SEQUENTIAL COCONUT TODDY (SAP) AND NUT PRODUCTION

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ABSTRACT

Production schemes, namely sequential, production of coconut sap/toddy and nuts in same spathe/spadix (SCTNP); nut production only (NP) and toddy production only (CTWS) were tested at PCA Davao Research Center, using Laguna Tall for a period of three years. Palms under the CTWS and the SCTNP had more coconut sap yield over the periodic tapping and nut production (3 or 6 month's duration) in three years of tapping operation. Annual toddy yield in the SCTNP did not differ significantly with the CTWS during the first and third years of tapping. Generally nut yield of palms with SCTNP was about 50% lower than control palms (NP). As compared to palms under NP, copra yield per palm with SCTNP was likewise around 50% lower. Leaf nutrient concentrations of N, P, K. Ca. Mg, Na, Cl, S and B were not significantly affected by toddy-lapping under the four production schemes.

Results clearly showed that the sequential coconut toddy and nut production (SCTNP) is strongly feasible and economically viable to supply both toddy and nuts as farm products by small scale coconut farmers. Compared to the traditional practice of producing nut alone (₱ 7,500.00 per ha average annual income), SCTNP provides an average net income of ₱ 71,000.00 per ha (₱ 520.00 per tree), annually.

INTRODUCTION

Current conditions in the Philippines indicate that it is increasingly difficult for small coconut farmers to depend on copra production solely due to low and unpredictable price of copra. Production systems that increase productivity and income and results in farm sustainability are in order and should be acceptable very easily to farmers.

One way to achieve this is to diversify, coconut production. Toddy (coconut sap), the sweet exudates from the tapped unopened spathe of coconut would be the best product to consider being known to have many uses. It could be marketed as fresh adulterated beverages locally known as 'Tuba', as vinegar (under natural fermentation), 'lambanog' (gin), as raw material for lactid acid. The sap can also be converted to syrup, crude sugar or crystallized sugar (Fremond, 1966).

However, shifting to toddy production alone to assure high income of coconut farmers at the expense of copra or coconut oil is not a sound economic decision, particularly on a large scale. Therefore, to get the most from the coconut palm coherent with the countries economic interest, the sequential production of the two products: toddy and nuts from same spathes of palms (SCTNP) could be explored (Figure 1). Thus, the economic potential of palms arc fully exploited to supply both coconut toddy and nuts.

The objectives of the study are: (1) to investigate the possibility of producing toddy and nut/copra from the same spathe of palms (SCTNP); and (2) to determine the yield and economics of the SCTNP compared to other production schemes.

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[1] 1 US Dollar = 25 Philippine pesos (₱).

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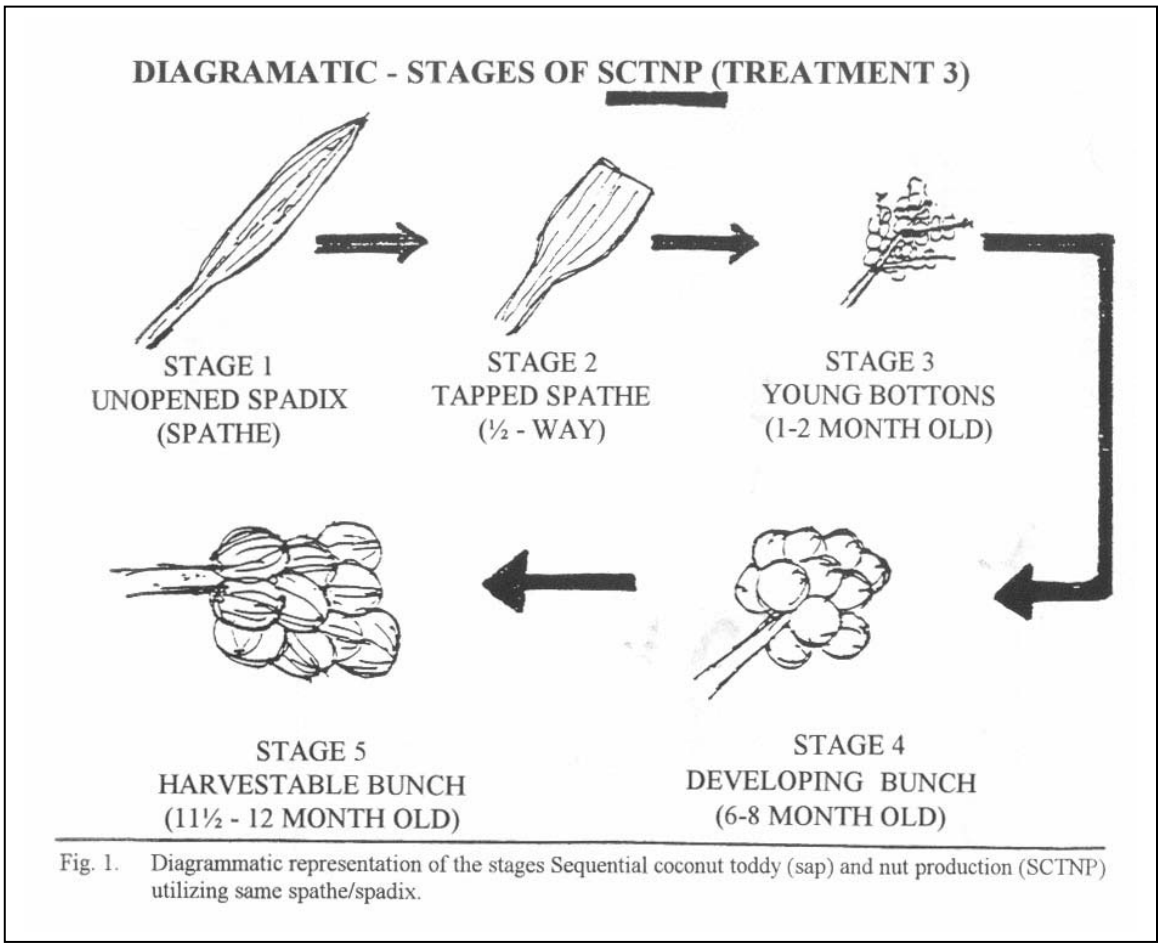

