farms (April 1995)

LOCATION/FARM	YEAR STARTED	ESTIMATED PRODUCTIVITY BENCHMARK NUT YIELD (PER TREE/YR)	NUT YIELD AFTER 3-4 YR (PER TREE/YR)	COPRA YIELD(T) AFTER 3-4 YR (PER HA/YR)	NOTES TREES/ HA	NUTS/KG COPRA[1]
		*	**	***		
1. Urdaneta, Magallanes/L. Rugador	'91	34 (0.65t)	97 (185%)	2.15 (230%)	95	4.50
2. Urdaneta, Magallanes/J. Abelleda	'91	40 (1.17t)	115 (187%)	3.17 (171%)	117	3.50
3. Kabulusan, Magallanes/E. Pagkaliwagan	'91	58 (1.50t)	102 (76%)	2.98 (99%)	117	4.00
4. Kaytitinga, Alfonso/F. del Mundo	'91	38 (0.80t)	73 (92%)	1.73 (116%)	95	4.00
5. Kaytitinga, Alfonso/T. Mojica	'91	27 (0.63t)	77 (185%)	2.25 (257%)	117	4.00
6. Castanos-Layos, Aguinaldo/J. Bautista	'91	42 (0.88t)	85 (102%)	2.15 (144%)	95	3.75
7. Castanos-Layos, Aguinaldo/V. Lopez	'91	35 (0.91t)	89 (154%)	2.78 (205%)	117	3.75
8. Tambo-Balagbag, Indang/C. Pagtalunan	'91	26 (0.61t)	81 (211%)	2.40 (293%)	117	4.00
9. Tambo-Balagbag, Indang/M. Mojica	'91	28 (0.65t)	80 (186%)	2.34 (260%)	117	4.00
10. Lumampong-Halayhay, Indang/Isaac Digma	'91	32 (0.75t)	85 (165%)	2.65 (253%)	117	3.75
11. Lumampong-Halayhay, Indang/R. Ponciano	'91	45 (1.05t)	89 (98%)	2.60 (148%)	117	4.00
12. Kaong, Silang/C. Miranda	'91	31 (0.72t)	135 (335%)	3.51 (387%)	117	4.50
13. Kaong, Silang/R.Gana	'91	39 (0.91t)	124 (218%)	3.22 (254%)	117	4.50
14. Balite, Silang/M. Capaya	'91	44 (1.03t)	81 (84%)	2.36 (129%)	117	4.00
AVERAGE		37 (0.88t)	94 (163%)	2.60 (210%)		

* Copra/ha/yr
** Percent copra yield increase over benchmark nut yield
*** Percent copra yield increase
[1] Fertilized

FERTILIZATION: PY1 = AS + KCl
PY2 = AS + KCl
PY3 = AS + KCl +DOL

TABLE 2
SCFDP Farms Benchmark Estimated Nut Yield (tree/yr), Nut and Copra Yield after 3-4 yr of Regular Fertilization (Region IV-B; Quezon, Batangas & Laguna), Selected Sample Farms (April 1995)

