NTERCROPPING COCONUT WITH SOME BIENNIAL AND PERENNIAL CROPS IN LEYTE, PHILIPPINES

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The performance of cacao, coffee, and pineapple as intercrops under coconut was assessed. Likewise, the effects of intercropping on nut production and the economic advantage of crop combination were determined.

Intercrops cacao and coffee produced bean yields only during the first few years due to the occurrence of super typhoon Rufing in 1988. In contrast, intercrop pineapple, a short stature crop, was not affected.

Nut and copra yields were increased among intercropped palms. Coconut and pineapple combination resulted to statistically highest net return. Economic returns among the other coconut intercropping schemes were comparable to coconut monocropping.

Generally, the values of the coconut leaf elements measured were within the critical level except for N which was below the critical value. Both leaf and soil N statistically decreased as croppings continued while K tended to increase. On the other hand, P and soil pH were likely maintained throughout the duration of the study. No trend was observed between treatments in all leaf and soil analyses results.

INTRODUCTION

ntercropping coconut has not been so far reported to have adverse effects on the growth and yield of coconut long as the proper cultural nagement practices are observed. ncia (1978) said that as a method op intensification, intercropping is mmonly practiced by the traditional mers especially in coconut areas ich exhibited gradual decrease in nut ld owing to the advancing age of the lm. In addition, competition for light under tall trees is not a problem arandang 1978). Also, this ercropping practice provides portunity for more efficient use of ilable labor. Magda (1982) stated that tercropping coconut with other crops kes the in-between idle spaces fully zed. Thus, the system improves the ng standard of the coconut farmers well as increases the yield of coconut nt 1978). Alviar (1975) showed that the cost and return of intercrops grown under coconut vary among species as influenced by the variations in the cultural management practices like weeding, pests and diseases control, and the use of fertilizers.

Several crops can be grown under coconut. However, in Leyte and other parts of the country which are always visited by typhoon, selection of crops to be used should be considered among other factors of production. Crops differ in their susceptibility to typhoon. As expected, short stature crops are believed to withstand strong typhoons compared to those that grow taller.

The present coconut-based cropping systems practiced by our coconut farmers are not yet convincing and attractive, probably because of insufficient technical knowledge on the recommended cultural practices on coconut and on intercrops, including their susceptibility to the agro-climatic limitations in the locality. Hence, this study was conducted from 1983 to 1991 to assess the performance of cacao, coffee and pineapple under coconut in Leyte Sab-a basin areas; to determine the effects of intercropping on nut productivity; and to study the economic advantage of the different crop combinations.

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MATERIALS AND METHODS

Treatments

A Randomized Complete Block Design was used in the study with the following treatments: T1 - coconut + cacao; T2 - coconut + coffee; T3 - coconut + pineapple; and T4 -coconut alone.

Cultural Management

The coconut area before the conduct of the study was primarily used for grazing animals like carabaos and goats and there was no intercropping done. The coconut trees were Tall variety, about 25 yr old, and spaced at 8 m x 8 m in a square system of planting with 14 experimental palms per treatment per replication. For the intercrops, cacao (Malaysian hybrid) and coffee seedlings (Robusta var.) were raised in the nursery prior to field planting. Cacao seedlings were field planted at a distance of 2.5 m x 3 m between rows and hills, respectively, with 528 plants per hectare, and coffee in a single row at a distance of 4 m within a row, at 300 plants per hectare. On the other hand, pineapple suckers (Hawaiian var.) were planted at a distance of 50 m x 30 m between rows and hills, respectively. Two triple rows of pineapple were planted between rows of coconut palms and an alleyway of 1.5 m between 3 rows of pineapple was used.

For coconut, fertilizer rate of 1.25 kg ammonium sulfate (21-0-0) and 2 kg muriate of potash (0-0-60) per tree per year was applied in split at 6 mo interval.

For intercrops, cacao was fertilized with complete fertilizer (14-14-14) at 100 g per tree for the 1st yr and increased to 250 and 300 g in the 2nd and 3rd yr, respectively. Thereafter, until the end of the experiment, rate was increased to 450 g. Application was done in split at 6 mo interval. Whereas on coffee, same fertilizer rate and method of application with cacao was done. However, the rate at 300 g per tree in the 3rd yr after planting was maintained until the end of the study.

Pineapple was applied with 28 and 22 g per plant of ammonium sulfate and muriate of potash, respectively. These were done at 3 mo interval until the end of the study.

Data Collection

In the case of intercrops, yield data such as the number of pods and dry weight of beans and number of berries and weight of dry berries for coffee were collected at the time of harvesting. For pineapple, fruit yield was recorded.

