Cultivars of the international trade are almost solely from the 'Gros Michel' and Cavendish sub-groups. 'Gros Michel' itself was the first to be grown on any scale for export, but it and its semi-dwarf mutant, 'Cocos', have been ousted from Jamaica and Central America by Panama disease. The remaining very large producer is Ecuador.

The Cavendish subgroup includes at least five useful levels of stature. The smallest, 'Dwarf Cavendish' seems best adapted for sub-tropical growing conditions, while 'Valery' is likely to have an increasingly large share of tropical cultivation, being both productive and wind resistant.

An outline is given of efforts in the West Indies to produce new tetraploid cultivars based on the 'Gros Michel' sub-group.

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THE PRESENT STATUS AND PERSPECTIVES FOR CACAO CULTIVARS IN LATIN AMERICA

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INTRODUCTION

Three main kinds of cultivars are being used at present as planting material of cacao:

1. Varieties such as the "groups of individuals that show genetic differences but that have one or more characteristics that differentiate them from other cultivars".

2. Clones: Individuals genetically alike and derived by vegetative propagation (cuttings, marcots, buddings or grafts, etc.) from a selected plant.

3. F_1 hybrids: A sexual family belonging in each case to an F_1 progeny of a cross between vegetatively propagated clones.

This paper presents a short description of the most important cacao cultivars of each one of the three categories grown at present in tropical Latin America.

Before describing the cultivars, it is convenient to define the meaning of some Spanish words used in the text. Shapes of cacao fruits are known as (13):

"Amelonados": fruits ovoid, largest diameter longer than 50% of length, shallow ridges, usually smooth, seldom warty, surface with or without slight strangulation at the base ('bottleneck').

"Calabacillo": fruits roundish, diameter 60 to 75% of the length, shallow, smooth surface.

"Angoleta": fruits elongated, largest diameter no more than 50% of the length, presence of ridges, warty or smooth surface, no bottleneck.

"Cundeamor": fruits elongated, largest diameter no more than 50% of the length, presence of ridges, warty or smooth surface, with bottleneck and pointed end.

The words "Criollo", "Forastero" and "Trinitario" refer to the main genetic complexes where the cultivars originate. The first two represent general varieties and the third represents hybrid populations between these two groups.

THE MAIN CACAO VARIETIES

Criollo

The Criollo complex has been known for its high quality attributes and has the following key characteristics (4, 5, 13, 14, 15, 20): "Cunde-

amor" and "Angoleta" fruits, always with five edges, straight or curved ends, warty surface, 10 well-defined ridges in pairs, thin and soft husk with slight lignification. Color of fruits from green to deep red with intermediates. Seeds generally large, plump, oval or cylindrical, white or slightly pigmented. Trees are smaller, less woody and weaker than in other complexes; roundish canopy, small oval and thick leaves of deep green color; flowers small with short pedicel, staminodes and guide lines of petals rose-colored.

Criollos were originally cultivated in Central America and Mexico and the Spaniards took them to Venezuela and Colombia (16) after the discovery of America. This report and the phenotypical similarities between the Criollos of these countries question the possibility that some of them have separate origin (13).

There are only a few differences among the Mexican and Nicaraguan Criollos. In the first group there is a predominance of Angoleta and green types with pointed ends, warty and sometimes smooth surfaces. Red and slightly red fruits are also present. In the regions of Chiapas bordering with Tabasco there still remain small areas with pure Criollos.

The Nicaraguan Criollos have more Cundeamor types with rough surfaces, bottlenecks and curved ends. Deep red types are frequent, but also green and intermediates are present. Only small plantings of this variety remain in some areas of Nicaragua, such as in Chinandega, Valle Menier. Isolated trees are frequent among coffee plantings of Masatepe, Masaya and other localities surrounding the Nicaragua Lake (20).

In Colombia also, Criollos are almost extinguished. A few localities in the Cauca Valley, in Caldas and in Antioquia, have Criollos; in general they resemble the Mexican group. "Witches broom" disease (*Marasmius perniciosus* Stabel) and "Mal de Machete" caused by *Ceratocystis fimbriata* are decimating Criollos.

