● **Estimate for Painting of Dining Halls and Kitchen of Canteen at R . R . I . I**

DETAILED ESTIMATE

Slno	Item	Quantity	Unit	Rate	Amount
	Schedule ' A' (KPWD 2010 Schedule of Rates)				
1)	Painting with ready mixed Plastic Emulsion paint of approved quality and colour, as specified, **one coat ,** to old wall surfaces , after rubbing with sand paper and cleaning the surface, etc. complete at all levels	250	m2	19.40	4850
2)	Whitewashing , 2 coats , on old surface , after cleaning the surface with sand paper and brushes etc. complete, at all levels	400	m2	6.60	2640
3)	Painting with Synthetic Enamel Paint , on old surface of woodwok / ironwork , after rubbing with sandpaper and cleaning the surface etc. complete at all levels	200	m2	23.80	4760
5)	Polishing with French Polish , 2 coats , on old surface of woodwork , using approved quality polish, after rubbing with sandpaper and cleaning the surface etc.	30	m2	14.15	425
	Total Schedule 'A' Add Tender excess @ 50%				12674.50 6337.25 19000.00
	Schedule 'B'				
4)	Painting with ready mixed Plastic Emulsion paint of approved quality and colour, as specified , to old wall surfaces **,for second or for each succeeding** coat , at all levels	250	m2	23.00	5750
					24750.00

Painting Canteen - estimate . xls

07/08/2012
AE(civil)

AGRICULTURAL SERIES.

DEPARTMENT OF AGRICULTURE,
FEDERATION OF MALAYA.

Agricultural Leaflet No. 27.

COCOA

(Theobroma cacao).

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September, 1949.

COCOA.

(*Theobroma cacao*).

This leaflet is being published in order to present, in condensed form, information on the planting and cultivation of cocoa. It must be pointed out, however, that the methods described are, in the main, those which have been found most successful in other countries. Except for three small plots planted by the Department of Agriculture between 1934 and 1940 there are no areas of cocoa in bearing in Malaya at the present time (1949), though numerous trial plots have recently been planted. Throughout the country there are to be found isolated trees or groups of trees of the old red-podded Venezuelan Criollo cocoa which used to be grown in Ceylon and Java and which must have found its way to Malaya more than 60 years ago. This cocoa, being of a special quality with limited demand, should not be used for general planting. Arrangements are being made to import suitable types of planting material and in the meantime all plantings are being established from pods harvested from the Department's plots on Agricultural Stations at Serdang and Cheras in Selangor, and Temerloh in Pahang. The trees in these plots are of Trinitario type producing cocoa known in the world's markets as 'fine'.

Description of Types.

There are two species of *Theobroma* which produce commercial cocoa: (1) *Theobroma pentagona*, and (2) *Theobroma cacao*.

Theobroma pentagona is grown only in Central America and is of little commercial importance. *Theobroma cacao* is a species of many different types differing in the size and shape of the tree, the colour and shape of the pod, and the quality of the bean etc. These types hybridise readily and intermediate forms are frequently found.

The types will be considered in three groups: (a) Criollo, (b) Forastero, and (c) Trinitario.

(a) *Criollo.*

A fairly distinct type characterised by plump, round beans which are white in cross section; by pods which generally taper to a point and which are sometimes slightly curved or assymetrical; and by fruit walls, which have ten distinct furrows, are rather 'warty' and can be easily cut. There are many local types, and the pods though usually red are sometimes yellow.

The Criollo type is said to be less vigorous than others and to demand higher fertility conditions. It produces a cocoa which is of exceptional quality but demand is limited as it is only used for grading and flavouring certain classes of chocolate.

(b) *Forastero.*

All types of cocoa other than Criollo may be included as Forasteros. The beans in cross section are generally purple and may be rather flat. The pods are smooth or less warty than Criollo, and the furrows are not so deep; they are generally not so long as Criollo and have a blunt end.

Amazonian Forasteros are the types mostly grown in West Africa and Brazil. They produce cocoa classified commercially as ' Ordinary '.

(c) *Trinitario.*

This is not strictly a variety but a name for a mixture of extremely diverse elements. In Trinitario cocoa the various characters of Criollo and Forestero may be found in every combination. The quality of Trinitario cocoa is the quality of the natural mixture or blend. The quality of the constituent elements varies from very high to very low. There is also a wide variation in yielding power.