Fig. 1. Diagrammatic representation of the stages Sequential coconut toddy (sap) and nut production (SCTNP) utilizing same spathe/spadix.

MATERIALS AND METHODS

Coconut population and palm selection

At the PCA-Davao Research Center, 18 year-old Laguna tall varieties was used, following a randomized complete block design with three replications (8 palms per treatment). The treatments (Figure 2) were as follows:

(1) Nut production only (NP)

(2) Continuous tapping-whole spadix (CTWS)

(3) Continuous tapping-half spadix (SCTNP)

(4) 3 Months tapping-3 months' nut production alternate (3MT.3MNP)

(5) 6 Months tapping-6 months nut production alternate (6MT.6MNP)

Palms used are grown in similar topography and with same age

Tapping tools and measuring devices

Pruning scythes (especially for toddy-tapping), bolos, bamboo receptacles, abaca twine and young leaflets (for tying) were used. The collected toddy was measured with the 1,000 mm plastic graduated cylinder.

Preparing the palm for tapping

With the bolo, V-shaped notches onto the opposite sides of the coconut trunk were cut (alternately) to serve as steps in climbing the crown. Notches were made enough to hold the feet of the tapper. Dried and weak senile leaves, stipules and bunches or spadices below the inflorescence to be tapped were removed.

Figure 2
Diagrammatic representation of the production periods during the year of the SCTNP and other schemes.

TREATMENTS:	SCTNP STUDY PRODUCTION PERIOD (MONTH) 1 2 3 4 5 6 7 8 9 10 11 12
1. NUT PRODUCTION ONLY (NP)	NUT PRODN.
2. TODDY (SAP)/ PRODUCTION ONLY (CTWS)	TODDY (SAP) PRODN.
3. SEQUENTIAL TODDY TAPPING (HALF OF SPATHE) and NUT PRODUCTION (Remaining half (SCTNP)	SEQUENTIAL TODDY and NUT PRODN.
4. ALTERNATE 3 MOS. TAPPING 3 MOS. NUT PRODN. (3 MT. 3 MNP)	TODDY NUT TODDY NUT
5. ALTERNATE 6 MOS. TAPPING 6 MOS. NUT PRODN. (6 MT. 6 MNP)	TODDY NUT

Making bamboo receptacle

Matured bamboos (With inside diameter of 10 cm) were selected as these are more resistant to weevil and rotting. Bamboos were cut crosswise at node length and the epidermis peeled off at interval of three-fourth of an inch to lighten its weight. Two small holes were bored below the rim of its open end and the two ends of the abaca twine inserted to serve as handle and for fastening it to the spathe.

