PLATE 1.—*Extensive coffee plantation in a highland area of Costa Rica.*

COFFEE PRACTICES IN CENTRAL AMERICA, THE WEST INDIES AND HAWAII

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DURING a recent agricultural study tour which included Central America, the West Indies and Hawaii, the writer was able to observe coffee production techniques in a number of the countries visited. Because of other commitments, the time available for visiting coffee plantations, and coffee processing and marketing centres was often limited.

Coffee-growing areas visited included Trinidad, Costa Rica, El Salvador, Guatemala, Mexico, Jamaica, Puerto Rico, and the Kona region of Hawaii.

As could be expected, the size of plantations varies greatly. In Hawaii there are few plantations of more than 20 acres in area. Plantation size in Central America varies from many small holdings of approximately five acres to large holdings of 500 acres or more.

Visits to the coffee centres were often brief. As a number of countries were visited in a relatively short time it is difficult to present a

general picture of coffee-growing techniques in each of the countries visited. It is proposed to record in this article observations under the following general headings :—

1. Varieties.
2. Soils and climatic conditions.
3. Plantation management.
4. Harvesting.
5. Processing.
6. Grading and marketing.
7. Summary.

To avoid repetition of information previously published in the *Papua and New Guinea Agricultural Journal,* reference should be made to an earlier article by the writer entitled *Coffee in the Highlands.* (Vol. 11, No. 1, July, 1956.)

Varieties

With the exception of Trinidad, the bulk of coffee produced in the foregoing countries is "arabica" or highland coffee (*Coffea arabica* Linn.). Trinidad production is small and is mainly "robusta" coffee, (*Coffea canephora* Pierre ex Froehner).

Throughout the arabica-producing countries, established plantings are mainly of bronze-tipped typica strains. However, it was evident, particularly in Costa Rica, El Salvador and Guatemala, that there has been a decided trend in favour of the green-tipped bourbon varieties. Many of the new plantings are of bourbon varieties. Technical officers engaged in coffee research and extension workers in these countries are of the opinion that the acreages of bourbon plantings should be greatly increased. Both by observation and through speaking with these men it was apparent that in Central America and Hawaii bourbon coffees behave similarly to bourbon coffees grown in the New Guinea highlands. Yields are said to be generally higher than typica varieties. The bourbons appear to be more vigorous and sturdier, especially at the lower altitudes. Under drier conditions also, the bourbon coffees are proving to be more suitable than typicas. Tests at the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, have indicated that the liquoring qualities of the bourbon coffees are not inferior to typicas.

The merits of the bourbon coffees are recognized by research and field men familiar with coffee production. There remains among many growers, however, the inherent prejudice of changing from one coffee variety to another. In Costa Rica for example, growers have long become accustomed to producing typica varieties with a large bean. Before the war the bulk of the high grade Costa Rican coffees was exported to the German market, which paid a premium for coffee with a large, bold bean. The Costa Rican growers therefore catered for this demand.

A brief description follows of a number of varieties that were seen.

(i) Caturra—A dwarf high-yielding bourbon variety, which is usually planted at a closer spacing than other bourbon and typica varieties.

(ii) Bourbon and Yellow Bourbon—The yellow bourbon, in which the ripe cherry is yellow, is a selection from bourbon and generally outyields that variety.

(iii) Villalobis—A common bourbon variety in Costa Rica.

(iv) Mundo Novo—A further bourbon selection from Brazil.

(v) Villa Sarchi—One of the more recent bourbon selections which is claimed, in Costa Rica, to be more adaptable to poor drainage conditions.

(vi) Pacas—A recent bourbon selection in El Salvador. Under experimental conditions this variety is growing extremely well without shade, and gives promise of being a high-yielding variety.

(vii) *Arabica* (Typica)—Refers to the bronze-tipped typica strains. All of the typicas produce a larger green-bean than the bourbons.

(viii) Blue Mountain—A typica variety. The genuine Blue Mountain coffee, from the Blue Mountains of Jamaica. In Jamaica the crop is small but of high quality. The coffee is of bluish-green appearance, very mild and sweet tasting in the cup, and pleasantly aromatic. In Central America it is thought that Blue Mountain is not as drought-resistant as and lacks the vigor of other typica selections.

