Transferring sugarcane varieties in complete safety

CIRAD’s quarantine

The availability of new sugarcane varieties largely helps to improve farming systems. To that end, CIRAD procures access for its partners to germplasm for research and varietal improvement purposes, and to new high-yielding varieties for industrial crops. Planting material is transferred from one place to another in vegetative form in the great majority of cases, which considerably increases the risk of spreading pathogens and pests. CIRAD’s sugarcane quarantine helps to remove those risks.

A system to guarantee healthy varieties

CIRAD’s sugarcane quarantine in Montpellier covers the main three quarantine operations:
- pathogen detection,
- elimination of pests and pathogens,
- plant material transfers.

Alongside phytosanitary constraints there are also legal constraints: ensuring, through appropriate contracts, that plant breeders’ intellectual property rights over the disseminated material are respected.

In practice, introduced plant material passes through three stages during which everything is done to detect any pathogens and pests and eliminate them:
- passage through a chamber meeting BL2-P standards to eliminate any risk of introducing pests considered as quarantine parasites in Europe,
- first quarantine cycle of 9 to 12 months, to detect sugarcane pathogens,
- second quarantine cycle of 9 to 12 months to multiply varieties before their release and dissemination; pathogen detection tests are also performed as verification.

The planting material therefore spends at least two years in quarantine.

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Detection of pathogens

Depending on the geographical origin of sugarcane varieties, it is sometimes necessary to search for a dozen pathogens, primarily viruses and bacteria, including phytoplasmas. These pathogens are responsible for mosaic, streak mosaic, yellow leaf, leaf scald, ratoon stunting, white leaf, among others.

Various detection techniques are used in quarantine: a visual search for symptoms, isolation on selective medium, serological and molecular tests (PCR, RT-PCR). For quarantine purposes, disease detection tools need to be able to identify very small quantities of pathogen and, during the same test, to detect all the variants of the same pathogen, or even of several pathogens.

A major challenge: identifying latent diseases

Three diseases undergo particular surveillance in quarantine because it is often difficult, or even impossible, to detect them by simply observing symptoms. Indeed, leaf scald – due to the bacterium *Xanthomonas albilineans* – and yellow leaf – due to the Sugarcane yellow leaf virus – can go through long periods without any symptoms occurring. For its part, ratoon stunting, caused by the bacterium *Leifsonia xyli* subsp. *xyli*, never displays any external symptoms during infected plant growth in quarantine glasshouses.

Pathogen elimination

Between two quarantine cycles, all sugarcane cuttings are systematically subjected to long hot water treatment (25°C for 48 hours and then 50°C for three hours) to eliminate a maximum of bacteria, fungi, insects and mites likely to be harboured by the cuttings. Phytosanitary treatments are also regularly carried out during plant growth (foliage spraying, watering at the foot of the plant), and at the end of the cycles (soaking of cuttings).

If a pathogen that is difficult to cure is detected, such as *X. albilineans*, the infected varieties are destroyed. However, if the identified disease is considered curable, such as ratoon stuntng, the varieties are cleared of the pathogen by long hot water treatment. In the case of sugarcane yellow leaf or streak mosaic (Sugarcane streak mosaic virus), apical meristem culture has to be carried out to obtain healthy plantlets.

Transferral of varieties

Around a hundred varieties are imported each year from various sugarcane producing countries. On leaving quarantine, around a hundred varieties are transferred each year to different CIRAD partners. Those varieties are used either by the industry for planting, or by research. They are of different types: already known elite varieties, new varieties for assessment, or belonging to ancestral species.