Trinitario cocoa is grown in the West Indies, Ceylon and Java and the produce is classified commercially as ' Fine '.

Soils.

It is not yet possible to say which soils will prove suitable for cocoa in Malaya. In general it may be said that cocoa requires a comparatively rich soil which can be well drained. The poorest rubber-producing areas are unlikely to be able to support cocoa. It is expected therefore that soils derived from igneous rocks, particularly Pahang volcanic and finer-grained granite soils, are likely to prove most suitable and that much greater success may be expected on areas opened from jungle than on areas which have already been under cultivation for many years. It may be possible to grow cocoa satisfactorily on coastal clays but, if so, it is certain that the drainage of these soils will have to be properly maintained. Cocoa will not tolerate water-logged conditions. Regarding the physical composition of cocoa soils Van Hall(1) writes that " different cocoa soils show in this respect great differences, and the plant cannot be said to prefer the stony soil of San Thome, the heavy alluvial clay of Surinam or the volcanic, porous soil of the Antilles and Java ".

Propagation.

Cocoa is usually raised from seed, but in the West Indies, where high yielding clones have been established, vegetative propagation by means of cuttings is being widely practised. Budgrafting by the modified Forkert method is also possible and this is used chiefly for establishing multiplication nurseries from which cuttings are subsequently taken for planting in the field.

For some years to come, and until high yielding clones have been selected and proved, propagation by seed will be the standard method in Malaya, and it is not proposed in this leaflet to describe in detail the technique employed in striking and raising the large quantities of cuttings which are required for planting substantial acreages of cocoa. As soon as high yielding clonal material is available, however, a special leaflet on propagation will be issued. In the meantime work on vegetative propagation technique is going ahead and initial trials of budgrafting and the striking of cuttings have been successful. The importance of this work cannot be over-estimated since seedling trees are extremely variable in yield and pod characters, and greatly enhanced yields can be expected when clonal material becomes available.

Several methods of propagating from seed have been employed. Although it is possible under favourable circumstances to raise plants from seed at stake, rats, mole crickets and other pests have been found to be very destructive of the young plants(1), and if, as in Malaya, it is desirable to conserve planting material as far as possible so that the maximum acreage can be planted with the seed available, then the practice of raising seedlings in nurseries is to be preferred. Further advantages of nursery propagation are: (1) selection of seedlings can be undertaken, weak plants being rejected, and (2) the young trees can be planted out in carefully prepared planting holes at just the right time (at the beginning of the wet season) and under these conditions the maximum initial growth can be expected. The advantages of sowing at stake are, of course, simplicity and low cost.

The method which has been employed successfully for raising basket plants in the nursery is as follows.

(a) *Sowing in Germination Sand Beds.*

Best results are obtained by using sand beds 3ft. wide x 10 or 11ft. long x 1ft. deep. Coarse river sand is used. Heavy shade is required which may be natural, *i.e.* rubber, or artificial, *i.e.* attaps. Wire netting covers are desirable if there is any chance of damage by rats or other animals.

The fruits are opened by making a longitudinal cut and the two halves of the shell are pulled apart; the seeds, embedded in a mass of mucilage, should then be taken out. For good germination, pods should not be kept longer than 14 days after harvesting; germination falls with the length of storage.

Seeds usually come away easily from the shell in a firm mass. They should be carefully separated one from the other but no attempt should be made to remove the mucilage. They are immediately planted in sand beds in rows 2 ins. apart, 1 in. apart in the rows, and ½ in. deep, and with their long axis horizontal. They are then watered heavily and shade is placed over them. Watering is thereafter carried out twice daily in dry weather.

Germination begins on the 8th day and continues to the 30th day; later germinated seedlings appear weaker than the others and may not be worth using. As soon as the cotyledons are above ground the seedlings should be transplanted to baskets.

(b) *Transplanting to Baskets.*

The standard basket used by the Department is 9ins. diameter at the top, 4 to 4½ins. at the bottom and 9ins. high. Smaller baskets can be used but bamboo pots are not recommended.

A mixture of 1 part cattle manure, 1 part coarse sand and 1 part jungle soil is considered to be the best to use. These ingredients should be well mixed before the baskets are filled.