(ix) San Ramon—A dwarf variety with short internodes and small leaves. This variety is said to have originated from the San Ramon area in Costa Rica. Although of little economic importance it is claimed to be useful for planting in exposed positions and under drier conditions. In appearance San Ramon coffee closely resembles the dwarf variety that occasionally appears in plantings through the highlands of New Guinea.

(x) Hybrids—Of interest were the first plantings of a hybrid, bourbon x typica cross. These plants were seen at Turrialba and at the time of the visit they were about eighteen months old and appeared to be very vigorous. On the basis of varietal improvement the Central American countries are conducting breeding and selection programmes. Varietal trials, breeding studies and progeny testing trials were observed in Costa Rica, El Salvador and Mexico.

Soil and Climatic Conditions

The soils and climatic conditions are rather similar to those of the Territory coffee areas. Plantings generally are confined to fairly fertile soils and particular emphasis is placed on providing good drainage.

Severe dry seasons of five months' duration are not uncommon in some regions. Where adequate shade and fertilizer is provided, the coffee plantings do not appear to be unduly affected by the protracted dry conditions. Variations in annual rainfall range from about 50 inches in drier areas to more than 120 inches in the wetter areas of Costa Rica.

Coffee is grown from 1,000 feet to 5,000 feet, with the bulk of plantings, except in Hawaii, being between 2,500 feet and 4,000 feet. At the higher altitudes, yields are generally lower but the quality is reputed to be superior to lower-level coffee.

Plantation Management

Because of the relatively high cost of labour, plantation management techniques aim at reducing labour costs to a minimum. There is a marked seasonal demand for labour during the height of the picking season, usually from November to March, but in the ensuing time labour strength is reduced to a minimum.

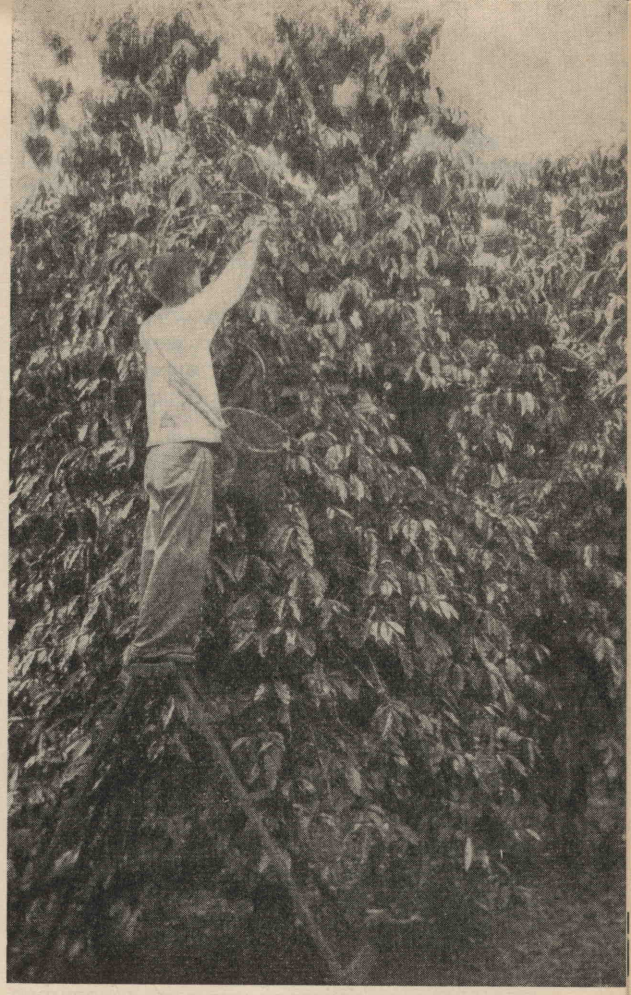

PLATE 2.—*Hawaiian picker using pandanus basket and low-level ladder to harvest multiple-stem coffee.*

Nursery Procedure

The coffee seed is usually thickly broadcast on to small well-prepared seed-beds. Shortly after germination, at the two-leaf seedling stage, the more vigorous seedlings are pricked out into larger nursery beds, at an approximate spacing of six inches by six inches. In some cases the seedlings are left in these beds until transplanting to the field. Often a third transplanting occurs when the seedlings are fairly well-advanced. Seedlings are usually transplanted to the field from 12 to 18 months after sowing in the nursery. Shading of the nurseries is usually discontinued after the first transplanting.

