THE BANANA IN CENTRAL AMERICA

I. CULTIVATION

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THE most traditional portrayal of banana cultivation is perhaps that in which an Oriental sage, sitting in pious contemplation in the shade cast by the plant, contentedly leaves it to its own devices in the knowledge that it will flourish and bear fruit for himself and for generations to come. In the early days of banana growing in Central America, the grace of Nature likewise played a prominent part in the inception of what was to become a major industry. By the middle of the nineteenth century it was known that the Gros Michel banana—now the principal variety of commerce—not only would grow but would grow marvellously on the rich soils of the Caribbean islands and mainland. It only remained to be demonstrated that the fruit, if harvested while still green and somewhat immature, could be transported to distant markets, even by sailing ship, and the stage was set for a characteristic display of American enterprise. On the fertile alluvial flats of Central America wonderful bunches of fruit were soon being produced in what was then considered large quantities, with the promise of infinitely more to come; railroads were being laid through forest and swamp; in due course the clipper gave way to the steamship, and the latter to the specialized, modern refrigerated 'banana boat'. It is a tale of more than ordinary fascination, not wanting in its record of blood and sweat, violent competition, diplomatic ingenuity, chicanery, folly and disaster, but one, be it said, telling of an agricultural industry, which, despite many vicissitudes, has enjoyed a great measure of prosperity and continued success.

The general procedure in establishing a plantation was almost incredibly simple. Large areas were roughly surveyed, sometimes, as shown by experience, very inadequately, and work on the construction of roadways commenced at once. The underbush of the virgin forest was cutlassed sufficiently to allow the laying out of the rows, the position to be occupied by each stool or plant being marked out by a stake. Suckers or 'bits' of the underground banana rhizome were then planted in holes 15 in. in diameter and 15 in. deep. The tall forest trees were then felled, creating unbelievable havoc and seemingly unconquerable confusion; but experience had shown that after

two or three months the young banana plants would begin to appear through the mass of trunks, branches and twigs. As both the growth of the young plants and the decay of the forest debris take place with great rapidity under the prevailing humid tropical conditions, very soon, with occasional cutlassing of the secondary bush around the young plants, an orderly plantation is established and bunches of fruit may be reaped within the year.

In those early days of banana growing, faith in the unbounded and unending productiveness of rain-forest soils had not been shaken by crop failure or the epidemic spread of disease. Accordingly, scientific procedure had not been consciously applied to this new industry. Thus, an area might be surveyed as to its boundaries, but anything in the nature of a modern soil survey was almost invariably conspicuous by its absence. This must not be taken to infer that the early explorers for banana land did not know their job. On the contrary, like the early Spanish settlers throughout the Caribbean, they were pre-eminently successful in searching out areas possessing outstanding fertility. But extensive areas of uniformly high fertility were considerably more rare than those early land explorers could possibly assess from the limited surveys they were able to make of vast areas of swamp and rain-forest; as a result, in the ambitious planting schemes so characteristic of this new and remunerative industry, large areas were utilized which were quite unsuited to the exacting requirements of the Gros Michel banana, or which, at best, could only be profitable for a limited period.

The passage of time showed that the extensive areas of virgin land which had been taken into cultivation throughout Central America could be roughly classified into three categories: (1) poor soils on which production fell off after four to seven years; (2) intermediate soils, probably with some initial defect in fertility, which deteriorated to the point of abandonment in the course of ten to fourteen years; and (3), good soils which could be cropped continuously, in many instances without replanting, for more than twenty years. In parenthesis, it may be mentioned that some areas in the Republic of Honduras have been supporting first-class stands of bananas, without replanting, for at least forty, possibly fifty, years.

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Fig. 1.

Photographs by I. M. Smith

OVERHEAD IRRIGATION OF BANANAS IN HONDURAS.

As to what now seems such an evident necessity, the need for good drainage, more often than not this was completely neglected. Provided standing water was not actually in evidence, a plantation was considered to be sufficiently well drained. Again, where irrigation would certainly have been attended with good results, this obvious requirement was not infrequently neglected. Here then, in brief, are some aspects of banana cultivation in Central America that might have been observed some twenty to fifty years ago.

