

**A SHORT HISTORY OF  
AGRICULTURE  
IN THE  
BRITISH COLONIES**

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BRITISH COLONIES

BY

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## PREFACE

**H**ISTORY is too often regarded as consisting of politics, with a little economics. Inadequate consideration is given to technical changes, and especially modern scientific discoveries, which have altered not only economic conditions but the homely life and mental outlook of human populations, and in some cases have involved changes in the ecology of our species. The story of agriculture in the British colonies has never been told as a whole, and the purpose of the present short account is to draw attention to this neglected aspect of their history. The emphasis has been deliberately laid throughout on the technical history of agriculture, and only sufficient economics introduced to make the story intelligible, as this aspect has been more adequately treated in existing text-books.

My intention has been, broadly, to confine this history to those territories which fall within the purview of the British Colonial Office; but some reference has been made also to the High Commission territories in South Africa, to the condominium of the Anglo-Egyptian Sudan, to Southern Rhodesia, and to what is now the self-governing Dominion of Ceylon, which has played such an important part in the history of tropical agriculture. None but incidental references have been made to the sub-continent of India, which would deserve a treatment to itself, or to the remaining Dominions, which lie for the most part in the zone of temperate agriculture and are involved in quite different problems. I have also excluded from this survey territories which have been at one time or another under British administration but are now no longer so—the thirteen North American colonies; Tangier, Minorca, and the Ionian Islands; Palestine, Transjordan, and Iraq;

Burma, Java, Weihaiwei. The history has been brought down to the end of 1948.

To avoid encumbering the text with a mass of footnotes, I have relegated all references to a selected bibliography at the end of each section of the book, listing titles among which will be found authority for all but the most minor facts quoted in the text. Footnotes have only been used to supply references where passages are quoted verbally or nearly so.

My grateful acknowledgements are due to Professor G. E. Blackman and Mr. G. E. Metcalfe, who were kind enough to read through the manuscript of the book and made valuable comments; but the responsibility for all faults remains mine.

G. B. M.

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# CONTENTS

## PART I

### THE AMATEURS, 1492-1660

I. AGRICULTURE AT THE DISCOVERY OF AMERICA	1
II. THE BEGINNINGS OF TROPICAL AGRICULTURE	5
III. THE POST-COLUMBIAN DISPERSAL OF CROPS AND LIVESTOCK . . . . .	14
IV. THE FIRST ENGLISH TROPICAL COLONIES . . . . .	21

## PART II

### THE MERCANTILE EMPIRE, 1660-1838

I. THE SUGAR COLONIES . . . . .	26
II. AFRICA AND THE EAST . . . . .	40

## PART III

### PRIVATE ENTERPRISE, 1838-1900

I. COLONIAL SUGAR PRODUCTION . . . . .	44
II. THE ORIGINS OF RUBBER PLANTING . . . . .	51
III. DEVELOPMENTS IN AFRICA . . . . .	54
IV. THE CEYLON PLANTING INDUSTRY IN THE NINETEENTH CENTURY . . . . .	57
V. NEW TRENDS IN THE WEST INDIES . . . . .	61

## PART IV

### PUBLIC SERVICE, 1900-1948

I. A NEW ERA . . . . .	64
II. THE COLONIAL AGRICULTURAL SERVICE . . . . .	67
III. SOIL CONSERVATION . . . . .	75

IV. PEASANT PRODUCTION OF CASH CROPS . . . . .	85
V. EUROPEAN SETTLEMENT IN TROPICAL AFRICA . . . . .	98
VI. LAND QUESTIONS AND AGRICULTURE . . . . .	110
VII. THE DANGERS OF MONO-CULTURE . . . . .	116
VIII. ADVANCES IN INSECT CONTROL . . . . .	125
IX. PROBLEMS OF LIVESTOCK IMPROVEMENT . . . . .	132
X. RUBBER AND THE DEVELOPMENT OF MALAYA . . . . .	143
XI. THE SUGAR INDUSTRY IN THE TWENTIETH CENTURY . . . . .	149
XII. COMMODITY RESTRICTION SCHEMES . . . . .	157
XIII. THE FINANCING OF COLONIAL AGRICULTURE . . . . .	163
XIV. CONCLUSION . . . . .	174
INDEX . . . . .	177

## PART I

# THE AMATEURS, 1492-1660

### I

## AGRICULTURE AT THE DISCOVERY OF AMERICA

AT the time of the discovery of America by Columbus in 1492 the pattern of world agriculture was profoundly different from that of to-day. Such important tropical crops as maize, ground-nuts, cassava, tobacco, and cacao were only known to American man, while sugarcane, sorghum, coffee, tea, and (for all practical purposes) rice and yams were equally confined to the Old World. Amongst fruits America had a monopoly of the pineapple and avocado pear, as the Old World of the citrus fruits, date-palm, and mango. Each region also had its characteristic leguminous crops. The dwarf bean (*Phaseolus vulgaris*) was unknown outside America, although *Phaseolus mungo*, black gram, was a crop of great antiquity in India; while the cowpea is of distinctively African origin.

The dog was the only domestic animal common to both hemispheres. Most of the kinds of farm livestock which we know to-day were already exploited in Europe and Asia, though the turkey was still solely an American bird—herded in the south, but flying wild in the forests of North America. The only quadrupeds which the natives of America had succeeded in taming were the llama and the guinea-pig.

Of the few crops whose cultivation had already spread to both hemispheres, hardly any were of major importance in both. The coco-nut palm, stand-by of many peoples in the Old World, was only found by the European explorers in localized areas in America and in these was not of the



first importance. The sweet potato, if grown at all outside America at this date, was only cultivated in a few Pacific islands. Gourds provided a useful but minor convenience of tropical life in both hemispheres. Only cotton was a commodity of the first rank to both sections of mankind. This, however, reached Europe in the first place from Asia, as is well attested by the etymology of the trade terms used. The word 'cotton' itself is of Arabic origin and had already found its way into Middle English, while 'muslin', which bears witness to the trade in this textile through Mosul, is recorded in English in 1609, and 'gingham', a word actually of Malay origin, in 1615.

Sugar-cane first became known to northern Europeans during the Crusades; it had, however, before this been introduced into Spain and Portugal by the Arabs. Its transference by the inhabitants of these countries to the American tropics, and the long story of human tragedy, and expenditure of blood and treasure, which this crop was to involve during three centuries, were still mercifully hidden in the mists of the future. Many other tropical products were still quite unknown to the civilized world. Amongst these was quinine, which was later to save life on the same scale as the wars and slave-trade arising from the sugar industry were to destroy it. This ignorance was the more tragic in that malaria was only too well known in a Europe where 'ague' was still a common complaint, and where malarial infection, due to neglected agricultural land falling into swampy condition, had been either a cause or an effect of the decline of the Roman Empire. Rubber was at this date no more than a plaything for a few South American children. Coffee was still only a solace of the Arabs, as tea of the Chinese, and cocoa of the Maya and Aztec peoples. Europe, with no alternative to dirty water except alcoholic drinks, exhibited a greater degree of degradation through drunkenness than some of these peoples.

Soil erosion, that recurrent menace to the human race, appears to have been at this time in one of its quiescent phases, and only presented urgent problems in a few local areas, of which northern China was probably the most important. Man has, however, never been able to neglect this peril for long except in a few favoured areas, such as north-western Europe where soils and rainfall are against it, and those regions where irrigated rice-growing demands methods of cultivation which prevent it. In the past soil erosion had been responsible for the decay of the Mesopotamian empires and of the Maya civilization in America.<sup>1</sup> However, in the future it was not again to become a major threat to mankind until in the twentieth century the rash over-cropping of newly settled regions with the mechanical aids made available by science was to raise the problem in a new and still more serious form.

Two periods are of outstanding importance in the history of agriculture. The first is that in which it originated. Not all the work of the scientific plant and animal breeders in the last few generations has yet conferred benefits equal to those obtained by primitive man over the long period when he domesticated cattle and selected the cultivated forms of such crops as wheat, rice, and maize. It will therefore be necessary in the next section to begin the history of colonial agriculture by going back to its origins for an understanding of its full significance. The other important period is the recent one, in which the full capacities of modern science have been turned to the mechanization of farm operations, the planned distribution of crops and livestock through the world, the development of fertilizers, control of pests and diseases, and the breeding of improved plants and animals. Greater changes have been made in tropical agriculture, and in the life of those

<sup>1</sup> H. H. Bennett, *Soil Conservation*, McGraw-Hill, New York, 1939, pp. 22, 54.

who live by it, in the past thirty years than in the preceding 300. No apology is therefore necessary for treating the history of this recent period in considerably more detail than that of the medieval or early modern periods.

A special feature of tropical agriculture is that in many countries the most primitive methods may still be found persisting side by side with fully modernized ones; while it also often happens that, of two neighbouring territories, one is still in a stage which the other passed through centuries before. It will therefore often be necessary in telling their story to depart from strict chronological order and to adopt a more functional treatment in order to make plain the significance of evolutionary processes which have taken place in different areas, often with striking similarity, but in widely separated epochs of history. Many examples might be quoted of this kind of evolution out of step. The Semang of Malaya and the pygmies of central Africa still live by hunting and collecting wild produce, and have no knowledge of planting crops or keeping animals, although they live next to peoples who do both. The Masai of Kenya, the Bahima of Uganda, and the Fulani of Nigeria still exemplify the nomadic stage of development, and cultivate no crops but live on the produce of their herds of cattle. There are even more numerous African tribes whose diet remains almost exclusively vegetarian. The distribution of crops to new parts of the world is a process which has never ceased, and the introduction of pyrethrum to Kenya and of the tung tree to Nyasaland are important examples from our own generation. In British colonial history the movement of agricultural settlers from Britain to the tropics, which began at St. Kitts in 1624, still goes on and is exemplified to-day in Kenya and Rhodesia. So it is with the introduction of new tools and methods of agriculture. In the fifteenth century all the hoe blades used in Africa must have been hand-made from local ore; to-day over

wide areas the majority are imported, but the locally made type still survives, and it would be hard to point to any sharp break in tradition or to say when the imported article became the more usual.<sup>1</sup>

## II

### THE BEGINNINGS OF TROPICAL AGRICULTURE

THE beginnings of agriculture date so far back that they cannot be traced with any certainty. Agriculture has certainly been practised in Egypt for more than 6,000 years. It is still a matter of controversy whether primitive man first learned to domesticate animals or to plant crops. Both these developments largely took place in Egypt and in nearer Asia. The dog had been domesticated before 8000 B.C., and was the only animal to be attached to man so early as to be carried by him in his migration into America; its antiquity is also suggested by the fact that breeds have been evolved which accompany men more widely than any other domestic animal, from the Arctic to the equator. Cattle, sheep, and goats are thought to have been domesticated between 8000 and 5000 B.C., and pigs, donkeys, horses, camels, reindeer, cats, and fowls between 5000 and 2000. By about 3000 B.C. cows were certainly being milked in Egypt and Babylonia, and not much later oxen were being used in both regions for ploughing and to pull carts. Both water buffaloes and humped zebu cattle were being reared in India in about 3000 B.C., though the former shows more traits of the wild state today in its timidity and tendency to gather into a defensive herd when frightened. The exact region in which each

<sup>1</sup> Exports from Britain to tropical countries were estimated in 1948 to be about 15 million hoes. The variety of local demand is shown by the fact that a single firm found it necessary to figure 157 different shapes of hoe-blade in their export catalogue.

animal was first domesticated is for the most part uncertain, but the evidence favours Egypt for the cat and donkey, and Burma or India for the fowl.

At the same time crop development was proceeding. Of the two great world grains, our cultivated wheat is thought to have originated in the Near East, and cultivated kinds of rice appear to have been developed from the wild species in more than one area—probably in south-east Asia and in tropical Africa, and perhaps also in South America. Rice cultivation was, however, first developed on a really large scale in India and China, where it is recorded as already a staple foodstuff in 2800 B.C. The use of agricultural products in customary ceremonies, magic, and religious ritual often affords a clue as to their antiquity amongst the peoples concerned. Beans were offered to the dead in Egypt from the earliest dynasties, and lentils were also so used and were regarded as sacred to the god of silence. In a similar way ground-nuts are found among the food offerings in ancient Peruvian graves, and are represented on funeral vases of pre-Inca times. Amongst tribes in Uganda the twin beans found in the coffee-berry are used in the ceremony of making blood-brotherhood, and the planting of the sesame crop is carried out with traditional rites; no such ceremonies and usages are found with crops which have been introduced in post-Columbian times. Pigs feature in many ceremonies in the Pacific region, to which they seem to have been early introduced, but are not found to do so in America or in Africa, where they are a comparatively new introduction and are still spreading into new areas in which they have not been known before.

For the further development of agriculture it will be interesting to consider in turn each of the main tropical areas in which existing British colonies are situated.

The most agriculturally advanced of these was the Far

Eastern region. In China crop husbandry was not only developed early but carried out with skill. The use of leguminous crops for green manuring is recorded in the fifth century B.C. (as it is in Greece in the following century by Theophrastus). A knowledge of advanced methods of agriculture was disseminated by the brisk sea trade which existed between China, Japan, Indonesia, and India long before Europeans arrived on the scene. Hindu merchants were attracted to Indonesia at an early date by the lure of the trade in spices. Of these, the clove and nutmeg were indigenous to the islands, while pepper, originally a native of the Malabar coast in India, early became one of their important agricultural products. When it is recalled also that Ceylon was actually invaded by a Chinese army in A.D. 1408 it is obvious that the opportunities for the interchange of agricultural knowledge and of crop varieties throughout this region were very great. In many of the littoral regions a high degree of civilization and of agricultural knowledge existed, though in the interior primitive tribes lived a much more simple existence. The Malayan peninsula itself remained comparatively untouched by these influences until Malacca, founded by a local prince about 1403, rapidly developed into an important entrepôt of the spice trade. As early as 1416 Chinese writers described holdings round Malacca as abounding in sugar-cane, bananas, fruit-trees, vegetables, gourds, and melons. In 1509, during the visit to the port of the first Portuguese fleet, some members of the expedition were kidnapped while ashore buying cloves. In 1516 a Portuguese writer, Barbosa, records exports of pepper grown in Kedah through the port of Malacca to China. In 1592 the *Edward Bonaventure*, first English ship in these waters, visited Penang and by committing piracies on Portuguese ships acquired a cargo in which pepper is listed as the first item, but which never reached England as the ship was wrecked before it could return.

Ceylon, on the fringe of this agricultural civilization, certainly partook in it. The first irrigation tank in the island is recorded as having been made near Anuradhapura in about 504 B.C. The island had a tremendous asset in its possession of the indigenous cinnamon tree, whose product attracted traders from far and wide.

Moving westward to Africa, that continent provides a striking example of the way in which early agriculture tended to reach its highest development in arid regions. Early agriculturists in hot climates often avoided the humid forest areas, for a number of reasons which can be well imagined. The intensity of insect and microbial life in such areas threatened the health of both man and beast. Grain could not be stored so well in a humid climate. Forests were difficult to clear with the primitive tools available. But, perhaps most cogent of all, weed growth was so luxuriant that it was difficult, especially by manual cultivation, to prevent it smothering the crops. Agricultural civilizations, therefore, tended to develop in arid areas where these difficulties were not present, but where water was available for irrigation. This principle is illustrated in Mesopotamia, and in Africa in the lower Nile valley. In these civilizations the most remarkable ingenuity was often applied to irrigation works, while other agricultural methods remained comparatively backward. A life based on irrigation exerted a profound effect on the social structure of the community, requiring it to be highly organized and closely knit, and even stimulated the growth of a legal system because of the necessity to define the rights and duties of users of water.

South of the almost impassable barrier of the Sahara a complete contrast existed. Before the Portuguese voyages of the fifteenth century this region had contacts with the outer world at only two points. The ports of the east coast had for centuries been visited by dhows from the Persian

Gulf and beyond, trading for mangrove poles and other products. These visits do not seem to have had much agricultural influence though the Persians are believed to have introduced the mango to east Africa in about the tenth century, and the egg-plant at some uncertain date; the Portuguese also found the coco-nut palm already present on the east coast, but were the first to introduce it to West Africa in 1498. The other point was where Mohammedan invaders by the trans-Sahara route reached the hinterland of West Africa. These also brought few crops with them, though it may be noted that cotton textiles, which had been in use in Egypt since Roman times, were being manufactured from locally grown cotton in West Africa when European traders arrived; Welsh in 1558 took the first consignment of West African cotton cloth from Benin to England.

For the interior as a whole, however, it is difficult to picture the state of an agriculture to which so many of the crops, now most important in the region, were still unknown. The legends of the tribes themselves may explain the immediate source of some of their crops, but not the beginnings of their cultivation. Thus the Baganda have a tradition that when Kintu, their first ancestor, moved into Uganda from the north he brought with him a banana plant from which the whole of their present crop is descended. The Bemba of Northern Rhodesia say that their ancestor Citi Muluba brought with him from the Luba country seeds of sorghum, finger millet, beans, cow-peas, and pumpkins in his hair. In those days sorghum must have been the chief grain crop of tropical Africa, though rice was known on both coasts, and finger millet (*Eleusine coracana*) and other small millets were no doubt grown in areas of lower rainfall or where good storage qualities were a prime consideration. Root crops were represented by yams and by that archaic low-yielding



crop the Kaffir potato (*Coleus spp.*) which still lingers in a few remote areas whose wide scatter indicates the range of its earlier distribution. Legumes included cowpeas and, in West Africa at least, the Bambarra ground-nut (*Voandzeia subterranea*). Palm-oil as well as cotton cloth was taken from Benin to England in 1558; and sesame was an ancient African oil crop.

Cultivation systems in tropical Africa were very primitive, and the only advance on 'shifting cultivation' which may have already been applied is the 'chitemene' system still practised in Northern Rhodesia, whereby vegetation collected from a wide area is piled on to one plot for burning in order to improve the fertility with the ashes. Even in these primitive systems, however, crop husbandry had important effects on social life, and it was the Bantu tribes north and west of Lake Victoria, precluded from nomadism by their adoption of the perennial banana as a staple food in this region of fertile soils and reliable rainfall, who first evolved a complex and stable form of government that proved so surprising to the nineteenth-century explorers who first stumbled upon Buganda and Bunyoro.

The people of this isolated region were not, however, so devoid of useful livestock as were those of America. The horse had been introduced with Mohammedanism into the principalities that now lie in Northern Nigeria. Cattle were much more widespread, though it is difficult now to disentangle the story of the three races from which, until European settlement, the whole cattle population of Africa has been derived. The oldest of these are the long-horns owned by various Hamitic tribes and thought to be descended from or related to one of the breeds of ancient Egypt, as their owners are perhaps related to the ancient Egyptians. This breed seems to have been domesticated originally from wild cattle indigenous to Africa itself, the *Bos africanus* of the Nile valley. Nearly pure representatives

of these longhorns still exist in the Ankole cattle of Uganda and the dwarf N'dama cattle of the West African coast. The other two races which have contributed to the African cattle complex are the dwarf shorthorn (*Bos brachyceros*) and the zebu (*Bos indicus*). Both these widespread species (*B. brachyceros* has relations as far afield as the Channel Island cattle) represent introductions into Africa from Asia. The dwarf shorthorn was present in Egypt from at least the third millennium B.C., and the zebu from the second; but both probably reached tropical Africa at a much later date, and the second in particular by direct introductions to the eastern seaboard rather than by movements from the north. By the Middle Ages the process of fusion must have largely taken place which has produced many of the best-known present breeds of Africa, such as the White Fulani of Nigeria which are derived from a mixture of longhorn and zebu stock. In medieval Africa the camel and goat were also present, but the domestic pig has not spread in the continent until comparatively recent times, probably because the region was sealed off by Mohammedan populations who would not indulge in pig-keeping.

Turning now to America, well-developed agricultural systems again existed at an early date. These furnish further examples of the organization of complex irrigation, with the most elaborate works, but without any better means of cultivation than the hand hoe. Such were the Megalithic Empire of the pre-Inca people of Peru, whose great systems of terraced fields were constructed not later than 200 B.C., and the Maya Empire which was well established by 100 B.C. The staple cereal of these peoples was maize, though perhaps not in quite the same form as that in which we know the crop to-day. The story of this, the youngest of man's major cereals, is of extraordinary interest because it is the only one of such recent development

that botanists have been able to piece together its story in detail and to link it with historical periods.

The ancestors of the maize plant, *Zea*, and the genus *Tripsacum* are both supposed to have originated from a common stock in the tribe Andropogoneae of grasses. Both evolved on parallel lines with a tendency to separate the male flowers into terminal inflorescences and the female flowers into lateral ones. But whereas *Zea* remained an annual using most of its resources in a heavy seed production, *Tripsacum* became perennial and stored much of its food materials in the roots. The original maize was probably podded and the husk did not yet cover the cob. This maize, being carried by man from the region of the Andes to Central America, came into contact with *Tripsacum* and hybridization occurred, resulting in a new genus *Euchlaena*, the 'teosinte' which is still cultivated in Central America. *Euchlaena* hybridized with maize more easily than did *Tripsacum*, and repeated crossing between *Zea* and *Euchlaena* is thought to have transferred to the present *Zea mays* many genes originally found in *Tripsacum*. 'This gave rise', in the words of the historians of maize,<sup>1</sup> 'to some new types of corn not previously in existence, including the North American pointed pop corns, the dent corns, and the long, slender, straight-rowed flint and flour corns, types which are not represented in the Peruvian pottery and which even to-day are still unknown in the Andean region.'

But, as has been seen already, not all the crop plants of America were indigenous. The coco-nut palm was probably a native of Asia, though some botanists have placed its origin in America. The only certainty is that it must long ago have crossed the Pacific in one direction or the other. This passage could, however, have been effected

<sup>1</sup> P. C. Mangelsdorf and R. G. Reeves, 'The Origin of Indian Corn and Its Relatives', *Texas Agric. Expt. Station Bulletin*, 574, 1939.

by seeds carried by ocean currents, and does not necessarily imply man's intervention. In the case of cotton botanical research has shown that the cultivated cottons of the New World have twice the number of chromosomes of the Old World cottons and in all probability originated from a hybrid between a New World wild species and an Old World cotton carried across the Pacific by man. The family history of this genus presents exceptional features, for not all the wild species are primary ones amongst which man could have made his selections of cultivable sorts; some are secondary wild species which have arisen from cultivated kinds in regions where cotton has long been grown.

Agriculture in North America remained more primitive than farther south. It is interesting to observe in many instances the curious parallelism between man's development of agriculture in the Old and New Worlds. Although the diet in the two hemispheres was derived from almost totally different crops reliance was placed on the same families of plants, notably the Gramineae and Leguminosae; in some cases this parallelism extended down to the genus, as in the different species of *Phaseolus* which were cultivated in different parts of the world. The Old World had a variety of pack animals; the New attempted to solve the problem by the use of the llama in the south, and even of dogs in the north. The American Indians were ignorant of farm-yard manure, but attempted to obtain the benefit of manuring by burying fish in their maize fields, a practice which was copied by the early English settlers.

In the islands of the Pacific the only indigenous food crops of any importance were the species of *Pandanus* and perhaps the bread-fruit. To these were added the coco-nut, yam, and taro (*Colocasia antiquorum*), which were brought by the Polynesians from their original home in south-east Asia when they began to spread over the Pacific, perhaps about the beginning of the Christian era. Many local

varieties of these crops have since developed in the region, and for some of them a centre of distribution may be inferred from a concentration of varieties, such as is found for taro in Hawaii, yams in Fiji, and bread-fruit in the Marquesas. When European explorers came to know the Pacific islands in the eighteenth century they also found sweet potatoes in widespread cultivation; the Maoris were growing some twenty-five varieties of this crop. Its presence in this area is one of the botanical puzzles of history, and may or may not represent an early cultural contact of the islanders with South America. On the other hand, since tobacco introduced by the Spanish and Portuguese from America into their Asiatic colonies had already at the period in question spread in cultivation as far as New Guinea, the sweet potato may possibly not have been introduced at any earlier date.

### III

#### THE POST-COLUMBIAN DISPERSAL OF CROPS AND LIVESTOCK

THE discoveries of the Portuguese beyond the Cape of Good Hope, and the voyages of Columbus to America began a period of the most intensive dispersal of plants and animals about the world that has yet been known, although not all of it was planned or purposeful.

The first care of the Spaniards was to transfer their own familiar kinds of crops and livestock to America, with particular attention to livestock, for it was in this branch that American farming was most deficient. In spite of the small number of American animals which the original inhabitants had tamed, modern man has not found any further species domesticable, any more than he has improved in this respect on the accomplishments of his primi-

tive ancestors in the Old World. Columbus, therefore, on his second voyage in 1493, besides seeds of crops, took with him cattle, sheep, and horses to Hispaniola. By 1520 the cattle on the island had multiplied to 4,000 and in 1587 they were estimated at 35,000. In this the settlers were luckier than they knew, for in most parts of the tropics European cattle would quickly have succumbed to disease, but in these Caribbean island territories where cattle were unknown before, and which were consequently free of enzootic disease as well as isolated from epizootics, they survived. Stock introduced by the Spaniards and Portuguese from their own home countries, amongst which the Andalusian breed were the chief importation into the tropical belt, were in fact responsible for the whole cattle population of Central and South America until the comparatively recent introduction of British, Friesian, and Indian cattle.

As practical mariners the explorers also took pains to land stocks of animals on uninhabited islands, where they might be the salvation of ship-wrecked or starving crews in those days of uncertain navigation. Thus in 1609 Sir George Somers and his crew when wrecked on Bermuda were able to subsist on the pigs which had run wild on the islands, though it is possible that in this case the original stock were an escape from an earlier wreck.

This practice sometimes had surprising results. Pigs and goats landed by the Portuguese on St. Helena, then uninhabited, had run wild before 1545. Their subsequent history is worth following up as a connected whole. When Cavendish visited the island in the year of the Armada he found thousands of goats and 'great store of swine', also turkeys which somebody had already introduced from America. After the settlement of the island by the British the depredations of these goats on crops, trees, and hedges were found to be an intolerable nuisance, but at the same

time it was difficult to persuade the farmers to part with such a source of easy profit. However, in 1728 a general meeting of the inhabitants at last resolved that all goats ought to be exterminated over a ten-year period beginning in 1731. They did not live up to their resolve, and the trouble soon recurred. In the early nineteenth century the erudite Governor Beatson wrote a tract deploring the depredations of the goats, and giving a history of their place in the island life up to 1810. Again in 1908 the Governor of St. Helena in a report on tree-planting is found remarking that every goat on the island ought to be exterminated. The administration, however, still lacked the courage of its convictions, and when in 1930 an Arbor Day was held at which a demonstration plantation of trees was made, within a few days the goats had destroyed every sapling!

An interesting parallel case of the same stage in colonial development, but from a much later century, occurs in another island territory now British. In 1764 Bougainville landed nine cattle in the Falkland Islands with his French settlers, and this number was later augmented by importation of cattle from Montevideo during the Spanish occupation. These cattle soon ran wild and, during the period of abandonment of the islands and up to 1840, ships' crews used to hunt them and salt down the carcasses for provisions. Mackinnon in 1838 estimated their number in East Falkland at 30,000. In common with other observers he describes them as magnificent animals and mentions the killing of a bull which weighed 14 cwt. After rising to a maximum of 80,000 in 1847, commercial exploitation had brought their numbers down to 5,000 by 1868, when they were greatly outnumbered by tame cattle. A few wild cattle were, however, still surviving in 1907.

Columbus also took crop seeds with him on his second voyage, though here his guesses as to what would suit the new environment were less fortunate, as his consignment

from Spain is recorded to have consisted of wheat, barley, rye, bean and pea seed, and vine plants. More momentous for the future history of the New World was the fact that he picked up sugar-cane setts at the Canary Islands and transported them to Hispaniola. Sugar-works, however, took some time to erect, and the first West Indian sugar was not made until 1509, in that island. The Portuguese, on making their first settlements in America, introduced sugar-cane to Brazil in 1532. Both these introductions were, of course, of the thin type of cane which the Arabs had brought to the Iberian peninsula, the thick or 'noble' canes being at that date still unknown outside Asia and the Pacific islands. They are thought to have been of a variety which is still grown in Spain, though only as a chewing cane, under the name 'algarobena'. The importance of this variety in the New World, however, soon so greatly overshadowed that in its old habitat that it became universally known as the 'Creole' cane, and it was on this cane that the historic sugar trade of the seventeenth and eighteenth centuries was founded. It was not replaced until the French greatly increased yields by the introduction to the Caribbean in 1790 of the 'noble' Bourbon cane from Mauritius, where it had been grown since 1650.

With the commencement of the slave-trade from Africa about 1500 another source for plant importations into America was open, and it is probable that some of these came as provisions carried in the slaving ships. The unfortunate slaves had at least one advantage over the white settlers: they came from one ecological environment to another which was closely similar, with high temperatures and heavy rainfall. Just as root crops, mainly yams, had formed a principal item in their diet in West Africa, so down to the present 'ground provisions' assume great importance in West Indian diets, though one of the most favoured of these is the taro, here known as 'eddoes', which



was an introduction from Asia and not from Africa. The slave ships were probably responsible for the introduction of the cowpea to America, which took place at an early date since Hariot describes a crop, now identified as this, being cultivated by the Indians as far north as Roanoke Island during the English expedition of 1585. That the slavers also sometimes carried livestock is suggested by an observation that the present sheep and goats of the Bahamas appear to be of African derivation.<sup>1</sup>

Some crops, however, which are now of great importance in the American tropics, did not reach them till a surprisingly late date. Of particular interest is the history of coffee, whose world-wide dispersal did not begin until nearly the end of the period here under review. Indigenous to Abyssinia, the *arabica* species was cultivated in Arabia perhaps from about the sixth century A.D., though it was used for chewing rather than drinking until about the fifteenth century. The Dutch took the plant to Ceylon in 1658 and to Java in 1699. From Java a single plant reached the Amsterdam Botanic Garden, whence young plants raised from its seeds were sent to Surinam (Dutch Guiana) in 1718. From this plant nearly the whole of the enormous coffee population of South America is descended, a fact which accounts for the great uniformity of the crop and has limited the scope for its improvement by selection.

Trials in their home countries of the new crops from both East and West were even more exciting to the Europeans of the time than the dispersal of what they already knew. Cartier found beans of *Phaseolus vulgaris* being grown in Canada in 1535, and probably took seed of them back to France; at any rate the English first learned of them through the French, and have ever since called them 'French beans'. Tobacco began to be cultivated in Ireland

<sup>1</sup> H. C. Sampson, *Report on Development of Agriculture in the Bahamas*, Empire Marketing Board, 1931, p. 18.

and England during the last quarter of the sixteenth century, and this cultivation was in one way of importance to the colonies because seed of the best varieties brought to England was thence sometimes redistributed to the colonies. It was most likely in this way that seed of the 'Orinoco' and 'Trinidad' varieties (perhaps brought home by Raleigh from his expedition of 1594-5) reached Virginia, where they were found superior to the indigenous varieties at first grown by the settlers. This is the first instance of the British Isles assuming that surprising function which they were later so often to perform, of a clearing-house for colonial crops.

Potatoes may have been brought to England by Drake in 1586, and grown on Raleigh's estates in Ireland. At any rate it is certain that the botanist Gerarde was growing them in his garden by 1596. The potatoes referred to by Shakespeare in the *Merry Wives of Windsor* (c. 1599) would, however, be sweet potatoes, which at that date were much better known in Europe and already being grown in the Mediterranean countries. Turkeys were introduced into English agriculture about 1530 through the continent of Europe, and were already famed as a Christmas dish when Thomas Tusser wrote in 1573. One American tree, *Thuja occidentalis*, had been introduced to Britain in 1596, and the swamp cypress and pencil cedar were here by 1650.

A whole host of other foreign plants, some of them useful or ornamental and some which turned out to be unsuitable, were brought to England during the Elizabethan age or earlier. Thus we have records of the introduction of the almond, apricot, beetroot, and castor-oil plant in 1548, the peach in 1562, Cannas in 1570, tomato and Hibiscus in 1596. Tomatoes, however, found no favour at this period, and played no part in English diet until quite recent times. In 1822, Loudon's *Encyclopaedia of Gardening* still says that love-apples 'are little used'.

