Some Aspects of Coconut Agronomy in Papua and New Guinea.

L. A. DOUGLAS.

Coconut Agronomist, Lowlands Experimental Station, D.A.S.F., Keravat.

INTRODUCTION.

The export earnings from Coconut Products in Papua and New Guinea amount to approximately £7,000,000 annually. As this is 40 per cent. of the total value of exports from the Territory each year, the position of the coconut is clearly one of great importance to the economy of the country.

With increasing costs, it is imperative that all operations on the plantation be performed as efficiently as possible. This paper deals with several aspects which are of interest to the owner-manager. Articles of a more specialized nature will be found in this, and other editions of the *Journal*.

NURSERY PRACTICE.

It has been clearly shown by Liyanage (1955) that improvements in future plantation productivity can be achieved by selection of seedlings in the nursery. Therefore, the practice of planting nuts directly in the field is not recommended as this severely restricts the efficiency with which seedling selection can be carried out. Some important aspects of nursery practice are outlined in the following discussion.

Seed Selection.

In the past, it has been the practice for some individuals to regard high yielding palms as "mother trees" from which all nuts for the nursery were obtained. Thus Sampson (1923) advocated the selection of certain high-yielding trees for this purpose.

Recently, some questions regarding the effectiveness of mother palm selection have been asked. Charles (1961) critically reviewed evidence on the subject, and concluded that there was no evidence to support the practice of mother palm selection of coconuts. He further stated that all that could be recommended was that seed for planting should be taken from blocks of well-grown, healthy palms, from which any markedly abnormal types had been removed. This is in fact the usual method of obtaining seed nuts in the Territory.

All nuts collected for planting must be approximately the same age. If this is not so, then the effectiveness of nursery selection is considerably reduced (as explained in "Seedling Selection" of this section). Therefore, to ensure that nuts of a uniform age are collected, areas from which seed nuts are to be taken should first be harvested, and then the next fall of nuts is taken for planting.

Location.

The nursery should if possible, be established on level soil which is well drained. As a dry period may seriously retard the growth of the seedlings, it is an advantage to have a supply of water nearby, so that supplementary applications can be made when necessary. A light overhead shade may be provided for the nursery, although where this is not done the plants will still grow satisfactorily if an adequate supply of water is available.

Planting.

Nuts are normally planted in long rows in the nursery. A distance of 18 inches between the rows and 12 inches along the rows should enable each seedling to be removed together with a large proportion of the roots.

The depth of planting should be such that the nuts are almost covered by the soil. Placing the nuts horizontally has been shown to result in a higher percentage germination than when they are placed vertically. (Report, Coconut Industry Board, Jamaica, 1961-62). However, Piggott (1964) states that in British Guiana, where the insect *Strategus aloeus* L. is a serious

pest of seedlings, vertical planting is favoured, as this allows the pests to be readily detected and controlled. In the Territory, where no similar pest is present, horizontal planting is recommended.

Seedling Selection.

Liyanage, (1955) suggested three criteria on which to base selection of seedlings in the nursery :—

(i) *Early sprouting*—In Ceylon, all seed nuts that have not germinated within 20 weeks of planting are rejected. This however fails to allow for the retardation in germination which occurs during a period of dry weather. Therefore, as Charles (1959) states, a more satisfactory criterion might be the rejection of all ungerminated nuts as soon as the first 70 per cent. have shot.

(ii) *Seedling vigour*—The age of the seedlings determines the efficiency with which selection on this basis can be performed. It is easy to detect differences in vigour with older seedlings, but on the other hand, these will be more severely set back at transplanting than will younger ones. A compromise must therefore be reached, and under conditions of adequate rainfall, the four-leaf stage is recommended as the stage at which the final selection should be carried out, and the seedlings transplanted to the field.

(iii) *Resistance to pests and diseases*—Any seedlings which are badly attacked by pests and diseases in the nursery should be rejected. If they were transplanted, it is doubtful whether they would survive, and further, their genetic constitution may render them more susceptible to future attacks than is the case with other seedlings.

By selecting in this manner, the cost of planting material will be considerably increased. However, this is a minor item when the total costs of planting, and the advantages to be gained by such selection, are considered.

MARKING OUT AND PLANTING.

Spacing.

Different spacings for coconuts have been adopted in the various coconut growing countries. Menon and Pandalai (1958) report that spacings adopted in different countries are :—

India 7.5-9.0 m. ; Ceylon 8.0-8.7 m. ; Malaya 9.0-10.0 m. ; Indonesia 10.0-11.0 m. ; Seychelles 9.0-10.0 m. ; Trinidad 10.0-11.0 m. ; British Guiana 9.0 m.

In Papua and New Guinea, coconut palms have been most commonly planted a distance of 30 feet apart. Planting on the triangle is recommended, as this allows 55 palms per acre compared with 45 per acre when palms are planted on the square.

