

Morpho-agronomic Description of Plantain (*Musa AAB, ABB*) and Banana (*Musa AAA*) Materials Grown in San Andres Island

Descripción morfoagronómica de materiales de plátano (*Musa AAB, ABB*) y banano (*Musa AAA*) cultivados en San Andrés Isla

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Abstract

During the first semester, 2005 we studied the plantain and banana cultivars in small farms of 15 volunteer regular producers, who were participating in joint programs of the Agriculture and Fisheries Secretariat of San Andres Island and the Colombian National University Caribbean Headquarters. We described morphologically the *Musa* cultivars identified in the island, as well as agricultural practices of the island producers, using the INIBAP, IPGRI and CIRAD (1996) descriptors and bibliographical reviews. We identified four clones within the plantain sub-group *Musa AAB*: a Horn type and three French-Horn types; and within the *ABB* sub-group a Bluggoe (dubbed “Boscó”) and a Felipita type. The banana sub-group *AAA* had two Gros Michel type, known as “Banano Común” and “Banano Chino”, as well as one of red banana (“Banano Rojo”). The plantain crop has paramount importance for San Andres farmers, and the clone named “Boscó” is the preferred one for its taste, and its adaptation to the edaphic and climatic conditions. Banana is less cultivated; the soil and the climate, as well as diseases (*v.gr.* the leaf spot disease or sigatoka) limited the growth of their clones. This work suggests a list of easy to implement agronomic practices that would enhance the production of the predominant producing systems of the island.

Key words: *Musaceae*, banana, plantain, identification, morphological characteristics, agronomic practices

Resumen

Durante el primer semestre de 2005 se estudiaron los cultivares de plátano y banano en fincas y parcelas de 15 agricultores típicos participantes en programas conjuntos de la Secretaría de Agricultura y Pesca de San Andrés Isla y de la Universidad Nacional de Colombia sede Caribe. A partir de descriptores de

INIBAP, IPGRI y CIRAD y revisiones bibliográficas. se describen morfológicamente los materiales de *Musa* cultivados en la Isla, así como las prácticas de los productores isleños. Se identificaron cuatro clones del subgrupo plátano (*Musa AAB*): un Hartón ('Horse') y tres Dominico-Hartón ('Tallo Negro', 'Tallo Blanco' y 'Cincuenta') del subgrupo *ABB* se hallaron un material de Bluggoe ('Boscó') y un Felipita. El subgrupo banano *AAA* presentó dos materiales Gros Michel (denominados Común y Chino) y uno de banano (Rojo). El plátano tiene gran importancia para los agricultores de la Isla, siendo el Boscó el clon más aceptado entre consumidores por su adaptación a las condiciones edafológicas y climáticas. El banano es menos cultivado; ya que los suelos, el clima y las enfermedades como sigatoka negra, condicionaron el desarrollo de clones. El trabajo sugiere prácticas de fácil implementación que podrían aumentar la producción en los sistemas de huerto mixto tropical que predominan en la Isla.

Palabras clave: *Musaceae*, banano, plátano, identificación, características morfológicas, prácticas de cultivo.

Introduction

The majority of plantain and banana crops in the family of *Musaceae* have originated from two wild species: *Musa acuminata* and *M. balbisiana* that, through polyploidy and hybridization, have generated the cultivated varieties. The ploidy and genomic composition of the different clones represent *M. acuminata* and *M. balbisiana*, as A and B respectively (Simmonds, 1966; Belalcázar, 1991; Sierra, 1993).

Although it is clear that, in general, the technical method differ between industrial and peasant systems, it is without doubt that the fertilization in musaceae is important for root development, and thus for tolerance to nematode and diseases to the root system (Sarah, 1998). Thus, Echeverry (2001) found that crops of the clone Cachaco (*Musa ABB*) that did not receive fertilization produced racemes with lower weight than those fertilized with organic or synthetic compounds. In the cultivation cycle of Dominico-Hartón, climatic factors, together with lack of weed control, and other practices may cause delays in flowering and consequently a longer harvest time (Cayón et al., 1994).