Those nations having colonial possessions in the Old World were naturally anxious to stock them up as quickly as possible with the most attractive of the American crops. The remarkably rapid dispersal of some of these crops throughout the tropics was facilitated by the fact of the Portuguese having possessions in India and East Africa, and the Spanish in the Philippines. Thus it is not surprising to find pine-apples recorded in India as early as 1583, though in England the fruit was not seen until Evelyn's time, and not generally known until the eighteenth century, when it became fashionable for gentlemen to grow it in hot-houses (English pine-apples continued to have a great reputation until the advent of steamships made their importation from the tropics so easy that home cultivation was abandoned). In India in 1616 sweet potatoes and tobacco are also mentioned by Terry as common crops.

Crop introductions into West Africa, more fortuitous in origin, had much more far-reaching consequences. It is likely that here again some crops, such as ground-nuts, were first brought as provisions on ships trading for slaves. The rapid spread of American crops through the hitherto isolated African tropics is an extraordinary fact which by itself should dispel any idea that the African peasant is impervious to new ideas when these are manifestly of advantage to him. As early as 1535 John Leo described maize as a common crop on the Niger River 200 miles inland. In 1597 it is recorded as commonly used for food and beer-making in East Africa. Maize, cassava, sweet potatoes, ground-nuts, and tobacco were soon established throughout the continent, and by the time that European explorers penetrated the interior in the nineteenth century all memory of their being introduced crops had been lost, though an anthropologist can still deduce this fact by the absence of customs or legends concerning them. Cassava flour, maize, and ground-nuts were from an early date

common rations for the slaves both while awaiting transport on the coast and during the sea voyage; but it is probable that much of the appalling loss of life in this trade can be attributed to the contemporary ignorance of dietetics.

Some of these crops took a long time to reach Asia. Cassava, for example, was only introduced to Ceylon in 1786 from Mauritius, where it had been imported by the Governor La Bourdonnais from Brazil between 1735 and 1745. It only reached India in 1794 as an importation to the East India Company's newly established Botanic Garden at Calcutta. The slow spread of this uninteresting but useful root reflects the fact that Asia, with its old-established and highly developed agriculture, did not need to augment its dietary with the American crops nearly so much as Africa, and to this day has remained far more conservative in doing so.

Livestock imported from the newly opened regions of the world were in time to play a part in improving European breeds, but mostly at a much later date than we are now considering. Although an Arab stallion was purchased for King James I in 1616, the first importation of significance for the development of the English thoroughbred was that of the 'Byerly Turk' in 1689. Chinese pigs, which have contributed some blood to our modern English breeds, were not used for crossing until 1770.

#### IV

### THE FIRST ENGLISH TROPICAL COLONIES

WITH the planting of English settlers on the North American mainland we are not here concerned. The first settlement on what is now British colonial territory was that of Henry More and sixty settlers on Bermuda in 1612. Tobacco early became the principal crop of the colony,

and continued to be exported until the early eighteenth century. Here in 1616 the first plantation of sugar-cane was made in English territory. In the same year the landing of a negro and an Indian slave, taken from one of the Spanish islands, ominously linked with this event the first instance of slavery under the English flag. The colony thrived by its agriculture, and a population of 15,000 was rapidly attained.

St. Kitts in 1624 and Barbados in 1627 were the first islands within the tropics to be settled by the British. The main agricultural product of these, like Bermuda, was at first tobacco, of which with other crops the Barbados settlers had obtained planting material from the Dutch in Guiana, their fellow Protestants and natural allies in this Spanish-dominated region. Barbados also exported cotton, indigo, and fustic wood (*Chlorophora tinctoria*). On these products it apparently thrived, for the population is said to have reached 18,000 by 1640. The tobacco was grown with white labour on small holdings, some 5 to 30 acres in extent. But not even these early settlers in the tropics could for long escape the toils of the system they had themselves brought with them, an agriculture geared to world economy. By 1639 European markets had become glutted with tobacco, and there was an alarming fall in price. The first commodity restriction scheme in British colonial history was introduced in St. Kitts where, in an effort to bolster prices by regulating supply, the British and French settlers who shared the island agreed to plant no tobacco for a year. In Barbados under the influence of the same slump a few farmers were persuaded by the Dutch merchants who then had the carrying trade of the islands to take up seriously the cultivation of the sugar-cane, with which only sporadic trials had previously been made in the island. Some Barbadian planters visited Brazil to study Portuguese methods, and proper sugar-works were

started in 1642. Thus was inaugurated an enterprise of the utmost commercial and political importance to the British West Indies. The need for heavy manual labour in the canefields, particularly for harvesting, created for the first time an urgent demand for slaves, and the number of these in Barbados rose from a few hundred in 1640 to over 20,000 in 1651. The small holdings were rapidly engrossed by astute landowners to form larger sugar estates.

At this time the main apparatus of a sugar-works was the three-roller cane-mill invented in Sicily in 1449. Its rollers were originally made of wood. Iron rollers were first made as hollow shells to cover the wooden ones, and these came into use in the sixteen-fifties. They were made at his foundry near Derby by George Sitwell of Renishaw, who can thus claim to be the first pioneer of the great British export trade in tropical agricultural machinery.

Meanwhile, the process of settlement was going on. Nevis was occupied by the English in 1628, Montserrat and Antigua in 1632. In 1646 settlers arrived in the Bahamas, and in 1647 began the cultivation of cotton and tobacco on New Providence Island. The settlements of this early period were invaluable in providing agricultural stocks for later colonies; for example, in 1669 West, on his way to found a settlement in Carolina, was instructed to call at Barbados and pick up cotton and indigo seed, ginger roots, sugar-cane setts, 'ollive setts', and pigs. It was also historically fortunate that at the English capture of the great island of Jamaica in 1655, the conquerors already had sufficient experience of tropical agriculture to be able to undertake its development. This must have been materially assisted by the transfer thither of 1,600 colonists from Nevis soon after the occupation.

One feature of these early settlements deserves notice, for it runs as an unwritten principle through the history of British agricultural settlement in the tropics. In no case

was a previously existing population dispossessed of its cultivable land in order to make room for white farmers. Bermuda and Barbados were uninhabited when the English arrived (though Barbados had at one time carried a population of Caribs). The Bahamas were an empty land, from which the Spaniards had carried off 40,000 natives for work in the mines of Hispaniola. Even where, as in St. Kitts, clashes between the English and Caribs occurred, the latter were not cultivating any large proportion of the island's surface, though they grew cassava as their staple food and for the purpose of making large quantities of liquor. The English would have been content to leave them, as they did at first, to occupy the interior of the islands in peace, had not the Caribs themselves made such ferocious attacks on the settlers. At the conquest of Jamaica, no large Spanish population was dispossessed, for the inhabitants could only muster 500 men to oppose the English landing.

To save repetition in many places, the curiously constant observance of this principle in later centuries may be briefly referred to here. The British planters of coffee, and later tea, who laid out estates in Ceylon in the nineteenth century found the mountainous interior of the island unoccupied. The rubber planters of Malaya in the twentieth century hacked their estates out of virgin jungles. In Southern Rhodesia a sparse native population left much land open for European settlement. In those parts of the Kenya highlands where land was allocated to British settlers, the Masai had already ejected or were keeping out the cultivating tribes from areas far greater than they actually needed for their own nomadic cattle-herding; the best arable land of this colony is still to be found in the native reserves which were already under cultivation, though the 'White Highlands' by this historical accident include the best pastoral areas. In such lands as were

densely occupied by native agriculturists but did attract any European settlers, as in Uganda, only a few parcels of land were bought from native owners by non-natives, and legislation was soon passed by the occupying Government itself to limit the scale of such transfers.

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## PART II

# THE MERCANTILE EMPIRE, 1660-1838

### I

## THE SUGAR COLONIES

BY 1660 the amateur or experimental stage in the agricultural development of the British colonies may be said to have been passed. From the same period of the Restoration dates a new and centrally planned policy of colonial development along the lines advocated by the 'mercantile' school of economists. This set the pattern for development in the tropical colonies which persisted right up to the emancipation of the slaves. It had already been foreshadowed when in 1621 the Crown, at the instance of colonial interests, agreed to prohibit the growing of tobacco in England and Ireland, but exacted as a *quid pro quo* that the colonists should export the whole of their tobacco crop to England for sale. The system in its fullness rested on the Navigation Act of 1660, the Staple Act of 1663, and the Plantation Act of 1673.

The West Indies fitted into the mercantile pattern better than any of the other colonies, and raised few complaints during the seventeenth century, when the profits to be made from sugar production on the still-unexhausted soils of the islands were very high. Nevertheless, a rise in the sugar production of the French islands caused a sharp fall in the price of sugar in the English market from 40s. per cwt. in 1666 to 22s. in 1670. A similar situation produced another fall from 24s. 10½d. as an average price in 1727-8 to 16s. 11½d. in 1732-3, and this caused such distress to the planters that they used their great influence to induce Parliament to pass the Molasses Act of 1733 imposing heavy duties on foreign sugar imported into any British

territory. They gained a further concession by the Sugar Act of 1739 which granted permission, denied by the Navigation Act of 1660, to export sugar direct to foreign ports instead of through an entrepôt in England. Thus were made the first rifts in the mercantile system.

Another influence of the period, of quite different origin, but which also fell largely under the aegis of governmental or public planning, was the beginning of scientific interest in agriculture. The first botanic garden in Britain was founded at Oxford in 1632, to be followed by the Chelsea physic garden of the Apothecaries Company in 1673. Scientific enthusiasm was greatly stimulated by the formation of the Royal Society in 1660. In 1687 Sir Hans Sloane, who later became secretary of the Society, went to Jamaica as physician in the suite of the Duke of Albemarle. During his stay of fifteen months he collected about 800 new species of plants in the island, which was virgin ground to botanists, and he published a Latin catalogue of these in 1696. To the Dutch fell the credit of establishing the first colonial botanic garden at Capetown in 1694, largely for the propagation of plants from the East in transit for Europe. In 1730 John Bartram established a private botanic garden near Philadelphia; and, improving on this example, the Board of Trustees for the colony of Georgia founded an experimental farm near Savannah immediately upon the first settlement of the colony in 1733. This farm is of importance to the history of tropical agriculture because in connexion with it the botanist Robert Millar was employed from 1733 to 1738 in collecting plants and crop varieties from the West Indies, Central, and South America which might be acclimatized in Georgia. Even coffee and coco-nut palms were tried there. These expeditions were financed partly by the Board of Trustees, and partly by public-spirited subscribers, who included the Earl of Derby, the Duke of Richmond, and Sir Hans Sloane.

The Royal Botanic Gardens at Kew were established in 1760, and this encouraged the founding of the first government botanic garden in a British tropical colony at St. Vincent in 1780. The story of the collection of bread-fruit from the Pacific for introduction to this garden is one of the romances of history. The first English record of this crop was made by Dampier at Guam in 1686. Anson's scurvy-stricken circumnavigators were glad to eat the strange fruit in the Pacific in 1742. Captain Cook later discovered it to be present in Tahiti, and among the officers serving on his ships was one named Bligh. In 1787 Bligh was sent to Tahiti to collect bread-fruit plants for the West Indies, but his voyage ended in disaster, the mutiny of the *Bounty*, and the settlement of Pitcairn Island. After his miraculous survival, Bligh returned to Tahiti on the same errand in 1791, and triumphantly brought to the West Indies not only the bread-fruit but the 'Otaheite' sugar-cane, which was the 'Bourbon' variety under another name, and which was therefore introduced to the British West Indies one year after the French had brought it to their Caribbean possessions. The establishment of the garden at St. Vincent, however, proved to be an isolated event; for it was not until the period 1820-60 that other botanic gardens were established in British Guiana, Trinidad, and Jamaica, while the famous gardens at Peradeniya in Ceylon date from the same period. The West Indian botanic gardens thus formed were responsible in due course for plant introductions which led to important industries, for example the cultivation of the nutmeg in Grenada and of the lime in Dominica, St. Lucia, and Montserrat.

The dispersal of crops and livestock continued unabated throughout this period. The history of the dispersal of the cacao crop is of particular interest as it involves many points which are of practical importance for the plant

breeder to-day. The 'Criollo' or native cacao of Central America is stated to have been probably subject to human selection for at least 3,000 years. It was an established crop among the Mayas and Aztecs, though in Peru its uses were unknown before the Spanish conquest. By the middle of the sixteenth century this Criollo cacao had been introduced to Trinidad, where there were probably no indigenous trees, and in 1686 it was taken from there to Surinam, where there were certainly wild cacao-trees. In 1727 the cacao-plantations of Trinidad are recorded to have been practically destroyed, as were also those of Jamaica and Martinique in or about the same year, probably by disease, although the use of the word 'blast' in the original literature is ambiguous and may imply a hurricane in some cases. Thirty years later the Trinidad plantations were re-established with stocks brought probably from eastern Venezuela. These were either of already mixed type, or are thought with more probability to have hybridized with surviving Criollo trees in Trinidad, for when, seventy years later again, cacao stocks were re-introduced from Trinidad to central Venezuela, they were not recognized as Venezuelan types at all, but were given the name of 'Trinitario' or 'Forastero' (foreign), the latter of which terms is now used to cover so much of the world's cacao crop. Many so-called 'Forastero' types, however, though showing similar characteristics, are of quite different genetic origin from these. Such are the Brazilian crop, which probably originated from local wild or semi-wild stocks taken into cultivation about 1740, and the West African cacaos which represent an introduction (through Fernando Po) from Brazil or Surinam, showing affinity to the wild cacaos of the latter colony and a striking uniformity of appearance. However, the 'Trinitario' mixture soon proved to be notably hardy and prolific, though of poorer quality than Criollo, and introductions of this type have provided the

basis of the present crops of Ceylon and Java, though Criollos had earlier been introduced into both islands, and it has there again hybridized with them. The famous 'Cacao Nacional' of Ecuador, with its high market quality, represents a much more recent selection from local wild trees than any of these, and no extensive plantations were made in Ecuador before the nineteenth century.

As to livestock dispersal in the West Indies, it is interesting to note that by 1689 the importation of horses from New England to Jamaica was already frequent. In 1718 horses required in Nevis were chiefly brought from New England, as were also oats to feed them. Fodder was evidently something of a problem, but intelligent efforts were made to solve it, for in 1750 experiments were being made with lucerne in Barbados, but it was found that it could not withstand the dry season.

In striking contrast to these instances of crop and livestock dispersal is the history of quinine. Although popularized as a febrifuge for Europeans by its reputed cure in 1639 of the vicereine of Peru, Countess Chinchon (who gave her name to the plant—*Cinchona*), the world was content for another 200 years to rely for supplies on the wild trees of the South American forests. This was perhaps partly because there were still so few Europeans settled in the malarious tropical zone, and especially since some of the most populous settlements had been made in islands which were free from the disease (Barbados has no endemic malaria to this day, and Mauritius was not infected with the parasite until 1862).

The history of this period is in fact the history of sugar. The preponderant importance of the sugar trade and of the West Indian islands in colonial commerce and politics in the eighteenth century, even when compared with the North American colonies, is hard to realize to-day. The influence of the West India merchants and planters in

London, as in Paris, was so great that they could affect government decisions and influence strategy. To acquire or to defend a few square miles of sugar land, regiments of country yokels were sent out from England and France, to die like flies of yellow fever, but not before there had sprung, largely from their loins, a hybrid race which is in many respects better adapted to develop these tropical islands than either its white or its black ancestors. In the treaty-making of 1762, a section of British opinion considered the sugar island of Guadeloupe to be a prize more worthy of retention than Canada. Of the wealth of the West Indian islands at this period, and of their social brilliance which gave France an empress, accounts must be sought elsewhere: all were based upon sugar.

The importance ascribed to the West Indian planters in metropolitan agricultural circles is quaintly shown by the title-page of a book published in 1795, which reads as follows: 'A Treatise shewing the Intimate Connection that subsists between Agriculture and Chemistry. Addressed to the Cultivators of the Soil, to the Proprietors of Fens and Mosses, in Great Britain and Ireland; and to the Proprietors of West India Estates. By the Earl of Dundonald.' If we are sometimes tempted to decry the state of agricultural knowledge in the eighteenth century, reflection on the following passages in Lord Dundonald's section on West Indian agriculture may supply a corrective:

The very abundant crops of sugar at first produced, were undoubtedly owing to the accumulation of vegetable matter, in consequence of the Islands having been covered with wood for many centuries previous to their settlement and cultivation. There can be no doubt that the vegetable matter has in a small part only been expended in producing those abundant crops, and that by far the greater part has become oxygenated and insoluble by the exposure of renewed surfaces to the action of the atmospheric air, in consequence of the frequent

*stirrings and hoeings* [Dundonald's italics] which the ground has received.

and:

It is apprehended, that the less productive power of the soil of some of these islands, is more to be ascribed to the state in which the vegetable matter is now in [*sic*], than to its having been exhausted by cropping.

The laborious rediscovery of these principles of tropical agriculture in the twentieth century was, as will be seen later, to be hailed as a great advance in agricultural science; and much time and valuable soil fertility might have been saved if these early hints had not been forgotten by scientists.

The high relative importance attached by the world to West Indian affairs during the seventeenth and eighteenth centuries may be largely explained by considering a few statistics of the period. During the third quarter of the seventeenth century Barbados had a population of 60,000 (including 20,000 whites), while Virginia had only about 40,000, and Massachusetts did not achieve 60,000 until 1713. Even as late as 1744, the West Indies took English exports to the value of £796,112 while all the North American colonies together only took £640,114.

Although the supremacy of their trade was unchallenged, the sugar-planters were, nevertheless, not without their troubles. It has been pointed out<sup>1</sup> that the original settlement of the British West Indian islands had been undertaken by men from an England where the basis of farming was still a separation of arable and pasture areas, with the former under a succession of cereal crops in which fertility was maintained by dunging about once in three years and an occasional fallow. These ideas were carried over into

<sup>1</sup> *Agriculture in the West Indies*. Colonial No. 182. H.M. Stationery Office, 1942, p. 2.

sugar-cane cultivation, and since the islands were largely untouched by the British agricultural revolution of the eighteenth century which resulted in the practices of rotational farming and alternate husbandry, they have persisted as a weakness in the West Indian agricultural outlook to this day. The inherent dangers of the system became apparent as the initial fertility of the land was exhausted. Dunging became necessary with ever-increasing frequency, especially in the more overcrowded islands, and by 1714 it was stated that the soil of Barbados needed *annual* manuring to produce a cane crop. A similar position arose in the British Leeward Islands, which by 1745 were stated to be wholly under cultivation except for barren land and essential pasturage. Farm-yard manure was on occasion actually imported from England, as many of the merchantmen sailed in ballast on the outward voyage in those days.

The labour requirements of such a system were, of course, very great. The carrying of farm-yard manure in baskets to the cane-fields was considered to be one of the slaves' heaviest tasks. In 1717 30 acres of cane in Barbados were said to need the work of 150 slaves, whereas in the less exhausted French islands only 30-40 slaves were needed for this acreage. At this period of history 200-300 acres of sugar-cane land are considered by several writers to be a suitable size for a holding in the British islands, and the maximum amount that the proprietor and his family could supervise. Twelve cwt. of made sugar per acre was considered to be about an average yield in the eighteenth century, but it must be remembered that low-yielding canes were grown and methods of extraction very inefficient. Another index of fertility is given by the number of ratoon crops taken. This was highest in islands which still possessed virgin soil, as in Trinidad, where planters are recorded to have taken thirty and even fifty ratoons. A very common practice, however, in those days of manual



cultivation, was for a planter to replace individual stools in a canefield as they showed signs of exhaustion.

Towards the end of the eighteenth century, some reduction in labour was achieved by the use of 'moving pens' for folding cattle on land resting from cane in order to manure it. At this time it was considered in many of the islands where cultivation was oldest that about one-third of the cane lands should be in fallow at any given time.

In the processes of milling sugar, little change took place during the eighteenth century. Sugar-mills were worked by various sources of power—most generally by water-power in Jamaica, windmills in Barbados, Antigua, and St. Kitts, and tidal mills on the estates of British Guiana. In all the colonies, however, animal power in the form of cattle, mules, or horses was also used for some mills, with the exception of Barbados where the force of the trade winds was most reliable and windmills were used exclusively. In 1768 John Stewart introduced a steam-engine for working cane-mills into Jamaica, but the attempt proved to be premature and was not followed up. In 1805 a Barbados planter named Bell invented the 'dumb turner' to replace the manual operation of returning the cane for the 'second bite' of the three-roller mill, an operation which (largely owing to sleepiness during night-shifts) had led to such frequent accidents that cutlasses were kept in the mills to sever the arms of slaves who got caught in the machinery. The new appliance supposedly derives its name from the contrast to the volubility of the negresses whom it displaced. It was not until the nineteenth century that steam machinery really became a practical proposition on sugar estates. The first steam-mills started work in Trinidad in 1803, British Guiana in 1805, Jamaica in 1808, Mauritius in 1822, St. Kitts in 1838, and Barbados in 1846. One hundred and fourteen of these engines were exported by Boulton & Watt's works between 1803 and 1820, and another pioneer firm, Messrs.

Fawcett, Preston & Co., built seventy-nine between 1813 and 1817.

Many sugar-planters had no doubt been able to put by the capital needed for such conversions as a result of the high prices ruling for sugar during the early part of the Revolutionary and Napoleonic Wars, when revolution put a stop to the production of Haiti and all the French West Indian islands were cut off from Europe. But conversion to steam, with its attendant advantages, must have been also stimulated by the depression which followed immediately after. For in 1789 the ports of Cuba were thrown open to the foreign slave-trade, and the island soon became a sugar producer on a large scale and a serious competitor. The result was that the market collapsed in 1801, with a fall in London prices from 50s. per cwt. to 28s. within twelve months. More ominous for the future was the fact that under Napoleon's 'Continental System' the newly discovered process for the extraction of sugar from beet first began to be exploited on a large scale.

During the greater part of the eighteenth century sugar had hardly a competitor amongst exportable products of the West Indies. Jamaica had, indeed, started its life under British administration as primarily an exporter of cacao, but after the destruction of the plantations in 1727 this was entirely supplanted by sugar. Coffee, which was introduced a few years later to the islands, only slowly grew to importance. Jamaica, with its excellent environment for coffee-growing in the Blue Mountains, took the lead with this crop. Its production was much stimulated in 1783 when Pitt reduced the United Kingdom duty from 1s. 6d. to 6½d. per lb., and subsequently by the extinction of French coffee plantations in Haiti by revolution. Coffee exports from Jamaica rose from 2,000,000 lb. in 1784 to over 22,000,000 lb. in 1820.

The West Indian economic system in the eighteenth

century already showed one grave defect which still persists to-day. In their intensive efforts to achieve the maximum output of cash crops for export, food crops were neglected, and the British islands were very far from being able to feed themselves. Browne, a writer of 1756, states that great quantities of potatoes were annually imported into Jamaica from Lancashire and Ireland. Governor Lyttelton of Jamaica, in a report to the Board of Trade, showed that Jamaica's chief imports from British North America in the five years 1758-62 were 128,740 barrels of flour, 69,288 tierces of bread, and 31,355 barrels of beef and pork, while rice and fish in large quantities were also included. In the same period even more beef, pork, and fish were imported from Ireland, as well as butter and potatoes. The introduction of the bread-fruit, from which great things had been hoped in making the islands more self-supporting, did not achieve its purpose. The assessment of all wealth in terms of the export crop was nowhere better typified than in British Honduras, where at a public convention of settlers in 1766 it was agreed that 'all debts contracted in the Bay of Honduras shall be payable in logwood'. It is hardly surprising that at a later date in the same colony a ban was put on workers other than Caribs or Maya Indians engaging in cultivation at all, in order to maintain labour supplies for the lumber-camps. The situation of the West Indian colonies in respect of food supplies has hardly changed in two centuries, except that to-day foodstuffs are no longer drawn from the United Kingdom, and tinned milk is one of the most important local imports.

It will not be necessary in this history to consider the institution of slavery at very great length, because the use of slave, as distinct from free, labour did not have any great effect on the technical methods and operations of agriculture. In producing sugar, the colonies were only in competition with other countries where slavery also existed, and

hence none of them derived any special advantage from the employment of this form of labour. It was only after emancipation that the British West Indian planters felt the effect of competition from countries such as Cuba, Brazil, and Porto Rico where slave labour was still employed, and this was a contributing cause to the great Victorian crusade against the slave-trade on the high seas and slavery in other people's countries, which was felt by other nations to be carried out by somewhat high-handed methods.

In fact, slave labour was never particularly cheap. In 1689 West Indian planters were complaining that slaves, formerly obtainable at £7 each, had risen to £20 owing to the monopoly enjoyed by the Royal African Company. In spite of the cancellation of this monopoly, by 1727 the price was £17 to £27. In 1788 the average price for a Gold Coast negro was £40 and for a Creole slave £50. At that date one slave was reckoned to be needed for about every 2 acres of sugar-cane on the most favourably placed plantations. If a planter wished to breed slaves on his own estates to save the cost of purchase, he had to pay for the maintenance of considerable numbers of children, old people, and women who were not in regular work, and it was usual also to provide some modicum of medical attention.

Slaves were therefore employed, not for their cheapness, but because there was simply no other labour available—a fact which the planters proved by bitter experience in the years following emancipation. In the seventeenth century attempts had been made to cultivate the West Indian colonies by white labour, descending through successive stages from free labour or indentured immigrants to convicts such as the political prisoners of Monmouth's rebellion. But before the century closed it was accepted that there was no practicable alternative to slavery. Economically, the correct use of this unpaid labour, as of prisoner-of-war labour and other similar categories, would no doubt have

been for capital improvements, but in the absence of any other labour for routine production, this was impossible, and only came about accidentally in a few cases. The most important of these was the empoldering of the sugar estates in what is now British Guiana, under the supervision of Dutch plantation owners in the seventeenth century. The canals which were dug to drain the estates have proved equally useful in providing a cheap means of irrigation and of transport of the cane from field to factory, so that the benefits of the slave-made improvements have been continuously felt, and as recently as the depression of the nineteen-thirties enabled these estates to maintain higher rates of dividends than most others.

The labour organization of an estate employing slave labour shows, in fact, surprisingly little difference from that of any plantation in the tropics using free labour, even to-day. An interesting picture of it, at a period when the system had reached its highest stage of organization, is given in Loudon's *Encyclopaedia of Agriculture* of 1825, which draws largely on local accounts. The usual staff on an estate is described as:

An overseer for each estate, who has both free white men and slaves under him; a head driver, a slave; the head cattle and mule man; the head boiler or manufacturer of sugar; head carpenters, coopers, masons, coppersmiths, and watchmen; a hot-house or hospital doctor or doctress midwife; the great gang of able men and women; the second gang of rather weakly habits; and the third, or weeding gang, composed of children; cattle and mule boys, watchmen, invalids, and superannuated, and young children and infants.

As regards the methods of cultivation, the account goes on:

The soil is seldom either ploughed or dug, but generally worked with the hoe pick. The spade the negroes are awkward at using; and they are not less [*sic*] expert at the plough. White ploughmen have been imported by some cultivators; but the

prejudices of the overseers, the awkwardness of the oxen and negro drivers, and the effects of the climate in wearing out the spirits of the ploughmen, are said to have discouraged its use.

Anyone who has had experience of the organization of plantations in the tropics at the present time, will readily recognize parallels to almost every statement in these two excerpts.

The degree to which slaves were overworked, as judged by present standards for tropical field labour, can be exaggerated. In Jamaica the law forbade planters to work slaves after 7 p.m. or before 5 a.m.; half an hour was allowed for breakfast and two hours for dinner, so that the maximum working day was eleven and a half hours, but this was not fully exacted by all owners. The slaves were allowed one Saturday a fortnight for working in their own food gardens. On coffee estates, a day's task for a slave in a good crop season was to pick 30 lb. of cherry in a day—a task which would now be considered light for paid labour, though, of course, the slave was liable to flogging if he did not bring in the required amount. A common statement of slave-owners was that one European in his own climate would do as much work as any three slaves; and as comparisons of paid African workers in a similar ratio are often made to-day, it would not appear that much more work was got out of tropical labour then than now. The period of heaviest labour for the slaves was during the cane-crop season, from about January to May. Operations in the boiling-house were then carried on continuously (except at the week-ends) by day- and night-shifts, partly owing to an erroneous idea of the time that sugar should never be allowed to cool during boiling.

## II

## AFRICA AND THE EAST

THE agricultural history of tropical Africa throughout most of this period is almost a blank. No significant changes are known to have taken place in native agriculture, though in one isolated instance the Baganda discovered towards the end of the eighteenth century the use of bark-cloth prepared from species of *Ficus* to replace the skins which they had hitherto used as clothing. This provides an interesting parallel to the use of bark-cloth made from *Broussonetia papyrifera* in Fiji and elsewhere in the Pacific region.

It was the industrial revolution in Europe which brought Africa more prominently into the picture of world trade. Amongst the early consequences of that revolution was an increased demand for oils and fats, caused mainly by the needs of the new machinery for lubricating-oil and by the increased demand for candles. No shipments of palm-oil from West Africa to Britain are recorded between the last Elizabethan cargo in 1590 and the year 1772, when a regular importation through Liverpool began. In 1785 this amounted to 55 tons; it passed 1,000 tons in 1810. The delta of the Niger became known from this trade as the Oil Rivers.

A settlement which was already under British rule was not far behind in taking advantage of the mounting demand for fats. In the Gambia in 1817 beeswax still accounted for nine-tenths of the value of the very small exports. But there was a development of the greatest significance for its future history when in 1830 the first trial consignment of 100 baskets of ground-nuts was made. The mention of baskets also serves as a reminder of the disabilities of a time when jute sacks or 'gunny-bags' had not yet come into use; the first export of jute from India only took place in 1828, and at this time hempen sacks were still used on English farms.

By 1835 ground-nut exports from the Gambia had grown to 47 tons, and the trade was launched.

Thus in two territories were sown the seeds of an unpremeditated development which was to be of the greatest importance to British as well as colonial agriculture. For the residual parts of oilseeds processed in Great Britain contributed as oilcake and fertilizers very greatly to her agricultural economy, and played in particular a notable part in helping to maintain the fertility of the soil in these islands from the nineteenth century. This growing tendency of Britain to import, as it were, fertility at the expense of other countries first aroused a feeling of resentment in continental Europe. The great German agricultural chemist Liebig (1803-73) wrote in a somewhat flamboyant passage and with reference chiefly to British imports of bones:

England is robbing all other countries of their fertility. . . . Annually she removes from the shores of other countries to her own the manurial equivalent of three million and a half of men, whom she takes from us the means of supporting, and squanders down her sewers to the sea. Like a vampire she hangs upon the neck of Europe, nay, of the whole world.<sup>1</sup>

Such thoughts were used in the twentieth century to support an argument on agricultural and even political grounds that the residual products of agriculture should, as far as possible, be kept in the colonies by local processing. But, although this is now generally conceded to be desirable, the obstacles to the setting up of processing plant in countries without sources of power or skilled industrial labour have remained for the most part insuperable.

In 1787 the permanent British settlement of Sierra Leone was begun, and it is worthy of record that the Sierra Leone Company were sufficiently enlightened to employ the Swedish botanist Adam Afzelius, a pupil of Linnaeus, in

<sup>1</sup> Quoted in *Fertilizers and Manures* by Sir A. D. Hall and A. M. Smith. John Murray, 4th ed., 1947, p. 82.



the territory from 1792 to 1794. Nor did botanical exploration end with his departure, for the indigenous 'highland' coffee (*Coffea stenophylla*) was discovered in 1796.

On the eastern coast of Africa one outstanding crop introduction was made during this period. The production of cloves had long been a jealously guarded monopoly of the Dutch sphere of influence in the East Indies. In about 1770, however, the French succeeded in obtaining seeds of the tree and carried them to Mauritius, where their botanic garden at Pamplemousses antedates even that of St. Vincent. From there, probably in about 1818, the crop was introduced to Zanzibar, it is said at the request of the Sultan. That much over-worked Swahili word *shamba* (a farm) originated as a corruption of the French *champs*, which was at first used to designate a 'field' of cloves. Helped by a cyclone which largely destroyed the clove plantations of Mauritius not long afterwards, the crop soon became the most valuable export of Zanzibar, which still remains the world's chief supplier of this spice.

Another break in the series of spice monopolies occurred during the same period. The British on their occupation of Ceylon in 1796 decided to continue the cultivation of cinnamon as a government monopoly, which had been the system under Dutch rule. In 1832, however, the monopoly was abolished; as a result the quantity of exports increased, but their value gradually declined over a long period. The price of cinnamon in London fell from 5s. 1d. per lb. in 1841 to 1s. 6d. in 1857.