LOCATION/FARM	YEAR STARTED	ESTIMATED PRODUCTIVITY BENCHMARK NUT YIELD (TREE/YR)	NUT YIELD AFTER 3-4 YR (TREE/YR)	COPRA YIELD(T) AFTER 3-4 YR (PER HA/YR)	NOTES TREES/ HA	NUTS/KG COPRA[1]
QUEZON		*	**	***		
1. Ilayang-Talim, Lucena City/C. Ranuda	'92	40 (1.7t)	92 (130%)	4.70 (176%)	194	3.75
2. Ilayang-Talim, Lucena City/R. Mabuhay	'92	28 (1.21t)	76 (171%)	3.68 (204%)	194	4.00
3. Marquez, Padre Burgos/E. Salazar	'91	48 (2.06t)	102 (101%)	4.95 (140%)	194	4.00
4. Hinguiwin, Padre Burgos/V. Habrica	'91	34 (0.88t)	77 (126%)	2.25 (155%)	117	4.00
5. Palsabangon, Pagbilao/S. Pornobe	'91	28 (0.92t)	87 (210%)	3.23 (227%)	148	4.00
6. Bucal Sur, Candelaria/L. Manalo	'91	36 (1.18t)	100 (177%)	3.70 (213%)	148	4.00
7. Bucal Sur, Candelaria/V. Escalona	'91	30 (0.99t)	99 (230%)	3.66 (269%)	148	4.00
8. Antonino, Dolores/R. Conquilla	'91	36 (1.18t)	118 (228%)	4.37 (270%)	148	4.00
9. Antonino, Dolores/R. Bombani	'91	40 (1.31t)	97 (142%)	3.50 (167%)	148	4.00
10. Talisay, Tiaong/C. Rivera	'91	34 (1.12t)	104 (205%)	3.85 (243%)	148	4.00
BATANGAS						
11. Talaga, Tanuan/L. Opena	'91	43 (1.40t)	81 (88%)	2.99 (113%)	148	4.00
12. Banga, Talisay/E. Luna	'91	37 (0.96t)	75 (103%)	2.30 (140%)	117	4.00
LAGUNA						
13. San Ildefonso, Alaminos/J. Cachero	'91	50 (1.46t)	114 (128%)	3.55 (143%)	117	3.75
14. San Rafael, San Pablo City/A. Francisco	'92	45 (1.48t)	170 (277%)	6.29 (325%)	148	4.00
15. Paliparan, Caluan/D. Cueto	'91	86 (2.54t)	139 (62%)	5.14 (102%)	148	4.00
AVERAGE		41 (1.35t)	102 (158%)	3.87 (192%)		

* Copra/ha/yr
** Percent copra yield increase over benchmark nut yield
*** Percent copra yield increase
[1] Fertilized

FERTILIZATION:

Quezon
PY1 = AS + KCl
PY2 = AS + KCl
PY3 = AS + KCl + SP

Batangas
PY1 = AS + KCl
PY2 = AS + KCl
PY3 = AS + KCl + DOL

Laguna
PY1 = AS + KCl
PY2 = AS + KCl
PY3 = AS + KCl

TABLE 3
SCFDP Farms Benchmark Estimated Nut Yield, Nut and Copra Yield after 3 yr (3) Regular Fertilization (PCA Region VIII, Leyte), Selected Sample Farms (April 1995)

LOCATION/FARM	YEAR STARTED	ESTIMATED PRODUCTIVITY BENCHMARK NUT YIELD (TREE/YR)	NUT YIELD AFTER 3 YR (TREE/YR)	COPRA YIELD(T) AFTER 3 YR (PER HA/YR)	NOTES TREES/ HA	NUTS/KG COPRA[1]
		*	**	***		
1. Cabuyuan, Tanuan/A. Alacer	'91	38 (1.14t)	48 (26%)	1.80 (58%)	150	4
2. Quilao, Tolosa/M. Yarasan	'91	24 (0.59t)	51 (112%)	2.01 (240%)	148	3.75
3. Calubian, Dulag/R. Duquesa	'91	27 (1.30t)	49 (81%)	2.60 (100%)	198	4
4. Dacay, Dulag/A. Malate	'91	24 (1.20t)	54 (125%)	3.05 (154%)	198	3.5
5. Calubian, Dulag/B. Sinco	'91	41 (1.50t)	55 (34%)	2.50 (67%)	148	3.25
6. Tigbao, Dulag/D. Lusadio	'91	6 (0.26t)	45 (650%)	2.30 (780%)	198	3.75
7. Tigbao, Dulag/P. Cayundong	'91	36 (1.05t)	54 (50%)	1.79 (70%)	117	3.5
8. Buluntahan, Dulag/J. Argota	'91	26 (0.96t)	50 (92%)	1.98 (106%)	148	3.75
9. Pago, Tanuan/J. Almadin	'91	30 (0.82t)	71 (137%)	1.89 (130%)	100	3.75
10. Salvador, Tanuan/L. Arsena	'91	27 (1.0t)	61 (126%)	2.40 (140%)	148	3.75
11. Cansamanda, Dagami/E. Salve	'91	36 (1.6t)	56 (55%)	1.75 (9%)	117	3.75
12. Cansamanda, Dagami/R. Verbo	'91	41 (1.5t)	64 (56%)	2.50 (67%)	148	3.75
13. Cansamanda, Dagami/ A. Alfino	'91	45 (1.26t)	57 (27%)	1.90 (51%)	117	3.5
14. Hinulugan, Dagami/A. Lamamigo	'91	19 (0.55t)	59 (210%)	2.00 (2.64%)	110	3.25
15. Guinarona, Dagami/L. Palacol	'91	52 (1.92t)	57 (10%)	2.25 (17%)	148	3.75
16. Digahunguan, Dagami/R. Gernale	'91	24 (0.90t)	47 (96%)	1.98 (120%)	148	3.5
AVERAGE		31 (1.09t)	55 (118%)	2.17 (132%)		

