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Banana and Plantain Production in Latin America and the Caribbean

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THE cultivation of banana and plantain in tropical America and the Caribbean countries has a special importance, not only because they are part of the diet, but also in view of the economic benefits derived from the production activities, through contribution to the gross national product, the establishment of employment sources and the generation of foreign currency and fiscal earnings.

In addition, these crops have a peculiar characteristic: all countries in the western hemisphere consume *Musa* fruits in different amounts. With the exception of Canada, Chile, Uruguay and continental United States, all countries have some areas planted in banana or plantain. These crops are found in the most diverse ecological conditions, but the highest concentration is the lowlands of the humid tropics.

Socioeconomic Importance

The importance of these crops differs in each country. In Colombia in 1983, plantain was in first place in agricultural volume and fourth place in value. In Brazil these crops were 14th in cultivated area and second among main fruit products. In Venezuela banana and plantain represents 4.7% of the total value of agricultural production.

Consumption

The plantain is part of the daily diet in the majority of tropical America and Caribbean countries. Statistics on consumption are not precise, since they vary among regions of the same country. For example, the country of highest consumption is Colombia with 81 kg/person/year. However, in some zones this reaches 200 kg/person/year.

Value of Plantain Production

The contribution of plantain to the gross national product in the agricultural sector is difficult to calculate, since in some countries the value of production is estimated based on marketing of the product; the amounts of home consumption are not known, nor do they have estimates of value of its subproducts (pseudostem, leaves, etc.), which are important in animal production.

If we consider home consumption equivalent to 10% of production and a price of US$85/t (around US$0.03 per finger) the value of plantain production in the region would surpass US$600 million.

Value of Banana Exports

Banana production for export constitutes an important source of foreign exchange for various tropical American and Caribbean countries. In addition, it is an important generator of employment and fiscal earnings.

In employment generation in Ecuador, it has been estimated that activities related to bananas represent close to 30% of the total agricultural employment. This is higher in the Windward Islands (close to 60%) and it fluctuates between 8 and 10% in Central America and Panama.

The earnings for banana exports in Central American countries represent between 21% (Panama) and 28% (Costa Rica, Honduras) of the total earnings from exports in 1981.

In the Windward Islands, banana exports represent more than 60% of the value of total exports (Novoa 1983).

In other important exporting countries where this relationship is lower (8% in Ecuador, 5% in Colombia, 6% in Guatemala), banana production contributes to economic and social development of vast agricultural regions.

The value of exports (f.o.b.) of bananas from member countries of UPEB (Colombia, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, Dominican Republic and Venezuela) during 1983 reached US$769 million. If the value of exports from Ecuador, French Antilles, and the Windward

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Islands is added we obtain a value that surpasses US$1100 million annually.

Bananas represent considerable earnings for the governments of the exporting countries. This is why the export tax on banana that has been applied in various countries (Costa Rica, Guatemala, Honduras, Nicaragua, and Panama) has meant an additional earning of US$747 million between 1974 and 1984.

Production

It is relatively easy to find data about area planted, volume and value of banana and plantain production for export, but it is difficult to obtain figures for internal consumption.

The figures that are presented in Table 1 are approximate. However, it is estimated that the area cultivated with *Musa* in tropical American and Caribbean countries is over 1.5 million ha, of which around 12% is dedicated to planting of banana for exports.

The area planted with AAB plantains ('Horn,' 'French plantain,' 'Harton,' and 'Prata') is over 1 million ha, but there are no figures for area planted with ABB plantains ('Bluggoe,' 'Chato,' 'Topocho,' and 'Pelipita'), which are grown in gardens around homes.

Data on production volume (Table 1) are also approximate. With the exception of Brazil, Mexico, Puerto Rico and Venezuela the figures on banana refer to the exported volumes, which are 20–30% lower than the amounts produced, due to losses originated in the norms of quality of exporting companies. So, it is possible to estimate total plantain and banana production in the western hemisphere at close to 20 million t.

Table 1. Area planted and production of bananas and plantains in Latin America and the Caribbean (sources: UPEB 1985; FAO 1986).