Agricultural activity on the island of San Andrés (Colombia) is precarious, as the majority of the 500 producers are active almost exclusively without selfsufficiency (Polanía, 2004). However, the musaceae fruits are an important part of the culinary culture of the island, including in soups strong plates, and desserts. Despite the

importance of plantain and banana as basic products in the family basket of the island inhabitants, a detailed inventory of the existing varieties used on the island has not been carried out.

It is important to know the cultivars and the culinary culture, the identity, the edaphic and climatic conditions as well as the agricultural practices in San Andres, as the constant and secure availability of plantain and banana requires these efforts to evaluate, maintain and increase these materials in different ecological conditions in the producing zones (Belalcázar & Valencia, 1998). With this work, it is expected that the knowledge of the genus *Musa* in Colombia will be extended, through the determination and morphological description of material in productive systems in the San Andrés island, as well as the agricultural practices of the island producers.

Materials and methods

The field work was carried out on the island of San Andrés, located between 12° 29' and 12° 36' N and 81° 41' and 81° 43' O, at 800 km to the North East of the Caribbean coast of Colombia.

The plantain and banana crops were quantified on the farms of 15 volunteer producers, participants in programs together with the secretary for Agriculture and fishing, of the Archipelago Department, and the National University of Colombia, Caribbean campus, through field visits and interviews with the producers. The material was morphologically described using the highly discriminatory traits of the descriptors of INIBAP, IPGRI and CIRAD (1996). For this, three plants with a raceme in formation were characterized for each material observed. Each of the traits was characterized according to the methodology proposed by Daniels et al. (2001).

San Andrés possesses soils ranging from superficial (25 cm, with the presence of rock) to deep with a high concentration of exchangeable bases and organic carbon, lightly alkaline, with a high ability to retain humidity, high and medium porosity, and with textures ranging from open to clay, with a good availability of N, P, K, S, Ca, Mg and deficiencies in minor elements (Correa, 2006). The deepest soils are appropriate for commercial and semi-commercial crops (Correa, 2006). Mean precipitation in San Andrés is 1.393 mm/yr, with a particularly intense dry season between December and April/May and an average annual temperature of 27.7 °C (Polanía, 2004).

In order to measure the plant height a clinometer was used, and for the rest of the measures, a tape measure was used. The cultivation practices were identified from

programmed visits to each of the producers. Subsequently the information was systematized and compared with that found by Rodríguez (2004) on the island.

In the absence of references for other insular sites, the descriptions were compared with: Cardeñosa (1955), studies in Corpoica C.I. Palmira; Belalcázar & Valencia (1998), materials from the Colombian collection for Musaceas in the Research Center El Agrado in Montenegro, Quindío; as well as Rosales et al. (1999) and Daniels et al. (2001) who characterized material in different regions of the world. In addition our results were compared with recent studies in Brazil (Pereira et al., 2000; De Oliveira et al., 2002; Damatto et al., 2005; Rodrigues et al., 2006) and Colombia (González et al., 2003; Herrera & Aristizábal, 2003) who characterized morphologically cultivars and evaluated their production in specific edaphoclimatic zones, in the search for tolerance to disease and adverse conditions.

Results and discussion

Agronomic characterization

The herbaceous nature of the musaceae gives them special characteristics, such as a high consumption of water. Cayón, Belalcázar & Lozada (1998) estimate that the clone Dominico- Hartón requires a minimum monthly precipitation of 150 mm in order to satisfy its water requirements. Sierra (1993) maintains that soils with a good structure, porosity, drainage, high nutritional levels, and a pH between 5 and 7.5 favor the development of plantain and banana.

In San Andrés various materials are found pertaining to the triploid subgroup: one Hartón type and three Dominico-Hartón amongst the *Musa AAB*, one *ABB* (Bluggoe), and one *ABB* (Felipita). In the banana subgroup (*AAA*) two materials of the type Gros Michel, termed the common and the 'Chino' banana, were found as well as one type of the red banana (Box 1).

Box 1. Morphological characteristics of the plantain and banana material cultivated on the San Andrés island in 2005.

Cuadro 1. Características morfológicas de los materiales de plátano y banano cultivados en San Andrés Isla en 2005.