Transplanting

The usual practice is to transplant complete with a sod of soil around the roots—this is

termed " pilon " planting. By this method the transplanted coffee seedling suffers only a minor setback. No great emphasis is placed on digging large holes for field planting.

Planting with a sod of soil is also common in Hawaii. However, the " root-snapping " technique (reference *Coffee in the Highlands*) carried out approximately six weeks prior to field planting ensures a firmer sod-retention and also minimizes the danger of bench-root plantings.

Overlong or dangling roots are pruned short before planting in the field.

Spacing

Spacing distances range from about 6 feet by 6 feet to 13 feet by 13 feet, both on the square and the triangle. The tendency is for closer plantings to decrease or even eliminate weed-competition and to minimize the amount of pruning required. The closer plantings also afford a degree of self-shading as there are correspondingly larger numbers of trees per unit area. Although the closer spacings do result in lower yields per tree, it is claimed that this disadvantage is offset by the reduced management costs, particularly pruning and weed-control.

Two systems of hedgerow planting are worthy of mention. In El Salvador, a hedgerow system consisting of two rows of bourbon coffee, spaced 3 feet 6 inches apart and 3 feet 6 inches between plants in the row, with a 10-foot interval between the double rows. The particular planting was growing without shade and looked very impressive. This form of planting would appear to be most applicable for contour planting on sloping land.

Another modification of hedgerow planting consists of three rows of coffee with a spacing of 3 feet 6 inches between and within the rows and a 10-foot interval between the groups of three rows. In this system the middle row of each group of three appears lower yielding and less vigorous. From observation, the two-row hedge system seems better than the three-row system.

The aim of hedgerow planting is to provide the greatest possible degree of self-shading and so minimize the need for shade trees. Hedgerow systems also aim at preventing over-bearing and die-back.

A further planting technique, the principal object of which is to produce a large output of coffee for a limited number of years, is the " hill-planting " technique. In this system three to four trees are planted about 18 inches apart in a clump, with a spacing of 14 feet to 16 feet between clumps. Heavy fertilizing and irrigation results in accelerated growth and heavy yields.

Shade and Windbreaks

There is a variance of opinion on the value and amount of shade required. Unanimous agreement favours the necessity for windbreaks.

In each of the countries visited both shaded and unshaded plantings were seen. Shade provision varies from light and seasonal to heavy and permanent shading. Hawaii was the only country visited in which most of the plantings are unshaded. In the Kona area of Hawaii, as in certain areas of Central America, unusual climatic conditions, peculiar to the area, allow successful coffee production without shade protection. In the Kona district, local cloud formations develop over the coffee areas in the early afternoon and so protect the unshaded plantings from prolonged exposure to the sun. Similar local conditions occur in some of the higher rainfall coffee areas of Central America.

In both Jamaica and El Salvador, unshaded bourbon plantings are growing successfully in areas with an annual rainfall of approximately 70 inches and a pronounced dry season of at least four months' duration.

Of late there has been a tendency to reduce shade intensity and increase the rate of fertilizer application, the aim being increased yields. Field experiments have indicated that there is an inverse-relationship between shade intensity and response to increasing fertilizer rates. Furthermore, fairly heavy fertilizer applications fail to give as significant a yield response under dense shade as under light or no shade.

There is no overall preference for any one shade species. Bananas, citrus, *Grevillea* sp., *Inga* sp., *Erythrina* sp., and endemic species are all used. Tall-growing bananas are preferred for temporary shade.

The leguminous *Inga* sp. is widely used for permanent shade in Costa Rica. This species is tolerant to severe pruning, in that it can be pruned right back at the beginning of the wet season. New leaf growth develops during the

rainy season so that by the beginning of the dry season there is enough foliage to provide adequate shade for the dry season. At the beginning of the next wet season the tree is again pruned right back. The leaf prunings serve as a mulch and the heavier timber is utilized for fuel. From observation, the *Inga* sp. appeared to be the most suitable coffee shade tree in Central America.

Soil Erosion Control

In the coffee areas of Central America and the West Indies, it is not unusual to see coffee growing on steep hillsides. Land with a 50-degree slope may be planted in areas of land shortage. Successful coffee cultivation is possible on such land as a result of the effective anti-erosion measures adopted by the coffee farmers.

