



PLATE 1.—A Robusta coffee nursery being weeded.

ROBUSTA COFFEE IN SOUTH-EAST PAPUA

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The author, until recently District Agricultural Officer at Samarai, in this paper describes the cultivation of robusta coffee as a guide to European planters. Mr. Cole points out the firm nature of the market for robusta which exists in Australia, then outlines the procedures for establishing the plantation, including clearing, establishment of shade, nursery practice, transplanting and maintenance. He stresses the need for care in processing the coffee and emphasizes that faulty processing may spoil a high-grade bean.

THIS article is primarily intended for owner-planters in the Milne Bay district who are beginning to plant robusta coffee (*Coffea robusta*, a variety of *Coffea canephora*). Most of the findings discussed in this paper will also apply to other areas, but it is emphasized that they are the result of trial, observation and experiment carried out by officers of the Department of Agriculture, Stock and Fisheries stationed at Samarai.

Robusta coffee is not regarded as highly on the world's markets as its Highland cousin, arabica (*C. arabica*) but it enjoys a firm share of the Australian market, which is expanding.

The darker and sharper-flavoured robusta is used mainly in soluble coffee extracts, for espresso-type coffees and in many of the cheaper blends, or mixed with chicory.

The lower return for robusta coffee is partly offset by other factors—good yields and cheaper access to shipping points than in the Highlands—but the successful robusta planter must ensure that his return is maintained by efficiency of production.

This article should be read in conjunction with an earlier publication on arabica coffee (J. W. Barrie's "Coffee in the Highlands of Papua and New Guinea", *P.N.G. Agricultural Journal*, Vol.

11, No. 1) as many of the procedures are very similar to those used with the Highlands crop.

As the name implies, robusta coffee is a vigorous tree. If left to its own devices it will quickly grow into a tree more than 20 feet high and produce masses of suckers and laterals. Its leaves are large and glossy and the tree has a handsome appearance. There is a considerable variation in size, shape and vigor in the robusta coffee in Papua and New Guinea. This variation seems of little importance, though extreme types should be rogued out. Robusta may be differentiated from arabica by greater vigour, larger leaves and smaller beans. It may also be differentiated from liberica (*C. liberica*) which has very large leaves, is extremely vigorous, has very large cherries and is much slower to reach bearing. Liberica coffee is of little value.

The robusta coffee growing in the Milne Bay district was derived from two sources. In early experiments, seed was obtained from Popondetta but this was discontinued when it was noted that there was a great variation in tree type and later in bean size. All later introductions of seed came from the Lowlands Agricultural Experiment Station at Keravat, near Rabaul. This has resulted in a much more even line of trees, although variations are still present. A certain amount of variation is necessary as robusta coffee is to a large extent cross-pollinated and in most cases is self-incompatible. Therefore, it is essential when choosing mother trees for seed to select six or eight trees and to mix up the progeny of these trees as much as possible to ensure good fruit set. Similarly, if seed is purchased from native growers it should be obtained from two or three growers and bulked before planting in the nursery.

It is proposed to discuss the culture of robusta coffee under the following headings:—

1. Soils and climate.
2. Land preparation, nursery establishment and plantation management.
3. Pests and diseases.
4. Harvesting and processing.

SOILS AND CLIMATE

In the Milne Bay district, robusta coffee does well on a variety of soils and under a variety of climatic conditions. The best soils appear to be the acid, deep, well-drained, friable loams along the rivers and creeks or at the base of the ranges.

Even so, the silty gravels and gravelly loams of the D'Entrecasteaux Islands support thriving coffee gardens.

Robusta coffee appears to grow best at altitudes up to 1,500 feet, although some very healthy gardens occur in the Mullins Harbour area at 1,700 feet or more. However, growth rates appear slower under these conditions. Along the coast on suitable soils growth is vigorous and trees fruit heavily.

A most important factor is the available rainfall. Coffee does not flourish unless the rainfall exceeds 75 to 80 inches and is well distributed during the year. An even higher rainfall is preferred. Marked seasonal rainfalls as on the North-East Coast-Cape Vogel area and Good-enough Island are not suited to robusta culture. Similarly, heavy clays, laterites, ironstone gravels, Kunai country, calcareous soils, steep slopes and shallow soils do not favour successful robusta coffee growth in this area. Robusta will put up with periods of drought of two to three months but if the drought continues growth ceases and the plants droop and may drop the fruit.