A small stick is used to lever the seedling out of the sand beds. The shoot should be grasped firmly and care taken not to damage the seedling when it is lifted and placed in the prepared baskets. Particular care should be taken to see: (1) that the cotyledons are not broken off; (2) that roots are not bent or inverted (this can be avoided by making a suitably sized hole in the basket soil and carefully inserting the root into it); and (3) that stems are upright.

(c) *Basket Nurseries.*

Heavy shade is required. The Department has used attap "lean-to" sheds with the roof sloping back from about 7ft. above ground and these have proved very successful, but the shade of rubber trees may also be used. Seedlings suffer if exposed to direct sunlight for more than one or two hours per day.

Seedlings should be watered immediately after transplanting and subsequently twice a day if under attap shade. The seedlings will be ready for transplanting after 4 to 6 months.

An Alternative Method.

Another method of raising nursery seedlings is by direct planting in nursery beds, the seeds being spaced 1ft. apart. The beds must be well cultivated, well manured, and completely shaded with a roofing of palm leaves. The young plants may be transplanted when about 4 to 5 months old or they may be left in the nursery as long as 12 months. They are then dug out carefully with a ball of earth and transplanted into a prepared planting hole. This method has not yet been tried in Malaya, and, in order to conserve planting material the raising of plants in baskets is the method being practised.

Planting in the Field and the Provision of Shade.

Cocoa is usually planted in the field at about 12 x 12 ft., and various plants are used to provide both temporary and permanent shade. In a few countries, however, much closer planting, 6 or 8 ft. apart, is used and with this close planting permanent shade is often dispensed with. Temporary shade is considered

essential. Van Hall (1) mentions that, although cocoa has been grown without temporary shade in a few areas in Brazil and Ecuador, it cannot be recommended. Cheesman has stated that cocoa must have shade and protection when young. (4)

When planting in the field, normal planting holes 2 x 2 x 2 ft. are suitable. In the case of newly cleared land, jungle mould may be used to fill the holes, but in previously cultivated areas it is necessary to obtain turf, weeds or any suitable green material and to mix them with cattle manure or compost. The seedling may be planted while still in its basket as the latter will soon rot away but, provided the ball of earth is not broken in the process, it may be preferable to split and remove the basket.

It is usually considered necessary to provide temporary shade in two stages which may be termed primary and secondary.

Primary or "Ground Shade".

This can be provided by three methods.

(1). Planting low growing food crops such as keladi and tapioca. This is common practice in many of the older cocoa growing countries but it is clear that this method is only suitable when these crops will give worth-while yields without manure and where a ready market is available for them.

(2). Planting bush covers such as *Tephrosia candida*, *Tephrosia vogelii*, *Cajanus indicus*, *Crotalaria anagyroides*, *Crotalaria usaramoensis* and *Cassia mimosoides*. The Crotalarias are, in Malaya, subject to a rust (*Maravalia crotalariae*) and for this reason often fail to provide the required shade. Although in some countries rows of these covers are planted as close as 2ft. from the cocoa rows, early experience in Malaya indicates that 3ft. is the minimum and probably 4 to 5ft. is a more suitable distance. To obtain maximum shade the rows should be planted north and south, although when the land is at all steep, contour planting will be desirable.

(3). Supplying rings of palm leaf shade around the plants until the secondary shade plants are shading the cocoa. There are indications on many plots in Malaya that bush covers produce a retarding effect on the cocoa and that, where bush covers have been dispensed with and palm leaf shade provided, better growth has been made.

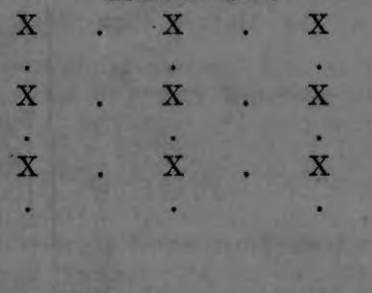
The bush *Leucaena glauca* is also often used as a primary shade and may be allowed to grow up and take over the functions of a secondary shade. It has been particularly popular in Java.

Secondary Shade.