On the very steep land, the coffee trees are usually planted on individual bench terraces with the terraces on the contour. Bananas are commonly planted between the terraces to help hold the soil and to provide food and shade.

Another form of erosion control is to plant almost on the contour, with the trees closely spaced in the row. The spacing between the contour rows is correspondingly larger. Between the contour rows and also the ends of the rows, silt pits are dug to accumulate the eroded soil. The silt pits are emptied from time to time and the soil is placed along the contour rows. Although this is a time-consuming practice it is a very effective method of retaining topsoil on steep land.

In other areas, contour drains with retaining hedges of either yucca, pineapples, sisal, bananas, or some grass species are planted. On land in which the slope is not excessive, the combination of permanent shade and closely-spaced plantings is usually regarded as sufficient for erosion control.

Mulching, although not extensively practised, serves a secondary function as an anti-erosion measure.

Weed Control

On a number of plantations visited, weed control did not present a problem as the fairly-closely spaced multi-stem plantings provided a complete canopy overhead. Under such conditions there is practically no weed growth.

With the open planting systems, including the hedgerow methods, weed control is regarded as an important phase of plantation management. On well-managed plantations chemical weed control is considered to be more economic than manual or mechanical weeding.

A number of herbicides have been tried to date, 2,4-D and Dalapon (as Dowpon) have proved most effective. A mixture of 2,4-D and Dalapon with diesel oil and water has proved very effective for mixed weed control and may be sprayed right up to the trunk of the tree. Depending upon the severity of weed growth a general rate of application would be in the order of 15 gallons per acre of a mixture of :—

Dalapon (Dowpon)	2 lb.
2,4-D (Dow 40)	2 lb.
Diesel Oil	20 gal.
Water	20 gal.

Fertilizing

The use of artificial fertilizers is not an accepted practice generally. Over the last ten years, however, there has been an increased use of fertilizer, particularly on the larger plantations. Composting and mulching, rather than fertilizing, is practised extensively on the smaller coffee holdings.

Good use is made of the coffee pulp for composting. The fresh pulp may be buried in pits between the coffee trees, but in general, compost made of pulp and other material, usually farmyard manure, is preferred. This is a common practice in Costa Rica where dairy farms are run in conjunction with small, highly productive coffee farms. Elephant grass (*Pennisetum* sp.) is grown for the stall-fed dairy cattle. A visit was made to a better example of one such farm in Costa Rica. The farm had a total area of 32 acres on which the owner managed 110 dairy cattle and 12 acres of first-class coffee. The cattle were entirely stall-fed from Elephant Grass grown in rotation plots on the farm and cut daily for feeding. Both the grass plots and coffee were fertilized from compost made of coffee pulp and farmyard manure.

The use of artificial fertilizers to boost yields is standard practice in Hawaii, because of the rather shallow and rocky nature of Hawaiian coffee soils. One, two or three applications of 10-5-20 N-P-K fertilizers are made during the growing season. An application of sulphate of ammonia is recommended near the end of the wet season. This has a beneficial effect in combating die-back during the dry season. A complete fertilizer containing 10-10-10 N-P-K is recommended during the first year of growth in the field to ensure a more vigorous and well-developed tree in its early cropping cycle. Fertilizer application rates, particularly for the 10-5-20 N-P-K mixture, range as high as one ton per acre per annum.