Periods of heavy consistent rain, which occurs in Milne Bay and the Sagarai Valley in particular, appear to do no harm. Recently, coffee trees in the Sagarai area were inspected after they had been subjected to 12 weeks' almost continuous rain. The trees were healthy and vigorous despite the lack of sunshine, although the soil was almost liquid mud. These trees were often standing in water for several days at a time, but appeared to have suffered no harm. Even where rainfall often exceeds 150 inches a year, the robusta flourishes, provided ground water does not become stagnant and free drainage of excess water can occur when the rain stops.

LAND PREPARATION AND NURSERY ESTABLISHMENT

Clearing, lining and holing

The best land for coffee culture is that which has been under forest cover for several years. Successful plantations have been established on old garden areas, but the built-up fertility of forest land gives the coffee trees a good start and the lack of weed infestation is an advantage.

Trees should be felled during the latter stages of the south-east wet and allowed to dry. With the onset of the doldrums in October-November

a good burn should be obtained, and, after picking up, the land should be relatively clear for pegging of lines and holing. Usually, it is unnecessary to grub the stumps for coffee as most of the stumps are softwood and soon rot out. Except for primary forest land or on land which has been under regrowth for many years there will be very few hardwood stumps to worry about. A good burn is rarely obtained in the April-May doldrums and if the forest is cut too early in the wet the regrowth is so vigorous that a second clearing is needed, or a very poor burn will be obtained.

Once cleared, the pegging of the land can be carried out. A large number of sharpened stakes about six feet long and about an inch in crown diameter will be required. Approximately 500 trees are planted per acre and each tree will be represented by a peg.

Pegging or lining may be on either the triangle or square, to give tree distances of at least 10 feet. The triangle is preferred as it gives about 13 per cent. more trees per acre. A non-stretchable wire may be used for pegging but we have

found two poles just as effective, once a good base line is established. Boys do not lose the sticks or break them as easily as they do with wire.

The technique used is to peg out a straight base line at 10-foot intervals. This base line should, if possible, be parallel to the direction of the main prevailing wind. This will vary somewhat due to peculiarities in local relief. Once the base line is established, two sticks exactly 10 feet long are needed for further pegging. By placing one end of a stick against a base line peg and an end of the other stick against an adjacent peg and bringing the two free ends together an equilateral triangle is formed. The point where the two sticks meet is pegged as the position of a tree. A move is now made along the base line to position further pegs. The ends of rows can be cornered out by a slight manipulation of the sticks. It has been found that native labourers become proficient at this form of pegging after a few minutes' instruction. A minimum of four labourers is required though five work much faster. The only points to be careful about are :—



PLATE 2.—Marking out exercise for native *Robusta* coffee.

1. The base line must be straight and accurately pegged for intervals.
2. The sticks must be accurate for length.
3. The sticks must be accurately placed against the pegs and the ends must meet cleanly.

In pegging, near enough is not good enough. A small error is carried on and multiplies as pegging continues. If a space is left for a roadway it is advisable to peg a new base line rather than attempt to carry the old line across the road. By pegging a new base line, any errors in the previous area are discarded in the new block. After pegging, a quick look along the line and along the diagonals will reveal errors in pegging.

Once the land is pegged, holing and planting of shade may be started.

Well-prepared holes give the young coffee tree a very good start. If the planter has been overambitious and has cleared and pegged too great an area for his labour to handle, he would do better to abandon an area temporarily rather than skimp on holes and shade.

In this district it has been found that holes which measure two feet by two feet give very good results. Small holes lead to root restriction and slower growth. Larger holes are no doubt better, but are more expensive to dig.

The holes should be dug as soon as possible before planting and left open to the weather. During the digging, the topsoil and subsoil are separated by placing on opposite sides of the hole and not in the row. Approximately one month before planting out the coffee, the holes should be filled with topsoil only. All stones are discarded and the replaced soils are mounded over the hole. Just before filling the hole it is as well to stir up the soil in the base of the hole as this may cake if much heavy rain has occurred. The replaced soil will tend to settle and if this is excessive more soil should be added to the mound.