Recent years have witnessed many notable changes. The method of establishing a plantation (that is, planting, felling and brushing) is still as before. Before the planting programme is considered, however, a careful and sufficiently detailed soil survey is carried out and unfavourable areas eliminated from the scheme. The general topography of the areas is also studied in order to establish, as economically and effectively as possible, the roads, railroads and tram-lines essential to the rapid handling of fruit, while drainage schemes not only take cognizance of the needs of particular localities but also may extend to the lowering of the level of swamps, the digging of canals and the dredging of rivers. In fact, it has often been said (by the engineers) that banana growing is much more a feat of civil engineering than of orthodox agriculture. Lastly, it may be added that extensive levees are thrown up where necessary to fend off flood water from productive areas.

Such operations as those described above are typical of the advances which have been made

during the past twenty years. The development of the technique of irrigation in areas where the rainfall is insufficient or badly distributed is of particular interest. Irrigation is, in fact, a major problem: it involves the construction of main channels and subsidiaries, sometimes over very considerable distances; the building of sluice gates; and in some instances the pumping of all water from wells and rivers. Lastly, a supply of sufficiently intelligent labour must be recruited to effect the surface irrigation of the plantations. It will be readily appreciated that there is more in successful irrigation than meets the eye; uniformity of application, avoidance of erosion and of waterlogging, judging irrigation cycles and quantities, costing,

and, not least, adequate drainage, all being relevant to the task.

It is in respect of irrigation that one of the most interesting of innovations in banana cultiva-

Fig. 2.

YOUNG BANANA PLANTATION SHOWING 'RISER' FOR OVERHEAD IRRIGATION.

tion is to be seen to-day. This consists in a replacement of surface by overhead applications, water being supplied to plantations by powerful pumps at the rate of 3,500 gallons a minute. The actual distribution is effected by rotating overhead nozzles or projectors, possessing an effective radius of about 70 yards, that is, each projector sprays approximately three acres (Fig. 1). The tall 'risers', that is, vertical 5-in. pipes which convey the water up to the projector nozzles, are spaced throughout the plantation as required (Fig. 2). The complete equipment, comprising a power house, two large pumps, 14-in. mains, sub-mains and laterals, thus represents a very considerable mechanical intrusion into the leafy greenery of a banana plantation. The results achieved have been very satisfactory. As to the working method, overhead irrigation is applied continuously for several hours at a time; the duration of each application is such as to provide the equivalent of several inches of rain, thus achieving the effect of a heavy, sustained, tropical precipitation. From a point of vantage the spectacle presented by the system in operation is quite remarkable, the great arcs of water, slowly swinging round, gleaming in the bright sunlight, or being resolved into miniature rainbows.

It need scarcely be said that such extensive projects have been the subject of careful costings. Notwithstanding the initial capital expenditure, the results obtained, as judged by increased production of fruit, decrease in labour costs, etc., have been such as to justify the experiment, and the system is being extended. Factors which require consideration include the fertility and probable duration of production of the area, the status of Panama disease (*Fusarium oxysporum cubense*) and its liability to rapid spread, and the proximity of adequate water supplies for pumping.

Overhead irrigation has not only proved successful as a commercial venture, but several important results, probably not anticipated, have also accrued. Not least is the fact that this method of supplying water has greatly facilitated agricultural operations on heavy clay soils, effecting, it is thought, an actual improvement in the tilth over a period of time. Further, it has made it possible to utilize for banana cultivation soils of much higher clay content than had hitherto been deemed possible or advisable. This is a very important consideration, since clay soils have not only proved productive of good fruit, but are also 'resistant' to the inroads of Panama disease. To what extent the conquest of clay will eventually be extended by overhead irrigation, in conjunction with other innovations, is a question that cannot fail to command the attention of all interested in tropical agriculture. It will suffice to say that a

high standard of production is to-day being obtained on clay soils which twenty years ago would have been omitted from any well-considered planting programme.