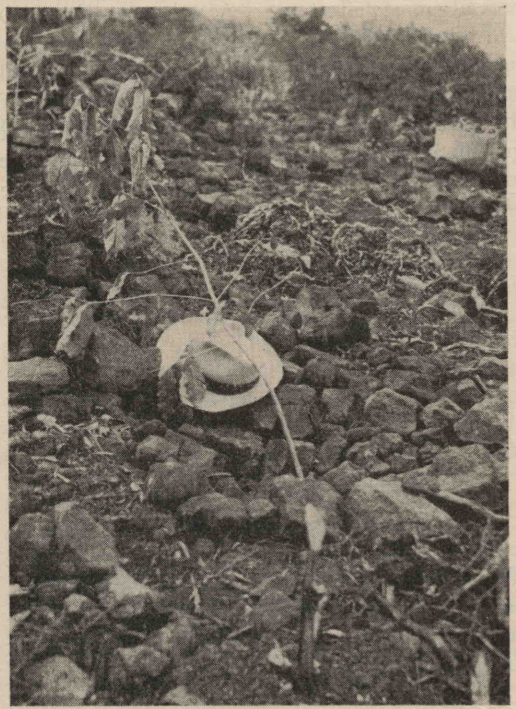

PLATE 3.—*Newly-planted coffee seedlings in recent volcanic rocks, Hawaii.*

There does not appear to be any generally accepted fertilizing programme in the Central American coffee areas. Sulphate of ammonia and 10-5-20 N-P-K are both used. The increasing use of 10-5-20 N-P-K appears to be a result of extensive fertilizer experiments in Hawaii.

In connection with the nutrition of the coffee plant, the technique of foliar analysis for diagnosing apparent major and minor element deficiencies has been well developed in Costa Rica. Coloured guide charts showing typical leaf patterns and foliage conditions for specific element deficiencies are available to growers.

Field workers claim that deficiencies of either nitrogen, phosphorus, potassium, iron, manganese, magnesium, boron, or zinc can often be recognized in the field. The following notes describe rather briefly the typical deficiency symptoms for the above major and minor elements :—

Nitrogen :

A general yellowing of the leaf, similar to unfertilized coffee grown with little or no shade. The first symptom is usually a yellowing of the leaf margin which may extend to give a blotchy yellow coloration over most of the leaf. There is some doubt as to whether the nitrogen deficiency causes a carbohydrate deficiency or vice versa. The recovery of a healthy leaf colour usually follows the application of a nitrogenous fertilizer.

Phosphorus :

Typical deficiency symptoms occur in the older leaves particularly on branches carrying a heavy crop. The leaves tend to change colour from the tip end and extending over the leaf. Yellows, reddish-yellows and reddish-purple colours may develop. The deficiency is remedied by phosphatic fertilizers.

Potassium :

Severe deficiency results in stunting and leaf fall. Die-back and blackening of the young growth, starting from the tip, is a recognizable symptom. Potassic fertilizers remedy the deficiency.

Iron :

Iron deficiency can be recognized by the typical " fish-net chlorosis " symptoms. These appear as a pale greenish-yellow leaf colour against which the leaf venation is clearly outlined. Because of the interaction between iron and other elements, iron deficiency symptoms may occur due to an imbalance in the plant between iron and some other element. This is noticed in Costa Rica where an imbalanced P/Fe ratio in the leaf may produce iron deficiency symptoms.

Manganese :

The deficiency symptoms for this mineral are said to vary slightly, depending on the degree of coffee shading. With well-shaded coffee, the terminal leaves change to a greenish-yellow colour with white spots developing. The older and more mature leaves retain their dark green colouring. For unshaded coffee, the colour changes are said to be more pronounced, changing from a yellow colour at the tip to a pale green for more mature leaves. The white mottling effect remains.

Magnesium :

Well-defined interveinal bronze areas of the older leaves characterize a magnesium deficiency. Before changing to a bronze colour the interveinal areas are successively pale-green, yellow-green and yellow in colour. The deficiency is controlled in Costa Rica by the application of magnesium sulphate.

Boron :

Typical deficiency symptoms include a fan-growth effect and die-back of the terminal shoots. Leaf distortion is also characteristic of boron deficiency. Spectacular yield increases have occurred in certain areas of Costa Rica from an application of two ounces of borax to the soil around the base of each tree.

Zinc :

Zinc chlorosis deficiency symptoms are somewhat similar to iron chlorosis symptoms. With zinc deficiency, however, a typical development is the formation of terminal bunches of small, chlorotic leaves. The bunch development results from a shortening of the internodes. Severe leaf fall may also occur. The deficiency is controlled by zinc sulphate sprays.

Pruning

Most plantings are pruned to develop the agobiada multiple-stem framework. Single-stem coffee was seen only in Jamaica. In the Central American countries the young seedling is bent over and pinned down to induce the growth of verticals for the multi-stem framework. The same objective is achieved in Hawaii by planting the coffee seedling at a 45-degree angle. For a more detailed account of the agobiada system, reference is made to *Coffee in the Highlands.*

Once the multiple-stem framework is developed, little further pruning is practised, except that from time to time low-bearing branches are cut out and replaced. Regular pruning did appear to be a more important phase of plantation management in Hawaii. The basis of multiple-stem pruning in Hawaii is to remove one vertical each year and allow one or more replacements to grow up as required. The tree can thus be cropped and pruned to a regular cycle varying from four to six years.