More commonly secondary shade has been provided by bananas or *Gliricidia maculata*, the former being popular in the West Indies and South America. Well filled planting holes should be used for both these plants. When planting bananas

it will be best to choose a tall variety, such as *pisang embun*, the fruit from which finds a ready market. *Gliricidia* is planted by means of 6ft. cuttings which are placed upright in the planting holes. Shoots soon appear at the top of the cuttings and in this way leafy branches are produced at a height where they can give good shade to the cocoa. If the cocoa is to be planted at 12 x 12ft. the secondary shade plants should be planted 6ft. from it both within and between rows and there will then be twice as many secondary shade plants as cocoa plants. If the cocoa is planted at 8 x 8ft. it will only be necessary to plant one secondary shade plant between the rows in the centre of each square formed by 4 cocoa trees. The two methods are shown diagramatically below.

(i) Cocoa planted 12 ft. x 12 ft.

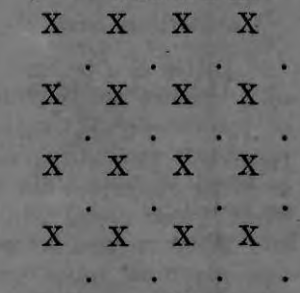


X = cocoa tree

Stand per acre:

Cocoa	302
Secondary shade	605

(ii) Cocoa planted 8 ft. x 8 ft.



. = banana

Stand per acre:

Cocoa	680
Secondary shade	680

Tertiary or Permanent Shade.

It will be necessary in Malaya, if permanent shade is found desirable, to find a suitable species which will grow reasonably quickly but which will also last well and will not succumb to disease. At present the following species are considered to be worth trying:

Enterolobium saman (Rain tree)
Peltophorum ferrugineum (Batai)
Parkia speciosa (Petai)
Albizzia odoratissima
Parkia Roxburghii
Adenanthera pavonina (Saga)

[*Albizzia falcata* (*moluccana*) is being tried in some of the earlier planted plots but owing to its habit of dropping branches and its susceptibility to root disease it is not now recommended for trial.]

These shade trees should be planted in well manured planting holes since it is essential that they should make good growth and be shading the cocoa by the time the secondary shade has been crowded out by the cocoa.

There is another method of establishing cocoa in the field which has been used in West Africa when opening new areas from jungle. In this method the trees which form the tallest canopy are left standing and all the other vegetation is removed and replaced by cocoa. Temporary side shade is usually provided by planting bananas, *Gliricidia* or tapioca around the plants, though an attempt is now being made to leave such an even top shade canopy that other planted shade will be unnecessary. Under this system forest seedlings are also encouraged to grow in order that there may be replacements for the big jungle trees which from time to time will fall. The whole system is based on the sound theory that it is desirable, as far as possible, to maintain the soil undisturbed and in the same condition as it was in the original jungle.

Cultivation and Maintenance of the Mature Plantation.

Little can be said of the tillage and weeding requirements of a mature cocoa plantation since wide differences of view and of practice exist in the main cocoa growing countries. While in many countries tillage is held to be superfluous it is of interest to note that in Surinam on heavy clays it is regarded as beneficial.

With regard to weeding, clean weeding, selective weeding, and slashing have been practised, though the former is not now at all common. An occasional slashing will probably be sufficient in a well grown mature plantation where the trees are covering the ground, and indeed the shade may be so heavy that practically nothing will grow. In young plantations, however, weeding policy has to be given much greater consideration. It is generally agreed that grasses are undesirable and, until more exact information on the effect of weeds on young cocoa is available, a system of selective weeding, in which grasses are eliminated and leguminous creepers and 'soft weeds' are encouraged, is advocated in combination with regular close slashing.

Pruning.

The cocoa tree has a peculiar characteristic habit of growth of its own. The stem grows straight up for a period of about 12 to 18 months and then when at a height of 3 to 5 feet, it ramifies from one point into 3 to 5 main branches. This ramification is known as jorquetting. These main branches continue to grow outwards but vertical shoots appear both on them and on the main stem. These vertical shoots, known as chupons, will jorquette again to form new branch systems. The branch shoots are known as fan shoots. It often happens that large numbers of chupon shoots or suckers appear from the base of the stem and, if these are left, a tree having a large number of main stems will be formed. In some countries such trees are allowed to develop, and in all cocoa growing countries trees with two or even three main stems are quite

common. Van Hall (1) points out that if several stems give a higher yielding tree than one stem, then this is only an indication that the trees have been planted too far apart. He considers that there is only one case where it is necessary or desirable to allow a sucker to grow up; this is when the main stem has been physically damaged or attacked by insect pests.