The data taken during every harvest of 10 sample coconut palms per treatment at an interval of 3 mo were number of nuts per palm, copra weight per nut, and copra yield per palm.

Initial and final analyses for both coconut leaf and soil samples were done. These were analyzed at the Department of Soil Science, University of the Philippines at Los Baños.

Statistical Analysis

The measurement over time analysis was used to analyze the data on the different sets of treatment throughout the duration of the study. All the data were processed and analyzed at the Electronic Data Processing Center of ViSCA.

RESULTS AND DISCUSSION

Yield of Intercrops

Cacao. Yearly yield data of cacao are shown in Table 1. No pods were harvested during the first 2 yr after field planting, thus net loss was obtained from the cost of production. In the later part of the 3rd yr after field planting, few pods were harvested, resulting to net return of production cost. The poor growth of the crop could be due to low N level in the soil which was below the critical value as shown in the coconut leaf analysis results (Table 6). Increasing yield and net return were observed during the first 3 bearing years, and yields drastically reduced in the succeeding years as brought about by the super typhoon Rufing that visited the experimental sites. The highest yearly net return amounted to P10,207, while the bulk of production cost was observed during the first year or period of experimental establishment. Although the system noted net losses in some years, still average yearly net return of P1,016 was obtained using cacao as intercrop under coconut.

TABLE 1
Yearly Cacao Bean Yield, Gross Return, Expenses, and Net Return per Hectare

YEAR	YIELD (kg/ha)	GROSS RETURN (P) 1/	EXPENSES (P)		NET RETURN/ LOSS (P)
			LABOR	MATERIAL INPUT	
1984	0	0	3900.00	4810.16	(8710.16)
1985	0	0	2350.00	1740.40	(4090.40)
1986	383.75	11512.50	3800.00	1940.00	5772.50
1987	465.79	13973.70	4600.00	2210.00	7163.70
1988	575.58	17267.40	4500.00	2560.00	10207.40
1989	123.38	3701.40	3600.00	2520.00	(2418.60)
1990	269.91	8097.30	3560.00	2460.00	2077.30
1991	139.96	4198.80	3485.00	2585.00	(1871.20)
Mean	244.80	7343.89	3724.38	2603.20	1016.32

1 At P30/kl

TABLE 2
Yearly Coffee Bean Yield, Gross Return, Expenses, and Net Return per Hectare

YEAR	YIELD (kg/ha)	GROSS RETURN (P) 1/	EXPENSES (P)		NET RETURN (LOSS (P)
			LABOR	MATERIAL INPUT	
1984	0	0	3750	2656	(6406.00)
1985	0	0	2000	1080	(3080.00)
1986	0	0	2100	1458	(3558.00)
1987	4.48	134.40	2250	1558	(3673.60)
1988	64.10	1923.00	2450	1508	(2035.00)
Mean	13.72	411.48	2510	1652	(3750.52)

1 At P30/kl

Coffee. Coffee grown under coconut was losing in all the years of production, even if yields were obtained in some of the coffee plants (Table 2). This could be attributed to the limiting soil factors like N which was below the critical value as indicated by the results of the coconut leaf analysis. Likewise the occurrence of super typhoon Rufing hindered good growth and development of coffee plants.

Pineapple. Yields of first and second croppings of pineapple grown under coconut are shown in Table 3. Generally, fruit size as well as the weight decreased from the first harvest (main crop) to second harvest (1st ratoon) and third harvest (2nd ratoon), respectively.

All the years of pineapple product showed encouraging net returns exc during the 1st yr of each cropping per where there was no fruit harvest yet

Compared to other intercro pineapple was not adversely influen by the low soil N as shown by encouraging net return. Likewise, be a short stature crop, its growth development was not affected by occurrence of strong wind or typho

Yield of Maincrop Coconut

Figure 1 illustrates the yearly c yield as affected by different intercr During the first few years of the st yields of coconut were very low finally increased after treatm implementation. The increase coul due to the applied fertilizers, both fo maincrop coconut leaf analysis re (Table 6). Copra yields of more tha were observed during the ne

succeeding years when coconut was intercropped with pineapple followed by those intercropped with cacao, while yields reduced in the following years as attributed to the occurrence of strong typhoon. Being a perennial crop, and nuts took more than a year to mature and be harvested, yields declined in the later part of the experimental period.

Results of this study showed that intercropped coconut obtained statistically superior copra yield compared to unintercropped coconut (Table 4). Among the intercrops, pineapple resulted to more copra yield. While comparable copra weight per nut was observed in all treatments.