* Copra/ha/yr
** Percent copra yield increase over benchmark nut yield
*** Percent copra yield increase
[1] Fertilized

FERTILIZATION: PY1 = AS + KCl
PY2 = AS + KCl
PY3 = AS + KCl + SP

TABLE 4
SCFDP Farms Benchmark Estimated Nut Yield (tree/yr), Nut and Copra Yield after 3-4 yr of Regular Fertilization (Region IX, Zamboanga City), Selected Sample Farms (March 1995)

LOCATION/FARM	YEAR STARTED	ESTIMATED PRODUCTIVITY BENCHMARK NUT YIELD (TREE/YR)	NUT YIELD AFTER 3-4 YR TREE/YR	COPRA YIELD(T) AFTER 3-4 YR (PER HA/YR)	NOTES TREES/ HA	NUTS/KG COPRA[1]
COCO-REHAB (14)		*	**	***		
1. Patalon, Z.C./B. Bustamante	'91	24 (0.80t)	55 (129%)	1.84 (130%)	117	3.5
2. Sinubong, Z.C./B. Garcia	'92	23 (0.77t)	75 (226%)	2.51 (226%)	117	3.5
3. Sinubong, Z.C./N. Sierra	'91	20 (0.60t)	60 (200%)	1.75 (192%)	117	4
4. Sinubong, Z.C./R. Soler	'91	22 (0.64t)	55 (150%)	1.61 (152%)	117	4
5. La Paz, Z.C./L. Adorable	'91	25 (0.73t)	70 (180%)	2.05 (181%)	117	4
6. Talisayan, Z.C./C. Salve	'90	25 (0.73t)	80 (220%)	2.67 (266%)	117	4
7. Talisayan, Z.C./M. Fajardo	'90	21 (0.61t)	80 (280%)	2.34 (284%)	117	4
8. Sinunuc, Z.C./P. Ledesma	'91	22 (0.64t)	75 (240%)	2.20 (243%)	117	4
9. Maasin, Z.C./A. Buscas	'91	25 (0.75t)	58 (132%)	1.70 (133%)	117	4
10. Maasin, Z.C./C. Fernandez	'91	27 (0.79t)	85 (215%)	2.49 (215%)	117	4
11. Ayala, Z.C./F. Coronel	'91	29 (0.85t)	70 (141%)	2.05 (241%)	117	4
12. Tulungatong, Z.C./E. Samsor	'91	27 (0.79t)	73 (170%)	2.13 (170%)	117	4
13. Talabaon, Z.C./S. Duqueza	'92	22 (0.85t)	75 (240%)	2.19 (158%)	117	4
14. Lumbangan, Z.C./M. Acejas	'93	23 (0.67t)	50 (117%)	1.46 (118%)	117	4
NUTRIENT SUPPORT (4)						
1. Patalon, Z.C./A. Manongsong	'91	7	48	1.25	117	4.5
2. La Paz, Z.C./J. del Mundo	'91	6	68	1.99	117	4
3. Maasin, Z.C./A. Buscas	'91	6	90	2.34	130	5
4. Guisao, Z.C./T. Arquiza	'91	7	110	2.86	117	4.5
AVERAGE (REHAB)		24 (0.75t)	69 (188%)	2.07 (144%)		