The tapping process

The spathe immediately following the fully matured one was selected. It was trained to a drooping position by tying the tip of the spathe and slowly pulling it downward avoiding breakage at its base with the other end of the twine fastened to the petiole of the nearby leaf frond below. The training was done until the spathe reached the drooping position. The lip of spathe was cut-opened and the wound refreshed by making a thin slice mice daily (morning and afternoon). When the sap starts to flow the spathe was wrapped with dried banana leaves previously soaked in water and tied with leaflets from a young leaf frond. The wounded end of the spathe was then inserted into the rim of the open end of bamboo receplacle. The twine handle of the receplacle was fastened to the spathe and its mouth covered with the stipule or 'guinit'. The sap (toddy) from producing spathes was collected in the morning and its wound kept refreshed by making a thin slice morning and afternoon to ensure continuous flow of sap.

In the sequential coconut toddy and nut production scheme (SCTNP), tapping operation, vas terminated when one half of the spathe remains (eight to ten inches long). In the two periodic tappings for production of toddy and nut/copra (3 months and 6 months), and also in the production of toddy alone (CTWS) the whole length of the spathe was tapped. Collection of toddy produced was also done in the afternoon when the daily production sap reached its maximum.

Fertilization of experimental palms and leaf analysis

All palms including the control (nut production alone) were applied annually with 1.5 kg ammonium sulfate and 1.0 kg sodium chloride (common salt). Leaf samples were collected analyzed for leaf nutrient concentration at the Tissue Analysis Laboratory of the Philippine Coconut Authority, Diliman, Quezon City.

Gathering of Data

Data on toddy production was recorded daily from each tapped spathe of all experimental palms. The daily yield data was consolidated and statistically analyzed.

Nut and copra yield were gathered following the 60 days harvest cycle. Nut samples were collected, dehusked, and weighed every harvest. Copra recovery per nut was computed based on the weight of nut samples and multiplied by 25% (for Laguna Tall). The copra yield per palm was obtained by multiplying the copra per nut with the number of nuts harvested per palm.

RESULTS AND DISCUSSIONS

Possibility of the sequential dual production schemes

Based on the inherent characteristic of the coconut palm (Child, 1964) and observations by the proponents, most of the female flowers that develop to mature nuts are situated at the lower portion of the spadices (inflorescence) hence, the feasibility of producing toddy from the first half of the spathe and followed by nut production from the remaining half of every spadix. However, during the initial tapping operation it was observed that some palms did not produce a drop of sap. Also, it was observed that some palms exude from the first spadix a soft substance known in Visayan dialect as "Bulakaw" but not in the succeeding spadices. This phenomenon is not well understood.

Toddy (coconut sap) yield

The sap yield of palms with combined production of toddy and nut per spadix (SCTNP) did not differ significantly with those producing toddy alone (CTWS), particularly in the first and third year of tapping (Table 1). However, the differences between years may be attributed to the tapping efficiency of the tappers. Other factors affecting yield of toddy are age of palms, climate (Browning. 1916): and phenotypic yield group (Maravilla, 1972).

In three years palms for toddy production only year-round (CTWS) produced highly significant more sap over two production scheme With two periodic tapings (31 months and 6 months) intervals. The scheme with continuous tapping of half the spadix (SCTNP) also produced much more than the 3 month-tapping internal (3MT.3MNP) and 6 month-tapping interval (6MT.6MNP). The significantly low yield obtained in these schemes with periodic tapping intervals was due to shorter continuous tapping duration unlike the two schemes (CTWS and SCTNP) with continuous toddy production where palms have more spadices tapped in a year.

In terms of daily yield per palm, the differences among the different production schemes were not statistically significant (Table 1). Toddy yield per spadix of Laguna Tall palms with

sequential combined toddy and nut production in same spadix (SCTNP) was significantly lower compared with spadix fully lapped (CTWS).

Nut and Copra yield (per palm)

As shown in Table 2 during the first year palms without tapping (NP) or nut production alone produced the highest nut yield per palm. The lower production in SCTNP palms compared with palms without tapping is partly due to abscission of buttons and immature nuts caused by the movement of tappers in going up and down during the process of tapping.

The same reason for lower nut yield may apply on palms with periodic tapping (3 and 6 months). In addition, these palms had much lesser number of bunches for nut production as a result of toddy-tapping (sap production).

In the second production year nut yield of SCTNP palms did not differ significantly (but about 50% lower) with those without tapping. As in the first year the yield of palms without tapping was significantly greater than those with periodic lapping. This is expected as the other spathes/spadices were utilized in the production of toddy.

In the two production years, in terms of nut and copra, palms without the tapping (NP) has the highest yield per palm over palms under the sequential dual production schemes. However differences in copra recovery (copra wt/nut) were not statistically significant among treatments indicating toddy-tapping has no adverse effect on copra weight per nut.