Unfortunately, there is little experimental evidence to indicate which is the optimum spacing distance. Results from Jamaica (Report Coconut Industry Board Research Dept. 1961-62) suggest that under the conditions on that island, the maximum yield is obtained from palms planted on a 22-foot square. However, it is thought that planting at this close spacing in New Guinea would lead to an increase in Threadblight disease (*Corticium* sp.) and therefore the wider spacings are preferred. In this regard, the author recently noted on Bougainville that Threadblight was more prevalent on palms planted at 25 and 27 feet triangle spacings than it was on palms planted on 30 feet triangle.

Planters establishing coconut palms on fertile, well drained soil should keep in mind the possibility of a later interplanting with cacao. Where a 30-foot triangle spacing is used, there should be little need for the provision of extra shade for the cacao, while competition between the two species should not be too severe.

The location for each palm should be carefully determined, as any trees out of line may hinder maintenance in the future. A measuring tape should therefore be used when marking out and stakes should be used to mark the positions determined.

Dimensions of Planting Hole.

The size of the holes necessary for the coconut seedlings varies according to the type of soil which is present. Menon and Pandalai (1958)

state that in some districts in India, where very coarse material known as "laterite" is present, holes of dimensions 3 ft. 6 in. x 3 ft. 6 in. x 3 ft. 6 in. are dug. Layers of mulch are placed in the bottom of such holes, the purpose of this being to provide nutrients for the seedlings which the laterite has in insufficient quantities.

Where a soil of reasonable physical and chemical properties is present, as is the case in most coconut growing areas in the Territory, the planting hole is usually 10 to 12 inches deep and measures 12 inches square at the top.

Transplanting.

Transplanting from the nursery to the field should be done as quickly as possible, so that seedlings are not left out of the ground for any appreciable length of time. Further, it is best to transplant during wet weather, when the sky is overcast, as this will ensure that a ready supply of moisture is available to the plants over a period when mortalities due principally to lack of water, may occur.

Following planting, attention should be given to fertilizer requirements for the particular soil type involved. For example, Charles and Douglas (1965) found that to maintain satisfactory growth on yellow-brown clay-loam soils on New Ireland, an application of 10 oz. potassium chloride per plant was necessary in the first year after transplanting. It was also necessary to increase this rate of application as the tree grew larger.

Aspects of pest and disease control, and plantation maintenance, in connection with seedlings, are discussed in the following sections.

GENERAL PLANTATION MAINTENANCE.

To ensure that production does not decline, adequate attention should be given to all aspects of plantation maintenance. The following discussion is limited to the more important of such maintenance considerations.

Grass and Cover Crop.

Of particular importance is the control of grass and leguminous creepers such as *Pueraria* sp. If these plants are allowed to grow unchecked, many nuts may be lost, and seedlings may be smothered. (*Plate* 1.)

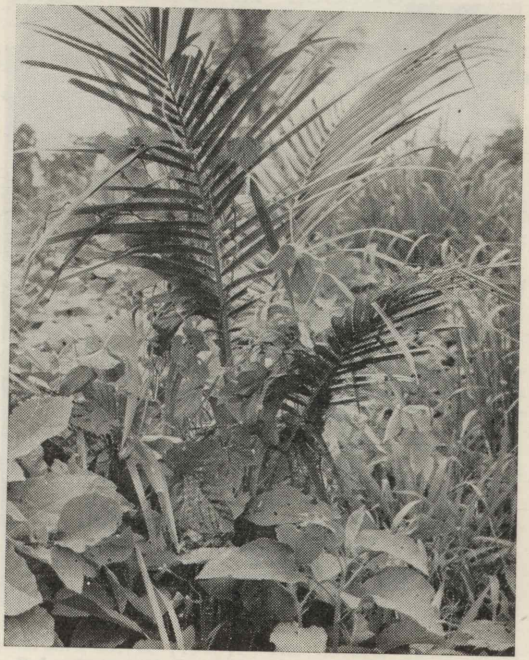

Plate I.—Leguminous creeper smothering seedling.

In the past, all grass on the plantation was cut by labourers using sarifs. Today, rotary mowers and large rollers which are pulled by tractors are used for this purpose where the terrain is not too uneven. When labourers are employed to cut grass, it is usually found most satisfactory to set a minimum daily task per man, and to pay a bonus for any work done in excess of this.

Roads.

If tractors are to have access to all parts of the plantation, the roads must be kept in good condition. Where gravel or coronous pits are nearby, this material should be used on the roads, as the vehicles are then not liable to get bogged in wet weather.

Pests and Diseases.