Pruning is not recommended before the third year after planting out. The tree will develop normally if shade is adequate and the soil suitable. After that, regular treatment once a year is usually considered desirable though no heavy pruning is carried out. The yearly round merely consists of removing the base chupon suckers (or " water shoots ") close to the stem and removing all dead or diseased twigs or branches.

Manuring.

Nothing is known of the manurial requirements of cocoa in Malaya. It is generally agreed that if cocoa is going to be a successful crop here it must be capable of growing and cropping reasonably well on newly opened land without large manurial applications. It may be shown later that manures can produce economic responses but if satisfactory growth cannot be obtained without them the prospects of cocoa growing cannot be regarded as very bright. It may be well worth while, however, to apply a small dressing of artificials shortly after planting, and a dressing of 4 ozs. NPK per tree, as recently recommended by Pound (5) for cocoa in British Honduras, may with advantage be applied 3 months after planting. A suitable mixture would be as follows:

1 part sulphate of ammonia
2 parts rock phosphate
1 part muriate of potash

Pests.

Of some 60 insects found on cocoa in Malaya, only half a dozen have been selected for detailed mention, these being the most serious pests in the field. Pre-war studies were summarised by Miller (6).

Leaves and Succulent Shoots.

The cockchafer, *Apogonia cribricollis* Burm., is a shiny, black beetle 3/8 in. long which feeds on the leaves from dusk onwards through the night. By day it lies buried near the surface of the soil in which the cream-coloured spherical eggs are laid which develop in 7 days into root-feeding " white grubs ". Dusting with DDT and Agrocide 3 or spraying a wettable DDT or lead arsenate (1 lb. in 25 gallons of water) gives some control but requires repetition in wet weather in order to maintain a poisonous deposit on the leaves which may be so heavily attacked as to be skeletonised.

The citrus mealybug, *Pseudococcus citri* (Risso), is a convex, oval insect covered with a fine white powder; it sucks sap from the plant and may cause a leaf crinkle or even a severe deformation of the shoot. Spraying with White Oil or nicotine compounds checks it to some extent but not so rapidly as some of the new systemic insecticides such as TEPP or Parathion (E605). These pyrophosphates are very strong poisons and even at the low concentration of only 1 part in 3,000 parts of water require most careful supervision in application.

The very convex, densely wax-covered mealybug *Phenacoccus iceryoides* Green, found more abundantly on dhal and other shade crops than on cocoa itself, is also checked by pyrophosphate sprays. It is spread by the honey-coloured ant *Anoplolepis* (*Plagiolepis*)*longipes* Jerd. which nests in the soil and feeds on the sugary secretion of the mealybug.

Stem-Borers.

The red coffee-borer, *Zeuzera coffeae* Nietn., is the reddish caterpillar of a moth with translucent wings spotted with black and metallic blue, the body being covered with white hairs. Damage consists of tunnels made in stems after the caterpillar has hatched from the eggs laid on the bark. Control of all internal borers is difficult but injection into the burrows in the main stem or branches of a pyrethrum compound such as "Pyrethrex" is recommended. Injection is best done with a hand oil squirter.

Shot-hole Borers.

Two small brown beetles are found tunnelling in the twigs. The larger, measuring 1/8 in. long, is *Xyleborus mancus* Bldf. and the smaller, only 1/20 in. long, is *Hypothenemus areccae* Horn. recorded before the war as a secondary pest in dried pods. Control is best attempted by spraying with one of the pyrophosphates mentioned under the citrus mealybug.

Pods.

The mosquito bug, *Helopeltis theobromae* Miller, is a small green-bodied plant bug with black and yellow legs and long antennae. Damage is caused by the feeding of the wingless young and winged adults resulting in small, circular black scars on the pods. Heavy attacks lead to decay or premature fall of the fruit. Dusting at the rate of 12 lbs. per acre with Agrocide 3 at intervals of 6 or 8 weeks has been found to be the best treatment. As only a few insects per tree can cause severe damage, this dusting must be done very thoroughly.