Leaf Nutrient Status

Foliar analysis of Laguna tall variety shows that the leaf nutrient concentrations in N. P. K. Ca. Mg. Cl. S and B did not differ significantly among the treatments (Table 3). This suggests that cither tapping or the SCTNP schemes have no adverse effect on the nutrient status of palms. This is likely applicable to fertilized palms as those used in the current experiment.

Cost and Return Analysis

In the first production year, the schemes with continuous tapping (CTWS) obtained the highest total cost of ₱ 538.81 per tree (Table 4). While the no tapping scheme had the least cost (only ₱ 16.90 per tree). On the gross return, however, the CTWS and SCTNP obtained the highest return with ₱ 1,471.75 and ₱ 1,310.00 per tree, respectively. Based on the added cost and added return, the 3MT.3MNP incurred an added cost of ₱ 329.70 per tree but realized an added return of ₱ 503.50, giving a net return of ₱ 172.80 per tree. The SCTNP obtained and added return of ₱ 542.35 per palm with added cost of ₱ 192.15 and a total net return from CTWS of ₱ 716.15 per palm were realized. In the CTWS, an added return of ₱ 161.75 %vas still realized without added cost resulting to the total net return of ₱ 877.90 per tree, the highest net returns among the treatments.

On a hectare basis (100 palms), the CTWS realized a net return of ₱ 87.790, the SCTNP with ₱ 71,615.00 while the 6MT.6MNP with only ₱ 17,380 and ₱ 17,280.00 for 3MT.3MNP. Palms without tapping (nut production only) resulted in net return of only ₱ 5,510.00 per hectare.

In the second year, although the SCTNP had the highest total production cost among the schemes with toddy-tapping and nut production, it still obtained the highest net return of ₱ 544.44 per palm (₱ 544.44 per hectare). Palms with no tapping production (NP) got the least net return ₱ 103.53 per palm or ₱ 10,350.00 per hectare. In the third year, consistently the SCTNP had the highest net return ₱ 574.49 per palm among tapping and nut production schemes with dual production.

Implications of SCTNP

Many believe that when coconut trees are used for sap (toddy) or nut production, the opportunity to produce nut for 'buko' (8 month old soft meat), fresh 12 month old nuts and copra as raw materials for various uses is lost. Impressively from results of this research study, it strongly shows that it is practical, feasible and economically viable to produce both toddy and nuts in same spathes/spadices of palms through a sequential coconut toddy and nut production scheme (SCTNP). The technique involves the tapping for sap (the first half of the spathe) and allowing the remaining half to develop normally, producing the 8 month old 'buko' nuts or mature 12 months nuts.

In coconut regions and farming communities where the demand for coconut toddy (as beverage and raw material for vinegar) and fresh nuts is year-round for consumption and as source of income (sold as nuts and copra), the SCTNP could be an acceptable mature technology. To be profitable and sustainable the following conditions are obviously necessary: (1) skilled labor for sap production (toddy-tapping). (2) Suitable environment and proper nutrition of fully bearing coconuts; (3) market for toddy; nuts and copra; and (4) adequate initial operating capital.

CONCLUSION

This 3-year field study on SCTNP in the Philippines could have the following conclusions:

(1) Consistently toddy-tapping following CTWS produced the highest toddy yield.

(2) Consistently palms grown for nut production alone (NP) produced the highest nut and copra yields, but with the lowest production cost and lowest returns.

(3) Consistently, sequential coconut toddy and nut production (SCTNP) scheme realized satisfactory levels of toddy and nut yields, with an annual average net return of ₱ 71,000/hectare (₱ 520/tree) compared to production of nuts alone with average net return of only ₱ 7,500 per hectare.

(4) Toddy production and nut/copra yield under SCTNP may vary based on the age of palms, and agro-climatic conditions, thus yields and net returns from SCTNP technology could be lower under less satisfactory conditions (agronomic and economic).

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Table l
Yield (1/tree) of coconut sap (toddy), Laguna Tall variety, PCA-Davao Research Center.

Treatment	1988-1989	1989-1990	1990-1991	Ave Daily Yield
CTWS	588.7 a	535.2 a	607.0 a	1.6
SCTNP	524.0 a	396.0 b	418.0 ab	1.5
3MT.3MNP	229.8 b	219.1 c	222.0 b	1.4
6MT.6MNP	230.2 b	132.0 c	174.7 b	1.4
HSD .05	128.0	138.6	259.8	0.42 NS
.01	180.3	195.2	358.2	-

- CTWS - Continuous Tapping Whole-Spathe/Spadix
SCTNP - Sequential toddy and nut production in same spathe/spadix
3MT.3MNP - 3 Months Tapping. 3 Months Nut Production Interval
6MT.6MNP - 6 Months Tapping. 6 Months Nut Production Interval