Country	Area planted ('000 ha)		Production ('000 t)	
	Group AAB	Group AAA	Group AAB	Group AAA
Brazil	337	60	3345	1460
Colombia	440	23	2248	831*
Costa Rica	12	24	111	980*
Ecuador	50	58	500	1205*
El Salvador	5	—	28	—
French Antilles	2	14	14	292*
Guatemala	9	8	60	375*
Honduras	10	16	130	816*
Jamaica	4	3	29	40 (12)*
Nicaragua	9	3	67	94*
Mexico	14	56	100	1400
Panama	7	14	49	558*
Peru	64	—	731	—
Puerto Rico	4	2	99	91
Dominican Republic	52	2	258	18*
Venezuela	59	52	517	983
Windward Islands		15	—	128*
Total	1078	351	8286	9283

* Exported bananas.

Productivity

The productivity of the AAB plantain is affected by the cropping system used by farmers (subsistence, monocropping or multiple cropping). In Colombia for example, plantain productivity in multiple cropping fluctuates between 4–5 t/ha/year. In monocropping for export the productivity varies between 14–20 t/ha/year.

In relation to banana for export, Central America is the region of highest productivity with yields between 35 and 55 t/ha/year. In the Windward Islands (Dominique, Grenada, Santa Lucia and St. Vincent) where banana for export is intercropped (with coconuts, vegetables, fruit trees, etc.), the productivity fluctuates between 9 and 12 t/ha/year (FAO 1986).

In the French Antilles (Guadeloupe and Martinique), farms larger than 20 ha have an average productivity of 20 t/ha and in farms smaller than 3 ha, productivity reaches 10–12 t/ha/year.

Cultivars

In spite of the fact that important collections of germplasm and genetic improvement programs are found in Tropical America, the cultivars of banana and plantain for local consumption and export are relatively few.

In the case of the AAB plantain, there is a marked preference for the cultivars 'Horn' ('Harton,' 'Horn') and to a lesser degree for the French plantain ('Dominico'). In some regions of South America's humid tropics (Colombia and Venezuela) the ABB plantains 'Bluggoe,' 'Chato,' 'Topocho' are preferred.

The introduction of 'Pelipita' in tropical America is relatively recent and it is supposed to replace the ABB cultivars susceptible to Moko and Panama disease (race 2).

The AAA bananas that presently are being used for export belong to the Cavendish subgroup ('Giant,' 'Valery,' 'Robusta,' 'Grande Naine'). In the last 10 years there has been a process to change plantations from the 'Valery' or 'Giant Cavendish' clones for 'Grande Naine' which is shorter and less susceptible to damage by winds.

In Panama, for example, of 15 000 ha of banana for export, 64% is planted with 'Valery' and the rest (36%) with 'Grande Naine.'

Production Systems

Plantain

The surveys on plantain production in some countries are relatively recent and, with slight variations, similarities in production systems of different countries have been found. These can be illustrated with examples from Colombia and Costa Rica.

In Costa Rica the area in monocropping represents 9% of the farms (480) and 15% of the area (1800 ha). Production is mainly for export and farmers make use of intensive cultural practices with a high utilisation of fertilisers and pesticides (Lemelle et al. 1982).

In the production of plantain intercropped with annual crops (650 ha, 2650 farms) or perennial crops (3550 ha, 2220 farms), the use of agrochemicals is less, as is the intensity of cropping practices. The production is for home consumption and the local market.

In Colombia more than half the planted area (i.e. 228 800 ha) belongs to small farmers who use the plantain as a subsistence crop (Buritica 1984).

Based on data collected in Central America and the Dominican Republic, it is estimated that plantain production in these countries has been in the hands of approximately 40 000 small farmers. Therefore the basic characteristic of plantain production is a low level of technology with the exception of the small exporting sector. Successful export production is due to the extrapolation of management practices of banana production and the use of infrastructure created for banana.

In contrast to banana producers, plantain producers do not constitute an important pressure group, and for this reason they have not been able to influence, in most countries, the decisions on research policy.

Bananas

In tropical America and the Caribbean there exists a generalised opinion about the advance in the development and application of banana techonology. With the change from 'Gros Michel' to the clones of the Cavendish subgroup, in the late 1950s and early 1960s new banana cropping technologies were developed.

Various research teams were established (IFAC-IRFA, Winban, United Fruit Banana Research Board of Jamaica, and more recently, Standard Fruit Del Monte, UPEB, Brazil, Colombia, Costa Rica, Ecuador, and Venezuela) to serve the needs of the different regions.

In the Caribbean the Winban Research and Development Program has been directed at the problems of a large number of growers (more than 18 000) scattered over a wide variety of topographic, edaphic and climatic zones.