Cultivar	Grupo	Subgrupo	Altura (m)	Número de		Longitud de frutos (cm)	Forma	Color de		Uso del fruto
				hijos	frutos*			cáscara madura	pulpa madura	
Horse	AAB	Hartón	2.1- 2.9	3-5	< 12	26-30	Rectos en la parte distal	Amarilla	Crema	Cocción
Tallo Negro							Curvados			
Tallo Blanco										
Cincuenta										
Boscó	ABB	Bluggoe	> 3	> 6	12-17	21-25	Rectos	Amarilla	Crema pálido	En fresco
Felipita		Felipita					Rectos en la parte distal		Amarillo pálido	
Banano Común	AAA	Gros Michel	2.1- 2.9	3-5	16-20	Rectos	Púrpura	Marfil	En fresco	
Banano Chino										
Banano Rojo		Rojos								

* Determinados en la segunda 'mano' del racimo.

Generally, the plantain and banana clones found in San Andrés were not of great height, thus facilitating both the management of the crops and their harvest. The majority of the clones showed a low height, although the materials 'Boscó' (ABB) and 'Felipita' (ABB) had greater heights, such that the harvest and other tasks were more difficult in these clones. These materials presented at the harvest more than six offspring, being greater than the rest of the materials studied. Boscó (ABB) and Felipita (ABB) tolerate being planted in soils of low fertility and in hot climates, with inadequate distribution of rain and long periods of drought (Belalcázar, 1991); they are also resistant to the black and yellow sigatokas (De Oliveira et al., 2002).

The Musa clones present on the island presented up to 17 fruits in the middle hand of the raceme, although the material, Horse (AAB) had a lower average number of fruits per raceme. Similarly, on average six or seven hands per raceme were developed: Dominico-Hartón seven, Hartón six, Boscó six and Felipita seven. The three banana clones (Musa AAA) presented, on average, six double hands.

The fruits of Horse, and the common and Chino banana (AAA) are straight in the distal part, while the cultivars Tallo Negro, Tallo Blanco and Cincuenta (AAB) presented curved fruits and those of the clones Boscó, Felipita and Rojo were straight. All of the group AAB possessed similar characteristics in skin and flesh color (yellow and cream, respectively), while the fruits of the group ABB were a pallid cream in their mature flesh (Box 1). The fruits of the common and Chino banana were pallid cream in the mature flesh, and that of the clone 'Red' was the color of marble, but, in contrast to the others described, the skin was purple in the mature state.

The mature fruits of the clone types Hartón and Dominico-Hartón reached a length of 30 cm, longer than Boscó, Felipita, and the common and Chino bananas. The Red material was characterized by having shorted mature fruits.

All the clones were planted in both flat and inclined zones, but they developed better on the hillsides, possibly due to the depth of the soils (Correa, 2006). Although, a considerable quantity of plantain material (AAB, ABB) was found, most producers planted Boscó, which presented a preferable taste and better adaptation to the edaphic and climatic conditions on the island. The clone Felipita was also well adapted to conditions, but, due to the hard consistency of its flesh, it is not as well accepted amongst consumers.

Production systems

The clones Hartón and Dominico-Hartón (AAB) were limited by the climatic conditions, as the shallow soils and irregular distribution of rain affect their growth, development and production (Belalcázar, 1991). The producers note that this behavior is more noticeable in plots where a number of harvests have been realized and they consider the three clones strongly affected by irregular precipitation. According to Sierra (1993) under these conditions, irrigation is indispensable in order to guarantee a good physiological and productive behavior. However, Polanía (2004) and Rodríguez (2004) mention the difficulties that exist on the island to implement this practice.

The banana crop is not that relevant for producers on the island, and, in all cases, is less intensive compared with the plantain crop. The production of banana is sporadic and generally it is planted in association with other subsistence crops. Amongst the productive systems on the island, the banana clones, chino and red are least frequent, although the consumers prefer their taste. In fact, the fruits of the plantain types Hartón, Dominico-Hartón, Bluggoe and Felipita are cooked in different preparations, while the two banana clones Gros-Michel and Red are eaten fresh and used to make desserts.

