Underplanting Coconuts with Cocoa in West Malaysia

PART 1 – PLANTING

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Introduction

Shortly after the Second World War, an attempt was made in Malaya to establish cocoa as a component of the country's agriculture. This attempt, however, was unsuccessful, mainly because of the severe problems of dieback, experienced because planting material was restricted almost entirely to the Amelonado variety. West Malaysia has only two estates on the East Coast where cocoa is grown as a monocrop; development in these areas has not been without serious problems, but the use of different planting material offers more encouraging prospects.

Small-scale trials under coconuts in the Lower Perak district on the west coast were more successful; growth and early yields were much better than those experienced on the east coast inland plantings and by 1965 large-scale commercial plantings had commenced. The rapid rise in price in recent years gave stimulus to underplanting, and 1968 and 1969 have seen considerable expansion in acreage of cocoa under coconuts.

Climatically, the area being used for underplanting at present is monsoonal, although there are normally no prolonged periods of drought with less than two inches of rain. A six-year average gives an annual precipitation of 75 in. falling over 120 days, as shown in Table 1. The two wettest periods are October and November and, to a lesser degree, March and April. It is noticeable that peak cropping periods are March-April and September-October, virtually coinciding with the high rainfall. The soils of the area are coastal alluvia, predominantly marine clays, which are amongst the richest soil types in Malaya. They are acid, with pH values of 4.5-5.0, and normally contain medium to high levels of nitrogen, phosphorus and exchangeable potassium, high levels of exchangeable magnesium, and moderate levels of exchangeable calcium. Base saturation values are generally moderate to high (8).

The concept of underplanting coconuts with cocoa is not new, since such mixed plantings have been established in the Philippines (1) and Papua and New Guinea (15). It has been found that not only was there little evidence of a depressing effect of the cocoa on the coconuts, but that yield of the latter could increase (6). Clearly, there exist a number of situations where the soil is
sufficiently fertile to support both crops, especially with provision of adequate fertilisers. There is a considerable area of land on the West Coast of Malaya where coconuts alone are grown on good soils, and much of this could be underplanted with cocoa.

**Planting Material**

Most of the cocoa planted commercially at present is either legitimate or illegitimate Upper Amazon material or crosses between Upper Amazon and Amelonado; though some hybrids of Upper Amazon × Trinitario can also be found. In 1966 Sabah hybrid material became available. Based on the results of breeding trials in both Malaya (5, 9) and Sabah (4), a number of parental combinations have been selected from which yields are expected to be much greater than that of earlier material. Considerable prominence has been given to the clone Nanay 33 since trial results have shown this to be outstanding. Parinari selections are also included in crosses and a fuller account of the material used can be found elsewhere (10).

**NURSERY TECHNIQUE**

**Seed Germination**

Much of the planting material in Malaya is currently derived from hand pollinations carried out by the Department of Agriculture in Sabah, but with the establishment of seed gardens in Malaya, this dependence on imported materials should diminish. Every effort is made to germinate the seeds with the minimum of delay on account of their limited viability, even when packed in charcoal. Faster and more consistent germination has been achieved if the seed mucilage, which contains a germination inhibitor, is removed. This is done by rubbing the seeds with dry sand or sawdust after bulking them in wicker baskets for a day, during which time the mucilage becomes softer.

**Nursery Practice**

After germination, the seeds are planted in polythene bags of 250 gauge arranged in beds about 3 ft wide and any convenient length. Paths 1½ ft wide are left between the beds. The size of bag used depends upon the length of time which it is intended to retain the seedlings in the nursery. Thus, where the nursery stage does not exceed 2½ months a layflat size of 7 × 9 in. or 7 × 10 in. is sufficient, but where this period is extended up to 4½ months, the larger 8 × 12 in. size is preferred. All bags are perforated and, as the nurseries provide heavy shade, clear polythene can be used without the splitting which takes place with direct exposure to the sun. Bags are filled with good friable clay topsoil mixed with coarse river sand in a ratio of 2 : 1, except in the top inch of the bag, where the ratio of 1 : 1 is used to improve aeration and drainage. Various organic supplements, e.g., up to 15% well-rotted cow dung, are sometimes added to the soil mixture.

Nurseries are shaded both above and at the side, the latter being made necessary by the strong winds which occur near the coast. A peripheral fence of wire mesh netting keeps out rats. The initial shade intensity is about 80%, and as palm fronds are used this gives a dappled shade. After the first whorl of leaves has hardened, the shade is progressively reduced until by the sixth week from germination the light intensity is similar to field conditions (2).
Nursery Maintenance

When seedlings are grown in good conditions it has been found that the nursery maintenance required is minimal. The seedlings are watered during the early morning and late evening, taking care not to saturate the rooting medium. In coastal areas problems have arisen through brackish water leading to serious leaf damage, so piped water is preferred. The correct schedule for chemically-defined fertilisers, if one is required, has yet to be determined for Malaysian nurseries. The most usual nutrient deficiency symptom is the pale foliage colouration associated with a low level of nitrogen. This is readily corrected by weekly application of ½ oz urea in 1 gal. water per 200 seedlings. Considerable importance is attached to discarding any seedlings which are abnormal or poorly developed, though with Upper Amazon hybrids it is usually found that about 90% of the seedlings are suitable for field planting.