In the French Antilles (Guadeloupe and Martinique) IRFA-IFAC developed extraordinary technical and scientific work. In these islands bananas are grown in a great number of small farms.

In Guadeloupe there are some 1100 farms of less than 5 ha, and in Martinique there are 1500 farms of less than 3 ha with production between 10 and 12t/ha.

In Central America and South America, the technological development was due, in large part, to the efforts of the banana companies, which directed resources to research with the purpose of obtaining high productivity and fruit of the highest quality. This development has been most common in the countries where exporting companies grow and purchase bananas (Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Dominican Republic and Panama).

Agronomic Requirements

It is difficult to establish a complete picture of the specific agronomic requirements for a crop which has such a wide ecological and geographic distribution, and for this reason the considerations are general.

The plantain for local markets is grown from sea level up to 2000 m and in ecological zones as different as the dry tropical forests and the very humid tropical forests. The export plantain is grown generally in areas where the export banana is also grown.

Water

In tropical America and the Caribbean, banana plantations are found in three rain zones classified according to their need for irrigation (Soto 1986).

The first is formed by the humid plains of the Atlantic zone of Costa Rica and the region of Changuinola in Panama, where rainfall varies between 2500 and 4500 mm/year, distributed throughout the year. Deficits are rare and there is no need for irrigation. On the contrary, drainage systems must be built to evacuate the excess water during the seasons of highest rainfall.

The second zone has an annual rainfall of around 1500 mm, but concentrated in 8-9 months with deficits in the remaining months, which makes irrigation necessary. This is the situation of the plantations of the Aguan Valley in Honduras, the area close to Santa Marta in Colombia, and the plantations near Machala in Ecuador, the French Antilles, Jamaica and the Windward Islands.

In the third zone we find areas with high rainfall (2000-3500 mm/year), but also concentrated in 8-9 months, and so there are water deficits that affect the plantations. Consequently, beside the necessity of constructing efficient drainage systems, irrigation systems are also needed for the months of drought.

Such is the case for the plantations located in Uraba, Colombia, the Valle la Sula in Honduras, and the majority of the plantations in Ecuador.

Temperature

Banana plantations of Tropical America and the Caribbean are in the optimum growth range for this plant (around 28°C). During January and February, there are moderately low temperatures (winter in the northern hemisphere) that cause a reduction in plant growth, principally in Mexico, Costa Rica, Guatemala, Honduras and Jamaica.

Wind Effects

The effect of wind is a very important production factor in Mexico, Colombia, Nicaragua, and the Pacific Coast of Panama.

According to Soto (1986) the losses caused by winds can be estimated between 20 and 30%. In the Caribbean, besides the damage caused by winds, hurricanes have struck in the last 10 years ('David' in 1979 and 'Allen' in 1980), that have levelled plantations in the French Antilles and Windward Islands.

Soils

Musa is grown in the most varied soils. Plantains (AAB and ABB) for internal consumption or subsistence are grown in less fertile soils. The clones of the Cavendish subgroup used for export are more demanding and require the most fertile soils for high productivity. The best combination of deep, flat, fertile and well-drained soils are found in the alluvial soils of Central America, Colombia, Ecuador, Jamaica, and the volcanic soils of the French Antilles and the Windward Islands.

The demands of high productivity need the systematic addition of fertilisers. In the aspects related to mineral nutrition, there have been considerable advances. The most important contributions in this field are the results of studies done by IRFA.

Plantation Management

Management practices are similar in tropical America and the variability of application is due principally to the efficiency and availability of labour in each country or region.

The planting systems most used are in triangles and double rows. The recommended population densities are 1650–1850 production units/ha for Valery and 1850–2000 units/ha for Grande Naine, using one single follower. In most plantations pruning is manual and in some cases 2–4,D is applied.

For weed control mechanical and chemical methods are used. For the latter, herbicides approved by the EPA (Environmental Protection Agency) are used. Presently the chemical control is based on the application of herbicides, post-emergents (principally paraquat), alone or in combination with other herbicides.

Bunch Management

The fruit protection operations are combined and involve: bunch covering (polyethylene bags impregnated with insecticide), lower hands remotion, male flowers elimination and propping. These practices are well known and numerous papers have been published about them.

Postharvest Handling

During more than two decades numerous investigations have been carried out on the harvesting, packing, transport, and ripening of fruit. In Central and South America the technology developed by the exporting companies is applied. In the Caribbean the exception is the Windward Islands where harvesting and packing is done in the field by farmers.

