REPORT ON MECHANIZATION OF AGRICULTURAL CROPS IN NEW GUINEA

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Mechanization of Cacao, Lowland Coffee and Rubber.

THESE three plantation crops are discussed together because there are many points of similarity in the mechanization approach to cacao and coffee. There are wide points of difference between these crops and rubber but certain phases of rubber production have already been included in an earlier report.

Mechanization of these plantation crops is reviewed under four headings :—

(*a*) General Considerations ;
(*b*) Planting and Plantation Maintenance ;
(*c*) Harvesting ;
(*d*) Transport.

1. *General Considerations.*—

Emphasis is placed on the initial consideration that mechanization has to conform to the pattern of tropical conditions in New Guinea plantations. In particular, it is wise (a stark necessity in part) to restore as soon as possible after planting the natural forest processes of soil consideration and fertility maintenance. With sufficient humus forming and overhead canopies, the leaching from heavy rainfall is controlled and soil temperature is kept below the point where plant foods would be lost. The stark necessity of these needs is such that efforts are made to use the canopies of existing crops in the development of new ones. Hence the dual crop association of cocoa or lowland coffee planted between the rows of an established coconut or kapok plantation.

Mechanization can be used to make it less laborious and cheaper to control these processes to best advantage but it must not interfere with them to the disadvantage of the new crop. New Guinea temperatures, rainfalls and soil porosities cause rapid deterioration in soil fertility if the balance between the flora and the soil is disturbed. The process of building up fertility is rapid but not nearly so fast as its destruction, a process well described as violent. This speed in build-up and violence in destruction of fertility is the characteristic difference between the New Guinea Agricultural environment and that of temperate regions.

2. *Planting and Plantation Maintenance.*—

Land preparation for planting so far as clearing the land is concerned is a special study on its own. Planting the trees or bushes from a nursery is essentially a manual process under New Guinea conditions. There are transplanting machines available overseas of three main types designed for the following purposes—

(*a*) transplanting seedling trees ;
(*b*) planting grass sprigs and sweet potato slips ;
(*c*) transplanting vegetable seedlings.

These machines are on the border-line where small issues can decide whether their use is justified. They do not plant as well as can be done manually. Native labour is well adapted to planting work and probably is more efficient in this activity than in many others. Under these conditions, transplanting machines have an experimental interest only.

It is in the maintenance of the plantations that the major scope for mechanization lies. In cacao and lowland coffee, the plantation has to be kept clean of extraneous growth during the critical years when the shade tree canopy and the cocoa, etc., has formed its own forest association. The interspersal of shade trees with the cocoa narrows the room for manœuvring a tractor. The planting plan can modify this. The terrain and work of an average cocoa plantation favours the use of a light (20 to 35 h.p. maximum on drawbar) crawler tractor. If a wheel tractor were used, a 20 to 25 h.p. low clearance four-wheeled standard type would be likely to give the most general

Fig. 1.

Forest country (secondary growth) in the Warangoi area, Gazelle Peninsula, New Britain. The secondary forest growth illustrated is typical of the country which would have to be cleared. It is proposed to plant cocoa.

Fig. 2.

Young cacao plantation at Keravat Experimental Station, Gazelle Peninsula, New Britain. The protective canopy overhead cannot be seen.

Fig. 3.

Rotting vegetable debris on Rabaul cacao plantation. This protective ground cover of decaying matter is of vital importance in maintaining a relatively cool soil temperature—below sixty-eight degrees Fahrenheit. In association with the high and low canopy it gives a protection against soil erosion and excess leaching.

Fig. 4.

Illustration from a Madang plantation of soil erosion by rain-water run-off. It took only two or three weeks to do this on an unprotected hillside planted with sweet potatoes. This picture contrasts with Illustration No. 3 which shows a protective cover of plantation debris under a high canopy of legume trees and a low canopy of cocoa.

Fig. 5.

Lowland Coffee at Keravat Research Station. This illustrates a typical legume tree grown between the coffee bushes to provide a high canopy (similar to the canopy used to protect cacao).

Fig. 6.

Canopy formed by typical leguminous trees used to shade cacao and lowland coffee. The legume provides a high canopy which protects the cacao and the cacao provides a low canopy protecting the soil from the force of the raindrops and the heat of the sun.