A characteristic of the cultivation of the Gros Michel on heavy clay soils is that the initial growth tends to be somewhat tardy, so much so that planters may be induced to think that their venture has been ill-advised and destined to failure. Experience has shown, however, that if fertilizers are applied during the first few months, the initial lag is greatly reduced; plants improve pro-

Fig. 3.
HARVESTING OF FRUIT, HONDURAS.

gressively with age, especially after the foliage canopy is established, and consistently good yields may be obtained. Such detailed attention to potentially productive areas is now part of the working policy of the larger companies and is in sharp contrast to the method of exploitation followed by abandonment of former days. The aim, in brief, is the highly commendable one that all sections of a farm shall be so worked in respect of fertilizing, pruning, spacing, etc., as to make for a good general standard of productiveness.

Reference has been made to the losses periodically caused by floods. These inundations are violent but usually of brief duration. They may prove exceedingly destructive, taking a heavy

toll not only of plants and fruit, and leaving plantations a wilderness of smashed vegetation smeared with several inches of mud, but also permanent railroads and bridges may be swept away. The path of the flood water is determined by topography, fertile areas in the river bends being especially subject to inundation and erosion. A recent experiment of very considerable interest and practical value lies in the utilization of the silt-laden flood water, which is contained and controlled by channels and levees in such a way that its burthen of earthy matter is deposited in selected low-lying areas. Each flood—and several may occur in one year—thus results in the deposition, in swampy areas, of several inches of friable and fertile top soil, eroded from higher up the valley. In a surprisingly short space of time—a few years at most—hitherto valueless low-lying areas are so built up that they can be drained and planted with bananas. This useful work is now being undertaken on a not inconsiderable scale.

In the banana lands of the Ullua River (Republic of Honduras) such reclaimed areas can be seen to-day. They are supporting excellent stands of young plants, and the incidence of Panama disease was, as observed by me at the beginning of 1940, negligible. Such innovations are of the greatest significance in the agricultural development of Central America. They mark the transition from the impermanence and rough-and-ready exploitation of other days to the rational utilization of natural resources and to that permanence which should result from a system which aims at the maintenance of a high standard of productivity in favourable localities. To the consumer on distant

markets, such preparations for the future also bring the assurance that there will be no abatement in the supplies or quality of the product to which he has become accustomed.

Some fifteen to twenty years ago, with the abandonment of vast areas on account of Panama disease and deterioration of fertility under continuous single crop cultivation, the question was frequently mooted as to the fate of the banana industry when all the good virgin areas became used up. The question is still asked and it may now be answered. So far as Central America is concerned, there seems no reason for supposing that production will seriously decline for many years to come. In recent years, there has not only been adequate production on the major properties, but actually over-production of bunches of the first quality. Extensive areas, mapped for banana growing, have not yet been touched, other new and highly productive areas are being developed on a very conservative scale, and, as indicated above, existing plantations are not only being maintained in first-class condition but also are being daily added to by the control of flood water.

To the agriculturist as to the layman, the spectacle of a modern banana division, comprising some sixty square miles under cultivation, with surface and overhead irrigation provided where necessary, and supplied throughout with a pipeline system for the application of Bordeaux Mixture (used to control *Cercospora* leaf disease), is one that engenders confidence for the future. To those who have been responsible for such notable achievements, and for much courageous experimentation on a grand scale, great credit is due.

THE BIRTH OF GLACIAL GEOLOGY*

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THE year 1840 will always be remembered as one of outstanding importance in the annals of geology. So far as Great Britain is concerned, glacial geology was born in 1840 with the visit to this country of Louis Agassiz. Glasgow will always be associated with this event, for Agassiz attended the tenth meeting of the British Association which was held there in the summer of 1840. At the meeting he took the opportunity of proposing the revolutionary theory "that at a certain epoch all the north of Europe, and also the north of Asia and America, were covered with a mass

of ice". Woodward, in his "History of Geology" (1911, p. 121) has said: "Since the days of William Smith no more momentous, and, as time has proved, no sounder, explanation of a vast and difficult problem had been given in geological science."

Agassiz wrote: "In the early part of the summer of 1840, I started from Switzerland for England with the express object of finding traces of glaciers in Britain. This glacier-hunt was at that time a somewhat perilous undertaking for the reputation of a young naturalist like myself, since some of the greatest names in science were arrayed against the novel glacial theory. . . ."

* Part of an address to the Geological Society of Glasgow on December 14.