Mauritius played an important part in the distribution of another crop when in 1826 Mr. C. Telfair obtained from south China plants of what was then known as the Chinese banana for his collection of *Musa* varieties in Mauritius. From this source one plant later found its way into the greenhouses of the Duke of Devonshire in England, where it was described and given the specific name *cavendishii* in

his honour. Planting material from Mauritius later reached the Canary Islands, where this species became so widely cultivated for export as to earn the name of the 'Canary banana'. The Pacific islands on the other hand, though so much nearer the banana's original home, were actually supplied by suckers from the English plants carried by missionaries to Samoa, whence they were introduced to Fiji and formed the original basis of the banana industry there.

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## PART III

# PRIVATE ENTERPRISE, 1838-1900

### I

## COLONIAL SUGAR PRODUCTION

THE emancipation of all slaves in the British West Indies in 1834, consummated by their release from the transitional status of apprenticeship to their former owners in 1838, heralded a new era. The restrictions imposed by the mercantile system had for some time been undergoing gradual relaxation, a culminating point of which was the legislative permission accorded to the British West Indies in 1822 to trade with all European ports and with foreign countries and colonies in the western hemisphere. The period in which emancipation fell was thus the beginning of that hey-day of *laissez-faire* and private enterprise which lasted until the close of the century or somewhat beyond. It is the effects of that private enterprise, armed with the new resources of capital and of material equipment created by the industrial revolution, upon tropical agriculture which falls to be considered next. As the detailed history of the developments in each major crop become of more importance in this period, it will be necessary to treat each separately, giving pride of place to sugar because of its historical pre-eminence and the continuity of its story with the preceding period.

No one could foretell the agricultural effects of emancipation in advance. In 1848 Lord John Russell declared that emancipation was justified by the fact that 800,000 negroes were now free peasant proprietors living in content and comfort. But such a boast, in so far as it was true, only applied with any force to the larger colonies such as

Jamaica, Trinidad, and British Guiana where there were unoccupied lands which the former slaves were able to take up as small-holdings. Most of the British governing class, from home experience following the period of enclosures, must have visualized the ideal status of the ex-slaves as that of free labourers on estates rather than yeoman farmers. The negroes were severed by many generations from any traditions of peasant farming in their own home countries, and as examples on the spot they had only plantation owners, imbued with the traditions of a bygone English agricultural system, and unversed in tropical rotational farming with annual crops and especially in food production. The freed slaves and their descendants did not cut then, and do not cut to-day, a good figure as independent peasant farmers. The imperial legislators, who were so impelled by their consciences to vote for emancipation, do not seem to have felt any moral compulsion to provide technical assistance for the slaves in attaining the yeoman status which Russell thought so desirable. It is interesting to speculate as to what would have been the effect on West Indian agriculture, then and now, if experimental farms and extension services had at that time been available to work out a suitable local system of subsistence farming.

The effects of emancipation on the planters were immediate. The cost of sugar production is recorded to have risen from 7s. 6d. per cwt. of muscovado sugar in Antigua to 16s. 6d., and in Barbados from 6s. to 15s. 6d. In Jamaica many sugar estates were converted into cattle ranches, and most of the existing 'pens' date from this period. Exports of British West Indian sugar to the United Kingdom fell by more than a million cwt. between 1834 and 1840. Nevertheless, the best sugar estates remained in production, assisted by the practical monopoly of the British market which they still enjoyed owing to the high duties on foreign sugar. In

the small, densely populated islands the former slaves were willing to accept paid work on the estates as they had no alternative means of livelihood. The labour shortage, however, remained acute, and was particularly severely felt in two large territories which had only recently come under British rule, British Guiana and Trinidad, where large negro populations had not been built up before emancipation. These colonies attempted to solve their problem by the importation in turn of Portuguese, then of Chinese, and finally with great success of East Indian indentured labour. The first consignment of East Indian labourers arrived in British Guiana in 1838, for Mr. John Gladstone, father of the statesman; the last were landed in 1917. The problem and its solution were not peculiar to the British colonies only, for even the Dutch Government of Surinam maintained a recruiting-office for indentured labour in British India during the latter part of the nineteenth century. The negro inhabitants affected to despise these 'coolie men' who would accept work that they themselves did not care for, while at the same period, in another part of the British colonial Empire, Indian immigrants into East Africa, some of whom ultimately became plantation owners, felt themselves equally superior to the masses of African race. Each of the nationalities of immigrant labour has left its traces upon the agriculture of the Caribbean. The Portuguese and Chinese have only done so to a small extent, though Chinese farmers may still be found affording advanced examples of the arts of market-gardening and irrigation in Trinidad. The East Indians, now forming a large proportion of the population, have had much more effect. As farmers they have widely popularized the zebu cattle, which have turned out to be so well suited to this environment. In British Guiana they have taken up on a large scale the cultivation of rice, a crop never previously popular in this region though always bulking largely in its imports. It was typical

of the philosophy of an earlier period that it was actually a criminal offence in British Guiana, fearing the deflexion of labour from the sugar plantations, to grow rice at a time when it was being imported from as far as India and Burma to feed the Indian immigrants. It is of incidental interest to note that Mauritius, in a very similar situation to the West Indies with an economy based on sugar, was also in the middle of the nineteenth century importing rice and labourers by the same ships from India.

Shortage of labour was not the only economic trouble which the sugar industry faced during the nineteenth century. In 1854, a heavy blow was dealt it when the duties on foreign sugar imported into Britain were finally withdrawn. Beet-sugar grown in Europe and supported by export bounties became a most serious competitor, and in 1883 the volume of it entering world markets for the first time surpassed that of cane-sugar, though this position was again to be reversed in the twentieth century. In 1897 when the United States imposed heavy duties on European beet-sugar, that country became momentarily the chief customer for British West Indian sugar, but this opportunity ceased in 1898 on the passage of the McKinley tariff. A partial substitute was provided when in the same year Canada adopted a preferential duty favouring British West Indian sugar.

The sugar planters reacted in various ways to this increasing storm of misfortunes. One effect was to provide a maximum incentive for the cultivation of alternative crops. Cacao cultivation on a serious scale in Trinidad and Grenada began to develop when the British sugar preference was abolished. Regular banana exports from Jamaica began in 1870. Cotton cultivation in the West Indies was much extended during the world cotton famine caused by the American civil war, but declined again as soon as the war was over.

But by far the most important effect of adverse economic circumstances upon the sugar industry was to stimulate it to technical improvements in its methods. During the second half of the nineteenth century enormous strides were made in this direction, reflecting great credit on the leaders in the industry and setting it on its modern basis as one of the most efficient forms of agricultural production. The earliest technical improvements were, by force of circumstances, those which also effected a saving in labour. In Barbados when the first steam-driven mill was set up in 1846, there were 506 windmills in the island; by 1911 the greater part of their work was done by 109 steam plants, though 226 windmills still survived; to-day the latter are extinct. On the other side of the world, in Mauritius, in 1823 there were 88 water-mills, 62 animal-powered mills, and 7 steam plants (windmills came into use here only at a later date). Here the last animal-mill had disappeared by 1848, and the last windmill by 1863, though one solitary water-mill continued in use to 1931. Following the steam-engine, the locomotive was pressed into the service of sugar, and light railways were built on estates for the transport of cane to the factory. As the century proceeded, by a blessing in disguise the cane-sugar industry was able to borrow technical improvements in factory processing from its beet-sugar rival, and thus equipped itself with triple effect evaporators, the vacuum pan, and the centrifugal separator. At the height of this movement, in a single instance the Colonial Company spent a third of a million pounds between 1870 and 1895 in modernizing its West Indian factory and transport equipment. British Guiana imported £1,307,500 worth of sugar machinery between 1880 and 1895.

Another move in the economy campaign was the amalgamation of small estates and the erection of central factories to replace smaller and less economic units. The

number of sugar factories in British Guiana was reduced from 180 in 1849 to 64 in 1896, and in Trinidad from 88 in 1889 to 39 in 1896. This greatly assisted in lowering the cost of manufacturing sugar, which was halved in British Guiana between 1883 and 1896, and in Trinidad in the same period fell from £8. 9s. to £3. 11s. per ton.

As the science of biology advanced the thoughts of the leaders of the industry turned to new possibilities in the improvement of the sugar-cane plant itself. Simultaneously experimental stations for this purpose were set up in two widely separated parts of the tropics: that of Barbados as a government institution in 1886, and others at Tegal and Kagok in Java supported by growers' associations in the same year, to be followed in the succeeding year by the famous Proefstation Oost Java. In both countries serious work led almost immediately to the observation for the first time of sugar-cane seed and its germination, which was made by Soltwedel in Java in 1887, and by Harrison and Bovell in Barbados early in 1888. Sir John Harrison, who was at that date Professor of Chemistry in Barbados, a post to which he was appointed in 1879 at the age of twenty-three, was a distinguished scientist who deserves to be remembered not only for his cane-breeding work but also for his important researches on the development of tropical soils in British Guiana. The varieties of cane bred at the Barbados station soon became famous under the designations 'B' (Barbados), 'Ba.' (Barbados selfed) and 'B.H.' (Barbados hybrid). Harrison, removing shortly afterwards to British Guiana, immediately began cane-breeding work there also, these Demerara varieties being known under the letter 'D'. It is interesting to note that D.625, which later became the standard cane of the colony, was bred there as early as 1892.

It was extremely fortunate that a mechanism for the production and distribution of new varieties was in existence in



the West Indies before they were struck by a peculiar phenomenon of the second half of the nineteenth century. This was described by contemporaries as the 'degeneration' or 'running-out' of the Bourbon or Otaheite variety of cane which had played a major part in production in all sugar-growing countries since the eighteenth century. Actually the variety seems to have been attacked by different diseases in a number of countries, in which perhaps predisposing conditions were present in large areas devoted to the sole cultivation of this crop and in over-worked soils in some cases. In about 1840 the variety failed in Mauritius and Réunion, where it had been longest established. In 1860 a similar condition prevailed in Brazil, where Bourbon canes are supposed to have been heavily attacked by *Bacterium vascularum*. In 1872 Bourbon was almost entirely wiped out in Porto Rico, while other varieties remained comparatively healthy. In 1880 the epidemic of 'sereh' virus disease, to which Bourbon proved very susceptible, began in Java. In the British West Indian islands the blow did not fall until the period 1890-5. In British Guiana the phenomenon was only late and partial, for Bourbon was not abandoned in general cultivation until the twentieth century, and as late as 1921 it still occupied 13 per cent. of the cane area.

Cane-breeding work in Barbados and Java and at the many other stations which were later established took different lines according to the problems with which each area was faced. In Barbados until recent years all selections have been made within the species *Saccharum officinarum*, and some varieties well suited to West Indian conditions have been the result. In Java, where the virus diseases, sereh and mosaic, posed an entirely different problem, the thin Indian cane *S. barberi* which is resistant to sereh, and the wild *S. spontaneum* which resists mosaic were used in the breeding programme. These were crossed, and the progeny

repeatedly back-crossed, to 'noble' (thick) canes of the species *S. officinarum* to obtain good yielding and milling qualities. The resultant canes of the 'P.O.J.' series from the Proefstation Oost Java have included some of the best varieties ever known, many of which have been widely cultivated in the British colonies and elsewhere.

The progress made in the production of canes of high yield and milling qualities, coupled with the improvement in factory extraction, had by the end of the century so changed conditions in the sugar industry that the conceptions of older planters were quite falsified. Leonard Wray, a well-informed observer who had experience in Jamaica and India as well as in Malaya, had written in *The Practical Sugar Planter*, published in 1848:

I must own I cannot well explain why planters should be so very anxious to obtain possession of cane seed; surely they can scarcely expect to obtain a finer variety of cane than the Otaheite or Salangore!—a cane that, under favourable circumstances produces from two to three tons of dry sugar per acre!<sup>1</sup>

In the twentieth century, *average* yields of the order of four tons have been attained in some countries, while 'under favourable circumstances' twenty tons have been produced.

## II

### THE ORIGINS OF RUBBER PLANTING

ANOTHER venture, in which private enterprise was to make some of its most outstanding contributions, traces its beginnings, inconsistently, from governmental initiative. 'Indian rubber' had been known long before the nineteenth

<sup>1</sup> Quoted in 'Sugarcane: Its Origin and Improvement' by E. W. Brandes and G. B. Sartoris, *Yearbook of Agriculture*, U.S. Dept. of Agric., 1936, p. 574.

century. The American trees from which were derived Panama, Ceara, and Para rubber had been discovered and described, mostly by French botanists, in the eighteenth century. Assam rubber (a species of *Ficus*) was already well known to Europeans. But, as with so many other tropical products, the industrial revolution found both new means of processing and new uses for it. With the discovery of vulcanization almost simultaneously by Goodyear in America in 1842 and Hancock in Britain in 1843, what had been a toy became an industrial raw material.

From about this period the Government of India, actuated by some foresight perhaps due to its origins as a trading company, became interested in obtaining planting material of the American rubber-bearing species, as also of another highly important American crop, *Cinchona*. The transference of these two kinds of plant to Asia is historically linked together. The interest of the Royal Botanic Gardens at Kew was enlisted, and in 1849 the first move was made when the botanist Richard Spruce was sent to Brazil to study its economic plants and to collect cinchona seed; he also brought back herbarium specimens of species of *Hevea* which enabled Bentham to make the first modern botanical descriptions. Spruce's preliminary work on the study of cinchona was supplemented by the dispatch in 1860 of Mr. (later Sir Clements) Markham, who was then employed at the India Office and had a first-hand knowledge of South America, to collect the wished-for seed. His quest was successful, the seeds were grown at Kew, and planting material sent to the East. Extensive planting followed in India, and also in Ceylon, where the story of the crop will be told later. Meanwhile Spruce had returned several times to Brazil, and in 1860 was accompanied by a gardener named Cross. In 1875 Cross was sent by the India Office to Panama to obtain plants of Panama rubber (*Castilloa elastica*), and conveyed 134 in good condition to Kew. In 1876 he was sent to

Brazil for Para rubber (*Hevea brasiliensis*) and brought a consignment of seedlings home with him. These were augmented in the same year by a supply of Para rubber seed obtained by H. A. (later Sir Henry) Wickham, who was then resident at Santarem on the Amazon. Cross obtained on the same expedition seeds and plants of the Ceara rubber tree (*Manihot glaziovii*).

Before the year was over about 2,000 *Hevea* plants raised at Kew from Wickham's seed were shipped to the Botanic Gardens at Peradeniya in Ceylon. The authorities are now divided as to whether or not a small number of Cross's seedlings were also included in the consignment. However this may be, it is from this historic consignment that have been derived nearly all the stocks of Para rubber in the eastern tropics. Malaya was in a position to take early advantage of the introduction, for, profiting by the experience of other colonies, its Government had established botanic gardens at Singapore in 1858, to be followed by others in Penang about 1887. Of the rubber seedlings originally received in Ceylon fifty were sent thence to Singapore but these all died. More were sent in 1877, when twenty-two were planted in the Singapore botanic garden, and seven in the garden of the Perak Residency; in the latter may be seen the hand of Sir Hugh Low, then Resident in Perak, who had started his career as a botanist. By 1884 trees of Para and Ceara rubber in the Singapore gardens were able to be tapped to provide samples for report. It is odd, in view of later developments, to find an ex-Governor from Malaya complaining that during the immediately following period British capitalists were slow to exploit the suitabilities of the Malayan soil for rubber which had been proved in government plantations.<sup>1</sup> The planters were at that time more interested in coffee, and commercial plantings of rubber did not begin until about 1895.

<sup>1</sup> Sir F. Swettenham, *British Malaya*, John Lane, 1907, p. 263.

## III

## DEVELOPMENTS IN AFRICA

PRIVATE enterprise of quite another kind was responsible for the extraordinary rise of cacao production in the Gold Coast. Cacao trees are known to have been growing in the territory in 1815, and in 1866 the Basel Mission was harvesting at Akropong pods from cacao which it had recently introduced from Surinam. But these early introductions, which were probably largely of Criollo type, failed to stimulate any commercial plantings. In 1879 one Tetteh Quarshie (the name is variously spelt), a Fanti blacksmith of Accra who had been working in the Spanish island of Fernando Po and had there seen intensive cultivation of the crop, returned to the Gold Coast with some cacao (variously stated to have been pods, beans, or seedlings) which he planted out to make the first local cacao farm, and which provided a source of seed to further African planters. Following on this example, the Basel Mission Trading Association imported further seed into the Gold Coast from Fernando Po, and the Government in 1887 from the Portuguese island of San Thomé.

Exports of cacao from the Gold Coast are first recorded in 1893 at 3,460 lb. The Government at that date were already reporting with satisfaction that assistance was being rendered to the infant industry by the Government Botanical Station established at Aburi in 1890. In 1894 exports were 20,312 lb. But it was not for many years that this crop climbed out of the ruck of miscellaneous products which the territory then exported; it is difficult now to realize that in 1891 the Gold Coast was the world's third largest rubber producer, from her wild forest resources. The rate of increase in cacao exports during the last four years of the century, though on a small scale was nevertheless extraordinarily rapid, as the following figures will show:

<i>Year</i>	<i>Cacao Exports in lb.</i>
1897	156,672
1898	414,201
1899	714,929
1900	1,200,794

The beginnings of the less important Nigerian cacao industry followed a similar course to those of the Gold Coast, for cacao is said to have been first introduced as early as 1874, also from Fernando Po, by a Nigerian chief called Squiss Banego, who established a cacao farm in the Bonny district from which the cultivation spread.

Other West African crops, too, as a result of private enterprise rather than governmental stimulation, were being increased to meet new world demands. Such a case was the export of ground-nuts from the Gambia, whose beginnings in 1830 have been referred to, and which was characterized by the further unusual facts that some of this produce was not even grown on British territory but was brought into Gambian markets by farmers from beyond the frontiers, while a further proportion was grown in the Gambia by 'strange farmers' who immigrated merely to grow one or two crops before returning home with their cash. In 1852 the Governor reported that the largest part of the crop was grown by these men. In these circumstances the British Government as the trade grew found it expedient to recognize the French 5-franc piece as legal tender in 1843, and in 1848 to accept the 'bourdeau' as a legal measure of volume equivalent to 8 bushels. These measures were also prompted by the fact that French trading firms were the largest buyers of ground-nuts, and for very many years the bulk of the exports went to France. The development of ground-nut cultivation was not officially assisted by any government action, but in 1840 the Governor paid tribute to the help given by agricultural instruction of natives at the Wesleyan

Mission's model farm at MacCarthy Island. In 1859 the annual export of ground-nuts had reached 15,000 tons. Long before the end of the century the greater part of the government revenue was derived from the export tax on this crop.

The export of palm-oil from the Niger region increased steadily throughout this period, receiving a marked impetus after the prohibition of the slave-trade, when shipowners who had previously loaded slaves were looking for alternative cargoes on this coast. Imports of 30,000 tons of palm-oil through Liverpool were reached in 1851. In about 1860 the industry received a severe shock when the production of paraffin was begun in the United States, but fortunately at about the same time it was put on a sounder economic footing by the discovery of the value for oil extraction of the palm kernels, which had hitherto been thrown away as waste material or used to pave floors. With the coming of British rule a botanical garden was started at Lagos in 1887 by an enthusiastic Administrator, Sir A. Molony. The Royal Niger Company, also, in the territories which they administered, had founded a garden for the distribution of plants at Asaba in 1888 and four other agricultural stations in 1889-90 for experiments with coffee, cacao, and other crops. Slightly later came the foundation of a botanical station at Calabar in the Oil Rivers Protectorate in 1893, and of a 'model farm' at Ibadan in 1899.

Other colonial powers were not behindhand in attempting the scientific development of agriculture in this region. In 1892 the Germans made the first plantings in their botanic gardens at Victoria in the Cameroons. These gardens were later resuscitated under the British mandate in 1927.

In the British territories in East Africa agricultural development can hardly be said to have begun before 1900, though a curator of the botanic gardens 'about to be esta-

blished' in Uganda was appointed in 1898. Other indispensable preliminaries such as the establishment of law and order, and railway construction, were also under way. In Zanzibar, the clove growers sustained severe losses in 1872 when a cyclone destroyed about two-thirds of the trees on the main island, though in the sister island of Pemba they were little hurt. A vigorous replacement programme following this disaster has led to the curious phenomenon of a large clove population of uniform age in Zanzibar, while in Pemba many of the trees planted at the time of the original introduction are still alive.

#### IV

#### THE CEYLON PLANTING INDUSTRY IN THE NINETEENTH CENTURY

THE history of the planting industry in Ceylon during the nineteenth century is of exceptional interest. It provides the classical instance of mono-culture—the growth of one crop, in this case coffee, over enormous contiguous areas—favouring the spread of plant disease to such an extent as to threaten the cultivation with extinction. This pattern was, with the growing commercialization of tropical agriculture, later to be repeated many times over. But in later times when it occurred expert advice was at least at hand; in the hour of Ceylon's crisis the science of mycology was as yet in its cradle, and the fungus which caused the trouble was often referred to by contemporaries as the 'coffee bug'!

Coffee exports, like those of cinnamon, had been a government monopoly under Dutch rule in Ceylon. That Government had established plantations at Galle and Negombo, but these coffee farms in the coastlands had been a failure, and thereafter the administration had contented



itself with the export of coffee bought from the subjects of the kingdom of Kandy in the interior. The British Government abandoned the monopoly but in 1830 there was only one European planter in the island, and it was not until the highland areas were opened up by road construction that conditions were created favourable for coffee-planting. This service agriculture owes to Major Skinner, the presiding genius of road-building in Ceylon from 1820 to 1867, through whose work the road from Kandy to Colombo was completed in 1831. The virtual father of coffee-planting was R. B. Tytler, who had studied in the West Indies the methods in use there, and applied them to his estate in Ceylon from 1837. The establishment of coffee exports was greatly assisted by the reduction of the United Kingdom coffee duty, which had previously been 6*d.* a lb. on West Indian coffee and 9*d.* on all others, to 6*d.* for both West and East Indian coffee in 1835. At the same time the world demand for coffee was rising, and West Indian production was falling owing to scarcity of labour following emancipation; British West Indian coffee exports to the United Kingdom declined from 291,897 cwt. in 1827 to 63,559 cwt. in 1845. Under these circumstances the highland areas of Ceylon were rapidly planted with coffee by enterprising settlers and civil servants, and the crop soon became the island's chief export. A severe, but only temporary, depression was, however, experienced in 1847, due partly to over-speculation in coffee estates and partly to the abolition of the preference hitherto given in the British market over coffee from Java and Brazil. The policy of free trade in the United Kingdom, which is claimed to have bestowed such great benefits on the home country, created difficulties for more than one colonial industry and its degree of advantage for the Empire as a whole has never been properly assessed.

In 1868 when coffee-leaf disease caused by the fungus

*Hemileia vastatrix* first appeared nobody took much notice. Coffee prices were experiencing another period of increase: during the year 1873 alone the price for average Ceylon coffee increased from £2. 14s. to £4. 10s. per cwt. The one expert on the scene, Dr. Thwaites, who held the post of Superintendent of the Royal Botanic Gardens at Peradeniya for the remarkably long period 1849-80, already prophesied doom to the industry but could not in the then state of botanical knowledge suggest any control for the disease. As the years went by production declined owing to the ravages of the disease, but for a long time this was masked by a steady rise in the monetary value of the exports. It is, indeed, probable that, as has since been noted in similar outbreaks, a decline in production was wholly ascribed to the disease which was partly due to other causes; for in the promiscuous planting of coffee over large areas during the boom, many trees must have been established on patches of less suitable soil, and many probably received unskilful cultivation. Throughout this period, too, the 'green bug' of coffee (*Lecanium viride*) was causing a good deal of damage as a pest. By the eighteen-eighties a blind eye could no longer be turned to the trouble. Exports, which in 1870 had been 1,054,030 cwt. of coffee, had by 1886 fallen to 179,254 cwt. although large new areas had been planted up to as late a date as 1878, when a maximum of 275,000 acres under the crop was attained. During the decade 1880-90 some 400 of the 1,700 European planters left Ceylon. The end was pathetic. By 1895 the acreage had fallen to 22,475 and in 1905 only 3,591 acres were under coffee.

Meanwhile Thwaites had been doing his best to provide an alternative crop. Cinchona, which had been introduced at the Hakgala botanic gardens in 1861, was his first choice, and the establishment of this industry was largely due to his efforts. The area under cinchona on the plantations increased from 500 acres in 1872 to 65,000 in 1883. But

cinchona suffered a different fate, as distressing as that of coffee. Over-production caused a disastrous fall in the price of bark from 12s. 2d. per oz. in 1878 to 1s. by 1892, and the crop was then practically abandoned in Ceylon. Although India remained a substantial producer of quinine for internal consumption, only the Netherlands Indies continued export production during the depression years, and in due course reaped their reward by capturing the bulk of the world trade in this product.

In Ceylon neither Thwaites nor the planters, in that era of rugged initiative, were yet daunted by their misfortunes; it was in this period that Ceylon planters acquired, in the phrase of a contemporary, a 'reputation for grit' that long remained their pride. Their next enterprise was much better rewarded. A small tea plantation had been established at Peradeniya in 1845, and from 1860 onwards Thwaites had carried out experiments to discover the best varieties and methods of cultivation, predicting at an early stage that this would become one of the staple crops of the colony. As coffee declined the area under tea rose from 350 acres in 1874 to about 150,000 in 1887. The seed from which the crop was established came from Assam, and already represented a hybridization between the local tea of that region and the type imported into India from China in 1834, so that in genetic make-up the Ceylon tea population is similar to those of India and Java. The exports of tea from Ceylon increased more than fivefold in value between 1884 and 1887 alone. In 1888 the imports of India and Ceylon teas into the United Kingdom for the first time exceeded those of China tea. Ceylon had successfully survived her ordeal and found a new staple.

## NEW TRENDS IN THE WEST INDIES

It is now necessary to turn again to the West Indies, where during the latter part of the nineteenth century the beginnings took place of several important new ventures which will carry this history into the next century.

Banana exports from Jamaica as an alternative to sugar have already been referred to. Small-scale shipments of bananas by schooner to North American ports from both Jamaica and Panama were first made in about 1850. In 1870 Captain Baker pioneered regular shipments from Jamaica to Boston, and in 1885 founded with associates the Boston Fruit Co., which acquired its first steamer in 1888. This group amalgamated with American banana-growing interests in Central America to form the United Fruit Co. in 1899. Messrs. Elders & Fyffes, who had become interested in the trade in 1901, associated themselves with the United Fruit Co. in 1902. These steps are interesting as representing, apart from some of the larger sugar companies, the first incursion of 'big business' with headquarters in the importing countries, into tropical agriculture. This agriculture was, indeed, growing up when its potentialities began to attract the big capitalists.

Meanwhile as the difficulties of the sugar-cane growers increased, a Royal Commission was appointed in 1897 to examine the state of the industry and make recommendations for its betterment. Its report led to several developments. In the first place, the British Government pressed internationally for the abolition of the export bounties on beet sugar which were being provided by several countries. This objective was eventually achieved by the Brussels Convention of 1903, but to tide over the intervening period Parliament made a grant of £250,000 to the sugar colonies, which in most cases was paid out to individual estates.

Barbados, however, used its share of £80,000 to found in 1902 the Barbados Agricultural Bank from which planters could obtain advances for cultivation expenses. This institution still serves a useful function and by 1942 its capital had grown to £247,388.

Still more significant for the future was the foundation, as a result of the Commission's report and under Joseph Chamberlain's stimulating tenure at the Colonial Office, of the Imperial Department of Agriculture for the West Indies in 1898. Its cost for ten years was to be defrayed by the Imperial Government. Headquarters were established in Barbados, and the original staff included a mycologist and an entomologist, the first such appointments to be made in the colonial Empire, and prompted perhaps partly by Ceylon's recent harrowing experience with coffee. The Department immediately took on executive work in Barbados, the Windward and Leeward Islands, and provided grants for experimental and development work in the other colonies.

Against this first real establishment of a public agricultural service must be set one extremely interesting development, following the pattern of voluntary organization, to round off the story of the century. In 1895 the Jamaica Agricultural Society was founded with official support, following demands made before the Legislative Council for agricultural improvement. To anticipate later developments, this society grew in the course of time to such strength that in 1945 it had 445 branch societies in the island with a membership of 14,332. It employed sixty-five agricultural instructors and carried out, in co-ordination with the Government's Agricultural Department, most of the extension work which in other colonies is usually carried out by such Departments themselves. For this work it received from Government an annual subvention which amounted to £46,025 in 1947-8.

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*PART IV*  
PUBLIC SERVICE, 1900-1948

I  
A NEW ERA

**I**F the latter half of the nineteenth century was characterized by the private planter in tropical agriculture, so were the following fifty years by the inception and growing importance of public service in this field. The foundation of the Imperial Department of Agriculture for the West Indies, related in the previous section, was the signal for numerous further developments of the same sort. Nevertheless, the planter remained a figure of great importance, particularly in some colonies, and it would be quite wrong to suppose that he has outlived his usefulness to-day. Only his historical picturesqueness, amounting sometimes to eccentricity, has faded gradually into a legend of the past. No longer to-day would one be likely to come upon a planter on the verandah of a lonely bungalow, paying out the month's wages to his labour in flowered silk dressing-gown and monocle, a glass of whisky at his hand and a tame monkey on his shoulder. No longer do the young Kenya settlers, with their brightly coloured shirts, wide-brimmed hats, and beaded belts, foregather in the local hotel with revolver on hip for no better purpose than to shoot the lights out. And yet one must not conclude from these memories that these men did not include some hard-working and skilful agriculturists, farmers who understood and loved the soil and who made the waste places of the earth to blossom under conditions of loneliness, monotony, and often hardship.

The moral justification of the planter's existence was that

he brought skill and capital and created wealth in areas where it would have otherwise been non-existent, most of that wealth reverting to the local inhabitants in the form of wages paid to labour. The agricultural officer was in the twentieth century an equally characteristic manifestation of the British contribution to tropical agriculture, but on quite a different basis. For he was the guide and counsellor of a population of peasant farmers cultivating on their own account. This transition arose largely out of the novel problems with which British administrations were faced when in the twentieth century the interior of Africa first began to be opened up on a serious scale, and in proportion as the African colonies gradually came to be the preponderant part of the colonial Empire. Hitherto, in the West Indies, in Ceylon, in Malaya, colonial administrators had been presented with territories in which Europeans were willing to live as planters in large numbers, where there was plenty of land for them to do so, and where the rainfall was sufficiently large and reliable for crops to be grown with every prospect of a reasonable return on capital invested. But in many parts of Africa one or all of these factors were lacking. A native population of peasant farmers did, however, exist, and it became increasingly obvious that it was through them that most areas in these colonies would be best developed. Skill would be best applied to giving them technical advice to improve their woefully low productivity, and capital was in the main only tempted to these areas in the form of trading installations to handle the export products of the peasant.

But the new conditions also differed from the old in the fundamental problems which they posed as to the method of agriculture itself. In the older insular or peninsular colonies with their high rainfall skilled knowledge had only been obtained of the perennial tree crops—coffee, cacao, tea, cinchona, rubber, and others—and of sugar, which is



usually grown almost continuously on the same land. In Africa agriculture rested on annual food crops, and many of the most promising export crops, too, such as ground-nuts, cotton, maize, and tobacco, happened to be annuals, so that very different problems in rotations, manuring, disease control, and other directions had to be faced. Above all, the agriculturist was an unskilful peasant who could provide little assistance himself to their solution.

It is, of course, true that British administrators had behind them the experience of work in India, a land of peasant farming with annual crops. But India did not present all the problems of the African colonies, for there the plough and the cultivation of cash crops were already known, and systems of agriculture had been worked out which did maintain soil fertility, although at a low level. Nevertheless, the comparative rarity of postings from India to the colonial service remained a weakness of the latter; and it has been remarked that in Nigeria it was not until an officer with Indian experience, Mr. O. T. Faulkner, was appointed Director of Agriculture in 1921, that the Agricultural Department, which had hitherto devoted itself mainly to the introduction of exotic export crops, began the serious study of indigenous agriculture.<sup>1</sup>

It was against this background of ignorance of the fundamental problems on the part of both the native farmer and his European adviser—an ignorance not fully realized by either—that soil erosion was to develop into a serious menace, and the problem of maintenance of soil fertility become acute. The story of these troubles and their attempted solution constitutes the most significant part of the history of colonial agriculture in the twentieth century.

<sup>1</sup> H. C. Sampson and E. M. Crowther, *Crop Production and Soil Fertility Problems*, Leverhulme Trust West Africa Commission 1938-9, Technical Reports, London, 1943, p. 33.