Shade Establishment

Under the conditions prevailing in the Milne Bay district, robusta coffee will not grow without shade. A total lack of shade, even in very cloudy areas such as the Sagarai Valley, results in stunted plants, yellowing and sunburning of the leaves, defoliation and even death of the plant. Insufficient shade results in yellow leaves, sunburning and retarded growth. Where shade is

adequate the trees are a healthy colour, grow well and begin bearing about two years after planting out.

Both temporary and permanent shade should be planted as soon as possible after lining and holing. If planted at the beginning of the north-west wet it will be well grown by the beginning of the south-east wet and coffee planting can proceed in the most favourable season. Well-grown and vigorous shade will also help to control any weed problems.

Permanent Shade Tree

The best shade tree for robusta coffee is *Leucaena glauca*. It is advisable to inoculate *Leucaena* seed before planting and it will be found that, once established, growth will be rapid and a good cover obtained. The main drawback is the large number of seedlings which come up. Provided the original trees are well grown, these seedlings are suppressed and can be dealt with, but if neglected, or if the original shade or cover is weak, a veritable jungle can occur.

It has been found that the best planting distance for *Leucaena* is 10 feet apart, initially. As the shade trees grow they can be thinned out considerably and still provide adequate shade cover. It must be remembered that it is easy to establish shade before the coffee is planted and it can always be removed if too heavy, but it is extremely difficult to establish shade in mature coffee if the original shade cover was too light. An excess of shade in the early life of a plantation is a good fault. It must be remembered that coffee planted with inadequate shade will be set back and may be a total loss. Therefore, no attempt should be made to plant coffee until the shade is right.

There are two techniques for planting shade trees :—

1. Planting seed at stake.
2. Planting rooted seedlings or cuttings.

With seed, a small area of soil midway between two pegs is stirred up with a knife point and a slight depression made. Four or five inoculated seeds are dropped into the depression and about a quarter to half an inch of soil is gently pushed over them. Germination will occur in four or five days if conditions are favourable, and provided weeds are controlled satisfactory shade will be established.

The second method is, however, recommended as being the better one. The *Leucaena* is raised in a nursery bed using inoculated seed and when three or four feet high the seedlings are pulled up or trenched out. The seedling is trimmed by cutting off the top nine inches or so and all lateral branches and leaves. About four or five inches of tap-root is left and all lateral roots are trimmed off. The seedling, or whip as it now is, is planted out by making a hole with a crowbar or pointed stick and pushing the tap-root down into the soil at the bottom of the hole. The hole is filled in by breaking soil off the sides of the hole. Using this method in moist soil or during rainy weather, we have had very few whips fail to take. One whip should be planted midway between two coffee pegs and further whips about six inches on either side of the central one. The whips usually shoot in about 10 days and if planted in suitable soils in January or February will be 10 to 12 feet high by June-July and will be providing a good cover within less than a year.

The nursery for the *Leucaena* seedlings should be established where it can be watered and where the soil is easily worked. A bed about four feet wide is dug up and the soil broken down to a reasonably fine tilth. The actual length of the bed will depend on the convenience of the individual planter. It is important to eliminate all weeds as they will grow faster than the *Leucaena* in the early stages and may suppress or kill it. Rows are marked out about nine inches apart, leaving a pathway in the centre of the bed. Seeds are inoculated and distributed along the rows. From eight to ten seeds per foot are sufficient as more will result in very spindly seedlings and less will cause excessive lateral branching. In three to four months, depending on weather, the seedlings will be ready for transplanting.

The method used to get the seedlings out of the ground will depend on personal preference. Good labour will pull from 500 to 1,000 or more seedlings in a day but poor labour or untrained labour will pull only 200 to 300 seedlings in a day and will end the day with blistered and skinned hands. If difficulty is being encountered it is far better to trench out the seedlings, especially if they are very well grown.

Temporary Shade

Once the permanent shade has been planted out, the temporary shade may be planted. It is

not absolutely necessary to plant temporary shade, but it has the following advantages:—

1. It enables the coffee to be planted out sooner.
2. It forces the *Leucaena* to grow up rather than out.
3. It helps to suppress weed growth.