Disease Incidence

The most common diseases affecting banana and plantain in the western hemisphere are Black Sigatoka in Central America, Colombia and Mexico, Yellow Sigatoka in South America and the Caribbean, crown rot and anthracnose, Moko disease and plantain virus (Stover 1978).

Since the detection of Black Sigatoka in Honduras (1972) and its rapid dissemination throughout Central America and northern South America, it has caused great losses to farmers. An example of the decrease of plantain production caused by this disease is illustrated in Panama. In this country Black Sigatoka was detected in 1981 and between 1982 and 1985 the area planted with plantain decreased by 22% (7432 ha in 1982 to 5800 ha in 1985), and 34% of the producers abandoned the activity and production decreased by 47%.

Banana research is now concentrated on the control of Black Sigatoka with chemical products, and control strategies have changed with the introduction of new fungicides. A high level of sophistication has been achieved in the use of aerial equipment (aeroplanes and helicopters), in infrastructure for elaboration of fungicide mixtures and in the use of electronic signals to carry out the operation.

Studies carried out in Costa Rica on total cost of control of Black Sigatoka in banana (more than US$17.5 million/year), indicate that there is no disease or pest in that country, in any crop, that can compare with the economic effects caused by the disease.

The cost of control of Black Sigatoka in Central

America, Colombia and Mexico, from the time it was detected in each country until 1985, surpasses US$350 million.

Nematodes

The nematodes causing most damage in the American region are *Radopholus similis* and *Helicotylenchus multicinotus*. Other species found in high levels, in some zones, are *Rotylenchulus reniformis* (Windward Islands) and *Meloidogyne* sp.

Different pathogenic types of *R. similis* have been detected in the Caribbean and Central America. Some plantations in Honduras, Guatemala and Colombia do not use nematicides. On the other hand, the damages are severe in Costa Rica and Panama.

Nematodes are perhaps the most important pest in Puerto Rico, French Antilles and Windward Islands. Treatment involves field applications of granular nematicides.

Insect Problems

In the last decade fruit insects have received the greatest emphasis in research in entomology compared with the leaf-eaters and those which attack the pseudostem, corm, and roots.

In the region there are three species of red rust thrips: the *Chaetanophothrips signipennis* (Costa Rica and Panama), *C. clarus* (French Antilles and Windward Islands) and *C. orchidii* that is found in almost all banana-growing zones of tropical America and the Caribbean.

Another insect that causes considerable damage to fruit, in Central America, Colombia and Ecuador is *Colaspis* spp. of which four species have been described: *C. submetallica* (Colombia and Ecuador), *C. blackeae* (Colombia), *C. ostmarki* (Panama and Costa Rica), and *C. gemellata* (Surinam).

The damage caused by these insects can be reduced by means of a polyethylene bag impregnated with insecticide. For *Colaspis* spp. more research is needed on its basic requirements and natural enemies (Ostmark 1978).

Cosmopolites sordidus has a great importance in banana in the Caribbean (French Antilles, Puerto Rico, Dominican Republic, Windward Islands) and in plantain in Tropical America. Techniques are known for its control. The pseudostem borers (*Castniomera* sp. and *Castnia* sp.) occasionally cause severe losses, principally in plantain in Central and South America.

Among the most important leaf-eaters (caterpillars) are: *Cermidia butleri* (from Guatemala to Ecuador) and *Antichloris eriphia* (South America).

Generally a complex of parasites and predators is present that exercises an effective natural control when insecticides are not used.

Some plantations of banana and plantain from Costa Rica to Brazil have been stripped of their leaves by brassolids of the genera *Caligo* and *Opsiphanes*.

Other minor pests are mites, aphids, grasshoppers, scales, mealybugs, leaf caterpillars. However, commercial control measures are available for all pests.

Cultivar Selection

The most important factors in selecting cultivars are: (a) resistance to *Fusarium oxysporum* f. sp. *cubense* (four races) in bananas; (b) resistance to *Mycosphaerella* spp. pathogens in bananas and plantains; (c) dwarfism, good organoleptic qualities in plantains, and good organoleptic and postharvest qualities in bananas; (d) resistance to *Pseudomonas solanacearum* in bananas and plantains; and (e) resistance to *Radopholus similis* in bananas and *R. similis* and *P. coffeae* in plantains.

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