In Venezuela there are several areas with Criollos: the Chama Valley in Merida has small holdings of Mexican types (4, 20); in the Valleys of Cepe, Chuao and Choroni, at the northern coast of the State of Aragua, there are still old paintings of Nicaraguan types. The third area, with a totally different Criollo cacao called "Porcelana", is the southern part of the Maracaibo Lake, between the rivers Escalante and Catatumbo (19). This is a smooth Angoleta, with pointed ends and two colors of fruits with no intermediates, pinkish red and whitish, the red types being more frequent. This is considered, in the international market, as the best quality cacao.

Forastero

This name is applied to cacaos originated in the Amazon basin and are under cultivation. Most of the Forastero varieties, except the "National" or "Arriba" cacao of Ecuador, are not considered fine quality types. The most important features to describe this complex are (4, 5, 15): "Amelonado" and "Calabacillo" fruits, with ten superficial or well-define ridges; husk thin or thick always with a lignified layer in the central part of the pericarp, sometimes with a slight bottleneck and with roundish or mammilar ends. Fruits in general are green, but a slight reddish coloration is present in a few populations. Seeds are small, cylindrical, flat and purple. Trees are vigorous, with abundant foliage and tolerant to most diseases. Flowers with staminodes and guiding lines of the petals purple.

"Matina" variety. In Mexico under the name of "Ceylan", "Sánchez" or "Costa Rica", and in the Atlantic Coast of Costa Rica, including its borders with Nicaragua, a Forastero variety known as "Matina", is cultivated and has practically replaced the local Criollos in Mexico and Guatemala. The main characteristics are: "Amelonado" fruits with small bottleneck, intermediate size, ten ridges, smooth and whitish-green surface, purple intermediate size and flat seeds, tolerant to "black pod" and *Ceratocystis fimbriata.*

"Pajarito" variety. In the Departments of Antioquia, Caldas, Santander, and Huila, of Colombia, the most common variety that has almost replaced Criollos is the so-called "Pajarito" cacao (20). Fruits are of "Amelonado" or almost "Calabacillo" shape, small, green thin husk, superficial ridges, smooth, seeds purple, small and flat. It is more tolerant to diseases and pests.

"Nacional" or "Arriba" variety. There are very few pure plantations left of this variety in the Provinces of Guayas and Los Rios in the western coast of Ecuador (20). Fruits are of a globose "Amelonado" shape with a slight bottleneck, rough surface, thick husk of whitish-green color. Seeds are large, slightly colored or purple.