FIELD PLANTING

Seed at Stake

Some growers prefer to eliminate the nursery stage by planting seeds directly into the field, and usually, three seeds will be sown at each point, with later selection and retention of the most vigorous, though sometimes rodent attack can be so severe that five seeds per point are required. This seed-at-stake method has been used with success on numerous occasions, but requires a greater supply of planting material and is often accompanied by pest problems. In general, a nursery is preferred, mainly due to the greater attention it is possible to give to the seedlings and the higher costs involved in field upkeep when the nursery stage is omitted. It remains to be seen whether the two different practices result in any variation in subsequent time to maturity and yield, and trials have been established to determine this.

Soil Cultivation and Planting

Before planting either seed at stake or seedlings in the field, the soil is frequently strip-rotovated. However, where the soils are of favourable structure, it is sufficient to eradicate the vegetation along the planting rows, using herbicides. Whilst a few resistant noxious growths require removal by hand, a herbicide mixture of Ansar, Amine-80 and sodium chlorate in a 3:1:5 ratio has been found suitable for most weed situations. This is applied as a “cocktail” comprising 3 pints Ansar, 1 pint amine and 5 lbs. sodium chlorate in 40 galls water to cover up to 7 acres as described in Part 2 of this paper.

As seedlings are very prone to transplanting shock, care is taken during transport from the nursery to the field to avoid this as far as possible. Greatest shock occurs when seedlings have been retained in the nursery for longer than two months, by which time the tap root will have forced its way through the bottom of the bag. If emergent roots are pruned about one week prior to field planting, this appears to reduce the level of shock attributable to tap root disturbance.

Actual planting technique depends on soil structure. If the structure is poor then holing is carried out in advance of planting, but in good quality soils a small hole of sufficient size for the plant can be dug at the time of planting. The seedlings are planted at the same depth as they were in the nursery. The bags are removed with the minimum of disturbance and soil filled and packed carefully around the soil core, a few inches at a time until the hole is filled.
Planting System and Density

Outside Malaysia, coconut harvesting involves collecting the nuts after they have fallen and this method is usually considered satisfactory. In Malaysia, however, germination of unshed nuts has been noticed on some palms and this, together with the great danger of theft of fallen nuts, has led to the normal practice for harvesting, by cutting the nuts from the palms, using a knife attached to a long pole. This has affected the layout of cocoa plantings since it is sometimes preferred to plant cocoa in alternate coconut rows only, thus leaving one row with freedom of access for the harvester and his cumbersome pole. At present, however, there is no great shortage of coconut land for cocoa planting, which does not encourage planting every coconut row. It is possible to plant every row, if a small premium is paid for coconut harvesting under the more difficult conditions. This premium is covered many times by the additional income from cocoa.

Coconuts are normally planted in avenues 26 ft or 30 ft apart; cocoa is planted in two rows 10 ft apart and equidistant from the palms. Within the rows the cocoa is spaced either 6½ ft or 6¾ ft, giving a stand per acre of 447 and 458 respectively. Triple rows have also been tried, but planting at this density becomes too dense. Field drainage sometimes presents a problem and a distance of 5 ft from the drain edge is maintained to avoid trees falling over. The high planting density allows selective thinning based on vigour and yield. Initial thinning is carried out at the end of the second year in the field, reducing the stand to a density of 400-420 trees per acre. There is no subsequent thinning until yields of 800 lb per acre are being obtained, at which time consistently low-yielding trees are removed. Removal at this stage should not result in over-large gaps in the canopy.

Shade

A certain amount of shade for the young seedlings on transplanting from the nursery is provided by the coconut stand; this is greater where the coconuts are of the Dwarf variety, which is planted at double the density normal for Tall variety palms. However, this shade is initially insufficient and additional shade is provided by 3-ft-lengths of fallen palm fronds, which are firmly set upright in the ground about 9 in. from the cocoa seedlings. These are later removed when the plants have become well established. Where there is insufficient overhead shade, three to five seeds of rapidly-growing shade plants are sown about 2 ft from the seedlings and at right angles to the cocoa row to provide low shade for a longer period. Suitable shade for this purpose can be provided by Sesbania aculeata or Cajanus cajan. This type of shade is desirable and has an additional attraction in that it helps to raise the height at which jorquettting occurs.

Where vacant patches occur in the coconut stand due to lightning strike, a common feature on these estates, overhead shade is provided by larger trees. Wherever possible, these gaps are filled well in advance of the cocoa planting. The larger trees are planted about 4 ft from the outside of cocoa rows and intermediate between the cocoa seedlings. Useful trees for this purpose are Gliricidia sp., Sesbania grandiflora and Leucaena leucocephala, with Gliricidia being very useful in that it is readily propagated by cuttings. Since Sesbania grandiflora is a smaller tree, it is planted at twice the density of the others.
Cocoa under Coconuts in Lower Perak, West Malaysia.

Table 1. SITIAWAN, PERAK, WEST MALAYSIA. (4° 13' N. 100° 42' E.)

<table>
<thead>
<tr>
<th></th>
<th>RAINFALL (40 yrs.) (a)</th>
<th>SUNSHINE (hrs. per day) (b)</th>
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<tbody>
<tr>
<td>January</td>
<td>7.9</td>
<td>6.7</td>
</tr>
<tr>
<td>February</td>
<td>5.5</td>
<td>7.4</td>
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<td>March</td>
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<td>April</td>
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<td>May</td>
<td>4.8</td>
<td>6.7</td>
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<tr>
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<td>3.3</td>
<td>7.1</td>
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<tr>
<td>July</td>
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<tr>
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<tr>
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<td>November</td>
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<td>5.6</td>
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<td>December</td>
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<td>Total for year</td>
<td>75.2 inches</td>
<td>2,392 hours</td>
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Sources of data:
REFERENCES