Cost and Return Analysis

Yearly net return and loss of coconut alone are shown in Figure 2. Among the intercrops used, pineapple resulted to higher copra yield and subsequently higher returns in most of the years of observation. Increasing trend of net returns was observed in the 3rd to 5th yr from planting. However, it decreased in 1989 as influenced by the strong typhoon that visited the experimental sites.

Table 5 shows the yearly combined gross return and net return/loss of various coconut intercropping schemes. Coconut plus pineapple obtained the highest gross income followed by coconut plus cacao, while the lowest was observed when coconut remained unintercropped.

The combined net return followed the combined gross income trend, except for coffee where the gross income was higher compared to monoculture coconut but resulted to net loss due to the additional expenses incurred for the intercrops.

Only coconut with pineapple intercrop showed net returns in all the years except in the 1st yr of establishment in each cropping season with no fruit harvest yet (Fig. 3).

The very low returns observed for both the maincrop coconut and intercrops could be due to low yields attributed to N deficiency of the area as indicated in the coconut leaf analysis results (Table 6). Yearly variation of net

TABLE 3
Yearly Pineapple Yield, Gross Return, Expenses, and Net Return per Hectare

YEAR		YIELD (kg/ha)	GROSS RETURN (P) [1/]	EXPENSES (P) LABOR	EXPENSES (P) MATERIAL INPUT	NET RETURN/ LOSS (P)
1984	(1st cropping)	0	0	7250	36250	(43500.00)
1985	(Main crop)	24795.53	173568.71	14200	6300	153068.71
1986	(1st ratoon)	23016.72	161117.04	14250	6350	140517.04
1987	(2nd ratoon)	16332.71	114328.97	10300	6250	97778.97
1988	(2nd cropping)			7025	36275	(43300.00)
1989	(Main crop)	24148.36	169038.52	14325	6225	148488.52
1990	(1st ratoon)	20213.75	141496.25	14225	6275	120996.25
1991	(2nd ratoon)	19162.60	134138.20	10225	6325	117588.20
Mean		15958.71	111710.97	11475	13781.25	86454.72

[1] At P 7/kl

TABLE 4
Summary Result of the Measurement Over Time Analysis on Copra Yield and Yield Components of Coconut as Affected by Different Intercropping Schemes*

TREATMENT	COPRA YIELD (t/ha)	NUT/ PALM	COPRA WEIGHT/ NUT (g)	COPRA YIELD/ PALM (kg)
T1 - Coconut + cacao	1.6 [ab]	40.1 [ab]	252.9 [a]	10.1 [ab]
T2 - Coconut + coffee	1.5 [ab]	40.9 [ab]	235.1 [a]	9.6 [ab]
T3 - Coconut + pineapple	1.7 [a]	45.0 [a]	243.0 [a]	10.9 [a]
T4 - Coconut alone	1.3 [b]	35.2 [b]	244.5 [a]	8.6 [b]

* Means in a column having common letter are not significantly different from each other (DMRT).

TABLE 5
Summary Result of the Measurement Over Time Analysis on Gross and Net Return/Loss per Hectare per Year of Coconut + Intercrop*

TREATMENT	GROSS INCOME (P/ha)	NET RETURN/ LOSS (P/ha)
T1 - Coconut + cacao	14787.64 [b]	1958.82 [b]
T2 - Coconut + coffee	7269.68 [b]	(1734.08) [b]
T3 - Coconut + pineapple	119648.47 [a]	87804.72 [a]
T4 - Coconut alone	6325.00 [b]	60.00

* Means in a column having common letter are not significantly different from each other (DMRT).

TABLE 6
Initial and Final Leaf Analysis Results Taken from Coconut Palms with Different Intercrops*

SAMPLING PERIOD	ELEMENT (%) N	P	K
Initial	1.70[a]	0.12[a]	0.88[a]
Final			
Coconut + cacao	1.45[b]	0.11[a]	1.06[a]
Coconut + coffee	1.37[b]	0.12[a]	1.46[a]
Coconut + pineapple	1.40[b]	0.12[a]	0.91[a]
Coconut alone	1.29[b]	0.10[a]	1.14[a]

* Means in a column having common letter are not significantly different from each other (DMRT).

return was also influenced by the environmental factors particularly the occurrence of typhoon in the experimetnal sites.

Leaf and Soil Analysis

Coconut leaf tissues analysis showed that values of the leaf elements measured were within the critical level except for N which was below the critical value. Leaf N content statistically decreased as croppings continued while K tended to increase. P was likely maintained throughout the duration of the study (Table 6).

