

Olmeca: hybrid cacao for high yield

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Abstract

The objective of this study is to report the morphological, performance and quality characteristics of the Olmeca hybrid. This genotype is the product of crossing the RIM 76A X EET 400 progenitors. The RIM 76 A genotype is a clonal selection of a creole cocoa genotype from Mexico and the EET 400 genotype is a commercial clonal selection from Ecuador. Its fruits of the Olmeca clone of up to 20 cm with elliptical shape, obtuse apex and weak basal constriction. Each fruit contains an average of 40 seeds and the hue of the cotyledons is dark purple. The evaluations of the yield of the Olmeca clone after 11 years of establishment in the farms El Morralero in the municipality of Comalcalco, Los Pinos in the municipality of Cunduacan and in the Ostitan of the municipality of Huimanguillo in the state of Tabasco, have shown averages of 46 fruits per tree free of diseases and an average fruit index of 16 in the years 2013 to 2016, this indicates that with this number of fruits, one kg of dry cocoa can be produced. Resistance to moniliasis in the field is of the order of 86%. The fermented dry cocoa bean and cocoa paste tasting has featured notes of cocoa, fresh fruit, walnuts, fruity, sweet malt caramel, and dried fruit. These attributes are in the commercial interest for the exploitation for the production of chocolates of origin of the variety, characteristics that are not yet used in Mexico. This hybrid has been registered in the National Catalog of Plant Varieties of the National Seed Inspection and Certification Service with number CAO-008-230218 and breeder's title number 2270. The multiplication of this variety is through the asexual route by grafting, which is available to producers in southern Mexico at CAEHUI-INIFAP, in Huimanguillo, Tabasco.

Keywords: *Theobroma cacao*, disease resistance, yield.

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In Mexico, cocoa plantations are established in an area of 58 467 ha, with genotypes of the amelonado (70%), calabacillo (26%) and creole (4%) type, which are propagated by seed. The production of dry cocoa beans is of the order of 28 363 t, with a yield of 449 kg ha⁻¹. The state of Tabasco has an area of 40 704 ha where 18 275 t of cocoa are produced, followed by the state of Chiapas with 17 518 ha in which 9 835 t of cocoa are produced (SIAP, 2018).

The cocoa genotypes present in these states show low yields and susceptibility to diseases such as moniliasis (*Moniliophthora roreri*) and black spot (*Phytophthora palmivora*) (Barron *et al.*, 2014). Additionally, the plantations are very old, more than 60 years old and the improved varieties are scarce.

In Tabasco, few studies have studied the organoleptic quality. Within the established plantations, there is a great heterogeneity of fruits, so the dry cocoa bean (mixtures) is acidic (García-Alamilla *et al.*, 2007). In a study carried out with cacao of the calabacillo, cundeamor, amelonado and angoleta type, they concluded that the cundeamor type presented better quality compared to the other three types evaluated, which showed lower acidity and without astringency (López *et al.*, 2013). The hybrid ‘Olmeca’ has been registered in the National Catalog of Plant Varieties of the National Seed Inspection and Certification Service (SNICS) with the number CAO-008-230218 and breeder’s title number 2270. The multiplication of this variety is through of the asexual route by grafting, which is available to cocoa producers in southern Mexico at the CAEHUI-INIFAP, in Huimanguillo, Tabasco.

Obtaining the hybrid

For the development of the Olmeca hybrid, the applied genotechnical method consisted of: performing a simple cross to generate the F1 hybrid; from the RIM 76 A x EET 400 genotype. The RIM 76 A genotype corresponds to a clonal selection of a creole genotype from Chiapas, Mexico, while the EET 400 genotype corresponds to a commercial clonal selection from Ecuador (Escobar, 2008).

The crossing of these parents originated a family (1995) and their descendants generated 30 plants (1996). Due to the heterosis of the F1 hybrids, the evaluations were per individual. As a result of this selection, the Olmeca hybrid was obtained, which has been reproduced by clonal multiplication by graft to maintain its genetic identity.

From this family of F1 hybrids, the Olmeca clone was selected which was evaluated from 2006 to 2016 in the El Morralero farms in the municipality of Comalcalco, Los Pinos in the municipality of Cunduacan and in Ostitan in the municipality of Huimanguillo in the state of Tabasco.

Among its morphological characteristics, its leaves are large and sharply shaped, medium green, with tender, light red leaves and its apex is predominantly apiculate. Its flowers have pedicels with moderate pigmentation, long and moderately wide sepals. Its sepal pigmentation is weak and in some cases absent. The ligule is yellow in color with intensely pigmented staminodia. Its fruits are large (up to 20 cm) with elliptical shape (Figure 1), obtuse apex and weak basal constriction. The surface of the fruit is smooth or slightly rough and has shallow grooves. The color of the fruit is

yellow when ripe and green/purple in the juvenile stage (Figure 1). The seed is covered with white pulp and medium sweetness. The number of seeds per fruit is high (40 seeds on average), oblong in shape and large. The hue of the cotyledons is mostly dark purple.