A modification of the agobiada system seen in El Salvador involved capping of each of the multiple stems. The numerous bifurcated stems produce a candelabra-shaped coffee tree. This more involved pruning technique did not appear to have any additional advantages over the less complicated agobiada system.

A further pruning technique worthy of mention is the Beumont-Fukunaga system. This system is only a recent development and under experimental conditions it has resulted in extremely high yields. Briefly the pruning procedure is as follows. The coffee plantation is first divided into blocks, each block consisting of four rows of coffee. In the first year of pruning the first row of coffee in each block is stumped after the crop has been harvested. In the second year the third coffee row in each block is stumped. By this time new verticals should be developed on the first row, stumped in the previous year. Similarly, in the third and fourth years, the second and fourth coffee rows respectively are stumped. Thus at the end of a four-year cycle the whole plantation has been pruned to give a complete renewal of bearing wood. Stumping back is done at the end of the picking season. Heavy fertilizing with little or no shade is recommended with the Beumont-Fukunaga technique. Even with heavy fertilizing it is considered unlikely that very high yields could be maintained for more than a few years.

The Beumont-Fukunaga system aims at producing very high yields with minimum pruning costs. Pruning can be carried out quickly without the use of skilled labour. By stumping the first, third, second and fourth rows in successive

PLATE 4.—*Development of the multiple-stem framework.*

PLATE 5.—*Rejuvenation of old coffee in Hawaii by stumping back.*

years, a degree of wind protection and mutual shading is afforded by the adjoining rows. Trials are being conducted using various spacings both between and within the coffee lines to determine which distances are likely to provide the maximum mutual shading.

To date the Beumont-Fukunaga system has not been recommended for areas which are subject to severe dry seasons. Under protracted dry conditions sucker development after stumping could be disappointing. Irrigation might offset the effects of prolonged dry conditions. Another alternative is that one vertical be left when each tree is stumped, to serve the same purpose as a "lung" branch in converting single-stem trees to a multi-stem framework.

Harvesting

Picking is done on a task basis with men, women and children participating. The picking season extends over a number of months with the bulk of the crop maturing between October and March.

To reduce labour costs for harvesting, the number of pickings is confined to a minimum of rounds—sometimes as low as three rounds per season. Up to 120 lb. of cherry is said to be a good day's picking. In Hawaii it was interesting to note that very light and inexpensive picking bags can be made from plaited pandanus leaves. The bags are strapped over the pickers' shoulders to allow two-handed picking. As a result of the small number of pickings per season, a percentage of the harvested coffee may be over-ripe or "buni" coffee. Low ladders are used where the multi-stem trees are too tall or cannot be bent over to allow picking from the ground. It was difficult to obtain approximate yield figures, although a yield of half a ton of green coffee per acre is regarded as good. With intense fertilizing in Hawaii, yields of one ton per acre are not uncommon.

Although the aim is to pick ripe cherry only, it was stated that unless periodic inspections are carried out partly-ripe cherry may also be harvested. The Government of Costa Rica aims at maintaining the high quality for which the country is known. Coffee inspectors travel around the country during the picking season to see that only ripe cherry is being picked and processed. It is an offence to pick and process either under-ripe or over-ripe coffee with fully ripe cherry.

Processing

Processing is carried out in large central mills, completely equipped to ensure the best possible quality coffee. The central mills usually process about 24,000 tons of cherry per year. One large mill visited in El Salvador annually processed 40,000 tons of cherry. A smaller but expertly-designed mill in Costa Rica processed 20,000 tons of cherry a season. The drying facilities for the latter mill included four acres of concrete barbecues, with 24 rotary hot-air driers.