The best temporary shade for the district is *Crotalaria anagyroides*. It grows rapidly and seeds freely and will last up to 18 months, although it is not needed after the first year. In its later life it becomes defoliated and straggly and serves no useful purpose. It is also susceptible to rust disease, leaf virus and pink disease, but these rarely cause much trouble in the first nine to 12 months of growth, by which time the plant has served its purpose. The *Crotalaria* plants may be removed by slashing with a knife and can be stacked between the rows. In a few months the plant will have completely rotted away. The stumps of the slashed plants rarely recover and the root system will also rot away quickly.

It has been found that the *Crotalaria* need not be planted as thickly as in the Highlands. The seed is planted in the coffee row and, starting about six inches from the edge of the hole, a small area of soil is broken up and three or four seeds dropped into the soil and covered. Further seeds are planted at about 12-inch intervals along the row and so on until the space between two pegs has been filled in. Germination will occur in a few days and growth will be rapid, provided the soil is moist and early weed competition is eliminated. This method does not use much seed, but provides sufficient temporary shade. Shade control can be achieved by partially slashing back the *Crotalaria*, should it become too heavy or overhang too much.

Nursery Establishment

This is one of the most important steps in ensuring a successful plantation. If the coffee seed or seedlings are not good it is impossible to obtain good producing trees.

The seed may be obtained from the Department of Agriculture, Stock and Fisheries or from native growers in Milne Bay. If obtained from native growers, then two or three growers should be chosen and the seed bulked. It is advisable to select healthy, vigorous, heavy-bearing trees

with fruit which is uniform in size, then no trouble will be experienced in processing the eventual crop.

Those who are interested in selecting their own seed or buying native-produced seed are advised to read the section on seed selection in

Coffee in the Highlands (Barrie, 1956).

Coffee seed should be planted out as soon as possible as it does not keep well. To save time and effort, it is advisable to plant the seed in a germinator bed first, and while the seed is germinating—it takes from four to six weeks—the nursery beds may be prepared. A suitable germinator need be only a few square feet in area but it must be well shaded and near a water supply.

An area of loamy soil is dug and a fine tilth obtained. The seed is placed flat side down in rows on the surface and covered with a layer of Kunai grass or a bag and well watered. The seed must be kept damp and shade must be provided or germination will be most erratic. From about the third week frequent inspection should be made for signs of germination. As soon as the seeds germinate they should be transferred to the main nursery beds. It is not necessary to wait until leaves appear before removing the seed to the beds. If removed as soon as the radicle appears there is no danger of bench-rooting, but if left till bigger the seed is easier to handle. Some growers prefer to move the seed as the radicle appears and before it achieves any length.

The main nursery bed should be sited near a water supply and as near to the planting area as possible. Good soil is essential if the seedlings are to grow well. The beds should be about five feet wide, as long as convenient and be well dug to remove weeds, roots and stones. The ground should be mounded up to provide good drainage. The application of a good mixed fertilizer may be helpful in some circumstances.

A shade shelter must be built over the nursery bed and should be high enough to allow labourers to move underneath it to weed the seedlings. A five-foot-wide bed should allow for four lines of seedlings and a pathway between the two inside rows of seedlings.

The seedlings should be planted nine inches apart in the row and the rows should be nine inches apart. Initially, the shade should be heavy but it can be reduced as the seedlings



PLATE 3.—Shade opened up to allow light through to *Robusta* coffee seedlings.

grow. Plaited coconut fronds provide suitable shade in the early stages and later green coconut fronds are suitable as they automatically reduce the shade supplied as the fronds dry out.

The actual length of time in the nursery depends on when the seed was obtained and also on personal preference. In Milne Bay, most coffee ripens in June and July and so seed must be collected then, but seed is available from other areas much later in the year, even December. It has been found that coffee transplanted in June or July makes much better growth than coffee transplanted in September or even during the north-west monsoon. Therefore, seedlings can be from six to 18 months old when transplanted. If care is taken with the transplanting, good results can be obtained with seedlings six months old, or even younger. When the seedlings are older they are easier to handle and recovery is quicker from transplanting.