Table 2
Nut and Copra Yield of Laguna Tall PCA-Davao Research Center

Treatment	FIRST NUT PRODUCTION YEAR			SECOND NUT PRODUCTION YEAR		
	Nut/Palm (no)	Copra/Nut (g)	Copra/Palm (kg)	Nut/Palm (no)	Copra/Nut (g)	Copra/Palm (kg)
NP*	99.4 a	285.2	28.41 a	25.2 a	290.9	7.34 a
SCTNP	22.1 c	275.0	6.18 ab	14.8 ab	238.2	3.54 b
3MT.3MNP	42.4 ab	295.6	12.55 b	10.9 b	261.3	2.85 b
6MT.6MNP	52.6 b	272.2	14.28 b	12.3 b	289.4	4.51 ab
HSD .05	27.5	65.1 NS	9.59	11.1	73.4 NS	2.99
.01	38.8	-	13.52	15.6		4.21

*NP - Nut production only (No Tapping)

Table 3
Effect of SCTNP and other production on leaf Nutrient Concentration (%) in Local Tall Coconuts* (Leaf No. 14). PCA - DRC.

Treatment	N	P	K	Ca	Mg	Na	Cl	S	B (ppm)
NP	1.908	0.158	1.493	0.400	0.239	0.065	0.582	0.149	8.0
SCTNP	1.925	0.156	1.411	0.472	0.239	0.061	0.630	0.165	8.8
3MT.3MNP	1.841	0.154	1.412	0.428	0.248	0.056	0.637	0.139	8.3
6MT.6MNP	1.940	0.151	1.542	0.389	0.244	0.064	0.620	0.148	8.1
CTWS	1.937	0.149	1.518	0.408	0.236	0.060	0.682	0.262	8.2
HSD .05	NS	NS	NS	NS	NS	NS	NS	NS	NS

N. B 1991 Leaf sampling: all nutrients, considered satisfactory to highly satisfactory levels.

Table 4
Cost and Return analysis of SCTNP and other production schemes in Laguna Tall, PCA-DRC

TREATMENT	ANNUAL YIELD PRODUCTION			COST LABOR (₱)	TOTAL COST (₱)	GROSS RETURN (₱)	ADDED COST (₱)	ADDED RETURN (₱)	ADDED NET RETURN (₱)	NET RETURN FR TODDY (₱)	NET RETURN HA (100 trees)
	COPRA (kg)	TODDY (l)	MATERIALS (₱)								
First Year				per tree							
NP	18.00	-	6.60	10.90	16.90	72.00	-	-	-	55.10	5,510.00
3MT.3MNP	-	299.80	153.56	193.10	346.66	574.50	329.70	503.50	172.80	172.80	17,280.00
6MT.6MNP	-	330.20	153.56	193.10	346.90	575.50	0.00	1.00	1.00	173.80	17,380.00
SCTNP	-	524.00	153.56	385.25	538.81	1,310.00	192.15	734.50	542.35	716.15	71,615.00
CTWS	-	588.70	153.56	385.25	538.81	1,471.75	0.00	161.75	161.75	877.90	87,790.00
Second Year											
NP	28.41	-	6.06	18.55	24.31	2,127.84	-	-	-	103.53	10,353.00
3MT.3MNP	12.55	219.10	9.06	238.05	247.11	602.52	222.80	474.68	251.88	251.88	25,188.00
6MT.6MNP	14.28	132.00	9.06	239.09	248.15	427.26	1.04	-175.26	-176.30	75.88	7,558.00
SCTNP	6.18	396.00	9.06	464.61	437.87	1,116.81	225.72	689.58	468.86	544.44	54,444.00
Third Year											
NP	7.34	-	6.06	6.90	12.96	33.03	-	-	-	20.07	2,007.00
3MT.3MNP	2.85	222.00	7.81	271.07	278.88	632.32	265.92	590.29	324.37	324.37	32,437.00
6MT.6MNP	4.51	174.00	7.81	275.85	283.66	500.72	4.78	-122.60	-127.85	196.99	19,699.00
SCTNP	3.54	418.00	7.81	540.60	548.41	1,149.50	268.28	648.78	380.50	574.49	57,749.00

* NP - Net Production only (no-toddy tapping)
CTWS - Continuous Tapping-Whole Spatbe/Spadix
SCTNP - Continuous Tapping- Half Spathe/Spadix
3MT.3MNP - 3 Month Tapping, 3 Month Nut Production Interval
6MT.6MNP - 6 Month Tapping, 6 Months Nut Production Interval