Squirrels can be very troublesome especially in areas close to the jungle. They will often destroy large numbers of ripe or immature pods. Shooting is the usual method of dealing

with these animals but cage traps are cheap and have been used very effectively on the cocoa plot at Temerloh (Pahang). Rats are also occasionally troublesome and poison baits or traps may be used to destroy them. These methods, together with periodical systematic searches for holes and nests, usually prove effective.

Diseases.

Red root disease, caused by *Ganoderma pseudoferreum*, is the most serious affection of the root system. This fungus disease, also common on rubber and tea, kills groups of trees by spreading from an initial point of infection by root contact. *Gliricidia maculata*, commonly used as a shade tree, is also attacked. All infected plants should be dug out carefully to remove all diseased roots, which should be burnt.

The leaves and stems are commonly attacked by thread-blight. The conspicuous white cords of mycelium of this fungus spread over branches and leaves and ultimately kill them. The disease is disseminated by means of dead leaves or small pieces of branches on which the fungus is growing. All dead branches should therefore be cut out and burnt.

Red dust is a disease caused by the alga *Cephaleuros parasiticus*. Small round spots are formed on the leaves, and, on the branches, cankers may be produced which cause die-back. This disease, which can be recognised by the red fructifications formed on the underside of the leaf spots and on the cankers, only attacks bushes which for some reason are not making vigorous growth. Control can be achieved by improving growing conditions.

Very serious diseases attack cocoa in other parts of the world but have not been recorded in Malaya. These include Witches' Broom disease, caused by the fungus *Marasmius perniciosus*, which occurs in Trinidad and South America, the virus disease Swollen Shoot which is found only in West Africa, and Phytophthora pod rot and canker caused by the fungus *Phytophthora palmivora* which is widespread in cocoa growing countries.

Fruiting and Harvesting.

Flowers are borne on the main stem and on the branches. A period of 4½ months elapses between flowering and ripening. A very small proportion of the flowers actually set fruit but in most cocoa growing countries fruit is set and pods harvested in all months of the year though there will be one or two peak periods. Red pods turn orange when they ripen; green fruits turn yellow, though in rare cases they may merely turn a paler green. The pods contain from 20 to 40 seeds and 1lb. of dry cocoa will be obtained from 10 to 12 pods.

Harvesting of pods within reach can be done with a parang; for pods high in the branches a special cocoa hook is required which will enable the harvester to cut the fruit stalk by either pushing or pulling. A suitable type of blade and hook is illustrated below.

Harvesters are usually followed by labourers who gather the picked pods into heaps. Lastly the pods are split longitudinally for the removal of the beans which are embedded in a white mass of pulp.

Preparation of Cocoa Beans for Market.

Cocoa is prepared for market by (1) fermentation, and (2) drying.

(1) *Fermentation.*

This process is carried out in square fermenting or 'sweat' boxes about 5 ft. wide and 6 to 7 ft. deep, set in rows of six or seven boxes. A good quantity of cocoa is required for the fermentation process to proceed satisfactorily. The boxes must be filled therefore to a height of at least 3 ft. Fermentation proceeds for 5 to 7 days and during this period the sugar in the pulp is converted into alcohol, then into vinegar, and finally runs off through holes in the bottom of the sweat boxes. The mass of cocoa beans and pulp has to be turned daily from one box to another in order: (1) to secure uniformity of fermentation by mixing the mass; (2) to prevent the temperature rising too high; and (3) to give aeration. In some countries the cocoa is washed after fermentation.

(2) *Drying.*

Sun-drying is the usual practice and it is often carried out on barbecues which can be pushed away on rails under cover when it rains. Alternately, movable roofs can be used on an immovable flooring.

Yields.

Yields vary widely. The Nigerian standard has been given as about 860 lbs. of dry cocoa per acre. (3). Trinidad average yields are said to be not more than 300 lbs. per acre, though this includes beans from many very poor and diseased areas not really suitable for cocoa. On the other hand good clones have yielded 1 ton per acre or more, and Cheesman (4) was of the opinion that, unless some unforeseen deficiency is discovered, the Pahang volcanic soils of Malaya should be capable of producing yields of this order when planted with the best clones. The Department's plot of 3/5th acre, containing 151 trees, at Cheras (Selangor), yielded the equivalent in pods of 675 lbs. dry cocoa per acre in the 12 months February 1948 to January 1949. (2)

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(1) Van Hall, C.J.J. Cacao. 1932. MacMillan & Co.