Irrespective of when the seedlings are transplanted, care must be taken to avoid benched tap-roots. Benched tap-roots are caused when

tap-roots are bent during transplanting and will result in a weak and unprofitable tree. When older seedlings are being used, the use of root pruning eliminates bench rooting, but with younger seedlings the tap-root should be pruned when the seedling is dug up.

Root pruning of older seedlings is carried out in the nursery about six weeks before transplanting. A spade is pushed into the soil about four inches away from the base of the seedling. The handle of the spade is tilted down and the end of the blade severs the tap-root with a distinct snapping sound. The plant is firmed down in the soil and left until needed. The young plant responds with a mass of new root growth which binds together a ball of soil around the root system. Transplanting is thus facilitated as the plant may be moved with the ball of soil and is not set back very much.

When younger plants are used, the tap-root must be cut off after lifting. A sharp knife or secateur is needed and the root should be pruned well back. The temporary setback of heavy root pruning is a small price to pay for a healthy plantation later on. The remaining tap-root should be fairly rigid and should not bend easily and so cause bench rooting.

Transplanting

The holes for the young seedlings should have been filled about a month before transplanting and probably the most important step in developing a coffee plantation is about to take place.

If the planting is poor, a poor plantation will result. The planter should take note of the following points:—

1. Try to transplant during wet or dull weather. If the weather is sunny then transplant late in the day and water the seedlings.
2. Use only strong, vigorous seedlings.
3. Do not dig up more seedlings than you can transplant in a day.
4. If roots are not protected by a ball of soil, quickly cover with a wet bag to prevent drying out.
5. Do not waste time between digging up seedlings in the nursery and setting them out in the field.

6. Do not plant too deeply. The young tree should be planted out at the same depth as it was in the nursery. If planted too deeply, the lateral root system will not develop and the plants will be weak. Coffee is a surface feeder and must have lateral roots for this purpose.

7. Make sure seedlings are root pruned before transplanting.

If the above points are noted there should be no trouble in establishing the coffee trees successfully.

Pruning

This very important aspect of coffee culture must be included in plantation practice. Failure to prune trees properly will result in a loss of yield, or force trees into biennial bearing. The trees may also become too tall to work and grow a mass of suckers.

A number of systems of coffee pruning have been tried in Milne Bay and the Agobodia or "Arch pruning" method has been adopted as the most suitable.

The young seedling is allowed to reach waist height (say 3 feet 6 inches) before pruning. At the appropriate time the laterals on one side are removed and the tip cut off. The seedling is now bent in the direction of the row and fixed in the form of an arch by pegging with a hooked stick. Any laterals on the upper side of the arch, which would interfere with the growth of vertical shoots, are removed. In very wet weather, when the soil is soggy, it is also advisable to hold the base of the trunk with one hand when pulling over the tree because seedlings have been almost pulled up in the process of bending.

In a short time, vertical shoots will develop along the stem. It is usual to select four or five of these shoots as the future tree. The selected shoots should be evenly spaced and vigorous and as far apart as possible. These uprights will grow quickly and develop laterals and the original arch will become set. The end of the arch, which bears no uprights, may now be removed.

It should be borne in mind that the tree should be arched in the direction of the row. If this is done there will be no impediment to movement down the row and no resistance will be offered to the prevailing winds.



PLATE 4.—Arch pruning of *Robusta* coffee.

As the verticals age and become denuded of laterals, or grow too tall, they are pruned and new ones are allowed to grow. The laterals carry the fruit and eventually the lower ones become exhausted and must be removed. This results in a tree which is spindly and has a heavy top hamper. It will be noted that suckers develop from the base of the verticals and one sucker should be selected to replace a vertical which is removed. It is possible by this method to rework a tree and still keep it in bearing.

If trees are overcropping it will be necessary to prune back some of the laterals or remove excess cherries. This operation is best carried out early in the fruiting cycle before the trees are affected by the excessive crop. Trees which overbear will be poor bearers later on and may develop biennial bearing. With young trees it is best to limit the crop until the tree is fully mature.

