Genetic improvement of banana

The genetic improvement of banana and plantain is made necessary today as a result of pest pressure and consumer demand in both the north and the south. However, the sector needs not only new cultivars but also good cultural practices.

New dessert banana and cooking banana hybrids are required.

The genetic base of export dessert bananas is narrow and the plant is subject to many diseases. The development of disease-resistant bananas is a major objective and new varieties will also make it possible to broaden the variety of supplies on the main import markets through market segmentation.

The need for new varieties of plantain (local varieties for cooking) also responds to a search for resistance to diseases. But the cultivation problematics are different. Plantain is not an intensive crop. A large number of varieties are grown and the problems met are not only related to pests and diseases but also to the agronomic management of the plant and distribution to local markets.

Long and complex techniques

Present varieties display special biological characteristics, and in particular marked flower sterility that is a handicap for breeders. However, sterility is not total and some clones can produce seeds when they are pollinated manually. In spite of these obvious difficulties, hybrids have thus been bred by sexual means. After selection screening, the latter have been multiplied vegetatively under natural conditions (from suckers) or by *in vitro* multiplication for rapid distribution to growers.

The implementation of complex crossing strategies first led to the distribution of new disease-resistant cooking varieties with good production potential. The plants bear larger bunches, display better sucker production and have a smaller habit. The fruit quality of most of the hybrids is very acceptable but progress remains to be made in the culinary and taste qualities in comparison with the traditional varieties. Work is continuing to take better account of these criteria and to specify the nutritional value of these new varieties.

The improvement of export varieties consisted of going back to ancestral varieties to reach the present hybrids in a similar way to what has happened naturally since the origin of bananas until today. This procedure is based on good knowledge of the evolution of *Musa* (the generic name of banana) and of the biology of the plant. The breeding of new varieties was slowed at first by the appearance of hybrids infected by a virus in the progeny. It was found that these infections resulted from the activation by crosses of virus sequence incorporated in the genome of one of the parents. This difficulty was overcome by concentrating work on the species *Musa acuminata*, whose genome does not incorporate activable sequences. New varieties resistant to the major diseases have recently been bred by crossing. Their potential for the domestic and export markets is being studied.

It is not because the so-called 'conventional' breeding techniques are long and complex that they should not be considered as being operational. Several teams have distributed improvement plant material bred using these techniques and new dessert and cooking banana hybrids are expected shortly.

GMOs form a possible approach for the improvement of banana as a complement to breeding using sexual methods. Among other things, it would make it possible to create virus-resistant plants as such genes are unknown naturally in the genus *Musa*. The approach is not yet operational, however. As for other transgenic plants, a set of conditions is required before the obtaining of results that can be taken over by users and that are satisfactory for consumers. The first condition concerns the degree of mastery of the method. Effective resistance strategies that are sustainable during transgenesis require the testing and validation of many technical approaches for which we have very little perspective for appraisal. The second condition involves bio-safety and is common to all genetically engineered plants. Finally, it must not be forgotten that the product must first and foremost be accepted by consumers.

The overall approach

Finally, responding to the pest threats to which bananas are exposed requires not only new, more resistant bananas but also good cultural practices based on in-depth knowledge of plant agronomy and the biology of these pests and diseases. Research in these fields receives less public attention but is just as essential as work on genetic improvement. It is clear that the development of bananas truly matching the requirements of growers and consumer expectations will be delayed unless an overall improvement approach is used ■