Generation of promissoryst cacao clones with high yield potential, disease resistance, and quality to improve the farmer's conditions in Latin America

Adriana Marcela Arciniegas Leal1, Dominique Dessauw2, Allan Mata Quirós3, Mariela Leandro Muñoz2 and Rolando Cerda Bustillo1

Affiliations
1. Agroforestry and Genetic Improvement of Coffee and Cocoa Unit. CATIE, Turrialba, Cartago Costa Rica.
2. CIRAD-CATIE, CRB PT, Station de Roujou, 97170 Petit Bourg, FWI, France.

Introduction

The development of improved cocoa varieties in combination with good agronomic and agroforestry practices is a constant need. Therefore, the research developed in the genetic breeding program at CATIE, Costa Rica, is focused on the selection of promising genotypes with high yield potential, self-compatibility, good industrial quality and tolerance to the main diseases, with emphasis on moniliasis (FPR, Moniliophthora roreri) and black pod (BRP, Phytophthora palmivora).

Thus, in 2007, CATIE selected and released a group of 6 improved cacao clones that are already established in Latin American countries (Phillips-Mora et al. 2012). Since then, CATIE continues the evaluation of other promising materials such as: CATIE-R5, CATIE-R52, CATIE-R58, CATIE-R73, CATIE-R78, CATIE-R91 and CATIE-R92. In order to release the best genotypes.

Objective of the study

To release improved clones with yield capacity, high quality and tolerance to the main diseases, with emphasis on moniliasis (FPR, Monilophthora roreri) and black pod (BRP, Phytophthora palmivora).

Methodology

Based on monthly evaluations during 9 years of exercising a trial of 160 clones established in La Lola farm, located in the Atlantic Coast of Costa Rica (40 m.a.s.l, 3369 mm of annual rainfall and 24.5°C average temperature), with high inoculum pressure to cacao moniliasis (FPR), CATIE selected a group of 7 clones being the most productive and with low natural incidence of FPR and BRP. After this selection, morphological evaluations continued using 6 flowers, 10 fruit and 6 seed characters. Pod and seed indices were also evaluated. Using artificial inoculation methods, the reaction to diseases was determined. (Phillips-Mora et al. 2005; Phillips and Galindo 1989).

Inter and compatibility evaluation was determined following the standard protocol described by Rayaert et al. (2011) and Estes et al. (2000), where a matrix of 49 crosses with a total of 960 pollinations was conducted. Quality evaluations included chemical analyses (obtaining catechins and epicatechin), complemented by sensory profile analyses performed at 2 main harvest times (March-April and November-December). Finally, the cacao trees were given structural prunings at the beginning of the trial and periodic maintenance prunings. On regular basis 600 g of granular fertilizer formula 18-5-15-6-0.3-7 divided into four applications of 150 g were applied beginning on the trial and periodic maintenance prunings. On regular basis 600 g of granular fertilizer formula 18-5-15-6-0.3-7 divided into four applications of 150 g were applied every 3 months. No diseases control is carried out in the trial other than the cutting of diseased fruit at the time of the monthly evaluations.

Results

The results suggest that 57% of the evaluated genotypes were green in color, with an indented apex, intermediate roughness and hardness of the mesocarp with the exception of CATIE-R58, which has an intense roughness and hardness; the shape of the fruit varied between cuneiform, angolita and amelonada, with an intermediate basal constriction between sight and intermediate (Figure 1).

Regarding compatibility, a high inter-compatibility (≥40%) was observed among the clones; and CATIE-R5, CATIE-R52, CATIE-R58, CATIE-R73, CATIE-R78 and CATIE-R91 were determined to be self-compatible with a retention ≥30%.

Conclusions

The selection of improved varieties with outstanding characteristics from targeted crosses requires 1 to 20 years to reach growers. In this case, only 4% of the clones evaluated in the trial were selected, suggesting that despite having a large population of crosses with promising parents, there is a selection pressure on individuals and very few become a valuable source of germplasm available to benefit the cacao sector.

The new genotypes created by CATIE have high production potential, combined with good disease resistance and self-compatibility. These clones are options for producers to improve their production and income. Producers can combine them with the best clones currently available, CATIE-R5 or CATIE-R8. The new clones will be tested in multi-location trials in several Central American countries and a catalog with a complete characterization of the clones will be distributed to producers.

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Literature Cited


Table 1 shows the results for the pod and seed indices, as well as the number of seeds per pod. At least 30 fruits were used for their determinations.

Table 2. Matrix of self and cross sexual compatibilities of seven cacao clones evaluated at CATIE. CIRAD-CATIE, Turrialba, Costa Rica.

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