Fig. 7.

Kapok and coffee association at Madang Agricultural Station. The kapok trees are used to provide a high canopy to protect the lowland coffee. A valuable crop of kapok is also obtained. The low ground cover is grass.

Fig. 8.

A close-up of coffee berries at Keravat.

Fig. 9.

Fermenting bin for cacao beans. Fleshy matter adhering to the beans removed from the pods is fermented off the beans in deep wooden bins.

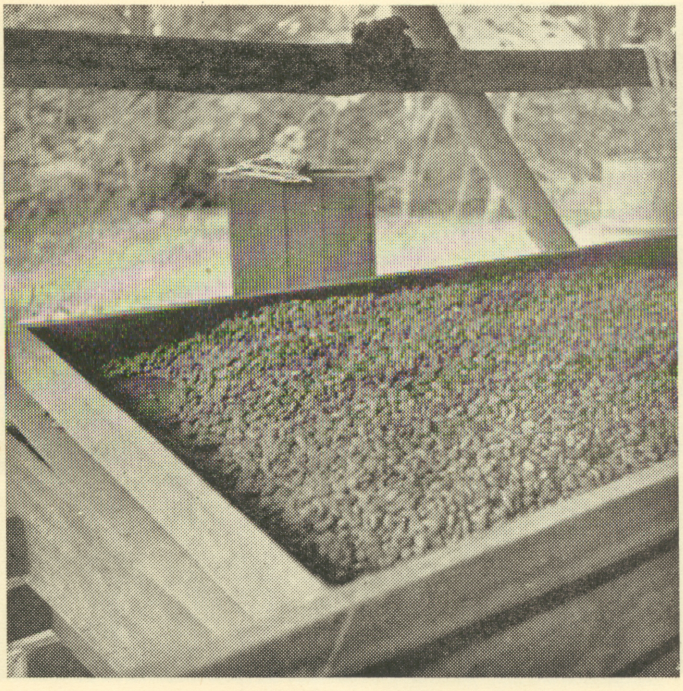

Fig. 10.

Cacao beans cleaned by ferr tation and drying out in readi for packing.

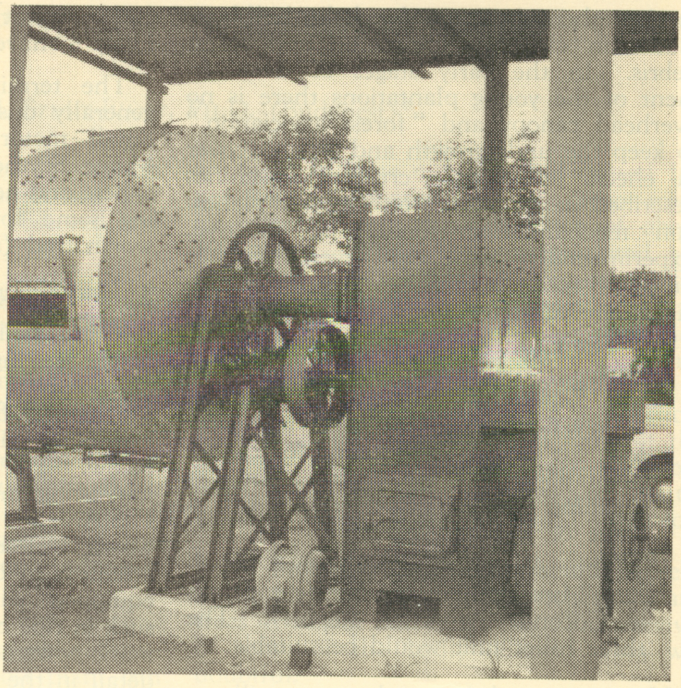

Fig. 11.

Coffee (and cacao) rotary hot-air drier, A.G.E. 5 h.p. 50 cycle 1,440 r.p.m. motor. The motor drives the rotary bin. A furnace and fan provides a current of hot air which circulates from the centre of the bin, through the beans and out through perforations in the sides of the bin. This plant is experimental so far as cacao bean drying is concerned.