## II

THE COLONIAL AGRICULTURAL  
SERVICE

ALTHOUGH Zanzibar appears to have been the first colonial territory to appoint a Director of Agriculture, R. N. Lyne, in 1896, similar moves in other territories were mostly inspired by, and followed after, the establishment of the Imperial Department of Agriculture in the West Indies. Agricultural Departments did not, however, have to be created *in vacuo* in all colonies, but were often based on an expansion of the existing botanic gardens services. Among the first to expand was Ceylon, as befitted a colony whose botanic gardens had already rendered such notable services to tropical agriculture, and where the *Tropical Agriculturist*, the first scientific journal to be devoted to this subject, had been founded by Mr. John Ferguson in 1881. For some years the title of Royal Botanic Gardens was retained for the augmented organization. In 1899 a botanical laboratory was built; in 1901 500 acres near Peradeniya were acquired for an experiment station; the scientific staff, numbering only three in 1896, had been increased to eight by 1903. In 1904 the Ceylon Agricultural Society was founded to supplement the work of the gardens, and like its counterpart in Jamaica employed agricultural instructors on its own account. Not until 1912 was a government Department of Agriculture formed to take over the work of the gardens on an enlarged basis. In 1916 a School of Tropical Agriculture was established at Peradeniya to train Ceylonese staff for the Department as well as private students. In 1921 two research organizations which had been working on rubber since before 1914 were fused under the title of the Rubber Research Scheme. A Tea Research Institute was founded in 1925 under the joint control of Government and planters; and a Coconut Research

Scheme, similar to that for rubber, was established by legislation of 1928, and began to function in 1931.

Other colonies were meanwhile not idle in the same field. Departments of Agriculture were founded—to take some geographically scattered examples—in Uganda in 1900, Southern Rhodesia in 1903, Malaya in 1904, and Northern Nigeria (then a separate Protectorate) in 1912. British Guiana, Trinidad, and Jamaica founded Departments in 1908 to develop local work more than could be done by the Imperial Department. By the outbreak of war in 1914 most of the larger colonies had Agricultural Departments, though staffs were still very small. Some of the smaller colonies, however, had to wait much longer than this. British Honduras had no Department until 1928. In the Falkland Islands, which had remained at such a primitive level that in 1948 it was said that the carcasses of 50,000 sheep bred for their wool were left to rot annually as the export of meat was uneconomic, it was only in that year that the appointment of an agricultural officer was felt to justify serious consideration.

The war of 1914–18 led to great difficulties in finding qualified recruits for these services, and in 1919 Lord Milner as Secretary of State for the Colonies appointed a committee to examine and report on the agricultural services of the colonies. Their report stated that 'it is not generally realized how rich a harvest may be reaped if the agricultural resources of the Colonies and Protectorates are properly developed, nor how small a part of the Empire has been so far subjected to such development',<sup>1</sup> and recommended an increase of staff and standardized salary scales. The difficulties still continuing, another committee set up in 1924 recommended the offer to trainees of Colonial Agricultural Scholarships (later known as probationer-

<sup>1</sup> Sir C. Jeffries, *The Colonial Empire and its Civil Service*, Cambridge, 1938, p. 44.

ships) for two years post-graduate training, one of which was to be spent at the Imperial College of Tropical Agriculture in Trinidad. This College was itself the outcome of the Tropical Agricultural College Committee also set up by Lord Milner in 1919, and it was first incorporated in 1921 as the West Indian Agricultural College. Such functions of the Imperial Department of Agriculture as still remained were amalgamated with the College organization in 1922. The College was further expanded in 1924 to become the Imperial College of Tropical Agriculture; it is established under a Royal Charter and has an autonomous governing body. The first Colonial Office trainees were sent to the College in 1925.

Much further discussion took place as to the organization of the agricultural services. It is of interest to record that suggestions for a Colonial Agricultural Research Service were turned down in the nineteen-twenties, since renewed proposals for a Colonial Research Service to embrace all the sciences were approaching finality in 1948. Instead, it was decided to create one service to include both research and field staff in agriculture, and accordingly the unified Colonial Agricultural Service came into being in 1935, at the same time as the Colonial Veterinary Service and Colonial Forestry Service. These services comprised only those members of the staffs who possessed university qualifications, and in 1939 the number of such posts was 379 in the Agricultural Service and 125 in the Veterinary Service.

An Agricultural Advisor to the Secretary of State at the Colonial Office was appointed in 1929, and assistants were added to him as the duties grew. A Colonial Advisory Council of Agriculture and Animal Health was also appointed in 1929 to supply the Secretary of State with expert advice. The Colonies share with Britain and the Dominions the benefit of agricultural research and information services

from the Commonwealth (formerly Imperial) Agricultural Bureaux which have been jointly established. Of these, the first were the Imperial Bureau of Entomology, founded in 1913, and the Imperial Bureau of Mycology, founded in 1920; both are now designated Institutes. Eight further Bureaux, ranging from Soil Science to Animal Nutrition, were established in Britain in 1929; and one, the Commonwealth Bureau of Biological Control, has been sited in Canada since 1940.

The university-trained members of the Colonial Agricultural Service have, of course, always been only the spearhead of the Departments in the various colonies. Many other Europeans have been employed, and their efforts have been supplemented by an increasing number of trained agriculturists recruited from the local peoples, who between the wars issued in mounting numbers from such training institutions as Makerere and Achimota Colleges in East and West Africa respectively, the Serdang School of Agriculture in Malaya, and the Hope Agricultural School in Jamaica. Agricultural teaching in these schools has been in many cases a duty carried out by officers of the local Agricultural Department. Finally, the junior staffs of Agricultural Departments have included thousands of agricultural instructors, laboratory assistants, and other personnel with varying degrees of specialized training.

It is worth quoting the official description of the duties of an agricultural officer which was issued at the time of the unification of the service. These were: 'To investigate native methods of agriculture and to discover what is useful in them; to stimulate the improvement of the indigenous methods of cultivation or the adoption of new methods; to give advice to owners; to instruct native subordinate staffs; to supervise Government experimental stations; and generally to assist in the work of the department.'<sup>1</sup> The pre-

<sup>1</sup> Sir C. Jeffries, *op. cit.*, p. 168.

cedence given by this date to native over plantation agriculture is worthy of remark. So is the duty which is placed first in the list for an agricultural officer, for this represents a swing of the pendulum at a time when it was realized that the methods of temperate agriculture had been too often enforced without regard to local experience. There have been times in later years when the opposite extreme has been reached, and the agricultural ruminations of elderly peasants treated with too much respect, when they sometimes were based on no more than superstition and prejudice.

The service which was formed along these lines has on the whole acquitted itself well in its task. To its members, as to the British planters, and as also to a small number of missionaries who have concerned themselves with agricultural improvement, is due the credit for a great deal of human betterment achieved under difficult and often trying conditions. That its research workers, although few in number, have achieved a high output of useful results may perhaps be partly attributed to their early adoption of the experimental layouts and statistical treatment of the results evolved first in Britain by R. A. Fisher and others, and to which British and American agronomists have devoted much more attention than their continental counterparts. Much arduous work by the service has been unpublicized because it achieves merely negative results, as in the prevention of famine. To take a single example, Uganda sustained heavy loss of life in the famine of 1918, less so in that of 1928, and none at all in the last twenty years; and a modern Agricultural Department, though it cannot prevent all crop failures, would be ashamed if it could not provide sufficient fore-warning of impending famine to enable foodstuffs to be imported in time for relief. A weakness of the service, on the other hand, has always been the tendency for its work to become clogged with the supervision of marketing (which

is not among the list of agricultural officer's duties mentioned above), at the expense of the stimulation of production. This was particularly apparent during the war of 1939-45, when agricultural staffs became involved in the operation of economic controls and the bulk purchase and sale of produce, for which they were quite untrained. The situation has largely been due to the absence of an Economic Secretary or a Department of Trade in British colonial administrations, a defect which is now beginning to be remedied.

Nevertheless, the work of the service compares creditably with that of any other colonial power, though Dutch scientists in the Netherlands Indies have set an extremely high standard in this respect. It is perhaps worthy of comment that the Japanese during their occupation of Malaya in 1942-5, fellow Asiatics and rice-eaters though they were, failed to maintain the high level of rice yields achieved under British administration although they imported agricultural staff and made efforts to increase production. By injudicious introductions of rice seed they brought in the very dangerous blast disease which had hitherto been kept out of the country; and they made exactly the same mistake as the British in early colonial days, of trying to introduce agricultural methods from their homelands into a tropical environment, as in the case of Taiwan paddy cultivation which gave very poor results.

As time went on, the need for regional research stations to undertake more fundamental work than was appropriate to the Agricultural Departments of individual colonies became increasingly felt. An important development took place in East Africa where at Amani in Tanganyika a station, founded by the German government in 1902 as the Biologisch-Landwirtschaftlichen Institut, was redeveloped in 1927 under British administration as the East African Agricultural Research Station, to whose support all the

British East African governments made contributions. At this station important fundamental work has been done on such problems as the physiology of the coffee-tree and disease resistance in cassava, which is of value to East Africa as a whole. When it was considered that the time had come for a larger organization to be established the staff of this station formed the nucleus for the East African Agricultural and Forestry Research Organization which was set up in 1948 with headquarters near Nairobi, six miles from the Central Veterinary Research Institute for East Africa which had been created in 1939. By a somewhat similar train of events a Cacao Research Station set up at Tafo in 1937 by the Gold Coast Department of Agriculture was in 1944 taken over by the West African Cacao Research Institute, established on a wider basis to serve all the British West African colonies.

Other examples of inter-territorial research stations include that created at Lyamungu in Tanganyika in 1933, with the help of a grant of £23,000 from the Colonial Development Fund, to serve the needs of East Africa for research on *arabica* coffee. The sugar-cane breeding station in Barbados was in 1932 put on a wider footing as the British West Indies Central Sugar-cane Breeding Station. This also received assistance in the form of a grant of £18,000 in 1948 under the Colonial Development and Welfare Act for cyto-genetical research.

In their early days the colonial Departments of Agriculture had been regarded mainly as 'revenue-raising' departments, designed by increasing crop yields to maximize the wealth of the people and the revenues of Government, so that improved social services could be paid for. Experimental research was the most highly specialized and, to many of the staff, the most interesting part of the work. But as time went on it became apparent that the difficulty of getting local farmers to adopt improved methods was at



least as great as that of devising the improvements, and consequently the work of the field staff acquired a greater significance. The fact that trouble can be caused by putting through agricultural improvements, however well-intentioned, without an adequate previous period of educative propaganda, was brought home by such incidents as the Zanzibar riot of 1936, which involved the deaths of an Assistant District Commissioner and a police officer and was, in the words of an official report, 'mainly due to discontent amongst the Arab traders and copra makers at the Government's efforts to improve the quality of Zanzibar copra'.<sup>1</sup>

It came to be realized that extension work involved techniques of its own, especially with the developments in publicity methods during the war of 1939-45, and the formation of Public Relations Departments in many colonies. Academic recognition was given to the subject by the creation of a Lecturership in Agricultural Extension Methods and Advisory Work at the Imperial College of Tropical Agriculture in 1948, probably the first appointment of its kind in the British Commonwealth. In having centralized extension services as part of their Agricultural Departments the colonies were also ahead of Great Britain itself, where a National Agricultural Advisory Service was not formed until 1946. But the new conception meant that extension work was devoted to much more than the raising of farmers' or the national income. For, by a better understanding of the homely biological facts around him, the primitive peasant is given the easiest possible introduction to western ways of thought and the scientific outlook. By learning the necessity of accurate observation, and by even the most elementary understanding of experimental method, he has ways of lifting himself out of age-old superstition and fears such as witchcraft. Science should not only

<sup>1</sup> *Annual Colonial Report on Zanzibar, 1936*, p. 39.

make him a better farmer, but widen his mental horizons, and should help to fit him for his place in an educated democracy.

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### III

#### SOIL CONSERVATION

SOIL conservation consists in the control of two dangers, soil exhaustion and soil erosion. It is the latter of these which by its dramatic nature and often catastrophic incidence has attracted more public attention, but in fact soil exhaustion is more dangerous because more insidious, and is in the long run more difficult to control, and it will therefore be treated first here.

The novel nature of the problems which faced British administrators in continental Africa has already been pointed out. The very coming of civilized rule altered the situation still further. Cultivation of cash crops began and vastly increased the cropped area. In Uganda, for example, 1½ million acres of cotton had been added to the previous rotation of subsistence crops by 1936, and the resultant strain on soil fertility was heavy. This strain was accentuated as, owing to the application of science to human and animal health, populations both of men and livestock began to increase at a rate never before known in tropical Africa.

As illustrating this tendency, figures again from Uganda show that the population rose from 2,843,325 at the census of 1911 to an estimated 3,962,570 in 1946; in 1920 (the earliest year for which useful figures are available) the number of cattle was put at 613,832 and of goats at 781,626, while by 1945 these had risen to 2,293,740 and 2,143,533 respectively. Another complication was the gradual introduction of mechanical aids to cultivation; one province of Uganda had 18,331 ploughs by 1935, but totals are no longer recorded. The power given by the plough enabled the inhabitants to put ever larger areas under cultivation; bad ploughing, and especially the drawing of furrows straight down the hill-side, was itself also a frequent cause of erosion.

The native cultivator himself had no idea of the implications of these developments. He had always relied for the maintenance of fertility on his traditional practice of shifting cultivation, by which a patch of land was farmed until crop yields began to fall and then abandoned to a long period of regeneration of the natural vegetation which eventually restored fertility. The first impulse of the European agricultural scientists who arrived on the scene in the new Agricultural Departments was to condemn this practice roundly, because it conflicted entirely with everything that they had been taught. Dr. Willis, a distinguished Director of the Ceylon Botanic Gardens, in a text-book of tropical agriculture written in 1908, did no more than express the orthodox scientific opinion of the time when he described shifting cultivation as 'utterly destructive of the natural capital of the country' and extolled the merits of continuous cultivation (referring of course to the perennial crops of the European planters). The wheel has, indeed, come full circle, for the agricultural scientist of to-day would be more likely to describe continuous cultivation in the scathing words quoted, and would point out that under shifting cultivation a sparse peasant population had been in

ecological balance with its environment. The danger lay, of course, in the fact that in the twentieth century populations were becoming too dense to permit of the necessary high proportion of land being in the resting stage. With neither natives nor Europeans understanding the true significance of the situation all the elements were present for a major agricultural tragedy.

Enlightenment was to come, but it is still impossible to say whether knowledge will spread in time wholly to prevent disaster. When at the cessation of hostilities in 1918 Agricultural Departments were free to turn from the urgent tasks of production to more fundamental matters, and at the same time to expand their staffs, it was soon realized that the maintenance of soil fertility at an adequate level was the major problem facing them in the African colonies. Still bound by the traditions of British agriculture, their first instinct was to resort to farm-yard manure, the mainstay of fertility in that system. But manurial problems in the tropics are very different. It was soon found that in some dry tropical regions such as Northern Nigeria very small applications of farm-yard manure gave astonishing increases in crop yields; but in the humid tropics even large dressings often gave disappointing results. Even where farm-yard manure seemed to answer the problem there were on most agricultural holdings no cattle to provide it. Cattle-keeping in tropical Africa was still largely left to semi-nomadic tribes who grew no crops, while the cultivators existed on a largely vegetarian diet and kept none of the larger livestock. Hence arose in Northern Nigeria an official campaign to encourage 'mixed farming', a new conception to the local people which it was hoped would solve many of their problems, providing draught animals and a source of animal protein in the diet as well as assisting soil fertility. The beginnings were small but considerable success was achieved in view of the difficulties. In 1928 the first three farmers began 'mixed

farming' under the supervision of the Agricultural Department; by 1946 the number had increased to 3,327.

This, however, was no solution in those large areas of tropical Africa where cattle could not be kept owing to trypanosomiasis carried by the tsetse fly. In the search for an alternative system of maintaining soil fertility in these areas recourse was had to another important practice in European agriculture, the inclusion of leguminous crops in the rotation, and as a consequence many experiments were carried out on systems of green manuring. In Southern Nigeria, one of the areas in question, the early results appeared promising, and for about a decade from 1930 green manuring was ardently advocated. Nevertheless, by 1943 it was admitted that green manuring only gave satisfactory results on peculiarly favourable soils, and that in general its effects were disappointing.

Meanwhile in Uganda the Agricultural Department, after similar disappointments with green manuring, was by 1934 in the galling position of having failed to arrest a serious decline in fertility on its own experimental farms. Advantage was here taken of empirical observations that land which had rested from cultivation for some time under grass, and particularly under the deep-rooting elephant grass (*Pennisetum purpureum*), showed great accumulated fertility when used for cropping. An experimental rotation involving only three years under annual crops followed by a resting period of equal length under this grass gave very satisfactory results. Some scientific explanation of this was discovered by the investigations of the soil chemist, Dr. W. S. Martin, who showed that fertility was associated with a crumb structure of the soil, which tended to be destroyed by continuous cultivation and cropping but was largely restored by the growing of perennial grasses. While such a simple picture may not be universally true under different tropical conditions, this work is of great significance as

representing for the first time in the history of this problem an approach made by investigation of and recommendations for specifically local conditions, without introducing preconceived ideas from temperate agriculture. It appears that many tropical soils may become 'exhausted' for plant growth, even though the supply of plant nutrients as shown by chemical analysis is still adequate, because the crumb structure has been so broken down that air and water cannot penetrate to the roots, and also because soils in this condition are peculiarly liable to erosion.

The conception of the resting period under grass is, of course, in a sense a return to the indigenous idea of shifting cultivation, though it is much less wasteful of land, because if fallowed plots are deliberately planted with grass to obtain a quick cover, the period required to restore fertility is much less than if the slower natural regeneration is left to take place. It also gained a ready acceptance because it happened to be in sympathy with a movement for 'alternate husbandry' or 'ley farming', which at the same time, though for largely different scientific reasons, was being vigorously advocated in Britain by Sir George Stapledon and others, and in America and elsewhere. This type of solution to the problem of maintenance of fertility has made a wide appeal in other tropical colonies, though with significant differences; elephant grass, for instance, requires much labour to plant and clear, and other grasses such as Rhodes grass (*Chloris gayana*) have been more widely used. Nigeria has not hesitated to borrow a leaf from Uganda's book, and has found a promising local grass for the resting period in *Pennisetum pedicellatum*. Nyasaland had bethought itself of the possible value for the same purpose of perennial legumes and, although no plant is available in the tropics which confers anything like the benefit of clovers in temperate agriculture, experiments have been made there with the pigeon pea.

The whole problem has been complicated throughout the twentieth century by the incidence of soil erosion. It is necessary to see this menace in proper perspective with relation to the tropics. Sub-tropical and temperate soil types are on the whole more liable to erosion, where rainstorms of equal intensity occur, than are those of the tropics. In the present century the most devastating erosion has occurred in non-tropical regions such as the United States of America, South Africa, China, and Australia. Within the British colonial Empire some of the worst examples have been seen in territories lying outside the tropics, such as Cyprus and Basutoland, or in the cooler tropical regions such as Kenya and Nyasaland. Erosion is also more likely to be a serious danger in areas of lower rainfall than in the humid tropics, where the rapid growth of vegetation at all seasons quickly provides a cover over bared ground. Thus Malaya, West Africa, and the West Indies have escaped comparatively lightly while East Africa has suffered maximum effects; though this is a generalization to which there are exceptions—Malaya was the first British territory to pass anti-erosion legislation with a Control of Silt Enactment in 1922, and in Sierra Leone in 1945 landslides drew public attention to the dangers of erosion.

The great acceleration of erosion in the early part of the twentieth century is due to the same causes which have already been noted as contributing to soil exhaustion. Increasing populations, the opening-up of newly settled regions with mechanical implements, the wish for a higher standard of living, and the urgent demand for maximum production from farms during two world wars have all played their part. The danger first came to a head in the United States of America, where the situation became so serious that in 1935 a national Soil Conservation Service was formed. Backed by ample funds, this Service has done pioneer work in discovering the best methods of controlling

erosion, for which all countries which are faced with the problem must always be in its debt.

Some British territories were not, in fact, behind the Americans in governmental attention to these problems. In the small hilly country of Basutoland, where soil erosion was already becoming a dangerous menace, the Department of Agriculture in 1935 began anti-erosion works comprising graded terrace banks, water disposal spillways, and dams, made by the use of both tractors and ox-drawn implements. To these were added in 1942 a system of contour buffer grass strips in the mountain areas inaccessible to heavy equipment. In this small territory the problem was reduced to manageable dimensions by early and energetic action. Before the outbreak of war in 1939 agricultural specialists from other colonies were already visiting Basutoland to see how such work should be handled. By 1947 the following works had been completed:

Area terraced in the lowlands—199,655 acres

Protected with grass strips in the mountains—164,203 acres

Areas with training banks in the mountains—26,176 acres

Number of dams constructed—238

Number of trees planted—835,804

At that date it was estimated that all further necessary work would be completed in another eight years.

A very different kind of problem had been handled with equal care in Cyprus. Here as early as 1907 an engineer's report had pointed out that erosion and winter flooding were mainly due to the enormous herds of goats which destroyed the young trees. The necessary action against the source of danger was here taken by the Forestry Department, whose cautious but consistent policy over many years is a model of good extension work. Although meeting considerable opposition in their determination to eliminate forest goat-grazing, they never moved too fast to antagonize



public opinion seriously. The first step was to insist on the requirement of licences for any goat grazing in the forests. Later, from 1938 onwards, owners of goats were persuaded to surrender these licences for cash compensation; since this would involve selling the goats for which they no longer had pasturage every assistance was given to them to find other means of livelihood. Between 1938 and 1945 £24,100 was paid out in such compensations. Finally, under the Goat Exclusion Law, a procedure is provided by which the property owners in a village may by free ballot opt for the prohibition of unrestrained grazing (commonly leading to forest grazing) within the village lands. By 1945, 178 out of 600 villages in Cyprus had already so opted. The total effect of these measures in forest protection has been very great.

In these two territories there is no doubt that the inhabitants would have brought upon themselves terrible losses by erosion, but for the intervention of Government. Unfortunately, action has not everywhere been so timely or so successful; and the problem is far more intractable in the larger colonies than in small territories. In Kenya the danger from erosion is particularly threatening, and has been greatly accentuated by the over-grazing of cattle, whose native owners measure wealth by their numbers, and are unwilling to keep these within the carrying capacity of the land. As early as 1929 the Kenya Agricultural Commission under the chairmanship of Sir Daniel Hall reported that 'in many areas the vegetation is being eaten right down to the roots, the surface of the soil becomes broken and with the rains erosion sets in. . . . It is necessary to take in hand at once the reduction in the numbers of livestock kept by the natives. . . . The Kamba reserve provides the gravest case, which calls for immediate action.'<sup>1</sup> The Commission obtained an estimate that this Reserve contained 190,000

<sup>1</sup> *Report of the Agricultural Commission*, Government Printer, Nairobi, 1929, p. 28.

cattle and 57,000 calves, though its grazing capacity was not more than 60,000 head. They stated of this Reserve that 'it is not too much to say that a desert has been created where grazing formerly was good'. In spite, however, of this call for 'immediate action' it was some years before energetic measures were taken, even in the Kamba country. In 1937 a grant of £10,000 and a loan of £24,000 were provided by the Colonial Development Fund for soil conservation work in this area. In 1936 Messrs. Liebig's entered into an agreement with the Kenya Government to erect a meat extract factory, which began operations in 1938. With this outlet for surplus cattle available, the authorities in 1938 at last set about the compulsory de-stocking of the Kamba reserve, but so intense was the opposition aroused among the people that the operation had to be abandoned.

A Soil Conservation Service, formed within the Kenya Agricultural Department in 1938, was starved of men and materials by the onset of war, and even in 1945 the annual report records that 'little work was done by the Soil Conservation Service in the native reserves'. It was, however, also stated that 'detailed plans were . . . prepared for conservation work in the Ukamba Reserve' and others, and these plans began slowly to be put into effect in the following years. But in the same year of 1945 an officer of the Agricultural Department, reporting on African cultivation in South Nyeri District, said:

Agriculture as a skilled industry is non-existent, the capital in the soil is being rapidly dissipated in a rake's progress, whilst malnutrition remains a problem still to be solved. Such a state of affairs is so grave and threatening for the future that urgent action is needed to save it from deteriorating past redemption. Unless radical reforms are introduced, the land and people of South Nyeri face disaster within the next decade.<sup>1</sup>

<sup>1</sup> *The Kikuyu Lands*, by N. Humphrey and others. Government Printer, Nairobi, 1945, p. 54.

Agricultural science had at least done one part of its task in giving warning of impending calamity.

One of the most startling aspects of the situation in Kenya, as in South Africa and some other countries, was the fact that native reserves which had been thought at the time of their delimitation to be capable of carrying comfortably any population that was likely to develop for generations to come, had so soon proved to be quite incapable of it, owing to reckless farming and unexpected rates of population increase. This made other colonies more anxious to obtain an accurate inventory of their resources in soils and vegetation while yet there was time, and resulted in such work as Trapnell's comprehensive ecological mapping in Northern Rhodesia, published between 1937 and 1947. Of fundamental importance also to the understanding of such problems was the basic work in soil classification and survey carried out by such workers as Milne in East Africa and Hardy in the West Indies. Soil mappers owe a special debt to Milne, who in 1935 at one stroke doubled the rate of survey work and saved needless repetition by evolving the concept of the *catena*, or series of soils recurring regularly in the same topographical sites, as in the endlessly alternating ridge-and-valley of so much of inland Africa.

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## IV

## PEASANT PRODUCTION OF CASH CROPS

THE extraordinary development of peasant production of cash crops for export in the British African colonies from about the beginning of the twentieth century was a thing never seen before in colonial history, with the possible exception of Van der Bosch's 'culture system' in the Netherlands Indies some sixty years earlier, an effective but oppressive system which relied on forced labour. Out of several examples which might be taken to illustrate these developments under British rule, none shows the process more typically at work than the history of cotton production in Uganda.

A remarkable conjunction of interests pointed the way to this development. England, with her great cotton manufacturing industry, had been restive over her dependence on America for its raw material both before and, more especially, since the American Civil War had caused great distress in Lancashire by cutting off supplies.<sup>1</sup> With a view to developing the growth of cotton within the Empire the British Cotton Growing Association was formed in 1902 at the instance of certain Lancashire chambers of commerce

<sup>1</sup> As early as 1857 the Foreign Secretary had addressed the British consul at Lagos on the desirability of stimulating native cotton exports. (Public Records Office, F.O. 84/1031.)

and the West African merchants of Liverpool. In the King's speech to Parliament in 1904 occurred the following significant words: 'The insufficiency of the supply of the raw material upon which the great cotton industry of this country depends has inspired me with deep concern. I trust that the efforts which are being made in various parts of my Empire to increase the area under cultivation may be attended by a large measure of success.'<sup>1</sup>

Nowhere did these words fall on readier ears than in Uganda. Here cotton of the Egyptian type had already been introduced; firstly, in the period of the great explorers, by Sir Samuel Baker in 1872, and then by the Department of Agriculture in 1903. But though these introductions had shown that Uganda was potentially a cotton-growing country the varieties used had not been entirely satisfactory. Next missionaries took a hand. The Church Missionary Society had for some time maintained a Uganda Industrial Mission, but as the work became too large for them to handle, a company known as the Uganda Company Ltd. was formed to take over the work in 1903. Mr. K. Borup, who was an employee successively of these two organizations, was able to obtain through the British Cotton Growing Association 2½ tons of cotton seed of American Upland varieties which were distributed to native chiefs in 1904. Success was instantaneous; it was found that the climate and soils of Uganda were suitable for the production of cotton of a staple length higher than the 'American middling' which supplied the bulk of the British market. Intense enthusiasm prevailed; 'if you go ahead now with cotton', wrote a missionary to a director of the Uganda Company, 'the ball is at your feet'.<sup>1</sup> The Company reported with satisfaction that 'the great chiefs in Uganda are shareholders in the Company, and that they have all taken up the idea of cotton cultivation with enthusiasm'.<sup>1</sup>

<sup>1</sup> Quoted in 'The Development of Uganda', *The Record*, 23 June 1905.

Both the Uganda Company Ltd. and the British Cotton Growing Association helped to pioneer cotton ginning in Uganda, although as the trade developed ginneries came to be mainly operated by Indian firms. The Agricultural Department imported further lots of American seed from 1905 onwards. Cotton rapidly became the leading export, and during and after the 1914-18 war such high prices were touched as to bring great prosperity to the country. In 1919 the Government felt justified in imposing an export tax on cotton, an economic measure of a type which is often condemned but has frequently been found to be indispensable in colonial finances. In this case the first proceeds of the tax were earmarked for the setting-up of two cotton experiment stations. At these cotton-breeding work was pushed ahead with satisfactory results; for example, in 1940 when the new variety B.P.52, of better spinning quality than the currently grown varieties, was first put into commercial cultivation it immediately sold at a premium on the Bombay market and, with a total crop then running at about 370,000 bales, the adoption of such improvements over large areas was shown to yield to the country a very satisfactory cash return compared with the sums spent on research.

Meanwhile a new research organization had appeared upon the scene. In Britain it was still felt that cotton-growing within the Empire was not being pushed fast enough; and with war-time difficulties accentuating this, in 1917 the President of the Board of Trade set up an Empire Cotton Growing Committee. As a result there was established the Empire Cotton Growing Corporation, which derives its income partly from a capital contribution of nearly £1 million made by the British Government, and partly from a levy of 6*d.* per standard bale on all cotton purchased by spinners in the United Kingdom, which was made enforceable by Act of Parliament passed to give legal

sanction to the foundation of the Corporation in 1923. In contrast to the British Cotton Growing Association, the Corporation is a non-profit-making body and exists to supply information, encouragement, and research services to Empire cotton growers. As early as 1921 it made its existence felt in Uganda by contributing three tractors and equipment for trials in cotton-growing. The Corporation had its own training scheme for cotton research officers, and was sending scholars to the Imperial College of Tropical Agriculture at as early a date as the Colonial Office; a number of these officers were later absorbed into the Colonial Agricultural Service. By 1938 the Corporation maintained experiment stations or scientific officers at Barberton and Magut in South Africa, Ukiriguru and elsewhere in Tanganyika, Domira Bay in Nyasaland, and in Trinidad and St. Vincent. After the Second World War it was decided to close down the South African and West Indian stations and to concentrate the work at a central and more conveniently situated research station, the construction of which was begun at Namulonge in Uganda in 1947.

That the application of European science to tropical agronomy is not entirely straightforward was proved once more by experience with cotton in Uganda. In the early stages some of the government experiment stations, in spite of great attention devoted to cultivation and clean weeding of the crop on the European pattern, were not obtaining such high yields as were local African cultivators. It was some time before it was realized that excessive weeding with the constant turning over of the soil was actually detrimental under tropical conditions as it destroyed the structure of the soil and exposed the organic matter to rapid oxidation. This information, which the shades of Lord Dundonald could have supplied, received scientific confirmation from work carried out at the famous English agricultural research station at Rothamsted by Dr. Keen,

who was later to become the first Director of the East African Agriculture and Forestry Research Organization. He showed that even in England the constant cultivations beloved of the traditional farmer are not profitable under all conditions, and that while weeding in the *early* stages of a crop is essential it is later less imperative. The sometimes slow but eventually sure methods of science were vindicated by the fact that in more recent years Uganda experiment stations have regularly obtained yields of cotton about twice as high as the district average.

Developments in the marketing of the cotton crop in Uganda are of more than local interest as they typify problems which have occurred in many other colonies whose economy is based on peasant production of crops for export. In the early days of haphazard buying of cotton at numerous casually chosen centres or from lorries the medieval English sin of 'forestalling' reappeared in a tropical society at a similar stage of development, while the wide-ranging lorries with their loads transferred cotton diseases from one area to another and also mixed the varieties. Another problem was presented during boom periods by the growth of mushroom ginneries whose overheads were too large in relation to the volume of cotton they could secure to be permanently satisfactory, so that prices to the growers tended to be depressed and marketing malpractices encouraged. The Uganda Government consequently found itself forced in 1926 to pass a Cotton Ordinance, limiting cotton buying to gazetted centres where both buying operations and the quality of cotton were subject to inspection by agricultural officers; the right to erect and operate ginneries was also controlled under licence. In 1933 further legislation divided the country into 'zones', in each of which a minimum price and the variety of cotton to be grown were fixed, and the area within which each ginnery could buy was correspondingly delimited. A somewhat similar sequence of



events has led to the same kind of marketing control in various colonies, for example, in the case of tobacco buying in Nyasaland.

