INTERCROPPING HYBRID COCONUT WITH COCOA

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INTRODUCTION

Over the last two decades there has been remarkable progress in the breeding of coconut. This has resulted in the creation of new types with high yield potential. Most of these are hybrids between dwarf and tall varieties. Field trials conducted in many countries have proved that hybrids are better than the local or exotic types. A limited number of different hybrids has been tested in Papua New Guinea and these studies indicate that the hybrids tested outyielded the tall varieties (See Harvest 11/2). Of the hybrids the Malayan Dwarf x Rennel Tall appeared to be the best yielder.

It is stated that coconut is the most suitable shade for cocoa. Therefore the use of high yielding hybrids for interplanting with cocoa will result in a higher return per unit land area. The advantages of having hybrid coconut in this intercropping system are:

a) A shade crop with potential high yields.
b) An easily manageable shade from fixed canopy size and
c) Low labour and management requirements.

This article presents some possible planting patterns for a coconut-cocoa intercropping system and observations made on early growth of Malayan Dwarf x Rennel Tall hybrids in such a system.

PLANT DENSITY

As a monocultured crop, coconuts are grown commonly at plant densities ranging from 130 - 180 palms per hectare. Mature coconut stands can conveniently be intercropped and interplanting coconut with cocoa is an established practice in Papua New Guinea and Malaysia. This practice is also being adopted in South India and Sri Lanka. However, in a redevelopment programme where interplanting hybrid coconut with cocoa is intended, palm stands of 120 - 180 palms per hectare are unsuitable. At these densities young coconut palms will create heavier shade which is a disadvantage to the growth of cocoa. Studies on light interception by pure stands of coconut grown at conventional densities have indicated that the percent light interception by coconut canopy increases with age and that nearly 90% of light is intercepted in about the tenth year and thereafter a gradual decrease is observed. Therefore lower palm densities are preferred which are capable of providing benefical shade to cocoa. Information about the right time to plant cocoa in relation to young coconut palms, and the optimum density of palms is lacking, and more experimental data are required to determine these. Some workers have suggested palm densities ranging from 45 - 100 per hectare and planting coconut two years before cocoa.

Many countries have adopted different plant spacings and densities for growing cocoa. Densities between 600 - 900 trees per hectare are commonly used. In Papua New Guinea 4cm square and 4m equilateral triangle arrangement has been recommended for clonal buddings and hybrids respectively. The former gives 625 trees per hectare and the latter 720 per hectare. There are also records of instances where high density (1550/ha) planting has been attempted.

PLANTING PATTERNS

Depending on the respective densities for each intercrop, different planting patterns could be adopted. The intercrops should be correctly spaced so that the individual crops are able to properly and efficiently utilize the available sunlight and soil nutrients without exerting severe competition over each other, i.e. there should be minimum negative interaction on yield of the individual crops. It should also

be noted that the spacing of the intercrops is a factor dependant on the type of planting material, vigour of the intercrops, soil and climatic conditions.

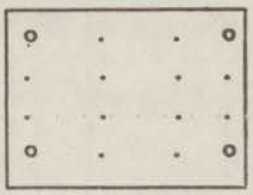
Four possible planting patterns are presented in Figure 1. These consider cocoa densities as low as 556 and as high as 1042 trees per hectare for a single density of 69 coconut palms per hectare (Fig 1A & 1C). Planting patterns for a higher coconut stand (80 - 83/ha) are presented in Figs 1B and 1D. In planting patterns 1A and 1C both coconut and cocoa are planted on a square system. The difference between the two planting patterns is the different spacings adopted for cocoa. An equilateral triangular system is adopted for both the crops in Fig 1B which gives a density of 80 and 641 trees/ha for coconut and cocoa respectively. A rectangular planting pattern for coconut is represented in 1D. Within this rectangular system cocoa is planted at 3.6 x 3.6m square and the cocoa lines adjacent to each coconut row are 2.6m away from the latter.

INTERPLANTING HYBRID COCONUT WITH COCOA

A trial has commenced to evaluate the performance of both hybrid coconut and cocoa when interplanted, the details of which are given below.

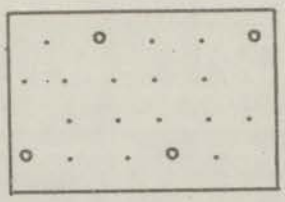
Experimental Details

The trial was conducted at Vunabang Plantation, Kokopo, East New Britain. The hybrid coconut used is from a cross between the Malayan dwarf x Rennel tall which is produced at the Isolated Seed Garden of Coconut Products, West New Britain Plantation, Numundo, West New Britain. Nine to ten months old hybrid seedlings were field planted in July, 1985 at 7.5 x 18m plant spacing giving 74 palms per hectare (Fig. 2). At the time of planting each planting hole received 120g of TSP. During the first year the palms were fertilized with 90g Urea, 60g TSP and 60g MOP.



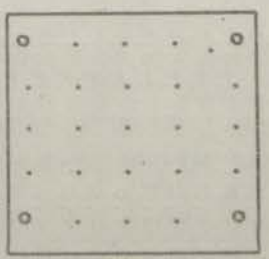
(A)

Coconut at 12m x 12m (69/ha)
Cocoa at 4m x 4m (556/ha)



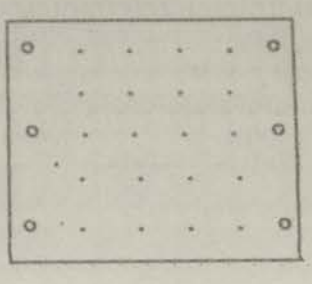
(B)

Coconut at 12m x 12m (69/ha)
Cocoa at 3m x 3m (1042/ha)



(C)

Coconut at 12m equilateral triangle (80/ha)
Cocoa at 4m equilateral triangle (641/ha)



(D)

Coconut at 7.5m x 16m (83/ha)
Cocoa at 3.6m x 3.6m (691/ha)

Fig. 1 Possible planting patterns for a coconut intercropping system.