Table 1-a. Brief description of cacao clones

Cultivar	Genetic Complex	Fruit			
		Shape	Color	Texture	Size (Index)[1]
R-10	Trinitario	Cundeamor	Green-white	Rough	Large (8.2)
R-13	Trinitario	Cundeamor	Green-white	Rough	Medium (10.2)
R-30	Trinitario	Cundeamor	Green-white	Rough	Large (9.7)
R-48	Trinitario	Cundeamor	Reddish	Rough	Medium (12.3)
UF-29	Forastero	Amelonado	Green-white	Medium	Medium (10.5)
UF-221	Trinitario	Angoleta	Purple	Rough	Large (6.7)
UF-613	Trinitario	Amelonado	Red	Smooth	Large (8.7)
UF-667	Trinitario	Angoleta	Reddish	Rough	Large (6.0)
UF-668	Trinitario	Angoleta	Green	Rough	Large (6.)
CC-9	Trinitario	Amelonado	Green-reddish	Medium	Medium (12.1)
CC-10	Trinitario	Angoleta	Green	Rough	Large (7.3)
CC-41	Trinitario	Amelonado	Green-white	Medium	Medium (14.4)
SC-10	Forastero	Angoleta	Green	Rough	Large (7.4)
Pqto.87	Forastero	Amelonado	Red	Rough	Large (8.3)
Oc-61	Trinitario	Cundeamor	Purple	Rough	Large (7.5)
Oc-77	Trinitario	Cundeamor	Purple	Rough	Large (8.7)
SC-5	Trinitario	Angoleta	Purple	Rough	Large ?
SC-6	Trinitario	Angoleta	Purple	Rough	Small (20.4)
SPA 9	Forastero	Amelonado	Green	Medium	Small (15.4)
Tenguel-15	Trinitario	Amelonado	Green	Rough	Large (7.5)
Sta. Rosa-34	Trinitario	Amelonado	Green	Rough	Large (10.0)
Porvenir-7	Trinitario	Amelonado	Green	Rough	Large (9.8)
Porvenir-10	Trinitario	Amelonado	Green	Rough	Large (9.3)
Tenguel-33	Trinitario	Amelonado	Green	Rough	Large (8.5)
Tenguel-25	Trinitario	Amelonado	Green	Rough	Large (9.0)
Curiquingue-2	Trinitario	Amelonado	Green	Rough	Large (8.4)
Silecia-1	Forastero	Amelonado	Green	Rough	Large (5.8)
Silecia-5	Forastero	Amelonado	Green	Rough	Large (6.0)
EET-374	F_1(Porv. 7 x SCA-6)	Amelonado	Green	Rough	Large (8.0)
EET-392	F_1(Silecia-1 x SCA-6)	Amelonado	Green	Rough	Large (7.7)
EET-399	F_1 (Silecia 1 open)	Cundeamor	Green	Rough	Large (7.5)
EET-400	F_1 (Silecia 1 open)	Amelonado	Green	Rough	Large (7.3)
ICS-1	Trinitario	Amelonado	Red	Smooth	Large (7.5)
ICS-6	Trinitario	Angoleta	Green	Rough	Large (6.3)
ICS-8	Trinitario	Angoleta	Green	Rough	Large (6.5)
ICS-55	Trinitario	Angoleta	Red	Smooth	Medium (10.5)
ICS-75	Trinitario	Angoleta	Green	Medium	Large (8.2)
ICS-89	Trinitario	Amelonado	Green	Rough	Large (8.7)
ICS-95	Trinitario	Angoleta	Red	Rough	Large (9.5)
ICS-98	Trinitario	Cundeamor	Red	Medium	Large (9.5)
ICS-100	Criollo	Angoleta	Green	Medium	Large (7.6)
SCA-6	Forastero	Cundeamor	Green	Medium	Small (17)
SCA-12	Forastero	Cundeamor	Green	Medium	Small (15)
IMC-67	Forastero	Cundeamor	Green	Medium	Large (8.0)
P-7	Forastero	Amelonado	Green	Medium	Large (7.4)
P-12	Forastero	Amelonado	Green	Smooth	Large (10.0)
TSA-654	F_1(SCA-6 x IMC-67)	Angoleta	Green	Intermed.	Large (7.6)
TSA-644	F_1(SCA-6 x IMC-67)	Angoleta	Green	Rough	Large (8.1)
GS-29	Trinitario	Cundeamor	Purple	Rough	Large (7.5)
GS-39	Trinitario	Cundeamor	Purple	Rough	Large (8.6)
C4P11	F_1(ICS-1 x ICS-6)	Amelonado	Green	Smooth	Large (6.5)
SIC-801	Forastero (S_1 Catongo)	Amelonado	Green	Smooth	Small (15)
SIC-812	Forastero (S_1 Catongo)	Amelonado	Green	Smooth	Medium (14.4)
SIC-823	Forastero (S_1 Catongo)	Amelonado	Green	Smooth	Medium (14.4)
SIC-831	Forastero (S_1 Catongo)	Amelonado	Green	Smooth	Medium (14)
SIAL-70	Forastero	Amelonado	Green	Smooth	Large (9.1)
SIAL-88	Forastero	Calabacillo	Green	Smooth	Large (9.9)
SIAL-163	Forastero	Amelonado	Green	Smooth	Medium (14.6)
SIAL-325	Forastero	Amelonado	Green	Smooth	Medium (12.3)

1. Number of fruits to make 1 lb of dry cacao
2. Average dry weight in gms of one seed
3. Average length of sepals
4. Abbreviation of "Elliptic-pointed"
5. Abbreviation of "Very good"
6. Abbreviation of "Witches Broom"
7. (t) means tolerant
8. Self Compatible
9. Self Incompatible

Trees are tall and robust, susceptible to "Witches broom" and Monilia pod rot. For this reason it has been gradually replaced in most of the cacao growing area of Ecuador by the so-called "Venezolano" variety, which is a "Trinitario" brought from Venezuela around the thirties.

"Forastero de Barlovento" variety. This variety is grown in one of the largest producing areas of Venezuela: the northern part of the State of Miranda. Fruits are of "Amelonado" shape (20), green husk, smooth or slightly rugous, ten superficial ridges, small, purple seeds.

"Camacita"' variety. In the estuary of the Orinoco River, a good portion of the plantations are made with a local variety known as "Camacita" (20). Fruits are of rounded "Calabacillo" shape, smooth, superficial ridges, thin and hard husk, seeds small and purple. Trees are vigorous, good yielding and tolerant to *Marismius perniciosus.* In many areas this variety is mixed with "Trinitario" types.