Coffee is purchased from the growers by the central mills either in cherry, parchment, or buni form. Most of the purchases are as cherry. Where both cherry and buni are purchased, the buni is processed separately from the cherry. Purchasing is either at the mill or at buying centres throughout the area served by the mill. Usually the grower receives a percentage of the value of his produce with the balance being

paid at the end of the season. One such system in Costa Rica was said to operate as follows :—

The grower is paid 50 per cent. of the value at selling time. At the end of the season, when the average green coffee price obtained by the mill for the season is calculated, the grower is paid the balance on a 6 : 1 ratio of cherry to green coffee.

Before the final payment, the following charges are levied against each supplier and deducted from his balance of payment :

(i) 5 per cent. government tax ;

(ii) 9 per cent. for the coffee mill. (The maximum profit allowable to the mill is fixed by law at nine per cent.) ;

(iii) A small charge is also made for processing.

After pulping and fermentation, the coffee is washed by passing it through centrifugal pumps and concrete water channels, which deliver it to extensive concrete drying barbecues. The wet beans are delivered from the water channels to the barbecues by mobile screw-conveyor units, which discharge large amounts of wet coffee on to the barbecues, quickly and simply. Before the introduction of these units, a greater amount of handling and more time were involved in moving coffee to and from the barbecues.

Once delivered to the large concrete barbecues, the coffee is either spread by workers using wooden levellers, or by a mechanical spreader. The latter machine was introduced fairly recently, is very effective and is expected to replace manual spreading, wherever the barbecues are large enough to warrant its use. The mechanical spreader is powered by a small petrol motor and has a six-foot spreading blade, not unlike a miniature bulldozer blade. Coffee can be spread to any desired layer thickness simply by adjusting the height of the blade, which is protected by rubber on its bottom edge. The machine moves on four broad rubber tyres without damage to the spread coffee. One mechanical spreader can easily cope with all the coffee on one barbecue.

When the coffee is to be moved from the barbecues, the spreaders move it into long heaped rows from which it is quickly bagged by the use of a mobile screw-conveyor.

No permanent covering is provided for the barbecues. Instead, waterproof tarpaulins are thrown over the coffee when required. A slight slope of the drying surface, from the centre of the barbecue, facilitates a quick run-off of moisture.

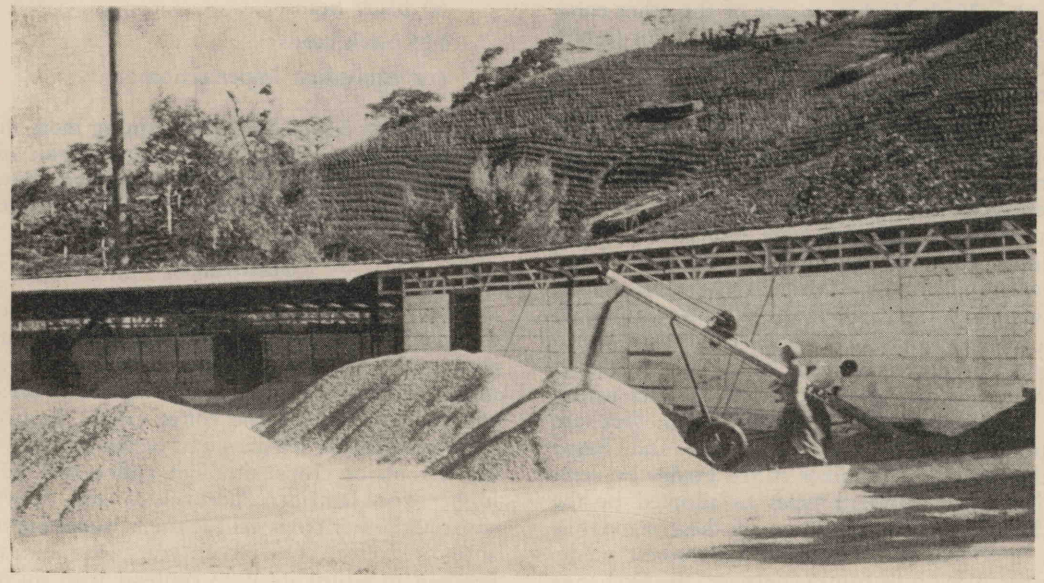

PLATE 6.—*Mobile screw-conveying unit delivering wet beans on to concrete drying barbecues at a modern coffee factory in Costa Rica.*

Both sun-drying and hot-air drying facilities are provided by the central mills. Rotary type hot-air driers are commonly used, although the American type tower-driers are gaining in popularity. Oil-fired driers are sometimes used, but more often the fuel used for the driers is either pressed pulp, parchment or buni husks, or prunings from shade trees.