* Copra/ha/yr
** Percent nut yield increase over pre-fertilization nut yield (benchmark)
*** Percent copra yield increase
[1] Fertilized

FERTILIZATION: PY1 = AS + KCl
PY2 = AS + KCl
PY3 = AS + KCl + SP

TABLE 5
SCFDP Farms Benchmark Estimated Nut Yield (tree/yr), Nut and Copra Yield after 3 yr of Regular Fertilization (Region XI, Davao City and Davao Norte), Selected Sample Farms (March 1995).

LOCATION/FARM	YEAR STARTED	ESTIMATED PRODUCTIVITY BENCHMARK NUT YIELD (TREE/YR)	NUT YIELD AFTER 3 YR (TREE/YR)	COPRA YIELD(T) AFTER 3 YR (HA/YR)	NOTES TREES/ HA	NUTS/KG COPRA[1]
COCO-REHAB (15)		*	**	***		
1. Poblacion Baguio Dist., D.C./F. Escalera	'91	44 (0.90t)	105 (138%)	3.50 (289%)	117	3.5
2. Malagos, Baguio Dist., D.C./M. Caro	'91	38 (0.76t)	110 (189%)	3.23 (325%)	117	4
3. Subasta, Calinan, D.C./C. Omo	'91	44 (1.5t)	115 (161%)	3.58 (139%)	117	3.75
4. Riverside, Calinan, D.C./O. Jamotillo	'91	38 (0.98t)	112 (195%)	3.27 (234%)	117	4
5. Maynaga, Pantukan, Davao Norte/N. Lamera	'91	29 (0.85t)	88 (203%)	2.94 (246%)	117	3.5
6. Lahi Pantukan, Davao Norte/P. Ocson	'91	40 (0.80t)	82 (105%)	3.20 (300%)	117	3
7. Lahi, Pantukan, Davao Norte/ M. Gaid	'91	41 (1.3t)	96 (134%)	3.74 (188%)	117	3
8. Del Pilar, Mabini, Davao Norte/M. Gaid	'90	55 (1.3t)	116 (111%)	3.87 (198%)	117	3.5
9. Cabuyuan, Mabini, Davao Norte/A. Salado	'90	37 (0.93t)	62 (68%)	1.81 (81%)	117	4
10. Lapu-lapu, Maco, Davao Norte/R. Tanjo	'91	44 (1.1t)	98 (123%)	2.86 (160%)	117	4
11. San Isidro, Tagum Davao Norte/J. Jumawan	'91	50 (1.3t)	110 (120%)	3.68 (183%)	117	3.5
12. Asuncion, Carmen, Davao Norte/F. Abenon	'91	45 (0.96t)	130 (189%)	3.38 (252%)	117	4.5
13. Quezon, Panabo, Davao Norte/C.Cabardo	'91	42 (1t)	80 (90%)	2.34 (134%)	117	4
14. Nanyo, Panabo, Davao Norte/Lolito Telmo	'91	50 (1.2t)	110 (120%)	3.67 (206%)	117	3.5
15. Nanyo, Panabo, Davao Norte/E. Caro	'91	42 (0.8t)	98 (133%)	3.27 (309%)	117	3.5
AVERAGE		43 (1.05t)	94 (140%)	3.22 (216%)		

* Copra/ha/yr
** Percent copra yield increase over benchmark nut yield
*** Percent copra yield increase
[1] Fertilized

FERTILIZATION:
DAVAO CITY
PY1 = AS + KCl
PY2 = AS + NaCl
PY3 = AS + KCl + SP

DAVAO NORTE
PY1 = AS + KCl
PY2 = AS + NaCl
PY3 = AS + KCl

TABLE 6
Summary of Mean and Range Indications of Initial Nut Productivity and Current Nut Productivity Levels on Selected Regions and Provinces as Affected by SCFDP Annual Fertilizer Application (as of March-April/95).