"Pará variety. This variety is cultivated sometimes mixed with the "Común" variety in many localities of Bahia, Brazil. Fruits are of "Calabacillo" shape, thin hard shell, ten superficial ridges, smooth surface with whitish-green or green color. Seeds are small, flat or roundish, and purple. Trees are vigorous and good producers.

'Comun" variety. This is the most extensively cultivated variety in Bahia, Brazil (20). Fruits are of "Amelonado" shape with bottleneck, ten ridges, thin shell, smooth or slightly rough surface, whitish-green coloration, Seeds are small, roundish or flat, purple. Trees are very vigorous and high yielding. This variety resembles very much the "Matina", the Dominican Republic common variety, and the "Amelonado" of Trinidad.

"Maranhão" variety. This variety is cultivated mixed with "Común" cacao in some plantations near Itabuna and Ilheus, Brazil (20). Fruits are large, of elongated "Amelonado" shape with bottleneck, ten rough or smooth ridges, thick shell of a green color. Seeds are medium sized and purple.

"Calabacillo" or "Amelonado de Trinidad". This is the name given to the most common cacao grown in the Dominican Republic (20). Fruits are very similar to the Bahian "Común" variety. Seeds are small or medium sized.

Trinitarios

This is the cacao complex corresponding to the hybrid populations derived from Criollos and various varieties of Forastero types grown together in every country. These hybrids of various degrees of introgression make very heterogeneous populations showing all the segregations possible for each characteristics of shapes, sizes, colors, textures of fruits, and seeds.

According to the degree of introgression the populations sometimes resemble closer one or the original variety, but in most cases the mixture is complete.

Trinitarios have been used in preference to Criollos or to introduced Amelonados because of the vigor (real hybrid vigor in many F_1 populations) reflected in production, better gradings in quality than Forasteros, and better tolerance to diseases than Criollos.

In many Latin American countries the majority of cacao planted belongs to the Trinitario complex. Trinitarios of one country or area might not be comparable to the ones of another country or locality because of the differences in parental origin and the degree of introgression or hybridity.

In Mexico, the majority of the cacao found in the State of Tabasco and in parts of Chiapas are Trinitarios of recent origin.

All the plantations in the Pacific northeastern coast of Guatemala are also of Trinitario types.

Along the borders of Nicaragua and Costa Rica, and in Valle Menier, Nicaragua, the majority of plantings are Trinitarios.

The present production of Ecuador is based mainly on Trinitario types called "Venezolanos".

Colombia's production, particularly in the Departments of Huila, Caldas and Antioquia, is besed on Trinitario populations.

A large portion of the Venezuelan cacao exports comes from the Paria Peninsula (State of Sucre). Tucupita in the Delta Amacuro territory, and several valleys of the northern part of the State of Aragua which are planted with Trinitarios.

The islands of Trinidad and Tobago, Jamaica, Haiti, and part of the Dominican Republic, also export Trinitario types.

The Most Important Cacao Clones

The pioneer work to produce high yielding clones was carried out in Trinidad, initiated by