The expectation of the early days that the bulk of the Uganda cotton crop would find its way to the looms of Lancashire was not borne out for very long. For many years before the outbreak of war in 1939 most of the crop had gone to the Bombay market, while Japan also was a larger buyer than the United Kingdom. Nevertheless, Uganda was an important corner-stone in one of those triangular systems of trade which have meant so much to an Empire based on freedom of trade. Importing from Britain more than she exported there, Uganda earned currency by her exports in other markets from which Britain was glad to take food and other necessities. The value of the colonial contribution in such systems of trade was never more apparent than after 1945, when in the prevailing dollar shortage the rubber of Malaya and cacao of the Gold Coast were among the most important dollar earners for the sterling block as a whole. Yet in spite of this direction of Uganda's trade it was typical of Britain's contribution from her side to the imperial structure that when in 1942 the Indian buyers found themselves unable to make offers for Uganda cotton because of war risks, it was the Imperial Government which stepped in and saved the situation with a guarantee by the Ministry of Supply to buy nearly half the crop. This led in 1943 to the adoption for the duration of the war of a scheme for government purchase and disposal, through an exporters' group, of the entire crop, an operation in which the Uganda Government continued to have the backing of the Ministry of Supply. Any profits accruing from this operation were to be credited to a special fund, which at the end of 1946 stood at over £5 million. With the memory still fresh in men's minds of the distress caused to primary producers by low prices in the slump of the nineteen-thirties, the Uganda

Government made plain from the outset its intention that a large proportion of this sum should be used as a stabilization fund to cushion the shock to producers in the event of any future serious fall in cotton prices.

In British West Africa the same stimuli to the encouragement of cotton growing were at work over the same period as in Uganda, but without equal result. The same American Upland variety, Allen, which proved so successful in Uganda, gives in Northern Nigeria lower yields and poorer lint, though since its introduction in 1912 it has acquired a better adaptation to its environment by becoming much more hairy and thereby more resistant to the attack of jassid insects. In Southern Nigeria, where a variety suited to intercropping and capable of giving a yield in spite of numerous diseases and pests is required, reliance has perforce been placed on local cottons, which are short-stapled and of low value. The best of these is the Improved Ishan, derived from a selection made by the Department of Agriculture in 1923. Total cotton production in Nigeria, however, has never done more than fluctuate around 20,000 bales.

If the problems of agricultural production which the African colonies had raised for British administrators were novel, those of agricultural marketing were no less so. The difficulties already alluded to in Uganda were simple compared to those of the cacao trade in the Gold Coast. Here the producers saw representatives of European 'big business' established in their own territories, and were only screened from them by the middleman African buyer of cacao, who operated usually with money advanced by the big firms. In 1936-7 thirteen European firms were responsible for 98 per cent. of all cacao exported from the Gold Coast. The largest buyers, with 38.6 per cent. of the crop, were the United Africa Co. Ltd., a firm formed by amalgamations in 1929 and controlled as to 80 per cent. of its

share capital by Messrs. Lever Bros. and Unilever Ltd. Other buying firms were associated with such well-known names as those of Cadbury, Lyons, and the Co-Operative Wholesale Society. Owing to extremely keen competition, the buyers were at this date offering to the grower prices higher than they could long sustain; and in 1937 all the large firms (with the exception of the Co-Operative organization) entered into a four-year agreement applicable to both the Gold Coast and Nigeria, providing for the division between themselves of all cacao purchased by them on an agreed basis, and in effect imposing a practically uniform price for cacao beans. Unfortunately this development also coincided with a fall in world cacao prices in the 1937 buying season. The African growers immediately saw in these events a combination aimed at lowering their returns to the benefit of the buyers, and much prestige and goodwill were lost by the buying firms. By mid-November the producers had organized themselves sufficiently to hold up all cacao sales, and also, since the suspect buying firms were the chief importers of merchandise, to boycott the sale of European goods other than necessities. Not until April 1938 was a Commission sent out by the Secretary of State for the Colonies able to patch up a 'truce' under which cacao buying was recommenced.

Hard on the heels of these events came the outbreak of war in 1939, which found buyers unable to take up the whole of the West African cacao crop owing to the inaccessibility of a large part of their markets. Such was the importance of cacao in the economic structure of the Gold Coast and Nigeria that here, as later with cotton in Uganda, the Imperial Government felt bound to come to the rescue, and made an offer to buy (through the firms' local organization) and to dispose of the whole cacao crop. As the war years drew on this Government in November 1941 made the further most advantageous offer that it would bear any loss

incurred in this operation but would hold any profit in trust for the West African cacao industry. In the event, losses were sustained in two years but over the whole period 1939-47 there was a profit of £25 million. In 1947 cacao buying was transferred to special Cacao Marketing Boards which had been set up in the Gold Coast and Nigeria, and upon which sat representatives of Government, producers, and merchants. To these boards were transferred also the profits made in the control period, which have been earmarked firstly, as in the Uganda case, to form a price stabilization fund, and secondly for such other purposes as research, control of cacao diseases, and the encouragement of producers' co-operative societies.

There are many similarities, besides those already noted, in the far-reaching effects of the development of peasant export crops in the Gold Coast and Uganda. It is noteworthy that it was in these two territories that the first great educational institutions of tropical Africa, Achimota and Makerere Colleges, arose; governments had the revenues to found them, and parents the money to pay school fees. The latter point was particularly noticeable in the Buganda Province of Uganda, where with a landlord-and-tenant system the large landowners had sufficient income from rents to educate their sons at Makerere and even overseas at a time when no such educational opportunities existed for the surrounding tribes of small-holders; yet all this was based upon cotton. Again, the rich rewards obtainable from agriculture in these two favoured regions attracted (as earlier in the Gambia) immigrants who often came to work as hired labourers for other Africans but remained to take farms for themselves. In the Gold Coast at the census of 1931 it was found that 289,217 of the population were alien immigrants. In Uganda in 1946 it was reported that immigrant labourers were entering at the rate of 100,000 a year from the Belgian mandated territory of Ruanda-Urundi.

The political boundaries of Africa are not natural ones, and nothing has proved this more clearly than the course of agricultural development. Another effect of the planting of perennial crops, such as cacao in the Gold Coast or coffee in East Africa, has been to tie down African populations whose 'shifting cultivation' previously comprised not only a local rotation of plots but also an element of nomadism. Even in the cotton-growing areas of Uganda the same consequence has resulted where increasing wealth has enabled the individual to build an elaborate house with a tiled or iron roof, in which he has invested too much capital to be willing to abandon it easily.

A rather different picture is presented by the peasant-produced exports of Nigeria, consisting largely of palm-oil and kernels which are derived not from planted but from wild trees. Low yields and an inefficient system of oil extraction were tolerated without notice as long as standards of quality remained low and there was little competition. But the writing on the wall was to be seen with the development of a plantation oil-palm industry in the Netherlands Indies and Malaya from 1910 onwards. There were some quarters in which this did not go unobserved, and amongst them were the Lever interests. In July 1924 a dinner was held in Liverpool in honour of Sir Hugh Clifford, Governor of Nigeria, at which Lord Leverhulme suggested in a speech the admission of the plantation system into Nigeria. 'Quite obviously', he said, 'in the cultivation of plantations there must be some security of tenure on land. . . . The African native will be happier, produce the best, and live under the larger conditions of prosperity when his labour is directed and organized by his white brother.'<sup>1</sup> Lord Leverhulme received no official encouragement for his ideas, but kept up a public attack, arguing that the

<sup>1</sup> A. N. Cook, *British Enterprise in Nigeria*, Univ. of Pennsylvania Press, 1943, pp. 262-3.

encouragement of trade was the first concern of good administration. Sir Hugh Clifford, interpreting the official view, said in the Nigerian Legislative Council in 1925 that on the contrary its first concern, from the time of Warren Hastings, had been to establish the rule of law and peace. Lord Leverhulme appeared at Lagos in his yacht, but the Governor would not accept an invitation to go aboard. In the end the Lever organization had to turn to the development of the concessions it had already obtained in the Belgian Congo, where its plantations were direct competitors of the Nigerian peasant. After this the Nigerian Government relented to a small extent in its policy, and there are now three plantations owned by the United Africa Co. in Nigeria and two in the British Cameroons.

Competition was now becoming a serious factor in the palm-oil trade. In 1925 Sumatra and Malaya produced 50,000 tons, the Belgian Congo 36,000, and the rest of West Africa 180,000. In 1938 the corresponding figures for the first two were 272,000 and 70,000 tons, while West African production had actually declined to 145,000 tons. These figures must be understood against a proper background for their significance to be realized. Over large areas of Southern Nigeria there are poor acid soils of which the oil-palm is tolerant, but where the hope of developing other economic products to meet the people's needs is slight. Palm kernels are exported to Europe for the extraction of the oil, whereas in a plantation factory this is done on the spot; the pericarp, on the other hand, undergoes rapid fermentation after picking, with liberation of free fatty acid which spoils the quality of the oil, so that extraction must be done immediately, whether by peasant or estate. Even so, the native-prepared oil is of poor quality with the free fatty acid content not below about 8 per cent. in the very best samples, while estate factories can get it down below 2 per cent. Furthermore, the African in Nigeria is working with wild

palms mostly of the *dura* variety which has a low oil content, while in the Belgian Congo the better *tenera* variety and in Sumatra the good 'Deli' type are planted, resulting in much higher yields of oil from the fruit. The disadvantage at which the peasant producer stands is thus very considerable, yet many of the Nigerian chiefs, with the power which the system of indirect rule gives them, are conservatively opposed to innovations. The idea of the planting of oil-palms, which would provide a ready means of improvement, has been resisted on the grounds that it may lead to individual land tenure, thereby undermining the tribal authority. The replacement of primitive oil extraction as carried out by the women, by efficient extraction with hand presses, has also been opposed because the women have earned a useful profit by these operations. The Cultivated Oil-Palm Ordinance of 1935, designed to encourage the planting of palms, proved abortive in its effect.

In spite of the regular increase in supplies of palm-oil demand increased at least equally rapidly, so that even poor qualities of this oil have always been able to find a market. This perhaps explains the comparative scientific neglect of this important crop in British West Africa, and the fact that it was even later than cacao in acquiring its own research station. The first impulse of the Nigerian Government in this matter seems to have been to get its work done in a cheap and easy way by taking advantage of the position of the United Africa Co. The area of the estates granted to the latter at N'dian in the British Cameroons was extended to ten square miles on certain conditions, one of which was that 'the estates were to be the means whereby possible improvements in palm culture will be tested on a large scale and demonstrated to the natives in a convincing manner'.<sup>1</sup> One of the most useful results has been the supply of seed

<sup>1</sup> H. C. Sampson and E. M. Crowther, Leverhulme Trust West Africa Commission 1938-9, Technical Reports, loc. cit., London, 1943, p. 26.

from selected high-yielding palms on this estate to the Agricultural Department. It was only in 1938 that the Government selected a site for the establishment of an Oil-Palm Research Station near Benin, but its development had not gone far when it was further delayed by the onset of war.

Such is the recent history of the Nigerian oil-palm industry, a case in which the best intentions have often led to tragic muddle, and where prospects are obscure as compared with other forms of peasant export production.

One point which remains to be noticed in the history of peasant-grown export crops is the development of government systems of grading and inspection. Where crops are sold on a world market the price obtained is largely affected by quality, the importance of which is with difficulty understood by the peasant cultivator, whose lots are in any case too small for grading on the farm. So great is the financial gain to the country by selling produce in standardized grades of guaranteed quality, that one colonial government after another has found the value of establishing a grading and inspection service. Coffee exports from the Bukoba district of Tanganyika may be cited as a very typical example. Here in the late nineteen-twenties keen competition amongst buyers and the high prices offered to producers resulted in the export of under-ripe, over-ripe, diseased, and damaged beans as good coffee, to such an extent that the confidence of overseas buyers was lost and not only did prices drop heavily but in 1931 the actual tonnage bought for export also began to drop. Government intervention became imperative and in 1932 legal export regulations came into force, under which all coffee exported had to pass a test of quality at the lake port of Bukoba and was then stamped with a government mark denoting and guaranteeing its quality. The effect of these measures was so immediate that in 1933, although there was a continued fall in general world prices for coffee, Bukoba *arabica*



rose by £5 a ton and *robusta* by £2. 10s. Similar instances could be given from many territories, and government grading and inspection services have been set up for such crops as coffee, maize, cacao, palm-oil, and others almost wherever they are peasant-produced.

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## V

### EUROPEAN SETTLEMENT IN TROPICAL AFRICA

DURING the twentieth century agricultural settlement by Europeans was proceeding in Southern Rhodesia and on a smaller scale in Kenya, Tanganyika, Nyasaland, and Northern Rhodesia. It is impossible here to detail the agricultural history of all these enterprises, but that of Kenya may be taken as a typical example, illustrating most of the mistakes that were likely to be made and much of the success that could be achieved.

From Sir Charles Eliot's term of office as Commissioner

for the East Africa Protectorate in 1901-4 it became an accepted principle of government policy that some parts of the empty highlands should be reserved for alienation to European settlers. The climate was healthy and good; it remained to be discovered what crops could most profitably be grown in this scenic wonderland, too warm to be temperate and too high to be tropical. To-day it is hardly credible that the first settlers lived by growing potatoes for shipment to South Africa, where they were sold even as far as the Johannesburg market. As time went on further paying crops were discovered, but to work out the practice for their cultivation was a costly and laborious process. For example, nowhere else but in Kenya is wheat attacked in one district by three species of rust fungus each with several physiological strains. To deal with this situation it was not Government, but a prominent and far-sighted settler, Lord Delamere, who brought out a young plant breeder from Cambridge named G. W. Evans; and Evans, with his crude field laboratory, bred from imported varieties the 'Equator' wheat which first proved resistant to rust and suited to the higher wheat-growing areas of Kenya. Later the Department of Agriculture took over the work and in 1926 bred 'Kenya Governor', a variety of similar usefulness at the lower altitudes.

The success of wheat and other crops led during the nineteen-twenties to a concentration in different districts on one-crop farming—wheat, maize, coffee, or sisal—which both tended to deplete soil fertility and proved dangerous when the market sagged for any one of these commodities. In 1930 the Government had to come to the rescue of maize producers with a subsidy on maize exported, and in December of that year a Maize Conference was held which resulted in £85,000 being spent to keep the industry on its feet.

With the onset of world-wide depression in the nineteen-thirties the position of many European farmers in Kenya

began to look desperate. Those who survived financially were helped by a number of causes. First, there was a general movement from one-crop to mixed farming. Coupled with this came the realization that in a country of great distances—farm to railhead, railhead to port, and port to export markets—production could not permanently be based on bulky low-priced commodities like potatoes and maize which might have paid in the past. High-priced animal products were much more likely to fill the bill, and consequently there was a steady increase in the output of such products as butter (helped by an efficient system of co-operative creameries) and bacon. Secondly, some slight assistance in export markets was given by the Ottawa agreements of 1932, under which Kenya gained preferences for her coffee in Canada, South Africa, and New Zealand, sisal in the United Kingdom and India, butter in the United Kingdom and Ceylon, and tea, maize, and oilseeds in the United Kingdom. But of more importance than any of these was the coming of pyrethrum. This crop, with which the world had previously been supplied from Dalmatia and Japan, was first introduced by Capt. G. Walker, a settler near Nakuru, in 1928. In 1929 selected seed was imported by the Agricultural Department from England. Following satisfactory results from quality tests, publicity given to the crop by the Department led to increasing interest being shown from 1931. At first production was only intended to meet local demands for insecticide. But pyrethrum, needing no elaborate equipment other than the erection of a drier, proved ideally suited to the smaller European farms, and the quality of Kenya flowers was so good that a large share of the world market was soon captured. As other crops became less profitable during the financial depression pyrethrum acreages expanded and saved many a farmer from bankruptcy. By 1938, in fact, the danger of over-production was obvious, and was

dealt with in legislation which will be considered in a later section.

If the success of the settlers was due largely to the outstanding enterprise of some of their number it must be confessed, also, that in the history of European settlement in Kenya nearly every possible mistake has been typified. A large proportion of settlers, especially in the earlier stages, were of quite unsuitable types. Some were attracted by the social life and opportunities for sport, and lived on private means which, while representing a useful contribution of capital to the young colony, decreased their interest in efficient and profitable farming. Many came from South Africa, a country of low farming standards where neglect of soil erosion has raised problems for the farmers in a manner that their compatriots in Kenya have only repeated. Ex-service men settling after the 1914-18 war had little knowledge of farming and underwent no adequate training. With many individual exceptions, the standard of farming in Kenya has always been disappointingly low. Mistakes in the use of capital have all too frequently been made. Many settlers reduced their own prospects from the start by taking on larger farms than their capital could possibly develop. Others spent their money on comfortable houses and had little left for farming operations. Few realized the necessity for a substantial capital reserve in a country where such calamities as droughts, locust attacks, and animal diseases might at any time be the cause of sickeningly heavy losses. This was particularly well exemplified when a great invasion of the desert locust in 1928-30, followed immediately by one of the migratory locust in 1931-2, assisted the depression in driving many farmers towards insolvency. Another great weakness of Kenya settlement was the large grants of land, especially those made in the early days, which remained practically undeveloped by their owners. The provisions of the law which required compulsory

development of a part of each property were insufficiently stringent to effect their purpose, and huge areas of the best land were locked up in the ownership of capitalists whilst elsewhere working farmers were struggling to make ends meet on marginal land.

There is no real evidence that in Kenya political power was used to prevent native competition in the growing of export crops, though Lord Hailey records that in the nineteen-twenties administrative officers did discourage native coffee planting.<sup>1</sup> But there was certainly legislation which could be misunderstood in this direction, as when in 1934 rules were made forbidding Africans from growing coffee except in scheduled areas, and then no areas were scheduled until 1937; even then an African coffee grower had to obtain a permit from the Director of Agriculture and an annual licence from the District Commissioner. It would, however, be true to say that encouragement was not given to Africans to grow such crops in the same way as in the neighbouring territories; and the time came in the nineteen-forties when the native-grown coffee crop of Uganda was several times the size of Kenya's European-grown crop, while in Tanganyika also the Chagga tribe and Bukoba district waxed rich on coffee. This policy was the more questionable because it could be plausibly argued that the native with his low production costs was a better competitor in the export market than the European; while on the other hand, the native with money in his pocket was the best customer for several products which demanded European production because of the skill or machinery required. Thus amongst the most stable forms of production in East Africa are those of sugar and tea, which are entirely grown by non-natives but find largely a native market; and even wheat falls increasingly into the same category.

The juxtaposition of European lands and native 'reserves'

<sup>1</sup> Lord Hailey, *An African Survey*, Oxford, 1938, p. 386.

in Kenya has produced all the usual elements common to such situations. Thefts of European livestock and produce by Africans have been a perpetual irritant between the two races. The crime of produce stealing, known to British colonial law as 'praedial larceny', is one that always arouses intense feeling in an agricultural community, and convictions are usually followed by heavy penalties owing to the difficulty of catching offenders. Still more exasperating is it when valuable imported pedigree animals are stolen merely to make a clandestine feast. It is perhaps easier to understand why sheep-stealing was a capital crime in eighteenth-century England when it is recalled that as recently as 1911 a Kenya settler shot an African for the same crime, and received considerable sympathy from local opinion in the public outcry which followed.

The relations between the two races were further complicated by the presence of numbers of African 'squatters' on European farms. Under the Resident Native Labourers Ordinance of 1925 such men were bound to work for their landlord for at least 180 days in the year, but the employer in his turn was required to provide them with sufficient land to grow food for themselves and their families. The presence of many 'squatter' cattle complicated the efforts to get rid of enzootic diseases such as East Coast fever, which were made under the Cattle Cleansing Ordinance of 1929 whereby districts could elect to impose rules for compulsory dipping of all cattle in their area. But worse than this was the fact that squatter cultivation and over-grazing were causing some of the worst erosion in many areas. This situation provoked further legislation giving District Councils in the European zone powers to introduce rules for the reduction of squatter cultivation and livestock. The Settlement Schemes Committee of 1944 recommended the elimination of all squatter cattle within five years. How acute the situation could be may be illustrated from a single

concrete case. In 1946 a settler with a farm of 4,600 acres had only 515 acres of it under cultivation, and also grazed 230 cattle and 5 horses. The remainder of the farm was occupied by 93 squatters with 468 other members of their families, who grazed on it 47 donkeys and 3,766 sheep. A state of affairs like this explains one aspect of the 'under-development' of so many European holdings, and the government Labour Commissioner had ample justification for his comment on the case that 'this was an impossible position and left an insufficient area for the farmer's own stock and cultivation'.<sup>1</sup>

Although many Africans thus found a way of life on European farms as squatters the tribes began to cast envious eyes on the land itself as their numbers grew, and the fertility of their reserves decreased under their criminally reckless systems of farming. In 1947 the Chief Secretary had to tell Kikuyu petitioners that 'no claim to farm lands in the Highlands can be entertained'.<sup>2</sup> An ironical aspect of the situation was that the Europeans' grass leys and protective grass on slopes, which were so imperative to maintain fertility, seemed so much waste of land to the Africans looking on from their reserves which were eroded through the very lack of them. In 1946 the leaders of the Wakamba told a visiting Under-Secretary of State for the Colonies that 'they regretted to see that grass was decaying on European farms and being eaten by wild animals which were not used for feeding the troops, while native flocks died for lack of grass'.<sup>3</sup>

By the time of the outbreak of war in 1939 agricultural practice among the little European community of some 2,000 farmers had settled down on sounder lines than ever before. The lessons recently learned by science about the maintenance of fertility had not been neglected. Kenya led the way in such developments as the proving of Rhodes

<sup>1</sup> *East African Standard*, 15 November 1946.

<sup>2</sup> *Ibid.* 17 January 1947.

<sup>3</sup> *Ibid.* 23 August 1946.

grass (*Chloris gayana*), especially the persistent indigenous Nzoia strain, as a suitable ley grass at moderate altitudes, and of *Bromus marginatus* for the higher farms; 'Kavirondo perennial sorghum' was also a Kenya discovery which had possibilities as a ley crop. Thus when exceptional war-time demands arose the farms of the highlands were better prepared to meet them. At the beginning of the war many settlers were away on military service, and their womenfolk did magnificent work in maintaining production. Later, it was the European farms that bore the brunt of an increase of production to feed an influx of white and black troops, prisoners of war, and refugees. The co-operative creameries, which in 1938 had turned out 2,800,000 lb. of butter, by 1946 produced 5,700,000 lb. of which only 2,400,000 were required for internal civilian consumption and the rest were available for military needs and export. Wheat was a commodity of which Kenya had been a net importer before the war; in 1938-9 production was only 23,020 tons and 1,450 tons were imported. During the war importation became impossible and the wheat-eating population increased. Production rose steadily to 75,090 tons in 1945-6.

Very different was the case with maize. Kenya, which had been a large-scale exporter before the war, shared with several other African countries the experience of becoming an importer during the war. For the continual increase in population was not matched by a corresponding increase in production from the native reserves with their declining fertility. The plight of African maize eaters would have been bad indeed without the surplus production from European farms, where both the yield per acre and the output per labourer employed were higher than in the reserves. But both Kenya and Tanganyika continued so short of maize that from 1943 onwards they had to call on Uganda to assist them with supplies. Uganda, which had never been a maize-growing country, viewed with reluctance the



widespread cultivation of a crop which had earned such a name for exhausting the soil of other territories, but accepted it as part of her war effort. Nevertheless even with this supply a bad season found East Africa short, and in 1943 Kenya had to import 50,000 tons of maize from overseas. Such a hand-to-mouth existence as regarded the staple food crop of the country did not augur well for the future.

European farming has, however, learned much from the lessons of the past. The Settlement Schemes Committee of 1944 produced no grandiose schemes for post-war European immigration, but recommended cautiously that about 500 new farmers could be absorbed. A proper means of training men in local farming conditions for the first time became available at the Egerton School of Agriculture at Njoro. Kenya farming has grown up; but its problems bristle with difficulties, and its future is unpredictable in this country where nature has provided incredible scenery as a background to so many improbable events.

The history of European settlement in the remaining tropical African colonies exhibits some differences of detail which help to illustrate the same principles as have been shown already at work in Kenya. Many false starts were made with unsuitable crops. In Tanganyika, for example, the early German settlers expended much effort on establishing plantations of Ceara rubber at a time when it was not yet realized that this could not compete commercially with Para rubber. Tanganyika also provides a classic example of the fallacy by which early European settlers so often supposed that dense tropical forest growth was an indication of great fertility in the underlying soil. The wooded slopes of the Usambara hills provided just such a temptation to plantation development, and here between 1891 and 1901 1,815 hectares of coffee had already been planted. But by 1905 the plantation companies were having

to explain away to shareholders the disappointingly low yields, although two able and orthodox scientists of the time, Zimmermann and Koert, could see nothing wrong with the soils. In 1908 *Der Tropenpflanzer* stated that 'coffee in Usambara was shrinking more and more', and in the same year one of the companies changed over entirely from coffee to rubber, only to change this again later for oil-palms in the effort to wring some profit from this stubborn soil. Not until a later date did agricultural science clearly realize, from this and other examples, that many tropical forests maintain themselves on inherently poor soils, building up by the continuous decay of their own litter a fertility which is rapidly dissipated when the area is cleared for cultivation.

Tanganyika was eventually to find its staple export crop in sisal, the first thousand bulbils of which were imported by the Germans from Florida in 1893. Its possibilities, however, went long unrealized, and not until 1907 was the trouble taken to import planting material into British East Africa (as Kenya was then known). Heavy restrictions on the export of bulbils which were shortly afterwards imposed by the Germans only succeeded, as has happened so often in the distribution of tropical crops, in shutting the stable door after the horse was gone. The sisal industry is one which has always shown a notable amount of self-help. In 1934 the planters contributed through the Sisal Cess Board to the foundation by the Agricultural Department of the Mlingano Sisal Experiment Station, which also received a grant from the Colonial Development Fund. During these depression years they were also active in promoting research into uses for sisal alternative to the main demand for it for binder twine to harvest the cereal crops of the temperate zone. In this way the manufacture of sisal sacks was started in East Africa, and it had already been discovered that sisal could make serviceable marine cordage before the need for

this became imperative when the allied navies were cut off from Philippine supplies of Manila hemp in 1942. The degree of co-operation was remarkable in an industry where before 1939 about 40 per cent. of the production came from German and Greek, 30 per cent. from Indian, and 30 per cent. from British plantations.

Nyasaland and the two Rhodesias have found agricultural possibilities controlled largely by the long haul to the nearest ports before exports can be sent overseas, which has imposed the necessity for high-valued produce of little bulk. Amongst early disappointments of the European settlers were the attempts at cotton-growing in Northern Rhodesia in 1923-4 and in Nyasaland from 1922 onwards; this crop, with its high labour requirements for picking, has never been able to carry the overheads of plantation as opposed to peasant agriculture in the tropics. Tobacco proved to be a more satisfactory alternative which eventually became the largest agricultural export of both territories. An interesting feature of inter-colonial trade is that in 1934 exports of Nyasaland tobacco were first consigned to West Africa, where a dark fire-cured type treated with oils and flavourings is in demand; so rapidly did this trade grow that by 1943 it consumed 15 per cent. of Nyasaland's tobacco exports. Tobacco as a European export crop in Nyasaland has been supplemented by a steady expansion in the planting of tea, now the country's second export. A more recent and very promising introduction is the tung tree first introduced in 1930 (*Aleurites fordii*) and 1932 (*A. montana*) by the Agricultural Department, and tried also with less success in other African colonies, at the original instigation of the British Paint Research Association, who found world supplies of tung oil unequal to the demand. These are all export crops, but in Northern Rhodesia the prospects for European farming were completely changed by the development of the copper mining belt as a great consuming

centre. The major product of the European farms is thus not any export crop, but maize for internal consumption, and the marketing of this bulky low-priced product is made easier by the fact that most of the alienated land runs in a belt along the railway line.

The agricultural history of Southern Rhodesia, which carries a larger number of European settlers than any of the territories mentioned so far, lies rather outside the scope of this story as it is really an extension of South African agricultural history. Indeed, a Kenya pioneer remarked somewhat bitterly that there they had to train even their oxen from scratch, whereas in Southern Rhodesia the settlers simply drove up trained bullocks from South Africa.

In fact, the agricultural history of the country has not been complex. The twin pillars of her agricultural economy have been tobacco and maize, but as with other African countries maize exports have shrunk in recent years and especially in wartime, and in 1944 tobacco and tobacco products were worth more than fifteen times as much as any other agricultural export. The Southern Rhodesian Government has always adopted a very thorough-going policy in agricultural affairs. One example of this may be seen in the care with which the infant tobacco industry was fostered. The first European farmer to plant tobacco in Southern Rhodesia was Mr. L. Cripps, near Umtali, in 1894. By 1904 the industry was so promising that the Government sent G. M. Odlum to the United States to study the best methods in tobacco-growing, and on his return he joined the Agricultural Department as Tobacco Expert. In 1907 he was sent on another mission to Turkey and Greece to study the growing of Turkish tobacco, and enlisted the services of fourteen Greek growers to act as instructors in Rhodesia. Another instance of forthright policy was the decision taken in 1908 that, in order to prevent hybridization and facilitate grading for export, the

cultivation of all but a few varieties of 'flat white' maize should be prohibited in the maize belt.

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## VI

### LAND QUESTIONS AND AGRICULTURE

WHEN the colonial Empire passed from the building up of plantation colonies to the absorption of peasant farmers' territories there was yet another aspect which was to raise a new set of problems. Administrators were faced with existing traditional systems of land tenure. Many of these, apart from being legally and socially imperfect, actually militated against efficient farming by lending themselves to such abuses as fragmentation of holdings, mortgage debts, rack-renting, and insecurity of tenure. Nowhere was this more in evidence than in lands where inheritance was controlled by Mohammedan law, with its insistence on subdivision among a number of heirs. This had led to such extreme fragmentation that in parts of the Near East a single date tree might be found to be the joint property of several owners.

Such a situation existed in Cyprus when in 1878 it passed from Turkish to British rule. In the twentieth century the

obstacles thus presented to modern farming methods became intolerable. Fragmentation had made fields so small that, in the words of an exasperated agricultural officer 'you can't get a tractor into top gear before you are in the next farm'. Even worse than this, ownership of tree crops and of buildings was often divorced from ownership of the land they stood on. To deal with these evils, a Land Utilization Committee was set up in 1943, which considered carefully the methods that had already been used for consolidation of fragmented holdings in the Central Provinces of India and the Punjab. A programme of reform was initiated by the Immovable Property Law of 1945 which repealed the Ottoman Land Laws and introduced provisions to check dual ownership of land with trees or buildings and to limit further subdivision of ownership. Minimum sizes of holdings were laid down for different types of land, for example,  $1\frac{1}{2}$  acres for all unirrigated land.

In the great Gezira development scheme in the Anglo-Egyptian Sudan the Gordian knot of land tenure was cut by the Government taking powers to rent the land from the original landowners for forty years at a fixed rent of 10 piastres per acre. Legal provision was included to prevent fragmentation of holdings by tenants or their transfer to merchants or absentees. This Gezira scheme, however, has had so much influence on colonial territories as a pattern of agricultural development that it must be considered in more aspects than that of only the tenure of the land.

The development was made possible by the construction of the great Sennar Dam on the Blue Nile, which was begun in 1919 and rendered irrigable a vast area which by 1937 amounted to 800,000 acres. The agricultural potentialities under irrigation of the area in question were tested in advance with the greatest care. An experimental pump scheme near Wad Medani to test its suitability for irrigated cotton had already provided an affirmative answer by 1913.

As the scheme developed two areas were canalized in advance in 1921 and 1923 to obtain further experience of cultivation techniques.

The whole scheme has been carried through under a triple partnership which has proved most successful in practice. The state, as senior partner, contributed the capital cost of the dam and the maintenance of the major irrigation works, and also pays the rent of the land. The second partner is the Sudan Plantations Syndicate, an organization which already had a staff experienced in growing cotton on the pumping-stations in the Sudan, and which was called in to act as general manager. The functions of this partner are (a) to level the ground and maintain field irrigation channels, supervise the cultivation through a staff of Inspectors, collect and store the cotton crop, (b) to carry out mechanical cultivation and to supply cotton seed, recovering the cost of both these operations from the cultivators. The third partner is the tenant cultivator, whose contribution is his own labour. In selecting tenants for the units of 40 acres into which the area is divided priority is given to the original landowners or to their nominees. But the scheme attracts cultivators from far and wide, and in 1935 9 per cent. of the tenants came from French Equatorial Africa and 2 per cent. from distant Nigeria.