Region (5)	Province/City (7)	Nut Productivity (tree/yr) Initial Mean	Initial Range	After 3-4 yr Mean	After 3-4 yr Range	Increase (%) Mean	Increase (%) Range
IV-A	Cavite(14)	37	26-58	94	77-135	163	84-335
IV-B	(Quezon, Batangas, Laguna) (15)	41	28-86	102	75-170	192	62-277
VIII	Leyte * (16)	31	6-52	55	47-71	118	10-650
IX	Zamboanga City (14)	24	20-29	69	50-80	188	117-280
XI	(Davao City, Davao Norte) (15)	43	37-55	94	62-130	140	111-203
AVERAGE(74 farms)		35	–	83	–	142	–

*Affected by strong typhoon "Garding", Dec/94.

TABLE 7
Summary of Mean and Range Indications of Initial Copra Yield and Current Copra Yield Levels in Selected Regions and Provinces as Affected by SCFDP Annual Fertilizer Application (as of March-April/95)

Region (5)	Province/City (7)	Copra Yield (ha/yr) Initial Mean	Initial Range	After 3-4 yr Mean	After 3-4 yr Range	Increase (%) Mean	Increase (%) Range
IV-A	Cavite (14)	0.88	0.61-1.50	2.60	1.73-3.51	210	99-387
IV-B	(Quezon, Batangas, Laguna) (15)	1.35	0.88-2.54	3.87	2.25-6.29	192	102-325
VIII	Leyte# (16)	1.09	0.26-1.92	2.17	1.75-3.05	132	17-780
IX	Zamboanga City (14)	0.75	0.60-0.85	2.07	1.46-2.67	144	118-284
XI	(Davao City, Davao Norte) (15)	1.05	0.76-1.30	3.22	1.81-3.68	216	81-325
AVERAGE(74 farms)		1.02	–	2.79	–	179	–

Affected by strong typhoon "Garding", Dec/94.

Annex
A guide on estimation of nut to copra conversion factor or NCCF (nuts/kg copra)[1]

NUT SIZE	FRESHMEAT THICKNESS	NCCF (nut/kg copra)	g copra/nut
Large	≥ 15 mm	3.00-2.50	330-400
	13-14 mm	3.25-3.75	305-260
	12-13 mm	3.50-4.00	285-250
	≤ 11 mm	4.25-4.50	235-220
Medium	≥ 15 mm	3.25-3.00	305-330
	13-14 mm	3.00-3.50	265-285
	12-13 mm	4.00-4.50	250-220
	≤ 11 mm	4.75-5.00	210-200
Small	≥15 mm	3.75-4.00	265-250
	13-14 mm	4.75-4.50	210-220
	12-13 mm	5.00-5.50	200-180
	≤ 11 mm	6.00-7.00	165-140

[1] Used by SS Magat, subject to further improvement (1995).

Photo 1

Photo 2

FIGURE 1
Photos 1 and 2 respectively, showing typical palms that are with very low productivity (below 1 ton copra/ha/yr), nutritionally deficient in Nitrogen, Chlorine, Sulfur and Potassium; and palms almost fully recovered from the deficiencies yielding more than 2 tons copra/ha/yr after 3 yr of regular fertilizer application.