Table 1-b. Brief description of cacao clones

Cultivar	Origin	Seed			Corolla Size (Radium mm)[3]
		Shape	Color	Size (Index)[2]	
R-10	Mexico	Oval	Purple	Large (1.6)	Large (9.2)
R-13	Mexico	Elliptic	Segregant	Large (1.6)	Large (9.8)
R-30	Mexico	Elliptic-ptd.[4]	Segregant	Large (1.6)	Large (9.8)
R-48	Mexico	Elliptic-ptd.	Segregant	Medium (1.5)	Large (9.2)
UF-29	Costa Rica	Elliptic-ptd.	Purple	Small (1.1)	Small (8.0)
UF-221	Costa Rica	Oval	Purple	Large (1.8)	Large (9.2)
UF-613	Costa Rica	Oval	Purple	Medium (1.4)	Large (9.3)
UF-667	Costa Rica	Elliptic-ptd.	Violet	Large (2.1)	Large (9.6)
UF-668	Costa Rica	Elliptic-ptd.	Violet-white	Large (2.0)	Large ?
CC-9	Costa Rica	Elliptic-ptd.	Purple	Small (1.1)	Medium (8.2)
CC-10	Costa Rica	Oval	Purple	Large (2.1)	Large (9.5)
CC-41	Costa Rica	Elliptic	Purple	Small (1.2)	Large (9.2)
SC-10	Venezuela	Elliptic-ptd.	Purple	Small (1.2)	Small (8.7)
Pqto.87	Venezuela	Oval	Purple	Small (1.2)	Small (8.1)
Oc-61	Venezuela	Oval	Segregant	Large ?	Small (7.5)
Oc-77	Venezuela	Elliptic-ptd.	Segregant	Small (1.3)	Small (8.2)
SC-5	Colombia	Oval	Segregant	Medium (1.4)	Small (7.7)
SC-6	Colombia	Oval	Segregant	Medium (1.3)	Small (8.1)
SPA 9	Colombia	Elliptic-ptd.	Purple	Small (1.0)	Small (7.6)
Tenguel-15	Ecuador	Elliptic-ptd.	Segregant	Large (1.9)	Small (7.7)
Sta. Rosa-34	Ecuador	Oval-ptd.	Purple	Large (1.6)	Medium (8.9)
Porvenir-7	Ecuador	Elliptic-ptd.	Purple	Medium (1.5)	Medium (8.9)
Porvenir-10	Ecuador	Elliptic-ptd.	Purple	Medium (1.5)	Medium (8.6)
Tenguel-33	Ecuador	Elliptic-ptd.	Purple	Medium (1.5)	Medium (8.7)
Tenguel-25	Ecuador	Elliptic-ptd.	Purple	Large (1.6)	Small (8.3)
Curiquingue-2	Ecuador	Elliptic-ptd.	Purple	Large (2.1)	Small (7.9)
Silecia-1	Ecuador	Elliptic-ptd.	?	Large (2.8)	Small
Silecia-5	Ecuador	Elliptic	?	Large (2.4)	Small
EET-374	Ecuador	Elliptic	Purple	Small (1.2)	Large (9.0)
EET-392	Ecuador	Elliptic	Segregant	Small (1.3)	Small (7.9)
EET-399	Ecuador	Elliptic	Segregant	Small (1.4)	Medium (8.6)
EET-400	Ecuador	Elliptic	Segregant	Small (1.3)	Small (7.9)
ICS-1	Trinidad	Elliptic-ptd.	Segregant	Small (1.2)	Small (7.4)
ICS-6	Trinidad	Elliptic	Purple	Medium (1.5)	Large (9.3)
ICS-8	Trinidad	Oval-flat	Purple	Medium (1.5)	Small (7.6)
ICS-55	Trinidad	Oval	Segregant	Small (1.0)	Small (6.9)
ICS-75	Trinidad	Elliptic	Segregant	Small (1.3)	Small (7.6)
ICS-89	Trinidad	Oval	Purple	Small (1.3)	Small (6.6)
ICS-95	Trinidad	Oval-ptd.	Segregant	Small (1.0	Small (7.9)
ICS-98	Trinidad	Oval	Purple	Small (1.1)	Small (7.0)
ICS-100	Trinidad	Elliptic	Segregant	Small (1.2)	Small (7.6)
SCA-6	Ecuador	Oval	Purple	V. small (0.6)	Small (7.4)
SCA-12	Ecuador	Elliptic-ptd.	Purple	V. small (0.7)	Small (7.2)
IMC-67	Peru	Oval-ptd.	Purple	Small (0.9)	Small (7.3)
P-7	Peru	Oval-flat	Purple	Small (1.0)	Small (6.9)
P-12	Peru	Elliptical	Purple	Small (1.0)	Small (7.2)
TSA-654	Trinidad	Elliptic-ptd.	Purple	Small (0.9)	Medium (8.3)
TSA-644	Trinidad	Elliptic-ptd.	Purple	Small (1.0)	Small (7.5)
GS-29	Grenada	Oval	Segregant	Small (1.2)	Medium (8.1)
GS-39	Grenada	Oval	Segregant	Small (1.3)	Medium (8.4)
C4P11	Trinidad	Oval	Segregant	Small (1.3)	Large (9.0)
SIC-801	Brazil	Elliptic-ptd.	White	Small (1.0)	Small (7.4)
SIC-812	Brazil	Elliptic	White	Small (0.9)	Small (7.9)
SIC-823	Brazil	Elliptic-ptd.	White	Small (1.0)	Medium (8.1)
SIC-831	Brazil	Elliptic	White	Small (1.1)	Medium (8.0)
SIAL-70	Brazil	Elliptic	Purple	Small (1.1)	Large (9.8)
SIAL-88	Brazil	Oval-ptd.	Purple	Small (1.1)	Medium (8.8)
SIAL-163	Brazil	Oval	Purple	Small (0.9)	Large (9.3)
SIAL-325	Brazil	Elliptic	Purple	Small (1.0)	Large (9.2)