When the cotton crop is sold the Syndicate deducts its expenses for ginning and marketing, and the proceeds are then divided in the proportion of 40 per cent. to the Government, 40 per cent. to the cultivators, and 20 per cent. to the Syndicate. Certain general costs, such as operations for the control of crop disease where necessary, are borne in the same proportions by the partners. The cultivator also obtains an income from the growth and sale of rotational food crops on his irrigated land. In the original plans a rotation was adopted in which cotton would be grown every

third year. This, however, was not found to maintain fertility, and the present rotation includes a fallow period, and cotton every fourth year. There are thus 200,000 acres of cotton grown each year.

The results of this scheme have been satisfactory to all concerned, though there have been times when anxiety was felt at dependence on one commodity with a fluctuating price. Before 1939 the Sudan Government was drawing 25 per cent. of its revenue from its share of the Gezira proceeds. The rotation adopted has also much increased the country's production of food, especially sorghum, and provided a surplus of this which is very welcome for export. The basis of the scheme is, however, to be changed, for an announcement has been made that in 1950 it will be replaced by a scheme of nationalization, which will involve the elimination of the second partner.

The success of the Gezira scheme was noted not only in the British colonies but also in foreign territories, some of which have in consequence experimented with similar schemes that in turn have influenced British colonial opinion. Such was the French project of the nineteen-twenties for the irrigation of a large stretch of country on the upper Niger. This scheme also had three partners—the Government, the cultivators, and the Office du Niger, a corporation financed in part by the Government. The scheme, though it still has possibilities of more active development in the future, has given rather disappointing results. The high capital expenditure has proved not to be recoverable, because cotton does not give its best yields in this area, and the rice produced cannot compete at world-market levels; the population of cultivators had perforce to be brought from distant areas and found the environment unfamiliar.

During the same period colonial opinion followed with interest experiments in other countries in 'collective'



farming for which great success was claimed. But these seemed on examination to contain little that was applicable to colonial conditions. The collective farms of the Russian steppes were adapted to crop growing but far less suited to livestock; they depended for success on great stretches of flat land, of uniform fertility and not thickly populated, and on the cultivation of small grain crops, which are so well adapted to mechanization. By contrast, those colonial areas in which land re-organization was most needed tended to be over-populated, over-stocked, hilly, of patchy fertility, and very mixed crops. Again, the Jewish collective settlements in Palestine were held up as models of technical efficiency; but their attainment of this depended on a constant influx of capital from American and other sympathizers, which was forthcoming for political reasons and did not seek the ordinary return on an investment.

An interesting attempt to secure some of these advantages was indeed made in the Belgian Congo. In the agricultural resettlement schemes started in the North Sankuru district about 1945, each cultivator opened up his holding as a narrow strip adjoining others on each side which were under the same rotation; thus any number of strips formed a continuous block which could be treated as a unit for providing such services as roads and water supplies, or if necessary for mechanical cultivation. The promoters of this design claimed that it ingeniously combined the advantages of collective farming with those of individual tenure.

British administrators concerned with land questions viewed these various developments with mixed feelings. Their agricultural advisors had imbibed during their training the long-cherished doctrine handed down from Arthur Young that 'property in land is, of all others, the most active instigator to severe and incessant labour'.<sup>1</sup> But

<sup>1</sup> Arthur Young, *Travels During the Years 1787, 1788, and 1789*, edition of 1792, p. 407.

the virtues of private ownership of land were becoming, in the tropics in the twentieth century, rather more doubtful than they had been; for example, this form of land tenure had not, in those parts of East Africa where it existed, prevented farmers from allowing extreme examples of soil exhaustion and erosion to occur. In the eighteen-nineties the system of private ownership written by Lord Lugard into the agreements with the Buganda Kingdom had seemed right and inevitable; forty years later, no local agricultural officer would have been prepared to defend the system of absentee landlordism into which it had grown, and it was wryly realized that its origin was only due to a mistake in Lugard's understanding of the native system. At the same time no one dared to suggest its abolition, for it had become a vested interest and the people clung to it. Indeed the irony of the situation was that, all over Africa, as the Europeans were increasingly realizing the disadvantages of private ownership of land, Africans were just reaching it in the course of their evolution from communal tenure by the tribe. The process is described at work in the Report of the Kenya Land Commission of 1933, which says:

the Kiambu district is already launched on a system of tenure quite exceptional in tribalism. It is not yet individual tenure, since the rule still seems to be that cousins separate, but brothers do not, and the group is therefore rather wider than a single family. And it is not even, in all respects, private tenure, since a right of communal pasturage remains. But these restrictions are disappearing and individual tenure is well in sight.<sup>1</sup>

In consequence of these opposing tendencies British colonial governments were indecisive in their attitude to land tenure, which was not necessarily a bad thing for agriculture. In the various resettlement schemes which were

<sup>1</sup> C. K. Meek, *Land Law and Custom in the Colonies*, Oxford, 1946, p. 96.

undertaken in tropical Africa in the nineteen-thirties and forties—at Anchau in Nigeria and Kingolwira in Tanganyika on tsetse-free land, and in some of the native reserves of Northern Rhodesia and the Kigezi district of Uganda to relieve population pressures—no revolutionary changes or experiments were made in the form of land tenure.

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## VII

### THE DANGERS OF MONO-CULTURE

THE economic dangers of mono-culture are fairly obvious. A territory which is dependent on a single export crop may suffer an economic calamity if the price falls or if a season is adverse to that particular crop so that yields are low. In such territories the Agricultural Departments nearly always devote a large proportion of their efforts to attempts to find other remunerative products. Thus, for instance, in Zanzibar which is so dependent on clove exports, many experiments have been made with alternatives such as pineapples and, more lately, cacao; in the Gold Coast, great efforts have been made to foster the citrus industry; in Uganda, with greater success, government encouragement has succeeded in building up the coffee and tobacco crops as supplementary exports to cotton.

But the danger arising from widespread incidence of plant disease on a crop concentrated on a limited area has

been much more slowly realized, in spite of the early experience of Ceylon with coffee-leaf disease. At first, indeed, there seemed to be indications that modern science could prevent such situations arising again. Ceylon itself had an alarm from cacao canker (*Phytophthora faberi*) which was so bad in 1902 that 98 per cent. of the cacao trees were infected and the average yield on plantations was only 56 lb. per acre. But by this time mycologists were on the scene, and control measures were quickly worked out which included the spraying of fungicides for the first time on any large scale in the tropics. By 1907 infection had been reduced to 3 per cent. and the average yield restored to 440 lb. per acre. It was hoped at the time that such triumphs could be endlessly repeated. But subsequent history has provided examples which point the other way in such devastating fashion that agriculturists are more tempted to wonder whether mono-culture can ever be considered safe.

The first of these examples was given by the Panama disease of bananas. This disease (caused by the fungus *Fusarium oxysporum var. cubense*) was first clearly described from Costa Rica and Panama in 1904, but is thought to have been present there from 1890 at least. In 1911 it appeared in Jamaica, and found a terribly vulnerable situation in this greatest British banana-growing territory and world's largest exporter of the fruit. In view of the fact that a strict quarantine was at the time in force against the entry of bananas or workmen's tools from Central America, and that the disease appeared within a very short time in several widely scattered parts of Jamaica, it has been suggested that the fungus may have been endemic in the island, but that its ravages only became noticeable when the acreage of bananas grew big enough to create ideal conditions for its spread. In any case, so great were the losses down the years that by 1931 15,660 acres of banana lands out of a total of 81,848 had been abandoned; in addition,

over 270,000 diseased plants had been notified in that year on the existing acreage. The rate of spread of the disease was estimated to increase by 50 per cent. each year. In 1935 the Government was spending over £5,000 in compensation to growers for healthy banana plants destroyed in the efforts to control the disease. By 1942 the abandoned banana lands had increased to 33,000 acres. In considering these figures, however, it should be borne in mind that, as in many similar outbreaks, some reductions in yield were attributed to the disease which were due to quite different causes, such as soil erosion; while the latter is also a predisposing cause of high susceptibility to disease which has been of increasing importance in the present century.

Attempts to control Panama disease were made from an early stage and enforced by legislation. For many years the procedure adopted was to destroy all banana plants in an area of 4 square chains round each infected plant, and to fence off this area. As this proved very unpopular and did not succeed in stopping the spread of the disease, the destruction was later reduced to the infected plant itself and the eight plants surrounding it, while finally the control was limited to the destruction and treatment of the diseased stools only with gas oil or by burning.

These palliatives were, however, always realized to be ineffective except as a means of gaining time for the discovery of better control measures, a point in which Jamaica was vitally interested since her main livelihood was in banana exports. The best hope appeared to lie in the development of banana varieties immune to the disease. The Jamaica industry had been based on one variety, Gros Michel, which is extremely susceptible to the disease but is one of the very few edible varieties which will withstand prolonged storage and transportation sufficiently to be exportable. Many other varieties which lack this quality are, however, immune to Panama disease; though a point of

unusual interest arose when it was discovered that the Canary banana, which in the West Indies is immune to Panama disease, was susceptible in the Canary Islands where it is grown in a mono-culture comparable to that of Gros Michel in Jamaica.

The problem was, therefore, to combine the quality of Gros Michel with the immunity of other bananas, no easy one since the edible bananas are sterile and seeds are practically unknown. Work to this end was started actively in Jamaica from 1924, and a little later at the Imperial College of Tropical Agriculture in Trinidad as a result of a decision taken by the Imperial Economic Committee in 1926. This latter work was partly financed by the Empire Marketing Board, a body which at this period afforded much assistance to colonial agriculture. The work was not carried out without complications. In 1932 a hurricane blew down the whole of the breeding stocks and collection of seedlings in Jamaica. A banana disease caused by the leaf-spot fungus *Cercospora musae*, long known in Fiji and Queensland where its effects are not serious, appeared in a most virulent form in Trinidad in 1934 and in Jamaica in 1936. Fortunately it was discovered that varieties resistant to Panama disease also showed resistance to leaf-spot, so that the breeding programme was merely intensified in the search for satisfactory varieties of this sort.

Much detailed and laborious work has been done in crossing Gros Michel with seed-bearing *Musa* plants to obtain the kind of hybrid desired. In a typical case, 71 bunches of Gros Michel pollinated from a fertile parent produced only 39 seeds, and of these only 3 germinated. Yet by painstaking work of this sort promising varieties immune to Panama disease have been produced both in Trinidad and Jamaica. But even the best of these, bred in Trinidad and known as I.C.2, is still not equal to Gros Michel in commercially desirable qualities; and so urgent

had become the need to replace Gros Michel in Jamaica that the immune variety, Lacatan, which had long been grown in South America and elsewhere, began to be planted on a considerable scale in the early nineteen-forties, although this too had been earlier rejected as not well suited to the export trade. It is still not clear on what variety permanent production can be based but, in the search for one, so much has been learned about banana breeding that on a long view the industry may even benefit from the occurrence of Panama disease.

In the case of 'swollen shoot' of cacao the picture is of gloom as yet little relieved. This disease, which either greatly reduces yields or kills the tree outright, is caused by a virus complex and was first reported from the Gold Coast by W. F. Steven in 1936. The provenance of the disease, previously unknown in any country, remains obscure. A decade after its original introduction the Agricultural Department had sadly to record that the rapid progressive decrease in cacao output over the last ten years had been mainly due to the onset of swollen-shoot disease. Careful surveys carried out in 1941-2 of two sample areas in the main region of infection (which was constantly expanding) showed that on nearly 60 per cent. of cacao farms the crop had died and that 90 per cent. of the standing mature trees were infected.

The history of the attempts to control this disease is of great interest. It has already been mentioned that until 1937 there was no adequate research station at which the specialists of the Agricultural Department could learn the effects of different treatments upon the cacao tree, which accounted for about 98 per cent. of the country's agricultural exports. Thus when pests and diseases began to appear one of the early recommendations made was to cut out diseased parts of the tree, a measure which resulted in the opening of the canopy and reduction of shade, and

actually proved to lead to increased insect infestation. Every effort was made to avoid such mistakes with swollen shoot. The first recommendation, for safety's sake, was to cut out any diseased trees together with a ring of healthy contacts, but experiments were at once put in hand to check this method. Thus by 1944-5 continued experiments 'led to the conclusion that the spread of the disease can be stopped by cutting out infected trees only, at the first sign of disease symptoms, provided the area is kept under constant supervision and any fresh infection promptly eradicated'.<sup>1</sup> The same report states that re-examination at the end of 1944 of areas previously treated by cutting-out showed that 'a considerable degree of success had been achieved in reducing the rate of spread of the disease. Complete control was obtained in many cases, especially in those outbreaks revisited and given subsequent treatment.' In this same season of 1944-5 the presence of swollen shoot was confirmed in Nigeria and the French Ivory Coast. The cutting-out of affected trees was begun in Nigeria in 1945.

By 1946 it was, however, apparent that voluntary cutting-out of infected trees on farms was not dealing with infections sufficiently thoroughly to control the disease and, fortified by the results of the experiments on this method of control, the Gold Coast Government considered it desirable in that year to pass the Swollen Shoot Disease of Cocoa Order to give legislative sanction to compulsory cutting-out. The scale on which operations were required is shown by the fact that between August 1945 and December 1947 about 2½ million infected trees had been cut out.

At this point occurred one of the most remarkable impingements of agriculture on politics in colonial history. An ignorant peasantry, resentful of the compulsory destruction of trees which still had life in them and which sometimes constituted their whole means of livelihood, had also in the

<sup>1</sup> *Annual Report of the Gold Coast Department of Agriculture for 1944-5*, p. 4.



Gold Coast long harboured suspicions of the motives of big business interests engaged in the cocoa trade. In this atmosphere political agitators encouraged them to conceive the idea that competing interests were using swollen shoot as a pretext to eliminate the cacao plantations of the Gold Coast. In February and March 1948 riots and disturbances occurred at Accra and other places in which twenty-nine people were killed and 237 injured. The Commission of Enquiry into the disturbances which was afterwards appointed found, among many 'proximate underlying causes' of the riots, 'the Government's acceptance of the scientists' finding that the only cure for Swollen Shoot disease of cocoa was to cut out diseased trees, and their adoption of that policy combined with allegations of improper methods of carrying it out'.<sup>1</sup> The Government appeared to be of the same opinion, since they had already suspended the compulsory cutting-out of cacao trees before the Commission's inquiry.

Nevertheless, the Commission recommended a resumption of compulsory cutting-out, with an increase in the rehabilitation grant of £12 an acre which had been paid to farmers whose trees were cut out, but coupled with this a suggestion that an inquiry into possible methods of control should be carried out by three plant pathologists of international repute from countries not commercially concerned in cocoa production. From a list prepared by the United Nations Food and Agriculture Organization a Canadian, an American, and a Dutch scientist were appointed for this unprecedented service. The report of these experts, published before the end of 1948, completely endorsed the programme for destruction of diseased trees pending the discovery of other methods of control, although they emphasized the fact that defence against the disease must be 'on

<sup>1</sup> *Report of the Commission of Enquiry into Disturbances in the Gold Coast*, Colonial No. 231. H.M. Stationery Office, 1948, p. 8.

a grand scale, far and beyond anything projected at present, if control programmes are to have a reasonable prospect of success'.<sup>1</sup> Nevertheless, they felt able to say that: 'We have a great appreciation for the splendid work being done at West Africa Cacao Research Institute and we strongly advise the cocoa farmers to have confidence in these scientists, who are working solely in the interests of the cocoa farmers of the Gold Coast.'

The position at the end of 1948 was that compulsory cutting-out had not yet been re-imposed, although it was stated at that time that about 50 million of the 400 million trees in the Gold Coast were infected and that an industry bringing in £40 million a year would be extinguished in twenty years' time if the disease could not be halted. Fortunately the financial position was such that the Gold Coast Cacao Marketing Board had been able to set aside £9 million for expenditure on rehabilitation grants to farmers.

One more striking instance of the dangers of mono-culture was provided by the 'sudden death' disease of cloves in Zanzibar. This (although probably present many years earlier) first attracted attention in the early nineteenth-thirties, when its ravages combined with the effects of the financial depression to make things difficult for many clove growers. Although the origin of this outbreak is unknown the symptoms on the clove trees are not entirely unprecedented, for a writer on the Straits Settlements in 1848 describes a trouble in which young clove trees 'assume the appearance of sudden blight as if lightning stricken, and they die'.<sup>2</sup>

Very similar were the symptoms which appeared with

<sup>1</sup> *Report of the Commission of Enquiry into the Swollen Shoot Disease of Cacao in the Gold Coast*, Colonial No. 236, H.M. Stationery Office, 1948, p. 3.

<sup>2</sup> J. Balestier, 'View of the State of Agriculture in the British Possessions in the Straits of Malacca', *Simmonds's Colonial Magazine*, vol. xv, p. 38, 1848.

increasing frequency among much older clove trees in Zanzibar. Out of one block of 800 trees marked in 1934 298 were dead by the end of 1947. In that year a grant of £3,000 was made from the Colonial Development and Welfare Fund for the study of the disease. It raged with less severity in Pemba than in the island of Zanzibar itself, where it will be remembered the trees were largely of one age planted after the cyclone of 1872; this age-class appeared to be the most susceptible, and by 1944 was reported to be in process of dying out. A large programme of seedling distribution had to be embarked on by the Department of Agriculture to provide replacements for the dead trees. And still science could discover no reason for this strange and sudden onslaught. The researches of local workers could not link it with any fungus, insect, virus, or soil deficiency. At last this small territory in 1946 was compelled to appoint from Amani a Director of Clove Research with a staff of several scientists to investigate problems centreing mainly round this strange disease.

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## VIII

## ADVANCES IN INSECT CONTROL

THE preceding section may have shown the problems of plant pathology in a somewhat gloomy light; but in the related sphere of control of insect pests science was to achieve some of its most brilliant triumphs of the twentieth century.

Among the most ingenious and interesting techniques that came into use was that known as 'biological control'. This received a great impetus from the case in which it was first applied with success. In the eighteen-eighties the citrus growers of California were suffering heavy losses from the depredations of the cottony cushion scale insect (*Icerya purchasi*) which had been accidentally introduced from Australia. An American entomologist, sent to Australia to discover what agencies prevented the insect from becoming a serious pest in its original habitat, found that it was there attacked by a ladybird beetle *Vedalia cardinalis*, and introduced this insect into California. Rapidly becoming established, it reduced the numbers of *Icerya* to insignificance and has continued to act as a completely satisfactory check upon this pest.

Under the stimulus of this success many similar experiments were made, of which some were satisfactory but many disappointing. As time went on it became clear that biological control often found its best opportunity in island territories with a small fauna where insects had few existing natural enemies, and especially against immigrant pests which had been accidentally introduced without their natural enemies. Thus some of the most striking successes have been achieved in Hawaii and, amongst British colonies, in Fiji. In the latter country the Government decided to explore the possibilities of biological control

against the coconut moth (*Levuana iridescens*). Several entomologists were concerned in the work, which resulted in the introduction of the Tachinid fly *Ptychomyia remota* from the Malayan region, where it was known to parasitize a related moth. In 1925 the *Ptychomyia* was reported to be definitely established in Fiji, and so successful that it was regularly causing 75 per cent. parasitism of *Levuana* caterpillars, and occasionally 90 per cent. The other Fijian coconut pests *Aspidiotus destructor* (a scale insect) and *Promecotheca reichiei* (a beetle) have been controlled respectively by a beetle introduced from Trinidad in 1928 and a Chalcid fly from Java in 1933.

Other insular colonies have had similar but not so striking successes, as in the case of the sugar-cane beetle *Phytalus Smithi* which is a pest in Mauritius where it was introduced with cane plants from Barbados; only partial control is given by the parasitic wasp *Tiphia parallela* which was introduced by entomologists from Barbados in 1914. In continental regions success is rarer still, though in a recent example good control of the coffee mealybug *Pseudococcus kenyae* in Kenya has been given by a species of *Anagyrus* introduced from Uganda in 1938.

The development and improved communications of tropical countries within the last century have led to the introduction not only of insect pests by accident into several countries, but also of plants which under new conditions have become noxious weeds. Thus species of *Lantana*, originally introduced as an ornamental shrub, have spread so much as to become a menace in Hawaii, Fiji, Ceylon, and elsewhere. Several kinds of *Opuntia* (prickly pear), native to America, have occupied vast areas of valuable land in Australia and other countries. From the experience with biological control of insects already described scientists naturally turned to see whether the agencies which kept such plants within bounds in their natural habitats might

not again include insects which might be introduced to control them. Although this problem had to be approached with much greater caution owing to the risk of plant-eating insects becoming crop pests in a new environment, several notable successes have been achieved and British colonies have not failed to avail themselves of this technique.

In 1914 the cochineal insect *Dactylopius ceylonicus* was introduced into Mauritius to control the prickly pear *Opuntia monacantha*, a result which had been completely achieved within fifteen years of the introduction. In Ceylon itself, while *Dactylopius ceylonicus* nearly exterminated *Opuntia monacantha* in the Northern Province, it failed to control *Opuntia dillenii* when this was accidentally introduced into the Southern Province; for this purpose *Dactylopius tomentosus* was introduced from Australia in 1924 and proved very successful. In Fiji the insect *Liothrips urichi*, introduced from Trinidad in 1930, does sufficient damage to the noxious shrub *Clidemia hirta* to prevent it competing with the native vegetation, and in the same colony the lacebug *Teleonemia scrupulosa* has since its introduction helped to control the *Lantana* menace.

Another direction in which insect control has advanced represents an indirect benefit of war. Between 1939 and 1945 intensive testing of many synthetic organic compounds, old and new, for their insecticidal value was undertaken. Two complex substances, known as 'D.D.T.' and benzene hexachloride, immediately proved their worth, and their discovery has so stimulated research work along these lines that they will probably be supplemented by many other effective compounds. This advance came at a propitious time for tropical agriculture because the potentialities of spraying insecticides from aeroplanes were just being realized. Thus great interest was taken when, after the end of hostilities, the South African Government used some of its Air Force machines to spread D.D.T. smoke

over tsetse infested areas in Zululand, with very satisfactory results in reduction of the tsetse population. In the Gezira area of the Sudan the authorities found that spraying cotton with the new insecticides against jassid insects was a most promising technique but could not be undertaken from tractors during irrigation. Accordingly in 1948 they engaged for this work the first helicopter that had flown in Africa. In Trinidad it was found that the froghopper pest of sugar-cane, an insect which had defied other methods of control in spite of intensive study over many years, was also susceptible to dustings from ground or air of the new insecticides.

Most encouraging of all, in the twentieth century a means of controlling the age-old plague of the locust came into view. This was due to the formulation of the 'phase theory' in 1921 by B. P. Uvarov, a scientist then working at the Imperial Bureau of Entomology in London, who had had experience of field work with locusts in Russia before 1914. Confirmation of his findings was given by Professor Faure of the University of Pretoria, and to complete the instance of international co-operation in science, the latter's experiments were financed by a grant from the Carnegie Corporation of New York. Briefly, the theory suggested that swarming locusts arise by a metamorphosis from the solitary phase in which they are found in their permanent breeding-grounds. This conclusion led to an intensive search for the breeding-grounds of the more destructive locusts. For the three species which are dangerous to agriculture in tropical Africa, those of the tropical migratory locust were found in reedy areas in the Middle Niger in French West Africa, those of the desert locust in the countries bordering on the Red Sea, and those of the red locust in remote areas of Northern Rhodesia and Tanganyika. It then became obvious that the control measures which were already in use against locusts, such as poison baiting, burning, beating,

and crushing, could be much more economically carried out near the permanent breeding-grounds *before* the swarming locusts had spread themselves over vast distances. From this point onwards the problem was not one of science, but of international collaboration and the contribution of funds by the many territories interested.

This problem proved much slower in solution, though the march of events did something to hasten the process. The damage done by locusts in Kenya in 1928-32 has been already referred to. In 1929 nearly 90 per cent. of Tanganyika's harvest is said to have been destroyed by locusts. In 1930 Nigeria had to import grain to prevent famine due to locust depredations. These and similar events perhaps helped to stimulate the first Anti-Locust Conference held at Cairo in 1936. A year later, at the International Conference for Protection Against Natural Calamities held in Paris, Dr. Uvarov pleaded for international collaboration in locust control. A first practical step was taken by the setting-up of the Anti-Locust Research Centre in London with Dr. Uvarov as Director, at which such work as mapping the course of locust invasions was undertaken on an international basis. As a result of further conferences, but after some delay imposed by the war, an Anglo-Belgian red locust laboratory was started at Abercorn in Northern Rhodesia in 1941. Following conferences in 1948 at Abercorn and Lusaka attended by representatives of all the countries concerned, an agreement was signed establishing the International Red Locust Control Service by all of them. Campaigns were to be financed by the Belgian Congo, British East and Central African territories, Southern Rhodesia, and the Union of South Africa.

Certain other moves were actually expedited by war between 1939 and 1945. When, as a result of war conditions, maximum food production in Africa and the Middle East became imperative, campaigns against the desert locust



were carried out as an operation of the allied nations with the use of military forces and equipment. This impinged on British colonial territory when in December 1942 swarms of the desert locust reached Kenya. Control action on a wide scale undertaken by military and civil authorities in co-operation, both in northern Kenya and in the territories to the north, was almost completely successful in preventing damage in the cultivated areas of Kenya, though campaigns were still being waged in 1947 (having been on an entirely civilian basis since 1946). In another part of Africa a laboratory for the study of the tropical migratory locust on an international basis was set up in the French Sudan towards the end of the war.

From these experiences many African territories have learned that a small expenditure contributed to anti-locust campaigns often far beyond their frontiers is an excellent insurance against locust invasion. It would be too early to say that the prevention of such invasions is yet in sight, especially in the Middle East region where international collaboration has proved most difficult. But the mechanism to achieve it is at least understood. Possibilities of control have also been greatly advanced by technical improvements, including the use from 1946 in Kenya and 1947 in Northern Rhodesia of the synthetic insecticide 'D.N.O.C.' (di-nitro-ortho-cresol) dusted from aeroplanes on locust swarms.

It is not always realized by the layman that in tropical agriculture losses of potential food by deterioration in storage are often quite as great as those due to inefficient cultivation. So much is this the case that, after a famine of mild proportions in Kenya in 1943, a Commission of Inquiry which was set up recommended that to prevent recurrences all possible steps should be taken to re-introduce the cultivation of *Eleusine* millet by Africans, because of its much better storage qualities than the more popular

maize.<sup>1</sup> The fact that famines could happen in this and other territories which have large seasonal surpluses of food had for some time turned the thoughts of administrators to the possibility of centralized grain storage, an idea which received new impetus from the possibilities of new insecticides as fumigants for stored produce. Kenya, which had long maintained a grain conditioning plant for export purposes at the port of Mombasa, opened one at Nairobi for treating internal supplies in 1945. These two plants have facilities for drying, fumigating, and removing impurities from grain. In 1945 255,870 bags of produce were conditioned in them, and 12,127 bags were fumigated. At the end of the war Uganda announced the decision to devote a part of her accumulated cotton profits to central grain storage. The Swaziland Government in 1946 built 18 grain storage tanks capable of holding 5,400 tons of grain. Mauritius has actually set up a Granary Department of Government, but this deals mainly with the warehousing of imported cargoes, and in the year 1946-7 handled only 5,056 tons of local produce as against 38,400 tons of imported. In 1948 the African Advisory Council in Bechuanaland gave favourable consideration to the setting up of a central elevator for grain storage.

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## IX

### PROBLEMS OF LIVESTOCK IMPROVEMENT

WITH the revolution in breeding methods that laid the foundation of British breeds of livestock in the eighteenth century it was to be expected that British colonists would carry these improved breeds overseas. There is always a tendency for colonists to introduce those lines of agriculture in which the mother country possesses special skill, as the French have done with essential oils in their colonies; and the Briton has a particular gift and liking for work with livestock. This expectation was in fact fulfilled. Early in the nineteenth century, for instance, Lord Charles Somerset introduced to Cape Colony the Devon cattle which are supposed by many authorities to have contributed some blood to the Afrikander breed. But in the tropics such introductions were disappointing. This appears first to have become plain in India, where the Military Dairy Department, after many years' experiment with various European and Indian breeds, did not succeed in establishing any cross-bred strain capable of holding its own under local conditions, and found that cross-bred cattle suffered far more severely from disease than Indian ones. All attempts to introduce European cattle into Southern Nigeria proved futile owing to losses by redwater. In the Gold Coast experiments for nearly ten years up to 1934 on crossing native with British breeds of cattle had not led to success. Colony after colony decided to concentrate rather on improvement by selective breeding of the local stock which were more resistant to

enzootic disease. In this they were encouraged by the results which had already been achieved in India, where, for example, on the government farm at Pusa the average milk yield of a herd of Sahiwal cattle had been raised from 5·8 lb. per cow per day in 1913 to 14·3 lb. in 1928. One of the great difficulties in milk recording in the tropics is that cows are accustomed to let down the last part of their milk only to the calf, and it appeared for long that this was an ineradicable habit. However, it has now been shown that heifers of tropical breeds can be accustomed to hand-stripping if trained from their first calf, and the original success at Pusa in building up a herd on this basis has been followed, with difficulty but to their great credit, by similar examples on government farms at Maseno in Kenya and Shendi in the Sudan.

As exceptions to the general rule there are some tropical areas in which the introduction of European cattle has met with success. One class of such cases is in insular territories. Efforts started in 1910 to build up a dairy herd at the government stock farm in Jamaica, and subsequent work in Trinidad, too, have shown that pure-bred animals of the Friesian, Red Poll, and Channel Island breeds can be kept, but that their stamina is improved by an admixture of zebu blood, grade cows with one-quarter or less of this still giving very satisfactory milk yields. This, of course, is due in the main to the comparative freedom of these islands from cattle diseases, which cannot, however, be relied on since redwater was introduced into Jamaica in 1903 with cattle from Central America, and dipping had to be made compulsory for all large cattle-owners. In other island countries, such as Fiji and Hawaii, introduced cattle have given similarly good results. The other cases of success have been in tropical highland areas where a cool climate favours European cattle and where European settlers are prepared to apply dipping, quarantines, and other measures for the

control of disease. Thus the dairy industry of Kenya has been built up on the grade cow derived from crossing a European milking breed with the local cattle.

Improvement in a cattle population by selective breeding from the native stock implies not only work at experiment stations, but also elimination from native herds of the inferior bulls, which in many parts of Africa are allowed to run with the herds and to serve as many cows as the best bulls. Campaigns for the castration of such animals, therefore, at an early stage took a prominent place in the programme of the Veterinary Departments, who have generally preferred to keep this work in the hands of their own staff, partly to ensure an intelligent selection of animals as sires, partly because the use of modern emasculating instruments is much to be preferred to native methods of performing the operation. A high degree of success was early attained in Nyasaland, where it was reported that in 1932 95 per cent. of cattle sent to the principal markets were bullocks, whereas in 1926 about the same proportion had been entire animals. In Uganda 150,000 animals were castrated in the three years 1930-2, an annual rate which proved hard to better, since in 1945 the number of cattle castrated remained at 46,542.

Although in continental areas the preference has been given, as already explained, to improvement of the local stock rather than the introduction of exotic breeds, it should be understood that this position is mainly the result of disease factors. Should the potency of these be reduced, breeding programmes might undergo a radical change. Such a desirable control of disease might be attained either by veterinary discoveries or merely by increasingly efficient administrative control in backward countries. The possibilities of the latter development have been strikingly shown in Swaziland and, coupled with the energetic anti-erosion campaign in Basutoland, suggest an illustration of

the principle that small units of government receive the best administration. Into this small territory, where a majority of the cattle are owned by Africans, East Coast fever of cattle was introduced in 1901—the result, like so many other outbreaks of animal disease, of livestock movements in time of war. So serious were the losses of cattle that in 1911 the Government embarked on a programme of building dipping tanks in the worst infected areas, and as these became available dipping was made compulsory for all cattle wherever an outbreak of East Coast fever occurred. As dip construction proceeded it became possible in 1921 to make regular dipping compulsory throughout the country. By this means losses have been kept down to a very low figure which may well be the envy of many larger and richer territories where the disease occurs. The law of Swaziland also now requires a blood smear to be taken from every beast that dies, and in 1945 72,588 such specimens were examined by the veterinary authorities. Such efficient control of disease nevertheless brings its own problems. The cattle population of Swaziland increased more than seven-fold from 57,601 in 1911 to 433,801 in 1947. In 1944 legislation was necessary for the compulsory de-stocking of over-stocked areas.