(2) Hartley, C.W.S. Investigations into the Growing of Cocoa in Malaya, *Malayan Agricultural Journal*, Vol. XXXII, No. 2, April 1949.

(3) Faulkner, O.T. and Milsum, J.N. Cacao. An Introductory Note. *Malayan Agricultural Journal*, Vol. XXVI, No. 1, January 1938.

(4) Cheesman, E.E. Report on the Potentialities for the Cultivation of Cocoa in Malaya, Sarawak and North Borneo. H.M. Stationery Office. Colonial 230. 1948.

(5) Pound, E.F. Memorandum on Cocoa with Particular Reference to Conditions in British Honduras. Trinidad 1948.

(6) Miller, N.C.E. Insects Associated with Cacao (*Theobroma cacao*) in Malaya. *Bull. Entom. Resch.*, Vol. 32, January, 1941.

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The types will be considered in three groups: (a) Criollo, (b) Forastero, and (c) Trinitario.

(a) *Criollo.*

A fairly distinct type characterised by plump, round beans which are white in cross section; by pods which generally taper to a point and which are sometimes slightly curved or assymetrical; and by fruit walls, which have ten distinct furrows, are rather 'warty' and can be easily cut. There are many local types, and the pods though usually red are sometimes yellow.

The Criollo type is said to be less vigorous than others and to demand higher fertility conditions. It produces a cocoa which is of exceptional quality but demand is limited as it is only used for grading and flavouring certain classes of chocolate.

AMENDMENT TO AGRICULTURAL LEAFLET No. 27.

COCOA.

PRUNING.

(*Page 7.*)

TERMS COMMONLY USED.

The terms are largely derived from the Spanish but are universal in cocoa-growing countries.

A cocoa tree has two distinct types of growth. These are:

Chupons (suckers, watershoots and seedlings).—These grow vertically and the leaves are arranged spirally. Buds from chupons grow into chupons.

Fans (side branches).—These grow horizontally or mainly so and the leaves are arranged in one plane. Buds from fans grow into fans.

NORMAL GROWTH.

A cocoa seedling starts off as chupon growth until it reaches a height of 2 to 6 ft. Vertical growth abruptly ceases and from two to five fan branches are produced. The point at which this change takes place is known as the *Jorquette* (pronounced *Horquette*). Jorquetting normally takes place when the plants are about 1½ to 2 years old.

The young tree obtains additional height by one or more of the buds below the jorquette sprouting and giving rise to vertical chupon growth. These in turn jorquette to produce more fan branches.

A cocoa tree therefore grows up in a series of tiers—chupon, jorquette, fans.

Pods are produced on both chupon and fan growths.

A cocoa tree normally rejuvenates itself by the production of chupons near the base of the trunk; these, if low enough to the ground, will produce their own roots and will eventually replace the original trunk.

PRUNING.

As a generalisation pruning need be confined only to the removal of excessive chupon growth. There is no need to prune fan growth.

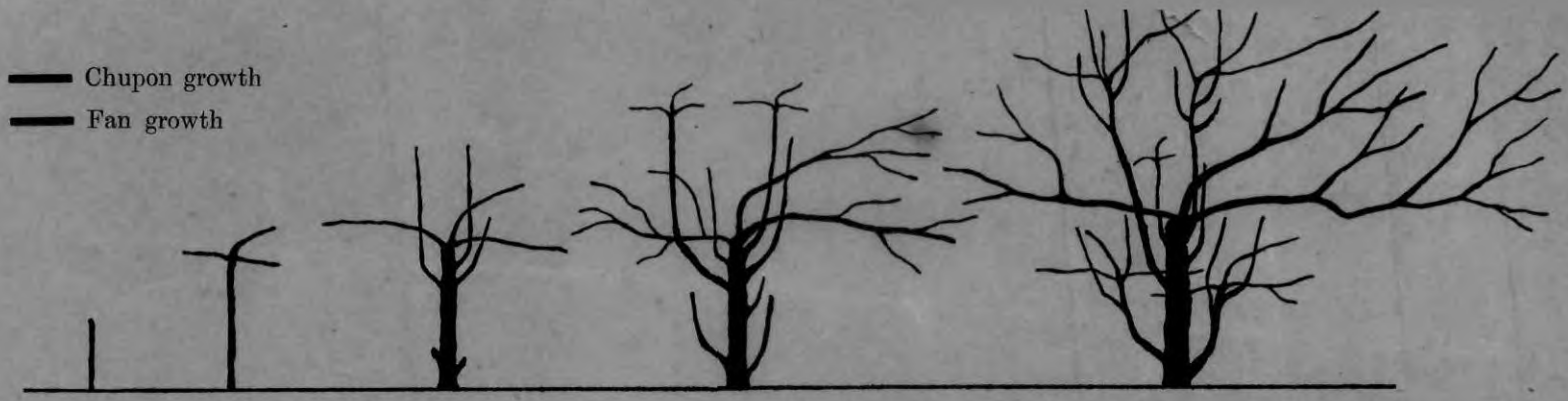
Seedlings.—The aim is to obtain a single stem. This will occur naturally unless the apical shoot has been damaged. If it has, then several stems will arise. If the plant is growing strongly remove all but the best of these; if not growing strongly, leave the lot until the plant is growing well—then prune.