Within the mills, spiral conveyors are very efficient in moving the coffee. After passing through the hullers, the coffee is passed through shaking-type grading screens. After being graded for size and shape, it passes on to air-pickers. Finally the high grades are hand-sorted on broad conveyor belts for discoloured and misshapen beans. Coffee destined for the European market, particularly Germany, is very carefully graded for size, shape and colour. In Hawaii an electronic eye separator, which separates for colour, is both very efficient and very expensive.

Grading and Marketing

The sale of green coffee is accomplished through an exporter who is a mill-owner and usually a grower. Various systems of payment operate for payments to the numerous growers supplying coffee to the mill. It is not unusual for mill-owners to advance money to growers.

From the exporter, the green coffee passes to the New York Market, to one of the other entry ports in the United States of America, or to one of the European markets of London, Le Havre, Hamburg or Antwerp.

It is of interest to note the system of grading adopted by the United States of America, the world's leading coffee consumer. Firstly, all green coffees imported into the United States of America are classified into either Brazils or Milds. Brazils comprise those coffees produced anywhere in Brazil. Milds include all coffees grown elsewhere. Both the Brazils and Milds are not only identified by the country in which they are produced, such as Colombians, Salvadors or Mexicans, but also by districts or states within the country or port through which they are shipped. The New York Coffee and Sugar Exchange Inc. determines coffee grades by comparison with standard types as adopted by the Exchange. There are seven of these standards, No. 2 to No. 8. No. 2 is the highest grade. For the placing of future contracts, the Exchange stipulates that No. 6 is the lowest grade deliverable.

In determining the number of a type, the coffee is graded by the number of imperfections contained in it. In general the various kinds of imperfections are black beans, stinkers, broken beans, shells, immature beans ("quakers"), stones and other foreign material. For counting the number of imperfections, the black bean has been taken as the basis, and all imperfections, no matter what they may be, are calculated in terms of black beans as follows :—

3 shells equal 1 black bean.

5 quakers equal 1 black bean.

5 broken beans equal 1 black bean.

1 small pod equals 1 black bean.

1 large pod equals 2 black beans.

1 medium stone equals 1 black bean.

2 small stones equal 1 black bean.

1 large stone equals 2 or 3 black beans.

The test is made on one pound samples.

By this scale a coffee containing no imperfections would be classified as type No. 1, but the possibility of this occurring is rather remote. The samples are graded as follows :—

6 black beans	No. 2.
13 black beans	No. 3.
29 black beans	No. 4.
60 black beans	No. 5.
115 black beans	No. 6.

(or equivalent imperfections.)

Types No. 7 and No. 8, containing more than 115 black beans, are graded by comparison with recognized Exchange types. Coffees graded lower than No. 8 are not admitted into the country.

Summary

Coffee production in a number of the countries discussed above is of major importance to their economies. El Salvador and Guatemala have a monocultural economy, as they are almost solely dependent on the coffee crop. In Costa Rica and Mexico, bananas and cotton respectively are the major crops although coffee still ranks high. For Jamaica, Puerto Rico and Hawaii, sugar and other crops eclipse the national importance of coffee. Of recent years, the industry has had to adjust itself to contend with fluctuating markets, outside competition and rising production costs. To a greater or lesser degree,

techniques have been and are being introduced to meet these exigencies. Broadly, these include.:—

(i) The concentration of processing equipment into large central processing mills.

(ii) Adoption of production techniques designed to reduce the number of labour units required per unit area. These include :

(*a*) Closer tree spacing to decrease weed competition and reduce the amount of pruning required.

(*b*) The use of multi-stem pruning systems in preference to single-stem.

(*c*) The increasing use of herbicides for weed control.

(*d*) Reduction of the number of pickings per season.

(iii) Increased yields by decreasing shade and increasing the rate of fertilizing.

(iv) Active experimental programmes, including varietal improvement, through selection and breeeding.

By these means the coffee industry is gearing itself to a minimum of manual labour. Although the principal aim is to reduce production costs to a minimum, producers are also ensuring that yields do not decrease and that coffee quality is maintained.