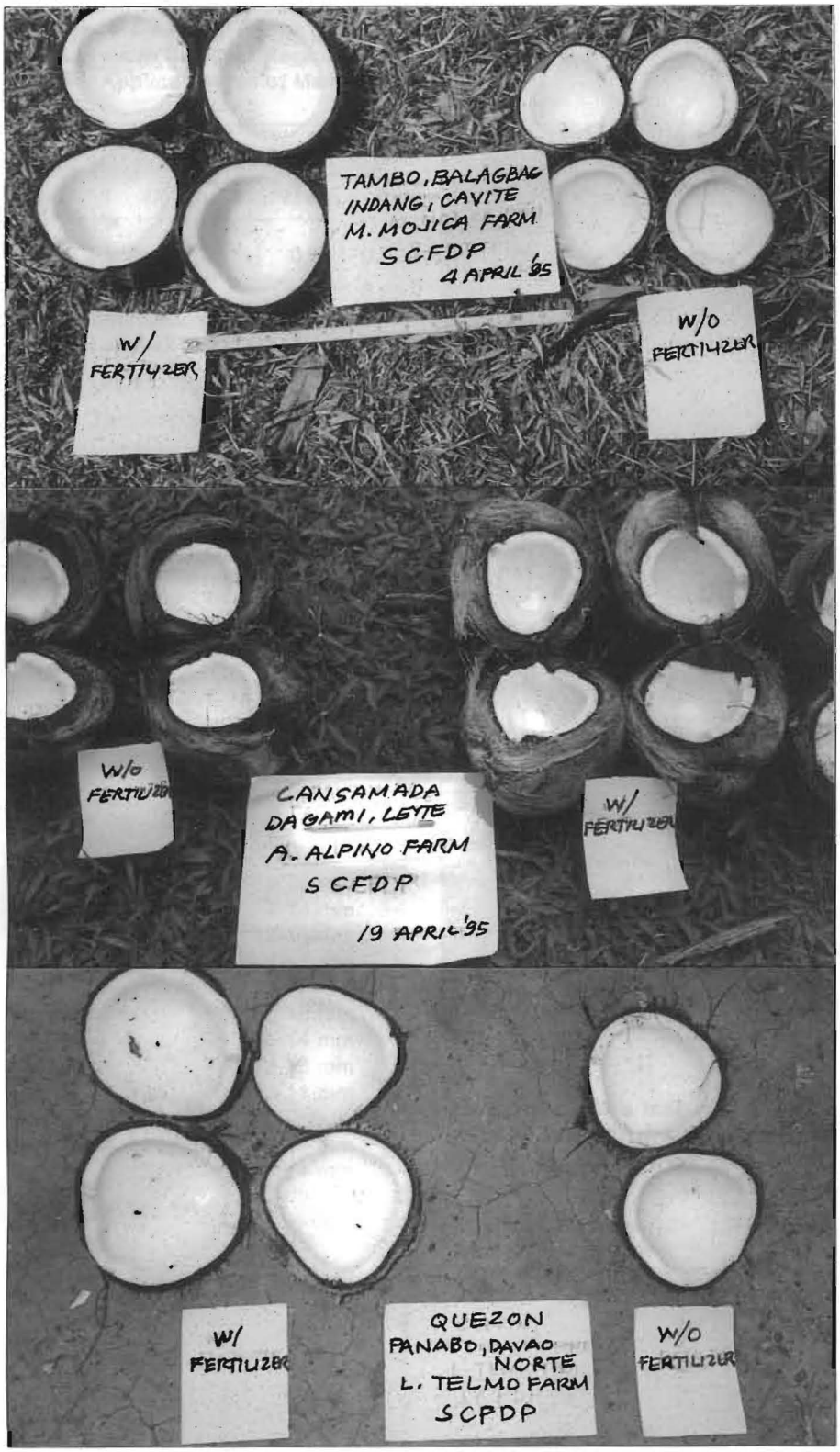

FIGURE 2
SCFDP farms demonstrated increased thickness of meat or high copra weight per nut as a result of balanced fertilization, with chlorine fertilizers (KCl and Common table salt or NaCl) as the major factor.

Photo 3. Fertilized – 4 nuts/kg copra in a Cavite farm (April/95)

Photo 4. Fertilized – 3.5 nuts/kg copra in a Leyte farm (April/95)

Photo 5. Fertilized – 3.5 nuts/kg. copra in a Davao Norte farm (March/95).