On the other hand, new veterinary discoveries have conferred a constantly increasing power to control tropical diseases of animals in the last sixty years. The discovery that several important animal diseases are transmitted by ticks had been made, outside the tropics, about 1893, and within a few years dipping the animals was recommended as a means of controlling these vectors. The true nature of East Coast fever was not, however, fully understood until in 1901 it was accidentally introduced into Southern Rhodesia with cattle from German East Africa; the Southern Rhodesian Government called in the eminent bacteriologist Professor Koch to investigate this new plague, and in 1903

he first clearly showed it to be a separate disease from red-water.

The same period saw advances in several other directions. Rinderpest, which had existed in Asia since time immemorial and had made occasional incursions into Europe, had in Africa apparently been confined to Egypt until about 1889 when it began a southward advance through the continent. This had several important historical consequences. The practical annihilation of the great herds of cattle owned by the Masai left the Kenya highlands largely empty for the British settlers who began to arrive not long afterwards. In East Africa the rinderpest was followed by famine and small-pox, and the joint effect of all three was so much depopulation that many areas, previously cultivated, reverted to bush, and this is thought to have been the cause of a great extension of the area infested by tsetse flies at about this time. On the other hand, it is stated that in Rhodesia and Nyasaland the deaths in this rinderpest outbreak of so many cattle and game caused a great recession of *Glossina morsitans*, one of the tsetse flies which feeds upon these. By 1894 the disease had reached South Africa, and in 1896-9 tremendous losses were suffered there. Active research by scientists in South Africa and elsewhere at last discovered methods of immunizing cattle against the disease. In this connexion the debt owed by the British colonies in Africa to South African veterinary scientists, and especially in many fields to Sir Arnold Theiler and his associates at Onderstepoort, cannot go unrecorded. By energetic measures, relying mainly on serum inoculation, South Africa was freed from rinderpest in 1903 and has since been kept free. The temporary immunity conferred by serum inoculation was later improved by permanent immunity given by double inoculation with serum from an immunized animal and virulent blood. But this led to some unfortunate incidents. When the double inoculation came

into use in Kenya in 1916 settlers complained that the inoculation was followed by outbreaks of redwater. The blood used had been taken from native cattle which, while showing no symptoms of redwater, had been infected in the past. A herd free from this disease had to be built up to supply blood for the inoculations.

At the present time, not only South Africa but the Rhodesias, Nyasaland, and the southern half of Tanganyika have been cleared of rinderpest. But in the colonies farther north the fight against it takes up a major part of the time of the Veterinary Departments. A large proportion of their staff is tied down to laboratory work by the necessity for producing immense quantities of vaccine for use in the case of outbreaks. The scale on which operations are required is shown by the fact that Nigeria immunized 1,468,005 cattle against rinderpest in 1946, Uganda 189,969 in the same year, and the Gold Coast 45,892 in 1947-8. In 1947 the Veterinary Research Institute at Kabete in Kenya produced 3 million doses of the goat virus used in rinderpest injections, besides more than 2 million doses of other vaccine. In these regions of Africa the rinderpest immunization camps have even come to play a social part in the lives of stock-keepers dwelling in lonely places. From the Gold Coast it is reported that 'The camps are held in the dry season when farming is dead and the visit to the camp makes a pleasant break in the lives of the country-folk. . . . Students of folk-song and dancing would be in their element at the camps.'<sup>1</sup> Success, however, in the fight against rinderpest has brought its own problems, for a 1946 report from Nigeria states:

This low death rate following the introduction of natural rinderpest, which is so commonly noted to-day, is consequent upon our past immunization efforts, but unfortunately, it is

<sup>1</sup> *Annual Report of the Gold Coast Department of Animal Health, 1947-8, p. 3.*



having a progressively adverse effect on the numbers of stock submitted for immunization at the various immunization camps, for the African memory is a notoriously short one and to-day few of the older men and fewer, if any, of the younger, appreciate the seriousness of rinderpest as an epizootic disease. It is becoming more and more obvious that if rinderpest, or for that matter any other disease, is to be kept under permanent control legislation will have to be introduced making it compulsory for all owners to submit their stock to immunization when called upon to do so.<sup>1</sup>

It is satisfactory to be able to record that international collaboration has been a prominent feature of the campaign against rinderpest. Several international conferences held on the subject in Africa have expressed their conviction that it is within the bounds of possibility to free the continent altogether of this scourge. At the latest of these, held at Nairobi in 1948 following talks between Britain, France, and Belgium, the important recommendation was made that the production of rinderpest vaccine for Africa should be concentrated at three centres only—Kabete in Kenya, Bamako in French West Africa, and Vom in Nigeria.

Not less important than the control of rinderpest is that of animal trypanosomiasis. In 1894 Bruce made the epoch-making discovery that the 'nagana' disease of animals in Zululand was caused by a trypanosome, and the story of the transmission of these parasites by tsetse flies was thereafter gradually unfolded. Trypanosomiasis makes the keeping of livestock impracticable wherever the tsetse fly is found, an area estimated at 65–75 per cent. of tropical Africa south of the Sahara. As it became apparent, in the years following the discovery of the cause of this group of diseases, that neither drugs or vaccines were known which could provide any effective control, attention was concentrated on attempts to eliminate the insect vector and so

<sup>1</sup> *Annual Report of the Nigerian Veterinary Department for 1946*, p. 4.

stamp out the trouble. So important was this work felt to be that in Tanganyika, where two-thirds of the territory is tsetse-infested and consequently uninhabited, a separate Tsetse Research Department of Government was set up in 1928. In Nigeria, where research had been proceeding since 1923, the work was carried on under the Sleeping Sickness Branch of the Medical Department, as human trypanosomiasis was there a graver problem than the animal form. In Southern Rhodesia the fly was at one time estimated to be advancing at the rate of 1,000 square miles a year, and a Tsetse Fly Act was passed in 1929 under which control measures could be taken. Uganda found itself compelled by the encroachments of the fly to establish a Tsetse Control Department in 1947. But in spite of intensive and painstaking research in all these and other territories the problem of real control remained unsolved. Methods of discriminative bush clearing, burning, or the creation of cleared barriers, which were tested in great detail, have done little more than limit the fly to its existing areas, and in some cases have actually failed to prevent its spread. At great expense and trouble a few small areas have indeed been freed from the fly; the Gold Coast can point proudly to 600 square miles cleared round Pong Tamale, and this is larger than most such examples. Southern Rhodesia adopted a policy of exterminating all game, which could act as a reservoir of trypanosome infection, from whole districts, which proved an effective method; but other territories considered the remedy worse than the disease. It remained broadly true that no economically practicable method of eliminating the tsetse was known, except by human settlement at a sufficient density to insure effective clearing of bush.

Meanwhile knowledge of drugs which had possibilities against trypanosomiasis had been overtaking that of tsetse control. In the second quarter of the twentieth century

pharmacology made a number of notable contributions to the armoury of the tropical veterinarian, which were largely due to an increase in research on complex organic compounds whose effect on insecticides has already been noted. Phenamidine and the quinoline derivatives appeared as new weapons against redwater; phenothiazine came into use against roundworms. In the field of trypanosomiasis itself the period since 1930 saw first the introduction of salvarsan, a drug of limited usefulness; and then in 1945 of drugs of the phenanthridinium series. These latter for the first time offered real prospects of controlling the causative parasite, but were scarcely out of the experimental stage when in 1948 there appeared another new drug, antrycide, for which even greater claims were made. Much is expected from this drug, which in experimental tests not only effected cures of diseased animals but could be used to confer immunity for a limited period. With these two, or even better, drugs it appears to be the organic chemist who has in his hands the ultimate control of trypanosomiasis. Not least of the benefits conferred by Britain on her colonies is the discovery of these drugs for a disease which is unknown within her own borders; work in which the credit may be shared by public and private enterprise, for phenanthridinium is a product of the Department of Scientific and Industrial Research, and antrycide of Imperial Chemical Industries Ltd.

Reference was made earlier to another problem of animal husbandry—that of local over-stocking, which has proved so intractable in Kenya. The holding of regular cattle sales is not only essential for its solution, but is implied by the policy of castrating surplus males and producing bullocks for fattening, and in fact by any attempt to organize a rational cattle industry with emphasis on production rather than numbers of cattle. The experience of Uganda in this respect should, therefore, be recorded as an antidote to

pessimism. In this territory over-stocking was only a local problem of small areas, but the amount of meat consumed in human diets was deplorably low when in the nineteen-thirties it was decided to organize periodic livestock auctions at selected centres under the auspices of the Veterinary Department. Starting slowly at first, cattle began to come forward in increasing numbers which were greatly augmented by the lure of high prices during the war period. This produced the unlooked-for position that, far from having to persuade the owners to sell surplus stock, over-selling took place and in the year 1942 it was estimated that over 20 per cent. of the cattle population and 30 per cent. of the sheep and goats were sold.<sup>1</sup> This was a rate too high to be maintained by replacement, and in subsequent years steps were taken to reduce cattle sales to about 12 per cent. of the population annually, by forbidding the selling in some cases of all female stock, in others of female breeding stock, out of certain districts. But by this time many peasants, who before the war had never eaten meat except perhaps at Christmas and Easter, had become accustomed to a joint every Sunday; and this newly acquired taste for meat, reinforced by returned soldiers who had become used to army diets, led to further unexpected results. One, when the supply of cattle had proved unequal to the demand, was a great increase in pig-keeping; the pig population of the Buganda Province, which had been practically nil before the war, was 20,604 in 1945. Another result of the increased taste for protein was the greater domestic consumption of ground-nuts, and consequent fall in the exports of this crop from certain districts.

Uganda also affords one of the first examples in the African colonies of that specialization amongst stockmen without which there can be no real advance in methods. In

<sup>1</sup> A similar situation arose a little later in Nigeria, where in 1947 22 per cent. of the total cattle population were slaughtered.

the nineteen-forties this became apparent in the development around the urban centre of Kampala of a class of native dairymen whose livelihood depended on milk sales; these men became, more than other stockowners, ready to listen to the advice of veterinary officers and were the first in the country actually to purchase concentrates for feeding their cattle. At the same time the cattle auctions in outlying districts provided an opportunity for stockowners there to act as breeders of store cattle for subsequent fattening nearer to the consuming centres. A specialization of function which took place centuries ago in Europe is thus just beginning to be paralleled in Africa.

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## X

## RUBBER AND THE DEVELOPMENT OF MALAYA

AT the end of the nineteenth century the world still depended for nearly the whole of its rubber supplies on wild trees tapped by the crudest methods. The first serious attempts to study the physiology of the Para rubber tree were made by two pupils of Marshall Ward, Professor of Botany at Cambridge in the eighteen-nineties. J. Parkin went out to work at Peradeniya in Ceylon, and in 1899 was the first clearly to demonstrate the existence of 'wound response', that is, the actual increase in yield of latex which follows on suitable tapping. This discovery provided the clue from which were developed modern systems of tapping by taking thin cuts progressively down one section of bark, and in this way it laid the foundations of the plantation rubber industry. The other young Cambridge scientist was R. H. Biffen, later to achieve fame in the very different field of wheat breeding and to become Sir Rowland Biffen. Biffen visited Central America and Brazil in 1897 on behalf of private interests concerned with rubber planting. The present use of acetic acid for coagulating rubber latex is due to his observation that burning palm-nuts, used to coagulate rubber in South America, gave off acetic acid in the smoke. He also suggested the separation of rubber from latex by centrifuging, a method which did not come into commercial use until a much later time.

Although Ceylon was early in the field and still remains a substantial rubber producer, it was in Malaya that the most remarkable development took place. Mention has already been made of the beginning of rubber planting in that country in 1895. In 1900 only 4 tons of plantation rubber were exported from the eastern tropics. At the end of 1905 the Federated Malay States had 40,000 acres under

*Hevea*, but still only produced 0.5 per cent. of total world supplies of rubber. By this time, however, the demand for rubber for tyres for the new motor-cars was stimulating the industry to an unexampled rate of development. In 1910 the price of rubber rose to 12s. a lb.; fortunes were made by the early planters, and the shares of planting companies were booming on the Stock Exchange. In 1912 Malaya had over 400,000 acres under rubber. By 1914 world supplies of plantation rubber for the first time exceeded those of wild rubber. In 1920 rubber exports from Malaya were 53 per cent. of total world production. Not until the early nineteen-twenties was expansion halted by a temporary slump, due to world trade depression and the fact that improved tyres were now doing two to three times as much mileage as before. A fall in price to 6d. per lb. was considered phenomenal, and led to the consideration of schemes for restricting production which will be described later. Yet in the still worse depression of 1932 the price of rubber was only just over 2d. per lb. In spite of these set-backs the figures for the year 1937 show that Malaya had over 3½ million acres of rubber, in which were invested £53,599,000 of external capital, and rubber exports for that year at £56½ million formed nearly half of Malaya's total exports. To such a size had this industry grown that the numbers of indentured, and later free, immigrant labourers brought into Malaya from China and India by rubber greatly exceeded those brought to the West Indies by sugar.

A feature of the industry of extraordinary interest was the gradual growing up of rubber small-holdings beside the big capitalist estates. These holdings are typically of about 5-10 acres, and the rubber is sold between coagulation and smoking to Chinese merchants who complete its processing. About half the small-holdings belong to Malays, the remainder to Indians and Chinese. By 1937 53.7 per cent. of the Malayan rubber acreage was on small-holdings or

Asiatic-owned estates. There has been a constant tendency for the acreage of small-holdings to increase relative to that of the estates, though production from small-holdings has not yet equalled total estate production. A similar process of development has occurred in rubber planting in the Netherlands Indies, whose history has run parallel to that of Malaya. Yet unless the estates had pioneered the way it is doubtful whether rubber small-holdings would have come into existence at all.

The rubber-planters of Malaya have at all times been keen to obtain scientific advice for the improvement of their methods and the lowering of costs, not least so under the stimulus of two financial depressions. Research work on rubber showed at one time a tendency to lag behind that in the Netherlands Indies, particularly during 1914-18 when the latter did not feel the effects of war to the same extent. To ensure adequate attention to this subject a separate Rubber Research Institute was founded in 1926 at Kuala Lumpur to take over all rubber investigations from the Agricultural Department. It was financed by a small cess on rubber exports, and is governed by a Board on which sit representatives of Government, planters, and small-holders.

Through work done here, and by other scientists, it has come about that the modern rubber tree is as highly bred and trained for its work as a pedigree dairy cow. A great advance was made when bud-grafting came into commercial use, first in Dutch territory, for the establishment of clones of trees all derived from one high-yielding mother tree and with a high probability, owing to their vegetative propagation, of reproducing the qualities of that tree. The oldest clones in Malaya which have been properly tested mostly date from about 1918. By 1940 Malaya had 356,552 acres of budded rubber. To enable small-holders to take advantage of this practice the Agricultural Department



made suitable bud-wood available for sale to them. A further development, now much employed, was the use of 'clonal seed' collected under trees of a single high-yielding clone, which proved to afford a cheap and easy way of maintaining high yields. Whereas in the days of planting unselected seedlings 500 lb. of rubber per acre was an average yield on good estates, clonal rubber on good land may now be expected to yield over 1,000 lb., and in the best conditions 1,500-2,000 lb. are obtained.

The treatment of the trees has also been brought to a fine art. Tapping systems are so elaborated that they are now known by symbols which have the appearance of mathematical formulae. Cover-crops and green manuring have been exhaustively studied. Artificial manures are widely used on plantations in Malaya to increase yields. Methods of handling the latex itself are also changing. For certain purposes preserved or concentrated latex is now shipped (some rubber companies owning tankers for the purpose) rather than coagulated rubber. Direct shipments of latex, totalling nearly 5 per cent. of world rubber exports in 1936, were showing a tendency to rise when they were checked by war and post-war conditions. Nevertheless, the Malayan rubber industry as a whole showed such resilience in recovery from the war that in 1947 exports were greater than in any pre-war year.

Throughout the period of the development of the rubber industry Malaya exhibited many of the usual symptoms of a colony with one supremely important export crop. Her Department of Agriculture had in the early days, as had so often happened elsewhere, devoted itself very largely to advising planters on economic crops, with consequent lack of attention to food crops and peasant farming. With plenty of money to spare the country had been content to rely for a large part of its food supplies on imports from overseas. In 1940 she was growing only 34 per cent. of her rice

requirements; and the dangers of this position were fully shown after the war when countries such as Burma which had previously supplied her with rice were no longer able to do so. It was partly because of the imperative necessity at this time of increased food production, a matter in which the Malay peasant was a broken reed, that Government accepted the presence on the land of large numbers of Chinese 'squatters', and thus greatly increased its political difficulties in suppressing the Communist troubles of 1948.

These weaknesses had, of course, become apparent at a much earlier date than this, and the Agricultural Department had long been doing its best to mitigate them. In encouraging rice growing it had had the assistance of a continuous influx of immigrants from Sumatra, who were much more inclined to the growing of this crop than were the local Malays. From 1915 onwards it had undertaken intensive work on the selection of high-yielding strains of rice, and in 1925 was able to distribute seed of sixteen pedigree lines which were estimated to increase the farmer's yield by 30 per cent. To the Department must largely be given credit for the fact that rice yields in Malaya are well above the average for Asiatic countries. In 1946, on the resumption of its functions after the Japanese occupation, it began pioneer work on the mechanization of cultivation for rice and other local crops, particularly as to the best types of tractor for use under these hitherto unexplored conditions, and the best season for carrying out mechanical cultivation.

The planters must also be credited with some strenuous and successful efforts to diversify the agricultural exports of Malaya. The pine-apple canning industry was founded about 1888 by Europeans who opened factories in Singapore. These passed into Chinese hands after a few years, but the industry has remained a substantial one down to the present day. Of greater eventual importance, however, was

the founding of oil-palm plantations, an enterprise whose story must be traced in greater detail.

In February 1848 two oil-palm seedlings were introduced as ornamental plants into the Buitenzorg Botanical Garden in Java from either Mauritius or Réunion, and in March of the same year two more arrived from the Amsterdam Botanic Gardens. Descendants of these plants continued to be propagated as ornamentals in the Netherlands Indies for the next sixty years. In 1910, however, a Belgian agronomist named Hallet, who was familiar with the usefulness of the oil-palm in Africa, decided to make commercial plantations in Sumatra, and naturally used the seed which was locally available. It turned out that he was extremely fortunate in doing so. The strain of oil-palms evolved in the Netherlands Indies, now known as the 'Deli' type, gives a high yield of fruits with a good oil content; it is usually referred to as belonging to the *dura* variety, but there are botanical indications of some different origin which cannot now be cleared up historically.

In Malaya, also, seed of oil-palms had been imported as an ornamental plant, first from Ceylon in 1875, and later on several occasions. Experimental plots for oil production were laid down by the Agricultural Department and some private planters in 1912, but the first commercial plantation was only made in 1917 by a Monsieur Fauconnier in the Kuala Selangor district. From the beginning of the industry the 'Deli' strain was preferred to any other locally available, nor was anything better found to replace it even when in 1926-7 the Department of Agriculture imported forty different lots of seed from West Africa. From 1926 a steady increase in acreage began; in 1934 there were thirty-three estates with 64,605 acres of oil-palms, and in 1940 the acreage was 78,256.

In one further direction Malaya showed itself fully alive to possibilities of diversifying its crop production, when in

1947-8 Professor Cheesman was appointed by the Secretary of State for the Colonies to make a tour and report on the potentialities for cacao cultivation in Malaya, Sarawak, and North Borneo—a subject of great interest in view of the decline in West African production owing to 'swollen shoot' which had led supplies to fall short of world demand. Professor Cheesman estimated a production of 100,000 tons of cacao a year to be a possibility for Malaya if the crop became established.

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## XI

## THE SUGAR INDUSTRY IN THE TWENTIETH CENTURY

THE technical improvements in sugar-cane cultivation and processing which had been gathering strength in the nineteenth century continued unabated in the twentieth. The movement towards large central factories was extended. One such factory which began operating in Antigua in 1905 produced 40 per cent. more sugar than before from the same amount of cane by more efficient extraction. In Trinidad there was built the largest sugar factory in the British

Empire, the Usine Ste. Madeleine, capable of an annual output of 60,000 tons of sugar. The estate companies kept abreast of developments in mechanization; as tractors came into use they were employed for cultivation, and in the nineteen-thirties gyrotillers were being used on sugar estates at a time when their merits had not been finally assessed even in temperate countries. In the control of insect pests of sugar-cane great advances were made. The new varieties of cane produced by the breeding stations were by 1911 estimated to comprise fully a half of the acreage in the West Indies, and to give average yields 10 to 25 per cent. higher than the old ones. As recently as 1948 it was stated that the introduction of a new cane variety in Barbados had increased the island's annual income by 3½ million dollars.<sup>1</sup>

The whole attitude of the planters to scientific research had undergone a change which greatly increased the tempo of development in the industry. In 1911 a Barbados planter said, 'I remember the times when science, as regards cane planting, was sniffed at by managers and others. . . . Now our planters run to the Department, examine the statistics of experiments and plant accordingly.'<sup>2</sup> At the same date it was estimated that the increased output of sugar, from Antigua and St. Kitts alone, due to the work of the Imperial Department of Agriculture would more than pay for the whole maintenance of the Department. In Trinidad and Grenada planters had already voluntarily agreed to increases in the export duties on their produce in order to provide further scientific assistance. Yet great as were the improvements already noted, the sugar-cane industry was to be still further revolutionized by the coming of the two great artificial fertilizers, sulphate of ammonia and superphosphate.

This could not have occurred without a series of previous

<sup>1</sup> *Farm Journal of British Guiana*, vol. xii, p. 54, 1948.

<sup>2</sup> *West Indian Bulletin*, vol. xi, p. 247, 1911.

historical events which made it possible. The first patent for the manufacture of superphosphate from rock phosphate was taken out by Sir John Lawes, the scientific squire of Rothamsted, in 1842. Sulphate of ammonia did not become available in bulk until Haber's discovery of the electrical process of manufacturing it, which was first put to use in 1913. Neither would have been of any use had not cheap steamship transport been available to bring these fertilizers to the tropics. For the British colonial Empire was poor in its resources of these materials. It is true that it has great reserves of rock phosphate, which have long been worked, in Christmas, Ocean, and Nauru Islands. But this raw material has to be transported to industrial countries to be converted into useful superphosphate; and a great proportion of it is taken up by Australia and New Zealand, which are comparatively near to the sources. So expensive is the transport of fertilizers to inland tropical regions that in 1948 it was calculated that superphosphate, a most beneficial manure for Nigerian soils, cost £15 per ton at the coast but exactly double this when delivered to agricultural areas in Northern Nigeria. Great significance, therefore, attached to the discovery during the war of 1939-45 of vast deposits of rock phosphate in Uganda as a potential future source of supply for eastern Africa at least. Sulphate of ammonia has to bear equally high transport charges before reaching the colonies from the exporting countries which have sufficient electrical power available for its manufacture; but the possibility of developing local production of this valuable fertilizer was one of the most attractive features about the proposals for development of hydro-electric power in the Rhodesias and Uganda which were made in the nineteen-forties.

The West Indies, however, were much less troubled by high transport costs in making use of artificial fertilizers, for they were all served by sea-borne traffic, and none of the sugar estates was very far from a port. Thus it came about

that the increasing use of fertilizers was one of the main factors which made it possible for a writer in 1936 to point out that during the past twenty-five years the production of sugar in the British Caribbean colonies had practically doubled, while in Barbados and St. Kitts it had actually trebled although the acreage under cane had remained almost constant. He amplified this by saying that 'yields which twenty years ago would have been regarded as distinctly good are now looked on almost as crop failures.'<sup>1</sup> Yet even on this high standard considerable improvements were to be made by the ever closer application of experimental techniques to the manurial requirements of particular soils. The results of experiments published in 1947 showed that at the Usine Ste. Madeleine a new combination of very high dosages of superphosphate and sulphate of ammonia could give an additional yield of 40 per cent. on certain soils over the routine manurial treatment, and an extra profit to the company of £50,000 a year. Yields of cane up to 80 tons an acre were obtained by these treatments.

The sum total of all these developments is that the increase over the last hundred years in yield of dry sugar obtainable per acre has been estimated to be as high as 1,000 per cent.—a figure not able easily to be matched by any other crop of either the tropical or temperate zones. Yet with this increase in production costs have been brought so low that a writer in the West Indies rather wryly remarks that 'had the British West Indies received assistance at the same initial rate as the beet-sugar industry in the United Kingdom they could have given away their sugar and still have declared dividends approaching 100 per cent. per annum'.<sup>2</sup> It says something for the pro-

<sup>1</sup> A. C. Mason, 'Empire Sugar', *Empire Journal of Experimental Agriculture*, vol. iv, p. 296, 1936.

<sup>2</sup> C. Y. Shephard, 'British West Indian Economic History in Imperial Perspective', *Tropical Agriculture*, vol. xvi, p. 175, 1939.

gress of human knowledge that it is with the crop longest cultivated by Europeans in the tropics that these outstanding results have been attained.

In the sphere of organization one of the most interesting developments of the period was the rise of the class of 'cane farmers'. These are small-holders, holding land on lease usually from a sugar company, and growing cane on a peasant scale for sale to the company's factory. Their existence, made possible by the pioneer efforts of the plantation companies, is in some ways a comparable development to that of the rubber small-holders of Malaya, and is of considerable interest as showing a possible future type of combination between capitalist and peasant farmer. Cane farming first began in a small way in Trinidad in the eighteen-eighties, and has been further developed there than in any other Caribbean colony. It first attracted East Indian immigrants, whose descendants still form a majority of the cane farmers, though West Indians have also increasingly taken it up. In 1909 there were already more than 11,000 cane farmers in Trinidad. In 1935 the Usine Ste. Madeleine had 14,000 acres of sugar-cane under cultivation by the company, and 6,000 rented to cane farmers, while in addition the factory was receiving cane from cane farmers on other lands.

A closely similar development took place on the other side of the world, in Fiji, another colony primarily dependent on sugar. Here factory production is now entirely in the hands of one Australian company, the Colonial Sugar Refining Co., who began operations in the colony in 1880. From the commencement the company farmed only part of its estates itself and leased out other parts to farmers to grow cane. At first some European farmers took up leases, but from 1913 onwards encouragement was given to small-holders, and here as in Trinidad the greatest number of cane farmers have been Indian immigrants, though some



Fijians have more lately followed their example. In 1924 there were several thousand Indian cane farmers, producing more than a third of the cane coming into the mills. So successful did the system prove that at present the Company relies almost entirely on the cane farmers for its supplies. Many of these are still on the Company's lands, others are lessees of Fijians, and the position in this respect has been made easier by the Native Land Trust Ordinance of 1940 which followed the offer made by the Fijians that land not required for their own maintenance should be thrown open to settlement. For their own tenants the Company provides houses, supplies manures at cost price, and hires out implements at low rates. The cane is reaped by co-operative gangs of the peasants themselves, their wages being debited to the grower of each piece reaped. Technical inspection and supervision by the Company have led to the standard of cultivation by the cane farmers being nearer to that of company-farmed land than in Trinidad. But, although the system has in general proved beneficial, dissatisfaction with the price paid for cane led at one time to a widespread refusal to cut cane by the farmers, resulting in an inquiry and report by the Professor of Economics at the Imperial College of Tropical Agriculture in 1945.

In spite of great technical advances in production the period was not one of unalloyed prosperity for the sugar-producing colonies. Their competitors were equally alive to the value of technical improvements; and, what was worse, sugar had become the plaything of international systems of subsidies, quotas, and tariffs, which were often manipulated for purely political reasons. In 1939 all Empire sugar, dominion as well as colonial, was receiving in the British market a preference of £3. 15s. per ton; in addition a supplementary preference of £3 a ton was given for a limited quantity of 'certified' sugar from the colonies only. In 1948 the report of a Commission stated that 'while

the West Indian sugar industry is by any standards reasonably efficient in management and equipment, it is doubtful whether it could survive in the future without the protection of the international quota and the Colonial preference'.<sup>1</sup>

A Royal Commission (the 'Moyne Commission') which made a general inquiry into the circumstances of the British West Indies in 1938-9 painted a gloomy picture of the agricultural situation. It could see salvation only in the development of mixed farming on a peasant basis, and a reduction in the dangerous concentration on single export crops in particular areas.

The outbreak of war in 1939 with its interruption of sea-borne traffic found the West Indies in a precarious position with their reliance on imported foodstuffs. Their position in this respect was shared with several other British colonies; all made creditable efforts to meet it, but space will only permit the quoting of a few figures from the West Indies as typical. Both governments and people worked hard to increase the local production of foodstuffs. In Jamaica legislation was enacted requiring the cultivation under food crops of a proportion of agricultural land varying from 2 per cent. for owner-occupiers to 8 per cent. for cash tenants. In Barbados it proved possible as the war continued to raise the proportion of land required to be in food crops from 5 to 35 per cent. The livestock population was also increased by requiring plantation owners to keep minimum numbers for every 20 acres of land. In Trinidad by 1944 the area under food crops was more than two and a half times the estimated pre-war acreage.

These difficulties with food-supplies were, however, also the symptoms of a more deep-seated trouble. For the British West Indian islands were in the twentieth century approaching a dangerous degree of over-population, with

<sup>1</sup> *Report of the British Guiana and British Honduras Settlement Commission*. Cmd. 7533. H.M. Stationery Office, 1948, p. 3.

densities ranging from about 300 per square mile, up to 1,200 in Barbados. In these circumstances it was natural that thoughts should turn to the possibilities of settlement in the undeveloped mainland territories. In the island colonies  $2\frac{1}{4}$  million people were living in 1948 in an area smaller than British Honduras, which had a population of only 70,000. The population of British Guiana was less than that of Trinidad, which is about one-fortieth of its size. A Commission was therefore appointed to look into this matter, and reported in 1948. Like others who had considered development before, it noted that the interior of British Guiana consisted mostly of poor soil, while both mainland colonies suffered from a complete lack of transport facilities. It therefore made only comparatively modest suggestions for development which might absorb a certain number of immigrants. Amongst the most interesting conclusions in the report was its firm declaration that 'we advocate the production of export crops on a plantation, not a small-holding basis'. This conclusion was based by the commissioners largely on the fact that 'our enquiries, supported by the expressed opinions of West Indian political leaders, establish the fact that there is no general urge towards the system of smallholdings'. Given the history and character of the West Indian population, it is probable that the views expressed in this report were more realistic than those of the Moyne Commission.

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## XII

### COMMODITY RESTRICTION SCHEMES

THE first half of the twentieth century, with its alternating trade booms and depressions, was characterized by a series of restriction schemes for commodities which included several major products of tropical agriculture. Some of these schemes, like that of the Brazilian Government under which millions of bags of coffee were destroyed, did not directly affect any British colony. In others, these colonies took a leading part.

The first of such schemes was that for rubber, a product in which it has always been difficult to adjust supply to demand. Amongst the reasons for this are that plantings must be made several years before production can begin, and the dependence of demand on consumption for a single purpose, that of motor tyres. Thus the fall in rubber prices in 1921 was largely due to the development of the high-pressure tyre with a longer life, and the rise in 1925 to that of the balloon tyre. The low point reached in 1921 had already been foreseen as a possibility some time before it occurred. In 1918 the council of the Rubber Growers' Association of Malaya proposed an adjustment of supply to demand, and from November 1920 to December 1921 a majority of estate owners in Malaya and the Netherlands Indies adopted a voluntary restriction of output. These measures, however, proved ineffective. In October 1921 Mr. Churchill, as Secretary of State for the Colonies, appointed a committee under Sir James Stevenson to

advise on the matter. The plan proposed by the committee was approved by a Cabinet about to leave office in the last minutes of a meeting. Mr. Churchill is quoted as afterwards remarking that 'evidently the Cabinet either felt that the scheme was so excellent that it required no discussion, or that it was so complicated that discussion was impossible'.<sup>1</sup> It was approved in Malaya and Ceylon, and went into force on 1 November 1922.