When to Prune

The best time to prune is open to question. The original pruning to develop the arch may be done when the tree is sufficiently developed. Overseas authorities claim the best time to prune is when harvesting has been completed. The tree is then semi-dormant as the crop has ripened during the dry. However, in the Milne Bay area, ripening occurs during the wet and the tree does not appear to have a dormant period. Flowering does not usually occur until September, so there is a period when the tree has no fruit on it and pruning can take place during this period.

Generally, with arch pruning, apart from the replacement of worked-out verticals and the removal of exhausted laterals and excess suckers, there appears to be little required in the way of pruning. Heavy pruning will result in lower yields and may force excessive leaf growth at the expense of flowering. Therefore, it is

recommended that prunings be kept as light as possible. However, it is essential to remove all excess sucker growth at all times or the tree becomes unworkable.

Mulching

As the coffee tree is a surface feeder, it consequently has a large proportion of the root system in the surface soil. To protect this root system from drought and excessive temperature it is advisable to mulch the ground. It must also be remembered that mulching helps to return nutrients to the soil and maintains soil texture.

In view of African work on mulching, it would appear that complete mulching is not advisable in this area except in the lower rainfall areas. Alternate row mulching would tend to be indicated in wetter areas. It has been found that lack of mulching has no serious early effects, although soil depletion may occur in the long run if no mulching is carried out.

Unfortunately, there are no large areas of grassland to our main coffee areas. Elsewhere it has been found that *Themeda* spp (Giant Kangaroo grass) is most suitable, while *Imperata* spp (Kunai) is most useful. Unfortunately, neither of these grasses is available in the quantities needed, although Kunai is often freely available on coconut plantations.

Pennisetum purpureum (Elephant Grass) has been recommended. It has been found to yield a big bulk of mulch, but unless dried out very well it rapidly takes root from the stalks and takes over the plantation. Once established it is troublesome to eradicate and adversely affects the trees. If it can be dried out properly, then it is most useful as a mulch. This grass stands cutting well and yields a large bulk of green material per year.

Cover Crops

These are not recommended as they compete with the coffee plants for soil nutrients and appear to have an adverse effect on the coffee trees.

Weed Control

This aspect of plantation management cannot be neglected if coffee is to yield well. Weeds compete actively with the shallow-rooted coffee tree and yields fall off very quickly. The worst offenders are the grasses, such as Kunai, which not only lower yields but may even limit vegetative growth.

Proper shade, mulching and hand weeding are all useful and will keep the weeds within bounds. Constant attention will be required, for if the weeds get away it will take months for the trees to recover. The exception seems to be *Leucaena* seedlings which appear to do little harm if prevented from growing too big.

It should be kept in mind that weeds are also a harbour for pests and diseases. A tree weakened by competition is much more readily attacked and suffers much more heavily than a healthy, vigorous tree. The weeding line should be active all the time and an area needs to be weeded about every six weeks.

Pests and Diseases

So far no really serious pests or diseases have occurred in the Milne Bay district. The main pests attacking coffee are :—

1. Coffee stem borer

This moth bores into stems and on reaching the heart wood begins to tunnel towards the tip of the affected branch. The branch wilts and then dies or may snap off at the point of entry. Attack may occur on any part of the tree, although usually a point several feet above ground level is attacked. If a vertical branch is attacked then there is a serious setback to yield from that branch. At present there is no economical method of control but as yet damage is not serious.

2. Mealy bugs

A number of reports has been received of mealy bugs and their attendant ants infesting the fruit clusters. On occasion the young fruit may die from the attack. Control may sometimes be obtained by spraying with white oil at one per cent. No serious infestations have been reported.

3. Scale Insects

The only scale insects noted to date are a green scale and a brown scale. Neither is serious and they occur only on trees which have been weakened by excess weed growth or insufficient shade, or both. Healthy trees do not appear to be affected by these insects.

4. Thread Blight (*Pellicularia koleroga*)

At one period it appeared as though this disease would seriously hinder growth of coffee in the Milne Bay area. Diseased trees were defoliated and some laterals and diseased growing

tips were killed. It has been noted that clean coffee gardens are not badly affected, especially where there is a free flow of air through the plantation. Humid conditions, weakened trees and restricted airflow produce conditions favourable to the disease. Where trees are infested, dead foliage and branches bearing the threads (which may be found on the underside of the laterals) should be removed and burned and ventilation of the plantation should be increased.