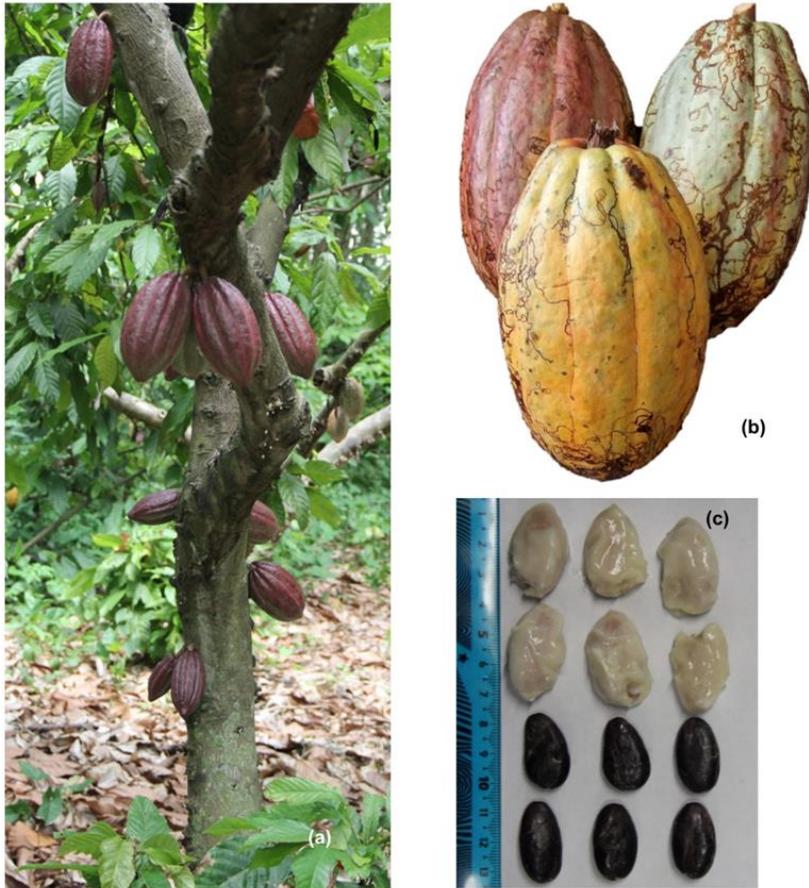


Figure 1. Fruits of the Olmeca hybrid genotype. a) the cacao tree is shown with tender fruits; b) ripe fruits are shown; and c) seeds with mucilage and bare seeds.

Reaction to moniliasis

Resistance to moniliasis of the Olmeca genotype in the field is of the order of 85%, while in direct inoculation tests they have shown 80% resistance to this disease, compared to the regional creole genotype, which presented 50% incidence to moniliasis.

Yield and fruit index

The evaluations of the yield in plants during a period from 2006 to 2016 have indicated that up to 46 fruits can be obtained per tree free of diseases and presented an average fruit index of 16 (2013-2016), this indicates that with this number of fruits can produce one kg of dry cocoa (Table 1). Compared to the regional creole control, it presented a very high fruit index since 30 pods are required to obtain one kg of dry cocoa.

Table 1. Average of the variables for yield (2013 to 2016) El Morralero, Los Pinos in and in the Ostitan, Tabasco.

Genotype	No. of ears produced	No. of healthy ears	No. of ears with black spot	No. of ears with moniliasis	Cob index	Dry weight of grain (g)	(%) resistance to black spot	(%) resistance to moniliasis
Regional creole control	46 b	19 b	4 c	23 a	30 a	1 b	91 a	50 b
Olmecca	61 a	46 a	6.1 b	8.54 b	16 c	1.6 a	90 a	86 a
Clone 420093	48 b	18 b	5.76 b	24 a	21.7 b	1.2 b	88 b	50 b
Clone 330093	64 a	45 a	8.96 a	9.6 b	28 a	0.72 c	86 b	85 a

In the El Morralero farms in the municipality of Comalcalco, Los Pinos in the municipality of Cunduacan and in the Ostitan in the municipality of Huimanguillo in the state of Tabasco. Values with the same letter are statistically equal (Tukey 0.05).

Organoleptic characteristics

The tasting of dry fermented cocoa bean and cocoa paste has presented notes of cocoa, fresh fruit, nuts, fruity, sweet malt caramel and dried fruits (Azpeitia *et al.*, 2018). These attributes make it of commercial interest for its exploitation for the production of chocolates of origin of the variety, characteristics that are not yet used in Mexico (Table 2). The genotype known as ‘National’ from Ecuador, which possibly comes from the local Amazonian population and with some hybridization with Trinitarian types, is distinguished by its special aroma, with floral and dried fruit notes (CAOBISCO/ECA/FCC, 2015).

Table 2. Organoleptic notes in 70% chocolate in four cocoa genotypes.

Genotype	Organoleptic notes in chocolate 70%
Regional creole control	Low acidity and astringency, cocoa, fresh fruit, nuts and vegetables.
Olmecca	Low acidity and astringency, cocoa, fresh fruit, walnuts, fruity, sweet malt caramel and dried fruit.
Clone 420096	Low acidity and astringency, cocoa, fresh fruit, nuts, vegetables and spices.
Clone 330096	Medium acidity and astringency, cocoa, fresh fruit and vegetable.

Based on the results of a tasting at the Chocolate Museum in Mexico City and at the Mexican Consulate in New York City, United States of America.

Conclusions

The Olmecca clone represents a quality cocoa as it highlights its high yield. with an index of ear of 16. Additionally it has resistance in 90% to the black spot and 86% to the moniliasis. These values exceed the regional creole control, as well as the experimental varieties with code 420093 and 330093.

Additionally, the Olmeca clone stands out for its organoleptic notes for its possible use in Mexico and in the world as Origin chocolate. Olmeca, has been registered in the National Catalog of Plant Varieties of the National Seed Inspection and Certification Service (SNICS) with number CAO-008-230218 and breeder's title number 2270.

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