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✘ Ecuadorian cacao, *Theobroma cacao L.*, is the third most important export product after banana and flowers. Ecuador provides 70% of the total production of the finest scent cacao also known as cacao 'Arriba' or 'National'. However, the sustainability of this crop is threatened by diseases of devastating impact.

Among the most severe are witches' broom *Moniliophthora perniciosa Stahel*, frosty pod rot *Moniliophthora roreri* and black pod *Phytophthora*. These diseases affect the pods, flower cushions, leaves and stems, causing a steady decline in production and reduction in bean quality. Impact studies carried out by INIAP in Ecuador determined an average of 43% of young fruits were destroyed due to physiological stress as a result of diseases.

Clones hold resistance key

Breeding for resistance is a key factor in maintaining sustainability for Ecuadorian cocoa production. Efforts have focused on witches' broom due to the virulence of the pathogen. During the 30s and 40s, INIAP collected, evaluated germplasm and identified sources of resistance. The entry SC-6 showed tolerance and has been used as a parent donor for witches' broom resistance.

Progenies derived from this donor were evaluated and a clone identified as Estación Experimental Tropical 454 (EET 454) was disease-tolerant. A set of ten 'National' clones were studied and preliminary observations suggested that clones, EET 103, EET 575, EET 576, were tolerant. National hybrid genotypes, EET 95, EET 103, EET 576 consistently have showed tolerance to the disease and are recommended for growing areas in the Amazon Basin.

Extensive evaluations for adaptation of national hybrid genotypes in the Amazon basin have been conducted. Multi-year-location trials detected new sources of resistance in cultivars INIAPT-632; INIAP-484 and INIAP-374; these three had low infestation and also a higher yield than the resistant parent. The Amazon's ancestral cacaos are continuously being evaluated in the search for resistant high-yielding clones; this goal is an ongoing commitment and further studies will identify stable tolerant cultivars.

Pest problems

Black pod is a disease caused by a complex of *Phytophthora* species infecting the pod and

immature pods called cherelles. Evaluations looking for resistance to *Phytophthora* have not yielded acceptable clones and studies looking for disease tolerant trees are underway.

Frosty pod rot caused by *Moniliophthora roreri* causes losses estimated between 40%-80% of the crop. The severity of the disease depends of the environmental conditions and the genotype. Studies at the Tropical Research Station of INIAP looking for resistance to frosty pod rot found 11 trees with an incidence lower than 15%, while the average incidence in the population was 60%. Further evaluations are needed to define if this resistance is due to genetics. An alternative control is breeding for disease avoidance or cultivars that escape the wet season.

Resistance rewards

Cacao culture is a tradition and continues to be the main component in the production systems of smallholders despite disease problems. Resistant cacao clones will boost productivity and improve the quality of life of 100,000 small farmers, and other 200,000 families that indirectly benefit of the cacao production.

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