The Stevenson Scheme was not adhered to by the Dutch Government. It had, however, the support of all the British rubber-producing territories, then estimated to produce 72 per cent. of the world's plantation rubber, and of the important British and some Dutch companies owning plantations in the Netherlands Indies. The scheme depended on a pivotal price for rubber, originally fixed at 1s. 3d. per lb., which was considered to cover costs of production without encouraging new planting. Each producer was assigned a standard production, based on past performance in the case of estates, and on assessment for small-holders where no records were available. It has been claimed that most small-holders were under-assessed and in this way received less than fair treatment under the scheme. Exports during each quarter were limited to a percentage of standard production which was increased when prices rose above the pivotal price and decreased when they fell below it. The starting quota for exports was 60 per cent. of standard production.

In the event really low price-levels were avoided as long as the scheme lasted, but fluctuations took place quite out of control, especially a boom in 1925. The scheme quite understandably aroused resentment in the United States, the major customer who took three-quarters of Malaya's rubber, and stimulated the growth there of a rubber-reclaiming industry which reduced the demand for the

<sup>1</sup> K. E. Knorr, *World Rubber and its Regulation*, Stanford Univ. Press, California, 1945, p. 96.

natural product. An increase in the pivotal price to 1s. 6d. in 1926 was a mistake. New planting of rubber was stimulated by the scheme especially in the non-participating countries, and in particular among native small-holders in the Netherlands Indies. By 1928 it was obvious that the scheme had outlived its usefulness, and it was terminated on 31 October of that year. For six and a half years the rubber market was left to find its own level.

As early as 1930, however, a renewal of restriction was considered, owing to the depression, by an Anglo-Dutch Liaison Committee organized by estate owners. After prolonged discussion the International Rubber Regulation Agreement was ratified by Great Britain, Holland, France, India, and Siam to be effective from 1 June 1934 to 31 December 1938. In spite of the various objections to restriction of production this plan received the blessing of a League of Nations committee in 1937 as serving a beneficial purpose. Under this new scheme each country taking part was assigned a basic production quota based mainly on past performance. The International Rubber Regulation Committee would decide from time to time (not by a mechanical formula, as in the Stevenson scheme) what percentage of the quota could be exported for the ensuing period. Internal regulation to arrive at the exportable amount was left to each country, and in Malaya was carried on as under the Stevenson scheme. New plantings were prohibited (except for a small concession in 1939-40), another measure which tended to penalize small-holders who had been undertaking more new planting than estates before the scheme. This plan, with its greater flexibility, is generally conceded to have been more satisfactory than the Stevenson scheme, and before the date of expiry was renewed by all the signatories for a further five years ending in 1943. During the war period the scheme meant little. From 1943 it was given a short renewal, and finally terminated

on 30 April 1944. In Malaya, however, the legislation restricting new planting was kept in force until April 1947.

These experiences with rubber control provided something to go on when, during the deepening depression of the nineteen-thirties, restriction schemes for other commodities came to be considered by countries whose producers were threatened with disastrous loss of livelihood. The next to affect the British colonies was that for tea.

In 1930, with supply obviously greatly in excess of demand, tea producers' associations in India, Ceylon, and the Netherlands Indies agreed on a reduction of exports, but the scheme was not a complete success. In October 1932 the Dutch Government took the initiative in approaching the British to propose a tea agreement. Such an agreement was finally signed by the governments of the three countries mentioned under which exports were regulated for five years from 1 April 1933. The scheme laid down for each country standard exports based on past performance; permitted a percentage of these, recommended by an International Tea Committee with headquarters in London, to be exported during each year of the agreement; and prohibited new planting. Later Nyasaland and the British territories in East Africa joined the scheme, undertaking in 1934 that their area under tea should not exceed 39,340 acres; and Malaya in 1936 undertook that new plantings should not be more than 3,000 acres. Exportable quotas permitted during the five years varied between 82.5 and 87.5 per cent. of standard exports. Just as rubber restriction by stabilizing the *status quo* had penalized small-holders with their rising share of the crop, so did tea restriction work to the disadvantage of the newer planting countries, and opinion in East Africa particularly was always restive under it. However, the international agreement was renewed for the five years 1938-43, the East African territories this time being allotted definite export quotas on a modified basis.

During the war the scheme had little practical effect; India and Ceylon did not reach their exportable amounts. The agreement was further renewed up to 1947, though from 1942-3 onwards export quotas were fixed at 125 per cent. of standard exports to allow unrestricted production. After 1947 the East African and Nyasaland governments did not renew their control legislation and ceased to be parties to the scheme.

The story of sugar regulation is somewhat similar. Under the Chadbourne Agreement of 1931 Cuba, Java, and a number of European beet-sugar producing countries agreed to limit their exports of sugar by quota, but like all partial agreements this failed to achieve the desired effect of raising prices. In May 1937, therefore, an international conference held in London drew up the International Sugar Agreement which was signed by twenty-one countries. This was to operate for five years from 1 September 1937. Each year the sugar requirements of the free market were estimated, and export quotas for each producing country allotted, by the International Sugar Council. Great Britain accepted for the colonial Empire a basic export quota of 950,000 tons. The actual revised exports permitted from each colonial territory in 1937-8, as shown in the following table, are of interest as showing their relative positions at that date:

	<i>tons</i>
Mauritius . . . . .	273,160
British Guiana . . . . .	186,600
Fiji . . . . .	141,000
Trinidad . . . . .	118,280
Barbados . . . . .	108,000
Jamaica . . . . .	103,100
Leeward Islands . . . . .	47,156
East Africa . . . . .	13,500
Windward Islands . . . . .	8,200
	<u>998,996</u>



By successive protocols this agreement has been extended, and was still in force at the end of 1948, but since 1941 the exportable amounts have been the basic export quotas without any reduction.

One other regulatory arrangement of a much more local nature must be noticed. In 1938 the Kenya Government enacted legislation under which no farmer might grow pyrethrum for sale except under licence (for which a fee was payable), nor might he sell it except to the agents of the Pyrethrum Board. This was done partly to secure satisfactory quality, but partly also, as the Director of Agriculture explained in introducing the bill, because 'in the event of over-production it will be necessary for steps to be taken to control production by the limitation of new plantings'.<sup>1</sup> In the same year Tanganyika fell into line when the Pyrethrum Growers' Association of the Southern Highlands appointed the same sole selling agents as for the Kenya crop; this again had the double objective to ensure uniformity of quality with Kenya and 'to avoid inter-territorial competition on the pyrethrum market'.<sup>2</sup> Happily, the course of events has been such that it has never been necessary to use the restrictive powers created in the pyrethrum industry; though a voluntary regulation was adopted in Kenya on 1st August 1947 by which 1,185 tons of pyrethrum flowers were held back from marketing.

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<sup>1</sup> *East African Standard*, 11 November 1938.

<sup>2</sup> *Annual Report of the Tanganyika Department of Agriculture for 1938*, p. 27.

## XIII

## THE FINANCING OF COLONIAL AGRICULTURE

THE development of tropical agriculture in the twentieth century has focused attention on a number of problems inherent in its nature, which may be described under the broad heading of financing it.

One of these is due to the exceptional number of hazards encountered in farming in the tropics. Damage to crops by hailstorms, cyclones, and hurricanes, the incidence of drought years, locust invasions, catastrophic outbreaks of animal disease, all threaten the farmer with the loss of much of his working capital to a degree unknown in temperate climates. As a palliative measure some efforts have been made to provide insurance against these hazards in various territories. The Uganda Government, having fostered a native-grown tobacco industry in the nineteen-twenties, felt it incumbent to pay compensation to cultivators who lost their tobacco crops by hail if these had been grown in recommended areas. The money for this is found out of a cess which has been levied on tobacco buyers since 1933. Mauritius in 1947 formed a Cyclone and Drought Insurance Board on which sit representatives of Government, the sugar-planters, and the millers. Planters pay a premium on each year's crop to cover them against the risks of cyclone and drought. Jamaica appointed a committee in 1948 to advise on insurance to meet hurricane damage to crops. In the same year a committee in Cyprus recommended the insurance of vines against hail. In Kenya the question of locust insurance was discussed after the disastrous invasions of 1928-32, but no practicable scheme could be found. In the livestock field by 1914 the Government of Swaziland was already paying compensation to owners for all cattle that died of East Coast fever or were slaughtered by government

order. In this case it was made possible by an insurance tax of 1s. per head per annum for European-owned cattle, and by a contribution on behalf of the natives from the Swazi National Fund.

Agricultural indebtedness is not perhaps a problem peculiar to colonial farming. An early step to meet it has been recorded in the formation of a Land Bank in Barbados in 1902. Land Banks on similar lines have since been established in many British colonies, and have performed a useful function. Their natural sphere of action is, however, amongst non-native planters and settlers rather than the peasant community. It is the need to finance the agriculture of the latter which is one of the peculiar problems of modern colonial agriculture. Rural indebtedness, based on the mortgaging either of the land or of next season's crops, is inordinately high in some tropical countries, notably in Asia and in the coastal regions of West Africa. Amongst the reasons for which money is borrowed are not only farming operations but also funerals, marriages, litigation, and the payment of fines. A survey of a typical Gold Coast village carried out in 1932-5 by W. H. Beckett showed that the 201 families in the village had an aggregate debt of £4,500 at interest rates ranging up to 50 per cent. per annum. Thirty-five families had mortgaged their farms, 85 sold some or all of their crop in advance, and 106 had received cash loans. To mitigate such evils the course of history in Europe in the nineteenth century turned the thoughts of colonial administrators to co-operative credit societies. It also appeared likely that much good could be achieved by co-operative societies for the marketing of produce, the purchase of agricultural implements and consumer goods, the encouragement of thrift, and other purposes. But early experiences showed that the path of co-operation held many pitfalls for the unsophisticated, and it soon came to be accepted that such societies should be controlled and as-

sisted by suitable legislation and by the appointment of a government supervisory staff.

It was the Asiatic countries, where the need was most keenly felt, who gave a lead in the development of this great work. As so often happened, the Colonies learned much from Indian experience. In the closing years of the nineteenth century Sir Frederick Nicholson, who had been much struck by co-operative societies of the Raiffeisen type in Europe, did much to stimulate their development in India. The first Act to regulate co-operative credit societies was passed in 1904. Following on this, an ordinance with similar objects was enacted in Ceylon in 1911, and in 1913 the Director of Agriculture was also appointed Registrar of Co-operative Societies. In this country, where the movement made such an early start, it has achieved a notable degree of success. In Malaya co-operative legislation was passed in 1922, and the Co-operative Societies Department was formed in the same year.

Meanwhile the movement was also gathering pace outside Asia. Amongst British colonial territories which early passed legislation to promote it (though in some cases more with an eye to European settlers than to native farmers) were Southern Rhodesia in 1909, Bechuanaland Protectorate in 1910, St. Vincent in 1913, Northern Rhodesia in 1914, St. Lucia and Trinidad in 1915. The West African colonies were stimulated to follow this example perhaps not only by the need they felt for such a movement but by the example of French West Africa, where 'sociétés de prévoyance', authorized in the older territories in 1901, were made compulsory, and by 1938 claimed 8½ million members. The Gold Coast, where African farmers had made some unsuccessful efforts to unite in societies, sent an officer to study co-operatives in India and Ceylon, who reported in 1929. An ordinance was passed in 1931, when it was stated that there were already 113 cacao producers' societies with

1,997 members. One of their main objects was the improvement of quality, and it was claimed in 1930-1 that, whereas the mean commercial purity of all cacao exported from the Gold Coast was 87·8 per cent., that of cacao prepared by co-operative societies was 96·8 per cent. The subsequent development of the movement in the Gold Coast has been greater than in any of the other African colonies, but only at the expense of the Agricultural Department putting a high proportion of their total effort into this work. In 1936 there were about 400 cacao growers' societies with a membership of 9,000 and a capital of £25,000, producing 6,000 tons of cacao of superior quality.

Another notable example may be traced back to the foundation of the Kilimanjaro Native Planters' Association in 1922 by coffee-growers of the Chagga tribe in Tanganyika. By 1930 this association had fallen into disorder, but it was re-organized and registered as the Native Co-Operative Union in 1932. The union unites a number of primary co-operative societies, supplies them with spraying material and other requirements, and markets their crop. In 1937 it had twenty-seven affiliated primaries with 24,000 members and sold about 1,200 tons of coffee; a European manager was employed to organize its business. By 1947-8 sales of coffee had risen to 4,250 tons. In spite of a considerable degree of success the history of the Union has shown that the way of co-operation is not always smooth, as in 1937 there were riots in the Moshi area among members who declared that owing to its heavy overheads the Union was paying them lower prices for coffee than they could get elsewhere.

Nearly all British colonies now have legislation to promote the best interests of the co-operative movement. It cannot yet be said in the colonies to be out of the experimental stage, and even in the Gold Coast a writer in 1944 confessed that 'Methods more effective than the Cocoa

Producers' Co-Operative Societies as at present constituted and run are necessary to stave off the advent of a depressed farm peasantry'.<sup>1</sup> Many who have studied the movement are convinced that it has great potentialities, not only for increasing farmers' incomes, but for training them in working together and in moral qualities. More sceptical observers point out that even in Europe co-operative societies have only achieved their greatest success where the standard of rural education is high, as in Denmark; and that those colonial territories which stand most in need of them tend to be the very ones where the peasantry are least educated.

Co-operatives could not in any case provide a complete answer to a problem which was succinctly stated by the Governor of Kenya in a dispatch of 1946, when he said that 'An ignorant man and his wife with a hoe are a totally inadequate foundation for an enlightened state of society, a high standard of living and elaborate social services'.<sup>2</sup> To raise the level of farm output amongst a whole colonial population required an initial infusion of capital on a scale hitherto unprecedented. The grants made by the Empire Marketing Board from 1926, then under the Colonial Development Act of 1929 and the Colonial Development and Welfare Act of 1940 for agricultural research and development, useful and increasingly generous as they had been, had not done more than touch the fringes of this problem. The possibility of profitably employing, and hence of obtaining, capital on the required scale for one area at least, arose from developments in the course of history elsewhere—the acute world shortage of fats after the end of war in 1945, and the invention of the bulldozer.

Such was the background against which the East African

<sup>1</sup> W. H. Beckett. *Akokoaso: A Survey of a Gold Coast Village*. London School of Economics, Monographs on Social Anthropology, No. 10, 1944, p. 45.

<sup>2</sup> *East African Standard*, 18 November 1946.

ground-nut scheme found ready acceptance. It originated in a suggestion for the mechanized production of ground-nuts in Tanganyika made to the Colonial Office in March 1946 by Mr. F. Samuel, Managing Director of the United Africa Co. Ltd. This plan appeared to the Government to be of sufficient importance to warrant sending out a mission to draw up a detailed report on the possibilities. The prospect of a protracted fat shortage seemed sufficiently certain to justify the investment of government funds with the expectation of a commercial return; at the same time the double purpose would be served of making Africa contribute a more equitable share towards the general needs of mankind, and of substantially raising the standards of living of the local population.

The report of the investigating mission on the whole confirmed these hopeful prospects. The plan which they drew up dealt in figures of a new order of magnitude for colonial agriculture. A total of 3,210,000 acres of uncultivated and largely tsetse-ridden bush were to be mechanically cleared for cultivation in Tanganyika, Northern Rhodesia, and Kenya. An investment of £24 million was estimated to be necessary; but on the basis of a potential crop of 600,000 tons of ground-nuts it was expected that £10 million annually would be saved on Britain's food bill. A new railway and a new port in southern Tanganyika were included in the scheme. But with £4,750,000 to be spent on agricultural machinery, the total manpower required at the peak of the scheme was estimated to be no more than 750 Europeans and 32,100 Africans.

The agricultural details of the scheme show how carefully the lessons of the past had been taken to heart. It was considered that the crop rotation should be two years of ground-nuts followed by not more than two years under grass. The Uganda deposits were to be drawn upon for phosphate fertilizer, of which 90,000 tons a year were

called for; 320,000 tons of ground limestone and 160,000 of sulphate of ammonia would also be required for annual application. Cultivation would be in contour strips to avoid erosion. Every precaution was to be taken to avoid plant disease in a scheme liable to so many of the dangers of monoculture, particularly by close spacing of the ground-nuts to control the 'rosette' virus disease; and a team of scientists would be employed to watch the position from the start. Local crushing of the ground-nuts was eventually to be aimed at, in order to retain the residual products in the country. Finally, it was envisaged that the cleared areas would ultimately be handed over to the management of the African inhabitants when these had learned improved methods of farming, and it was suggested that these areas could best be managed by co-operative groups.

With enthusiastic promptitude the British Government gave approval for the first year's work to be put in hand on 31 October 1946, only seven weeks after the plan had been submitted. The political wheel had indeed come full circle from the days when the shades of Warren Hastings had been invoked to prove that commercial development was not a prime function of Government, to those in which Government took credit to itself for the investment of such a huge capital in colonial agriculture. Historical irony lay in the fact that it was the United Africa Co., representing interests whose application had been refused in Nigeria on that earlier occasion, who were appointed by Government as managing agents of the ground-nut scheme until they could form their own organization.

The principles of the great project were in fact generally admitted to be sound. Agricultural scientists could make some criticisms, and above all point out that the scheme was no more than a gamble unless the many unknown factors were first tested by small-scale experiment, as had been so carefully done, for instance, in the case of the Gezira



scheme. But agricultural criticism was overruled by the political argument that the urgent need to alleviate the fat shortage made the gamble necessary; and indeed it seemed at the time to have many chances of success. As things turned out, the plan was destined to go forward on a small scale only in its early stages, and thus in spite of itself met the demands of many of its critics. For what the planners had not foreseen was that in the post-war world of 1947 and 1948 neither machinery, railway and port equipment, building materials, nor qualified staff were available in anything like the quantities demanded. Progress was restricted by a series of bottlenecks. Furthermore, unexpected difficulties cropped up, in the absence of preliminary experiments, when bush-clearing was undertaken with machinery which had never been used for it under local conditions before. At the end of 1948 it was announced that, instead of the 1,230,000 acres of ground-nuts forecast for 1949, there were not likely to be more than 23,000 acres, plus up to 37,000 acres of sunflowers. The inclusion of the latter oilseed in the pioneer stage of development was largely due to its suitability for combine harvesting, thus avoiding the difficulties which had been met in the mechanical harvesting of ground-nuts on land which was still imperfectly cleared of bush roots.

The announcement thus made not unnaturally loosed a storm of criticism. But history takes a longer view of events; and it was in 1948 far too soon to say what ultimate success would attend a scheme which was yet to operate in other provinces of the East African territories, and was carrying out research as it went, on different rotations and different types of crops which might prove better suited to this large-scale arable farming. There could be no doubt, however, of the long-term value of the research done and experience gained as to the potentialities for mechanical cultivation of the many million acres of land of a similar character in

Africa; especially at a time when world food shortage threatened to be the dominant problem of a generation, and a crusading spirit was called for to meet it.

By April 1948 the Government had its own organization ready to undertake the management of the scheme. This was the Overseas Food Corporation, set up by the Overseas Resources Development Act of 1948, and provided with capital resources by Government for the purpose of increasing world food production. Apart from the ground-nut scheme, it is only permitted to operate in the colonial Empire at the specific request of the Secretary of State for the Colonies, and therefore need not figure further in this story.

Development in the Colonies was otherwise provided for in the same act by the creation of the Colonial Development Corporation, a departure which was symptomatic of the new philosophy of colonial development engendered at the time of the ground-nut scheme. This Corporation was given power to borrow up to £110,000,000, normally in the form of advances from the Secretary of State for the Colonies, to carry out projects for developing colonial resources. Its first project, on which work began in 1948, involved the investment of £500,000 in clearing 10,000 acres of forest near Bathurst in the Gambia for the production of millets to feed poultry; the estimated output was 20 million eggs a year, besides table birds, for export to the United Kingdom. Before the end of 1948 the expenditure of £1 million was also approved for the development of a tung-oil industry on the Vipya Plateau in northern Nyasaland; and 14,000 acres had been purchased in North Borneo for the cultivation of Manila hemp.

Simultaneously with these events planning for the increased production of oil-seeds had been going on in West Africa, which had not stood idle while the East African ground-nut scheme was under discussion. In 1946 a mission

of experts appointed 'to enquire into the production and transport of Vegetable Oils and Oilseeds produced in the West African colonies' had recommended, amongst other things, a scheme for the mechanized production of ground-nuts in the Gambia. Before any action was undertaken, however, a further 'West African Oilseeds Mission' was sent out in 1947, and this mission in its report recommended mechanized cultivation of ground-nuts and millets on a scale comparable to the East African project. Two areas in Northern Nigeria, two in the Gold Coast, and one smaller one in the Gambia were recommended for development with a total of some 2,700,000 acres to be cultivated. The rotation suggested was: first year—cereals, second year—ground-nuts, third year—cereals, fourth year—ground-nuts, fifth and sixth years—grass ley. Eventual annual production of 225,000 tons of ground-nuts in ten years' time was envisaged, with a labour force of 104,000 and a capital expenditure of £25,150,000. The areas were to be worked by group farming of 'tractor units' of 600 acres each. Twenty families would provide the labour for each unit, every family having user rights to 20 acres of the 400 under crops. The costs of mechanical tillage would be met by contributions from each farmer out of the proceeds of his crop sales. Every twenty tractor units would constitute one 'group' for higher administrative purposes. The programme, however, laid down that during the first three years development would amount to no more than large-scale experiment on 12,000 acres only in each of the main areas.

In any case, action on this report was not hurried. The authorities were no doubt moved to deliberation partly by the example of the East African ground-nut scheme, partly by the need to confer with the Colonial Development Corporation which would have to provide most of the funds needed, and partly by an object lesson in the effect of a

bottleneck on agricultural exports which had recently been afforded them. This last arose in the following manner. In the pre-war season 1938-9 Nigeria had produced for sale 145,000 tons of ground-nuts; in 1947-8, owing to expansion of the crop (partly, it must be confessed, at the expense of cereals) to meet war-time demands, she produced 313,000 tons. But this vast crop was more than could be transported even as far as the coast; by April 1948 accumulated stocks up-country amounted to 330,000 tons, more than a whole year's crop. The main cause for this was a shortage of locomotives on the railway. As far back as October 1943 eleven locomotives had been ordered from Britain, and the order was later increased to twenty. Shipment of these engines from Britain was not achieved until May 1948 owing to a series of administrative muddles of which the Select Committee on Estimates had to say that 'the present accumulation of ground-nuts in Northern Nigeria was due not to the shortage of engine-building capacity, but to a complete breakdown of the organization in London for arranging priorities'.<sup>1</sup> Even with the culprits thus pilloried, the experience was hardly conducive to growing more ground-nuts in Nigeria, at least until the stocks were cleared.<sup>2</sup> In the meantime the Nigerian Government made sure that their plans for any future development scheme would be based on the best experience of the past by sending a mission to study the Gezira organization and other advanced systems of land usage in the Sudan.

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<sup>1</sup> *Fifth Report from the Select Committee on Estimates, Session 1947-48: Colonial Development*. H.M. Stationery Office, 1948, p. xxiv.

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## XIV

## CONCLUSION

IN telling the story of colonial agriculture within a brief compass much detail of the greatest interest has had to be omitted, and no attempt has been made to relate in full the agricultural history of any single territory. Salient facts have been selected to illustrate on the one hand the diversity of colonial agricultural problems, and on the other their frequent similarity in different parts of the world. Agriculture has been shown as held back from its fullest development, sometimes, indeed, by the ignorance and inefficiency of those who practise it, but equally often by causes quite outside the field of agriculture alone, such as poor communications or a social valuation of cattle unsuited to modern times. Any

such history is bound to throw into relief the fact that there is no single panacea which can be universally applied to the agricultural ills of colonial countries. Soil erosion can be prevented by one treatment in one place, but demands quite different measures in another environment; the poverty and lack of enterprise of the tropical peasant cannot be alleviated by any single means, though some, such as the co-operative movement and education in its widest sense, attack these evils over a broad front. Schemes for the cultivation of even a single crop, such as the ground-nut, must be adapted to local conditions of soil, rainfall, and other factors. Fertility cannot be maintained by the same methods everywhere. In short, if there is one lesson to be learned from the history of colonial agriculture, it is that generalizations are dangerous.

Another evident conclusion is that while short-term planning is essential, long-range plans cannot safely be made in a field where technical change is now becoming so rapid. The expectations of even the most competent agriculturists have been frequently falsified by advances in such subjects as mechanization, pest control, plant breeding, and manuring.

In the face of these two inherent difficulties, the best insurance for the prosperity of agricultural populations lies in the maintenance of the highest possible degree of technical skill among farmers and their advisers, so that they are ever ready to take advantage of whatever new opportunities may occur. And in that technical skill a knowledge of the lessons which are to be learned from past agricultural history forms not the least part.

# INDEX

- Afzelius, 41.  
 Amani, 72-3.  
 Antigua, 23, 45, 149-50.  
 Antrycide, 140.  
  
 Bahamas, 18, 23, 24.  
 Bananas, 9, 10, 42-3, 61, 117-20.  
 Banks, agricultural, 62, 164.  
 Barbados, 22-4, 32-4, 48-50, 62, 73,  
 150, 152, 155.  
 Bark-cloth, 40.  
 Basutoland, 80, 81.  
 Beans, French, 1, 18.  
 Bechuanaland, 131.  
 Beet sugar, 35, 47, 61, 152.  
 Bermuda, 15, 21, 24.  
 Biffen, Sir R., 143.  
 Biological control, 125-7.  
 Bligh, 28.  
 Botanic gardens, 27-8, 67.  
 Bread-fruit, 13-14, 28.  
 British Cotton Growing Association,  
 85, 86.  
 British Guiana, 34, 38, 45-6, 48-50,  
 68, 156.  
 British Honduras, 36, 68, 156.  
  
 Cacao, 28-30, 35, 47, 54-5, 91-4,  
 117, 120-3, 149.  
 Cameroons, 56.  
 Cane farmers, 153-4.  
 Caribs, 24, 36.  
 Cassava, 1, 20, 21, 24.  
 Cattle, 5, 15, 132-42.  
 Ceylon, 7-8, 24, 28, 42, 57-60, 67,  
 117, 127, 143, 165.  
 Chitemene, 10.  
 Cinchona (*see* Quinine).  
 Cinnamon, 8, 42.  
 Cloves, 7, 42, 57, 123-4.  
 Cocoa (*see* Cacao).  
 Coco-nut, 1, 9, 12, 13.  
 Coffee, 18, 35, 42, 57-9, 97-8, 102.  
 Collective farming, 113-14.  
 Colonial Development Acts, 167.  
 Colonial Development Corporation,  
 171.  
 Columbus, 15, 16.  
  
 Commonwealth Agricultural Bur-  
 eaux, 70.  
 Co-operative societies, 164-7.  
 Cotton, 2, 9, 13, 47, 85-91, 112-13.  
 Cowpeas, 1, 10, 18.  
 Cross, R., 52-3.  
 Cyprus, 80, 81-2, 110-11.  
  
 D.D.T., 127-8.  
 Delamere, Lord, 99.  
 Dogs, 1, 5, 13.  
 Dominica, 28.  
 Dundonald, Earl of, 31, 88.  
  
 East Coast fever, 103, 135.  
 Egypt, 5, 11.  
 Eleusine millet, 9, 130.  
 Empire Cotton Growing Corpora-  
 tion, 87-8.  
 Empire Marketing Board, 119, 167.  
 Extension work, 74.  
  
 Falkland Is., 16, 68.  
 Fiji, 14, 43, 125-7, 153-4.  
 Fragmentation, 110-11.  
  
 Gambia, 40, 55-6, 171, 172.  
 Gezira, 111-13.  
 Goats, 11, 15-16, 18.  
 Gold Coast, 54-5, 91-4, 116, 120-3,  
 132, 137, 139, 164-6, 172.  
 Green manuring, 7, 78.  
 Grenada, 28, 47.  
 Ground-nuts, 6, 20, 40-1, 55-6,  
 168-73.  
  
 Harrison, Sir J., 49.  
 Hoes, 4-5.  
 Horses, 10, 21, 30.  
  
 Imperial College of Tropical Agri-  
 culture, 69, 74, 88, 119.  
 Imperial Department of Agricul-  
 ture (West Indies), 62, 64, 67, 69.  
 India, 66, 133, 165.  
 Insurance, 163-4.  
 Irrigation, 8.

- Jamaica, 23-4, 34-6, 39, 45, 61, 68,  
 70, 117-20, 133, 155.  
 Jamaica Agricultural Society, 62.  
 Jute, 40.
- Kenya, 24, 82, 98-106, 115, 126,  
 130-1, 133-4, 136.
- Land tenure, 114-16.  
 Leverhulme, Lord, 94-5.  
 Locusts, 101, 128-30.  
 Longhorn cattle, 10.  
 Lucerne, 30.  
 Lyamungu, 73.
- Maize, 11-12, 20, 99, 105-6, 109-10,  
 131.  
 Malaria, 2, 30.  
 Malaya, 7, 24, 53, 68, 70, 72, 80,  
 143-9, 157-60.  
 Markham, Sir C., 52.  
 Mauritius, 42, 47, 48, 50, 126-7,  
 131.  
 Mayas, 11, 36.  
 Millar, R., 27.  
 Milner, Lord, 68, 69.  
 Mixed farming, 77-8, 100.  
 Montserrat, 23, 28.
- Nagana, 138.  
 Navigation Acts, 26.  
 Nevis, 23.  
 Nigeria, 55, 56, 68, 77-9, 91, 92-3,  
 94-7, 129, 137, 139, 172-3.  
 Northern Rhodesia, 84, 108-9, 116,  
 128-9.  
 Nutmegs, 7, 28.  
 Nyasaland, 79, 108, 134, 171.
- Oil-palms, 94-7, 148-9.  
 Oil Rivers, 40, 56.  
 Ottawa agreements, 100.  
 Overseas Food Corporation, 171.
- Palm-oil, 10, 40, 56, 94-7.  
 Panama disease, 117-20.  
 Pepper, 7.  
 Peradeniya, 28, 53, 59, 60, 143.  
 Persians, 9.  
 Peru, 11.  
 Phenanthridinium, 140.  
 Phenothiazine, 140.
- Phosphates, 151.  
 Figs, 6, 11, 15, 21, 141.  
 Pine-apples, 20, 116, 147.  
 Potatoes (*Solanum*), 19, 36, 99.  
 Pyrethrum, 100, 162.
- Quinine, 2, 30, 52, 59-60.
- Rice, 6, 9, 46, 72, 146-7.  
 Rinderpest, 136-8.  
 Rothamsted, 88, 151.  
 Rubber, 2, 51-3, 143-6, 157-60.  
 Rubber Research Institute, 145.
- St. Helena, 15-16.  
 St. Kitts, 22, 150, 152.  
 St. Vincent, 28.  
 Sesame, 6, 10.  
 Shifting cultivation, 10, 76.  
 Sierra Leone, 41, 80.  
 Sisal, 107-8.  
 Slave-trade, 17, 18, 21, 22.  
 Slavery, 23, 36-9.  
 Sloane, Sir H., 27.  
 Soil conservation, 75-84.  
 Soil erosion, 3, 80-4.  
 Sorghum, 9, 105.  
 Southern Rhodesia, 24, 68, 109-10,  
 135, 139.  
 Spruce, R., 52.  
 Squatters, 103-4, 147.  
 Stevenson scheme, 157-8.  
 Sudden death disease, 123-4.  
 Sugar-cane, 2, 17, 22, 28, 49-51.  
 Sugar production, 23, 26-7, 30-9,  
 44-51, 149-57.  
 Sugar regulation, 161-2.  
 Swaziland, 131, 134-5.  
 Sweet potatoes, 14, 20.  
 Swollen shoot disease, 120-3.
- Tafo, 73.  
 Tanganyika, 97-8, 106-8, 128-9,  
 139, 168.  
 Taro, 13, 14, 17.  
 Tea, 60, 160-1.  
 Theiler, Sir A., 136.  
 Tobacco, 14, 18-19, 20, 26, 108-9.  
 Tomatoes, 19.  
 Trinidad, 28, 29, 33, 45-7, 49, 68,  
 149-50, 153, 155.  
 Trypanosomiasis, 78, 138-40.



- Tsetse fly, 78, 138-9.  
Tung, 108.  
Turkeys, 1, 19.
- Uganda, 57, 68, 71, 75-6, 78-9, 85-91, 93, 131, 134, 140-2, 151.  
United Africa Co., 91, 95, 96, 169.  
Uvarov, B. P., 128-9.
- West African Cacao Research Institute, 73, 123.  
Wickham, Sir H., 53.
- Yams, 9, 13, 14.
- Zanzibar, 42, 57, 67, 74, 116, 123-4.  
Zebu cattle, 5, 11, 133.

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