5. Root Rots (*Fomes* spp)

Root Rots are mainly of the white type. They are not serious and account for only a few trees. The diseased tree dies. It has been found that tracing the affected roots and removing them eliminates the trouble. A trench is dug around the diseased tree and by working into the centre of the area roots are found and can be removed for burning. Provided all such material is removed and the soil replaced with soil from a non-infected area, a new tree can be planted in the position almost immediately.

At present there do not appear to be any other pests or diseases of consequence.

HARVESTING AND PROCESSING

The end result of all work in the plantation depends on these two stages. Lack of care and attention can spoil the final product, no matter how good the cherries are. It is impossible to improve poor cherries, but it is possible to spoil a good product. Only fully-ripe cherries should be harvested to ensure a high-grade product. If immature or over-ripe cherries are used, then an inferior product will result. Unfortunately, not all cherries in a cluster ripen together and if supervision is not good a mixed sample will be turned in by the pickers. It is difficult to give a colour classification for ripe cherries in this district. As the cherries ripen during the wet south-east season, there is little sunshine to colour the cherries. It has been found in the Sagarai Valley that the cherries turn yellow and have only streaks of pink colouring. Rarely does one see a well-coloured cherry under these conditions of heavy rain and dull, overcast skies. In Milne Bay, the cherries are usually coloured pink but rarely achieve a good deep red colour. In the D'Entrecasteaux Islands to date the cherries usually colour well.

The producer may well wonder how to decide when to commence picking. A good guide is to

pick a few cherries and press gently between thumb and forefinger. If ripe, the skin will split and the beans will be ejected easily. If a fair degree of pressure is needed to cause pulping, then the cherries are not ripe. Labour can be taught in a few minutes to select ripe cherries using this method.

The main picking season is May to August with June-July as the heaviest months. There will be some picking throughout the year, but mostly it will be of little consequence to the income of the plantation.

At present there are no accurate yield figures available. Trees in this area have completed two years in heavy bearing, show no signs of exhaustion or die-back and are heavily budded for the next flowering. As yet it is too early to say what ultimate yields will be, but at present they are heavy enough to be profitable and are increasing each year. Overseas authorities refer to yields in the order of 1,500 lb. of clean dry beans per acre. It is possible that these yields will be matched and even surpassed on the good silty loams in the better rainfall areas of the district.

Once harvested, the cherries should be transported quickly to the factory and processing should be commenced immediately. If the cherries are allowed to remain unpulped for too long, fermentation may take place in the heap. This can cause off flavours, discolouration and odours. All these are detrimental to the production of good-quality coffee beans.

The plantation owner is advised to have the morning pick pulped and placed in a fermenting vat as soon as possible after the midday break. The afternoon pick is then pulped and placed in a separate vat. Although this may double the number of vats in use, it is preferable to storing the cherries until late afternoon, with a consequent risk of a poor-quality sample.

The extra outlay in vats will be recouped by producing a superior product.

The bulked cherries should be dumped into a washing vat full of water and slightly agitated. Unripe and over-ripe cherries will float to the surface and may be skimmed off and treated separately as they produce an inferior grade of coffee. The ripe beans should be taken from the bottom of the vat and pulped before passing to the fermenting boxes.

The efficient working of the pulper will do much towards turning out a first-class product. It is necessary to have a good supply of clean water running through the pulper when the cherries are going through. If the pulper is adjusted too tightly, then many beans will be nicked or broken. Beans which have been nicked or broken will show stains from fermentation and may develop off flavours. If the pulper is too loose, many cherries will not have the skin and pulp removed or, worse still, they will be ejected with the waste and lost.

No matter how carefully the pulper is adjusted some pulp and unpulped beans will pass into the fermenters. In a well-organized factory this material is passed to a repulper. Much can be done to minimize this factor in robusta coffee. Normally the robusta coffee in this area is rather uneven in bean size and sometimes it is possible to pick the smaller cherries on different days from the larger ones.

The use of a grader to separate the cherries into more even sizes or grades is also to be recommended, especially when there is any great variation in cherry size.