1. Number of fruits to make 1 lb of dry cacao
2. Average dry weight in gms of one seed
3. Average length of sepals
4. Abbreviation of "Elliptic-pointed"
5. Abbreviation of "Very good"
6. Abbreviation of "Witches Broom"
7. (t) means tolerant
8. Self Compatible
9. Self Incompatible

Table 1-c. Brief description of cacao clones

Cultivar	Pollen Compatibility	Disease Resistance	Yield: Field Productivity	Yield: Combining Ability	Other key Characters
R-10	S. C.[8]	None	Fair	Low	
R-13	?	None	Fair	?	
R-30	?	None	Fair	?	
R-48	?	None	Fair	?	
UF-29	S. C.	Bl. pod, Fl. gall	V. good	Good	Red anther pedicel
UF-221	S. C.	None	V. good	Poor	
UF-613	S. I.[9]	Black pod	Fair	Good	
UF-667	S. C.	None	Fair	Good	
UF-668	S. C.	None	Fair	Good	
CC-9	S. C.	Die-back	Good	Good	
CC-10	S. C.	None	V. good	?	
CC-41	S. C.	Black pod	V. good	?	
SC-10	S. C.	W.broom[6] (t)[7]	Good	?	
Pqto.87	S. C.	W. broom (t)	Fair	?	
Oc-61	S. C.	None	Good	Good	
Oc-77	S. C.	None	Fair	Good	
SC-5	?	None	Good	?	
SC-6	?	None	Good	?	
SPA 9	S. I.	Ceratocystis	?	Good	
Tenguel-15	S. C.	None	V. good	Good	
Sta. Rosa-34	S. I.	None	V. good	Good	
Porvenir-7	?	None	V. good	Good	
Porvenir-10	S. C.	None	Good	Good	
Tenguel-33	?	None	Good	Good	
Tenguel-25	?	Ceratocystis	Good	Good	
Curiquingue-2	?	None	Good	?	
Silecia-1	S. I.	W. broom (t)	Poor	Good	
Silecia-5	S. I.	None	Poor	Fair	
EET-374	?	W. broom (t)	Fair	Good	
EET-392	?	W. broom	Fair	?	
EET-399	?	Ceratocystis	V. good	?	
EET-400	?	W. broom. C. fim.	V. good	Good	
ICS-1	S. C.	None	V. good	Good	
ICS-6	S. C.	W. broom (t)	Good	Good	
ICS-8	S. C.	None	V. good	V. good	
ICS-55	S. C.	W. broom (t)	Fair	?	
ICS-75	S. I.	W. broom (t)	Fair	?	
ICS-89	S. I.	None	Good	Good	
ICS-95	S. C.	W. broom (t)	V. good	Fair	
ICS-98	S. C.	W. broom (t)	Good	Good	
ICS-100	S. I.	None	Good	?	
SCA-6	S. I.	W.broom, Bl. pod	Good	V. good	
SCA-12	S. I.	W. broom	Good	V. good	
IMC-67	S. I.	W.broom(t) C. fim.	Good	V. good	
P-7	S. I.	None	V. good	V. good	
P-12	S. I.	Ceratocystis	V. good	V. good	
TSA-654	?	W. broom, C. fim.	Good	Good	
TSA-644	S. I.	W. broom	Good	Good	
GS-29	S. I.	None	V. good	?	
GS-39	?	None	V. good	?	
CAP11	S. I.	None	Good	V. good	
SIC-801	S. C.	Black pod	Good	Good	All parts of flower and flush, white
SIC-812	S. C.	Black pod	Good	Good	
SIC-823	S. C.	Black pod	Good	Good	
SIC-831	S. C.	Black pod	Good	Good	
SIAL-70	S. C.	None	Good	?	
SIAL-88	S. C.	None	Good	?	
SIAL-163	S. C.	None	Good	?	
SIAL-325	S. C.	None	Good	?	