In San Andrés the plantain and banana crops are found associated with other crops in a system termed tropical intercropping (Rodríguez, 2004), which is a group of wild or domesticated plants, mainly perennial or semi-perennial, located around the house or close by. This system is used to cover the basic needs of the family or small community where, occasionally, excess harvests are sold (Rodríguez, 2004). Plantain and banana plants are located around the houses, and in subsistence plots, mixed together and without any type of organization. In the home gardens clones of Boscó, Horse, Cincuenta and the common banana are found, although the area under banana was smaller than that of whichever of the plantains was found in the studied farms.

In commercial crops, planting was more organized and homogeneous, although clones of plantain and banana were also found associated. In this system, clones of Horse, Cincuenta, Tallo Blanco and Tallo Negro were found. The Boscó was also planted for commercial purposes, but in a lower proportion to that in subsistence plots. The material Felipita and the banana clones were not destined for commercial purposes but were found in small quantities amongst the commercial cultivars.

Cultivation practices are practically null in the subsistence plots, while in the commercial crops, weeding and pruning were carried out with regular frequency. In both types of crop burning was performed as an initial weeding practice. After holes were dug, ash was applied, and leaves and stubble applied around the plant to fertilize it, although the practice did not seem sufficient, and the producers state that the production of plantain Hartón and Dominico-Hartón and the bananas, mainly, reduces with time. Bolaños et al. (2003) observed that the application of organic compost positively affects the chemical properties of the soil and is reflected by an increase on the production of the plantain Dominico-Hartón, being most obvious after the second cycle of cultivation. This practice could be important in the management of waste from the agricultural practices on the island, and in its use as a nutritional source for crops. The planting of this type of crop is not frequent, given its perennial nature, however, when it does occur, the stems are selected from the mother plant considering their vigor and appearance.

While all the clones of *Musa* on San Andrés are affected by drought and minimal management, the most sensitive clones are those of type *ABB*. Crops of the subgroup *ABB* are most tolerant to the shallow soils, low fertility, drought and the black sigatoka (*Mycosphaerella fijiensis*) (Orozco & Chaverra, 1999), but they are sensitive to bacterial disease such as the Moko (*Ralstonia solanacearum*) and the rotting of the pseudo-stem (*Erwinia chrysantemi*), that are present on the island, and generate damage under drought conditions and poor (Belalcázar, 1991). On San Andrés island the black Sigatoka is present, although it is more limiting for

banana crops than plantain (Rodríguez, 2004). As a consequence, and in order to avoid its dissemination the identification and eradication of infected plants as well as the disinfection of tools after use is essential.

The production of plantain and banana material on San Andrés is viable, and a major effort in technical assistance and the implementation of cultural practices such as material selection in order to avoid disease and pest propagation is required. Additionally, pruning and monitoring, management of foci of black sigatoka, amongst other practices, will yield better cultivation conditions. In addition, education of producers in fertilization practices is required, in order to increase production and improve quality and maintenance of soil degraded by agricultural activity. In all cases, cultivation practices must be sensitive to the condition of the Biosphere reserve, awarded to the archipelago by UNESCO in 2000 (Polanía, 2004).

Conclusions

- Seven plantain clones in the groups *Musa AAB* y *ABB* were found, being an important part of the subsistence agriculture amongst the inhabitants of San Andrés. These clones are well adapted to the soil and rainfall distribution on the island.
- The clones of the group *Musa AAB* presented good development on hillsides. The clones of the banana *Musa AAA* are limited developmentally by soil and climatic conditions, and also by disease such as the black sigatoka.
- Both the field work, and the interviews with the producers allowed a detailed characterization of the cultivation practices for plantain and banana on the island. These studies provide tools to determine the weaknesses in the productive systems and propose possible solutions.
- A study of the technical and economic viability of the use of agricultural residues from livestock farming on the island as fertilizer for plantain and banana crops is urgently required,
- The archipelago was declared a Biosphere reserve by UNESCO in 2000, and so all proposed cultivation practices must be sensitive to the sustainable development of the activity.

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