Soil pH was more or less maintained after the conduct of the experiment (Table 7). In contrast, soil extractable P and exchangeable K showed slight increase after treatment implementation, while available N statistically decreased. Same trend on both leaf and soil analysis results was observed.

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TABLE 7
Initial and Final Soil Analysis Results Taken from Coconut Farm with Different Intercrops*

SAMPLING PERIOD	SOIL PROPERTIES			
	SOIL pH	TOTAL AVAILABLE N (ppm)	EXTRACTABLE P (ppm)	EXCHANGEABLE K me/100 g soil
Initial	5.6[a]	81.2[a]	6.3[a]	0.31[a]
Final				
Coconut + cacao	5.7[a]	62.5[b]	6.7[a]	0.36[a]
Coconut + coffee	5.5[a]	69.1[b]	6.8[a]	0.38[a]
Coconut + pineapple	5.5[a]	62.2[b]	6.0[a]	0.46[a]
Coconut alone	5.6[a]	71.0[b]	7.0[a]	0.43[a]

* Means in a column having common letter are not significantly different from each other (DMRT).

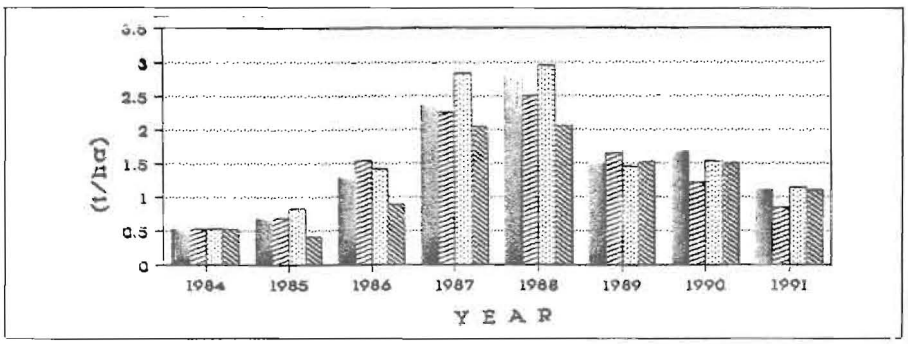

FIGURE 1
Copra yield (t/ha)

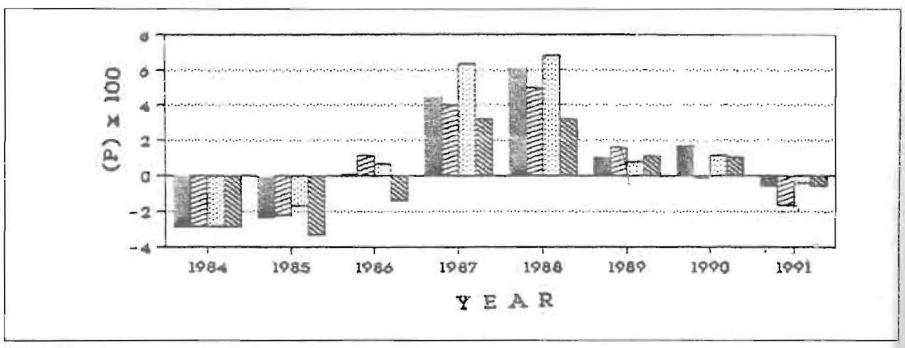

FIGURE 2
Yearly net return/loss (P) x 100 from coconut alone

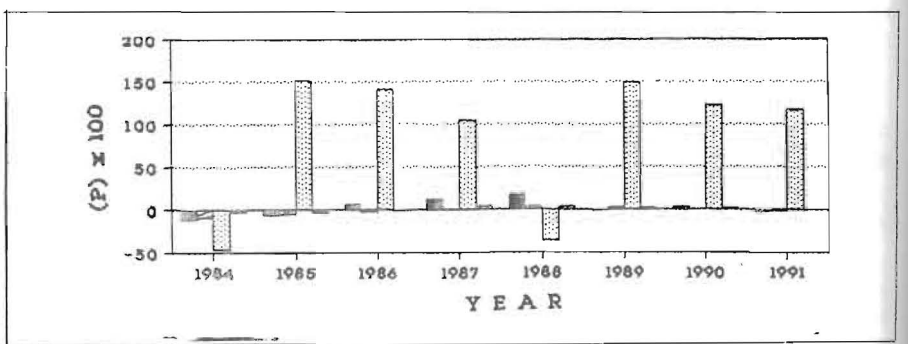

FIGURE 3
Yearly combined net return/loss (P) x 100 from coconut + intercrop