The pulped beans are transferred to the fermenting vat. This vat may be constructed of timber or of concrete. On a small scale, very good results have been obtained by using hollowed-out logs, similar to native canoes in appearance. The beans, if only a small batch, are just covered with water and agitated, then left to ferment for about 24 hours. Overseas authorities recommend that, when larger quantities are fermented, the water should be drained away and two feet or more in depth of pulped beans be left in the vat to ferment. Fermentation is complete when a handful of washed beans from the fermenting tank has a gritty feel when rubbed. If the beans are still slippery, then fermentation should continue.

Once fermentation has finished, washing should be carried out. If washing is delayed, then off flavours will be developed, due to over-fermentation. If washed before fermentation is complete, further fermentation will take place on the drying trays and cause off flavours. However, over-fermentation is the more serious fault.

Plenty of clean water is required for washing the beans. It is not possible to overwash the beans, but underwashing can lead to an inferior product. Several washings are given before the beans are drained and put out to dry.

As the coffee harvesting season coincides with the wet south-east winds, drying problems are to be expected. The plantation owner is strongly advised to install mechanical drying if possible. During very wet periods, it is extremely difficult to reduce the moisture content of the wet beans to the required 11 to 13 per cent. A useful test of dryness is to bite the bean. If the beans give to the bite, they are not dry enough.

If sun drying is to be used, then a drying period of nine days or more will be required. It has been found preferable to use trays which are portable and which can be supported on a raised platform. If the drying beans are allowed to come in contact with the ground, they may absorb off odours. The drying beans must be protected from rain or other sources of wetting if a discoloured product is to be avoided. It is important not to overcrowd the beans on the tray and a depth of no more than one inch should be allowed. During drying the beans should be frequently stirred to allow even drying.

When mechanical drying is used, much time is saved, but greater care must be exercised. Overseas authorities recommend an initial temperature of 80 to 85 degrees C. (176 degrees F. to 185 degrees F.) and after six hours the temperature is reduced to 75 degrees C. (167 degrees F.). Other authorities recommend lower temperatures and slower drying.

The dry coffee must be allowed to cool before bagging or storing. It should not be stored for long periods as it deteriorates and takes up moisture under conditions of heat and high humidity. Similarly it should not be stored on concrete floors but on wooden platforms raised off the floor. If stored for any length of time, or if the weather has been particularly humid, it is advisable to give the coffee a partial re-drying before attempting to hull the beans. It has been found that placing on trays in the sun for a day is usually enough to bring the coffee to the required degree of dryness for effective hulling. If hulled when insufficiently dried, many of the beans will be squashed or broken.

The hulling of the coffee consists of removing the outer skin or parchment and the inner or silver skin. Normally these skins are removed by machines and a polish imparted to the bean at the same time. There is a number of machines on the market for performing these tasks and the choice appears to be one of personal preference.

Following the hulling and polishing it is advisable to grade the beans into an even sample. Mechanical grading also helps to remove any trace of silver skin which has remained on the beans. Robusta coffee has a tight, silver skin, which often adheres fairly strongly to the bean, particularly if the bean is not completely dry. The jostling and bumping in a rotary grader does much to remove these traces. It must also be kept in mind that an even, well-graded sample is much better received in the trade. The roasting of an uneven sample presents certain difficulties and the presence of very small or broken beans gives the sample a poor appearance.

It should be the aim of the grower to produce an even, well-coloured sample, free of odours or flavours. Bean size is not as important as evenness of size, attractive appearance and freedom from flavours or odours.

The processed beans are packed by placing in double bags. Total weight of a packed bag should not exceed 180 lb. Clear and careful marking showing grade, number of bag and name of the plantation are necessary. A plantation name or mark which is well known and represents a first-class product can be a most valuable asset to the owner.

Territory robusta coffee is sold privately or through agents to buyers in the main eastern Australian cities. Before purchase, the coffee is sampled and tasted by liquorers and offers made for the shipment. The tasters will give a report on the sample used and the grower is strongly advised to take note of these reports, especially when off flavours or odours are said to exist. The rapid elimination of even a faint off flavour can mean the earning of a good name for your product, and as a result a premium price and a ready market.