1. Number of fruits to make 1 lb of dry cacao
2. Average dry weight in gms of one seed
3. Average length of sepals
4. Abbreviation of "Elliptic-pointed"
5. Abbreviation of "Very good"
6. Abbreviation of "Witches Broom"
7. (t) means tolerant
8. Self Compatible
9. Self Incompatible

a survey of the genetic constitution of the crop (17) and the setting of limits of selection (18). One hundred superior trees were selected and propagated vegetatively.

Most of the other cacao producing countries of this Hemisphere followed Trinidad's methodology with modifications regarding the limits of selection, and produced their own clones.

The initial intention was to use these selections as improved material for plantations, but the acceptance by farmers has been very low in spite of the experimental evidences of the extremely high yielding of certain clones. Apparently the high initial cost and the specialized handling required in the preparation of cuttings and the later management of more advanced horticultural practices has discouraged low-educated people to use them.

Prospects for large plantings of clones in the future are good, however, if farmers adopt more advanced horticultural techniques. Making a good selection and planting mixtures of clones which are high yielding and resistant or tolerant to the main local diseases, highly profitable plantings can be made in every country. In every Cacao Station there are experimental evidences of such a possibility. In areas with "Witches broom" and *Ceratocystis fimbriata*, good combinations of resistant or tolerant high yielding clones could be made of, for example, TSA-644, IMC-67, P-7, P-12, EET-19, EET-48, EET-96, EET-388, EET-399, EET-400, EET-401, EET-407, ICS-6, ICS-98, ICS-100, and others. All these clones have shown high yields in spite of some infection by diseases. It is quite likely that with good management of soils, shade, fertilizers, sanitation, fungicides, and insecticides, production could even be increased.

Areas without "Witches broom" are affected mainly by "Black pod" (*Phytophthora palmivora*) and *Ceratocystis*. High yielding clones with some tolerance to these diseases, such as UF-29, UF-221, UF-613, CC-10, CC-41, P-7, EET-19, EET-48, EET-61, EET-62, EET-95, EET-96, EET-399, EET-400, ICS-6, ICS-8, ICS-95, and others, could be used as reliable plant material. Some of the clones in this list, like CC-10 and UF-221, have been outstanding producers in spite of their susceptibility. This suggests that susceptibility only should not be considered a barrier for the economic use of a cultivar, particularly with diseases susceptible to chemical control.

Clones are still important now as parents of hybrids that have been easily and widely accepted by cacao growers.

A detailed description of the principal clones selected in Latin America was prepared in 1966 (9). In order to make this description, a preliminary search for the most useful and discriminatory characteristics was made at Turrialba (7, 8, 10, 11). The work included the selection of the characters and the determination of the proper sample size, in each case. Of 26 highly reliable characteristics used in the 1966 description, Table 1 in this paper includes only a few. These are the ones related to the most important agronomic attributes of fruits and seeds, overall yield, diseases and compatibility reactions, and combining abilities, if available.

Hybrids

Under this name are included the sexual families or progenies resulting of F_1 crosses between selected clones.

Hybrids have become, during the last 15 years, the most popular and accepted plant material for replanting old decaying plantations or the initiation of new areas. They have been the best solution for combining high yields and resistance to one or more diseases, obtained from some otherwise undesirable clones, such as SCA-6 and SCA-12 (which have too small fruits and seeds but are resistant to "Witches broom"), crossed with other susceptible clones that have other desirable agronomic attributes.

Experiment stations in Colombia, Costa Rica, Brazil, Ecuador, Trinidad, and Venezuela, have produced many F_1 hybrids with excellent yielding ability and some degree of tolerance to the main diseases. However, no attempt has been made yet to describe these progenies, with the exception of their performance in production and disease resistance. It is difficult to make a good description of the progenies because of the high heterogeneity in almost every character, due to the heterozygous nature of the parent clones. Most clones (with the exception of some SIC clones of Bahai) are not inbred individuals and, consequently, they segregate when producing their progenies. In the majority of F_1 crosses, one can see many fruit and seed sizes, shapes, colors and textures, depending on the origin of the parents. However, a few key characters could be used to describe hybrids and these must be identified in the future.

Table 2 shows a brief description, per country, of yield and disease reaction of the main hybrids.