All areas of the plantation should be regularly inspected so that any outbreaks of pests or diseases can be noted in their early stages. If this is done, then the expense involved in controlling such outbreaks should be reduced to a minimum. Control measures to be adopted are discussed in the next section, and in other papers in this *Journal.*

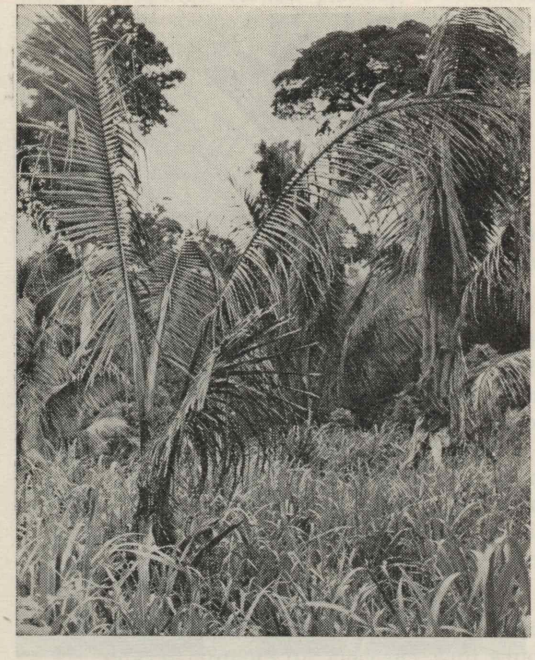

Plate II.—*Oryctes* damage on coconut palms.

Fertilizer.

From production records, and the general appearance of the palms, it should be possible to determine whether yield is below what might be expected. If production is low, or is declining, advice on the problem can often be obtained from D.A.S.F. Officers. Thus Charles and Douglas (1965) found that palms growing on yellow-brown clay-loam soil, New Ireland, required applications of potassium fertilizer in order to maintain production. Such applications must of course result in an increase in net income for the plantation if they are to be considered by the manager. Therefore, it is important that experiments be carried out to determine the optimum rate of fertilization, when net return is taken as the criterion for comparison of treatments.

Cultivation.

Cultivation is regularly carried out on plantations in some countries. Menon and Pandalai (1958) report that in India, intercultivation has been shown to increase yields substantially. Such increases have not been shown to occur following cultivation in the Territory. For example, in an experiment on a plantation on the Papuan Coast, no significant yield increases following cultivation were noted. (D.A.S.F. Annual Report 1962-63). A trial recently started on New Ireland has similarly failed to show any evidence of yield increases due to cultivation. Therefore this practice is not recommended as under conditions in the Territory it does not result in an increased net profit.

Replacement of Dead Palms.

The replacement of dead trees with seedlings is an almost continual task in some areas of the Territory. This applies particularly to Bougainville plantations, where lightning strikes frequently occur, and result in the death of up to 30 palms per strike.

Machinery.

As the use of machinery on plantations is being extended wherever possible, it is necessary that the manager should be able to service all such equipment satisfactorily. Further, it is an advantage if repairs can be carried out by the manager, thus avoiding the costs involved when outside labour has to be called in for this purpose.

Buildings.

All buildings on the plantation require regular maintenance, firstly to keep them looking respectable, and secondly to promote the longevity of the structures. Labourers with slight injuries can often be assigned to such tasks, as much of this work, though tedious, is not hard. The annual expense involved in building maintenance eventually proves less than the costs incurred when a poorly maintained structure must be replaced after relatively few years of service.

INSECT PESTS OF COCONUTS.

Control measures to be adopted against insect pests are discussed in a paper by L. Smee in this issue of the *Journal.* (pp. 51-64). However, it is desired to add some recent observations on a coconut pest, and on developments in the biological control of dynastid beetles in the Territory.

Aspidiotus destructor Signoret.

This scale, though present in the Territory, has never caused severe damage in this country. However, it has appeared in various other areas

as a pest of *Cocos nucifera.* Stephens (personal communication) reported that a very serious outbreak occurred recently on the Island of Efa in the New Hebrides. Leaves were almost completely covered by the scale insects, and a severe decline in production was noted. Several palms died after this insect attack.

Fortunately, control of this insect is now being effectively carried out by the coccinellid *Lindorus lophantae* Blaisd. which was an accidental introduction into the New Hebrides, as was *Aspidiotus.*

Dynastid Beetles.

Major pests of the Coconut Palm in the family Dynastidae are *Oryctes rhinoceros* L., which was accidently introduced into the Bismarck Archipelago (see typical damage to a young palm in *Plate* II) and two indigenous species : *Scapanes grossepunctatus* Sternb. which is restricted to the Bismarck Archipelago and Bougainville and *Scapanes australus* Boisd. which is found on the mainland of New Guinea.

Reference is made in Smee's paper (pp. 51-64) to current biological control experiments carried out in the Territory against dynastid beetles. The most promising of these involves the large reduviid *Platymerous rhadamanthus* Gerst. which has been released in large numbers at several locations. This reduviid can kill an adult dynastid beetle in a few minutes, death being caused by the predator inserting its proboscis into the soft tissue behind the head and the body liquid being sucked out. (Dun, personal communication).

DISEASES OF COCONUTS.

This subject is adequately covered in a paper by Dr. D. E. Shaw, Principal Pathologist, in this edition of the *Journal.*

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