After jorquetting.—Only one or two vertical chupons should be allowed to grow through the fan canopy to carry the tree up to the next tier. These one or two should arise just below the jorquette. All other chupons (suckers) should be removed.

Chupons at ground level.—If the trees are widely spaced, i.e., more than 11 ft. apart, it may be advantageous to leave one or two chupons provided they are forming their own roots. Remove all others.

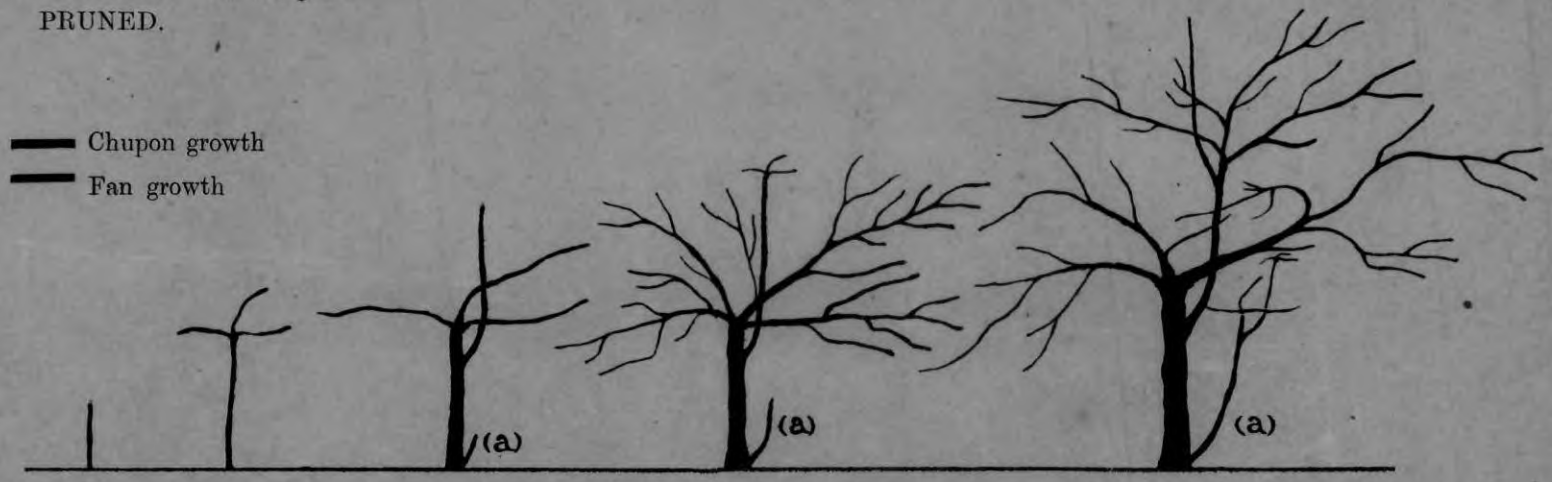
May, 1950.

UNPRUNED.



1st Jorquette

PRUNED.



1st Jorquette

NOTE.—Chupon at "a" should have been removed if cocoa at 11 ft. apart or less.
Pruning confined to removal of unwanted chupons (sucker growth).