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Table 2

MAIN HYBRIDS OF SEVERAL LATIN AMERICAN COUNTRIES

Country	Hybrid	Yield	Reaction	
			W. broom	Ceratocystis
Trinidad (21)	SCA-6 x ICS-1	Very good	Tolerant	Susceptible
	ICS-6 x SCA-6	Very good	Tolerant	Tolerant
	ICS-6 x SCA-12	Very good	Tolerant	Tolerant
	ICS-8 x SCA-6	Very good	Tolerant	Tolerant
	C4-11 x SCA-6	Very good	Tolerant	?
	ICS-6 x IMC-67	Very good	Susceptible	Tolerant
	ICS-8 x P-12	Very good	Susceptible	Tolerant
	SCA-6 x ICS-75	Very good	Tolerant	Tolerant
	SCA-6 x IMC-67	Very good	Tolerant	Tolerant
Ecuador (6)	ICS-6 x Sil-1	Very good	Susceptible	Tolerant
	ICS-1 x Sil-1	Very good	Susceptible	Susceptible?
	EET-103 x EET-387	Very good	Tolerant	Tolerant
	EET-96 x SCA-6	Very good	Tolerant	Tolerant
	SCA-6 x EET-95	Very good	Tolerant	Tolerant?
	SCA-6 x EET-62	Very good	Tolerant	?
	EET-274 x SCA-12	Very good	Tolerant	?
	EET-47 x SCA-12	Very good	Tolerant	?
	EET-94 x SCA-12	Very good	Susceptible	?
	EET-114 x Sil-1	Very good	Susceptible	?
	ICS-1 x SCA-12	Very good	Tolerant	Susceptible
	SCA-6 x EET-19	Very good	Tolerant	?
	EET-162 x SCA-12	Very good	Tolerant	?
	EET-69 x SCA-6	Very good	Tolerant	?
	EET-194 x SCA-12	Very good	Tolerant	?

Table 2 (cont.)

Country	Hybrid	Yield	Reaction W. broom	Reaction Ceratocystis
Costa Rica (2, 21)	Pound-12 x Catongo	Very good	?	Tolerant
	Pound-7 x UF-668	Very good	?	?
	Pound-7 x UF-667	Very good	?	?
	Pound-12 x UF-613	Very good	?	Tolerant
	Pound-12 x SCA-12	Very good	?	Tolerant
	Pound-7 x R-101	Very good	?	?
	Matina x Catongo	Very good	?	Tolerant
	SCA-6 x UF-667	Very good	?	Susceptible
	UF-221 x IMC-67	Very good	?	Tolerant
	UF-29 x Catongo	Very good	?	Tolerant
	UF-296 x CC-9	Very good	?	Tolerant
	UF-296 x CC-18	Very good	?	Tolerant
Venezuela (12)	Oc-73 x SCA-6	Very good	Tolerant	?
	Oc-77 x SCA-6	Very good	Tolerant	?
	Oc-60 x SCA-6	Very good	Tolerant	?
	Oc-61 x SCA-6	Very good	Tolerant	?
	SCA-12 x Cho-18	Very good	Susceptible	?
	SCA-6 x Cho-28	Very good	Tolerant	?
	SCA-6 x Chu-120	Very good	Tolerant	?

MINOR TROPICAL FRUIT CULTIVARS IN FLORIDA

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ABSTRACT

Previous work is reviewed and current, unpublished information is given on cultivars and experimental selections of minor tropical fruit crops which are cultivated in Florida. These include *Annona* species and hybrids, *Averrhoa carambola, Calocarpum sapota, Euphoria longana, Litchi chinensis, Achras zapota,* and *Psidium guajava.* Information includes successful methods of propagation for each species and problems associated with varietal improvement.

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INTRODUCTION

Southern Florida is noted for its diversity of cultivated tropical fruits. Although tropical fruits are of relatively minor economic importance in comparison to the enormous citrus industry, they do contribute significantly to the agriculture of the State. In addition, they are an important factor in Florida's reputation as a pleasant place to live.

All of the tropical fruits grown in Florida have been introduced from other parts of the world. Some of these exist today essentially as they did in the wild condition. Others, having been long associated with man, are much changed through casual or systematic selection. This paper is concerned with the species in which selection has progressed far enough that cultivars have been described, or are likely to be in the near future.

PROCEDURE

This information was compiled from research conducted at the University of Florida Sub-Tropical Experiment Station (SES), other re-