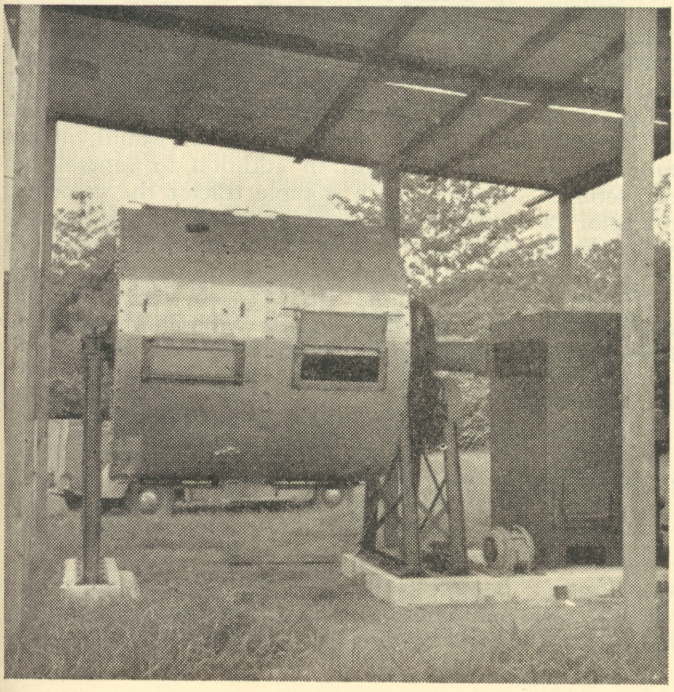

Fig. 12.

The rotary drier, showing a hot-air furnace.

service, there is scope for light bulldozer blades in clearing light scrub and forest debris. In the early stages of establishment of the young plantations there is no overhead canopy and "forest association" to keep the undergrowth and ground cover in check. The fern crushing machines described in the report on coconut plantation mechanization should be effective. Experimentally, work with several types is strongly recommended. The following makes are suggested for trial :—

(*a*) The Cuthbertson wheel-type bracken crusher; the details are described in the Report on Coconut Plantations. A seven-wheeled unit with an eight-foot cut would be available for rubber plantations, but for cocoa a smaller machine would be desirable—say a three or five-wheeled unit.

(*b*) The Australian "Robinson Woollard" bracken-fern crusher (see details in Coconut Plantation Report). The three roller unit would be suitable.

Uneven ground, logs and stumps will not prevent these machines from operating efficiently and at low maintenance cost. Operated with suitable weight they should control, without destroying, a legume ground cover.

The work of these machines might prove particularly effective in rubber plantations; there should be continuous control over the undergrowth during the whole economic life of the rubber trees. The typically rugged terrain of rubber plantations will not affect the efficiency of these machines. A light wheel or small crawler tractor of under 25 h.p. is sufficient power for haulage. The Australian machines can be drawn by two draught horses. If experiments are made with these machines, it is suggested that they be tried first in rubber and coconut plantations where they are likely to have the most use.

The terrain and work to be done is generally unsuitable for mowing machines. Small motor scythes such as the Allen Motor Scythe will be useful in a limited sphere and newly developed cutters employing some form of rotary blade may be worth trial (see the Hayter Cutter).

3. *Harvesting.*—

There is little scope for mechanization of harvesting. Keeping the plantations clean will be of material assistance. Mechanical field transport can help in the case of cocoa and coffee; this is mentioned below. The pneumatic principle for fruit harvesting now being developed in the U.S.A. and the United Kingdom will be worth close observation; particularly attempts in developing prototype machines equipped with flexible arms which can suck in ripe berries. The long-armed, pneumatic-powered secateurs (described in some detail in the Report on Land Clearing and Miscellaneous Crops) may have a use for harvesting cocoa pods. However, the present method is fairly efficient and the hand tools employed are inexpensive.

4. *Transport.*—

There should be a wide scope for tractor-trailers of the two-wheeled type, having a capacity of about two tons. This type of equipment is not expensive; with clean plantations such equipment would provide field transport in addition to general carriage; with a suitable tractor the combined unit would be manœuvrable and capable of work in uneven terrain. Transport in rough terrain could be organized manually to bring the crop (cacao and coffee) to central field depots where it could be picked up by the trailer.