O Coconut . Cocoa

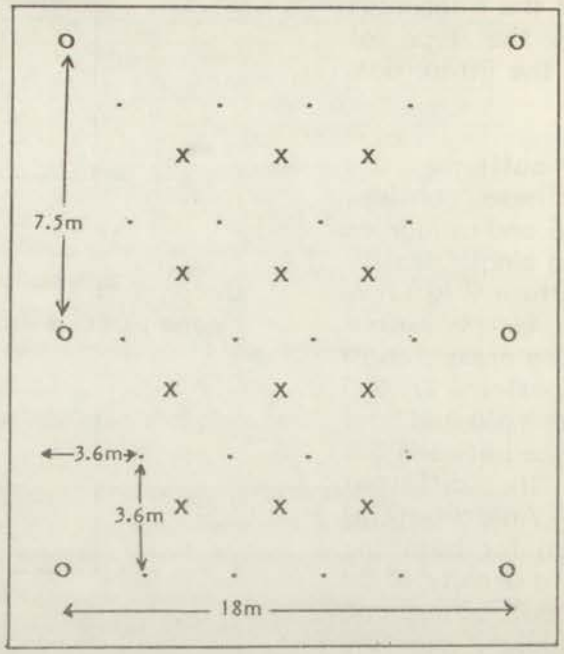


Fig. 2. Planting pattern adopted for the coconut/cocoa intercropping trial.

O Coconut; . Cocoa; X Gliricidia shade

When the palms were 9 months old gliricidia shade was planted at 3.6 x 3.6m square in between the coconut rows (Fig. 2). Planting of cocoa at 3.6m square was carried out in January 1987, i.e. when the coconut stand was about 18 months old. There were four rows of cocoa in between two rows of coconuts. This configuration gave 650 cocoa trees per hectare.

The damage to palms by the black beetle (Scapanes australis) was kept under control by weekly inspection of the palm and removing of adult beetles with a metal hook. All openings made by the beetles were closed with a bituminuous compound (e.g. hydroseal) to prevent any secondary attacks, especially by palm weevils. About 30g of BHC powder or lindane granules were applied to the palm axils every two months as a prophylactic measure.

RESULTS AND DISCUSSION

The Malayan dwarf x Rennell tall hybrids showed good field establishment during the first year. They also showed hybrid vigour as indicated by early flowering and stem differentiation. At 24 months after field planting 40% of the palms were flowering (Table 1). At the time when stem differentiation was noted the trunk girth measured 130 cm and at 30 months 16% were flowering and after 30 months the average trunk girth was 137cm. These results indicate that once the stem has differentiated there is little growth in girth.

The canopy radius, the horizontal distance from the centre of the palm to the tip of the fronds with the furthest extension, exhibited rapid increase during the period 18 - 24 months and then slowed down in the next six months (Table 1). The results show that from 18 - 24 months the canopy radius increase was 45.5% and during the next six months the increase is 19.4 percent. It is expected that very soon the canopy radius will reach its maximum after which it will remain more or less constant for many years.

Trials conducted at Kerevat, East New Britain, have recorded copra yields of 240g/nut and about 18.2 kg copra/palm/year. At similar yield levels, it is expected initially to obtain around 1.3 tons of copra/ha which will increase with the age of the palms.

No growth measurements were carried out on cocoa during the first year of its growth.

Table 1. Percent flowering, stem girth and canopy radius during early growth of Malayan dwarf x Rennell tall hybrids.

Age (Month)	Flowering %	Stem Girth (cm)	Canopy Radius (cm)
18	-	-	237
24	16	130	345
30	48	137	412

The cocoa stand also exhibits good field averaged 11.9 cm and 112.2 cm respective ly. Bimontly recordings on growth parameters will be carried out during the second year of its growth to evaluate the performance under coconut shade.

It is difficult at this stage of the trial to arrive at a definite conclusion on the advantages and disadvantages of the intercropping model presented. At wider coconut row spacings a time gap of two years between the time of planting coconut and cocoa appears to be unnecessary. In the present trial the cocoa was planted 18 months after coconut and there is possibility of planting cocoa even earlier than this if the gliricidia shade could be controlled so it will not interfere with the growth of the coconut. The growth of the cocoa will be affected by the amount of the shade provided by the coconut canopy. In the present trial coconuts are grown at low density and therefore overshading by coconut is not expected. Nair and Balakrishan (1976) who studied the pattern of light interception by coconut canopy and the availability of light for interplanted cocoa reported that the percentage interception of light by coconut palm is maximum during the morning and evening hours and the peak period of light availability for cocoa is from 1000 to 1400 hours. With the wide row spacings adopted in the present design it might be expected that the cocoa would receive a higher proportion of sunlight around the midday hours. Furthermore the light environment for cocoa could be modified by orienting the coconut rows in an east-west direction. A trial is in progress to study the effect of shading on the growth of cocoa by a coconut canopy when the coconut rows are oriented either in the east-west or the north-south direction. Results of this will be reported later.

FURTHER READING

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