

relatively limited environment several banana varieties adapted to different situations?

#### Christophe Jenny

The second idea is the right one—the cohabitation of a larger number of varieties. Obviously, we shall probably begin by extending one new variety. The adoption of a new banana variety is not a small affair for any of the stakeholders in the chain. This will certainly require adaptations at different levels and this mosaic will only be attained little by little, but it is very probably the right solution. It can be considered that Cavendish banana will keep a major share of production for different reasons. They are very well suited to the industry that was developed for them. As the production of other varieties carries a lesser phytosanitary risk, the pressure on Cavendish will also be lowered and production conditions might be slightly improved. And then it can be considered that there will rather be groups of varieties adapted to large zones.

#### Alain Zolty, Afrique Agriculture

Who will have access to these varieties? Will they be in the public domain? Can any company wishing to grow bananas have access to these varieties, and what are the Americans doing in this respect?

#### Christophe Jenny

I have presented to you today the development of new banana

varieties in the French West Indies. The priority for CIRAD-FLHOR, located in the West Indies, is to work in close relation with and in priority with West Indian planters. However, we have high potential for varietal creation. One might consider that once these varieties have been adopted by West Indian growers they can be developed elsewhere later. Then if a large amount of plant material is produced, it is possible that planters might make a choice and that from there we might also work with other growers elsewhere. But priority is awarded to the West Indian planters with whom we work. We develop products that they have chosen and on which they will work with us. They will be the first beneficiaries.

Today, varietal creation of dessert banana for export is fairly limited. Few organisations are working on varietal creation today. One can mention FHIA (*Fundación hondurana de investigación agrícola*) in Honduras, CIRAD-FLHOR and that is about it. Indeed, the Americans traditionally and preferentially work with FHIA products. You have no doubt heard of 'Goldfinger' (FHIA 1) and a number of other hybrids. I know that there have been production and marketing trials, especially in Canada and Australia. At the same time, I do not see FHIA hybrids gaining a majority share in American plantations. This is all that the Americans are doing at the moment. I am not sure that they

desire change and new varieties as much as we French and Europeans do. They are relatively satisfied with the standard Cavendish fruits that they master under their production conditions.

#### Hugues Tezenas du Montcel, CIRAD-FLHOR

I would like to add a point, and perhaps a concern. CIRAD-FLHOR works in priority with the French West Indies. I believe that this is a good thing, given the participation by our planters and our priority objectives. However, if there is indeed a threat of Black Sigatoka disease in the West Indies, other diseases of Cavendish are more crucial for the world as a whole, and in particular Panama disease (race 4). Central America and the Caribbean are unaffected so far but the disease is found throughout Asia, in Australia, the Philippines and increasingly in Indonesia. You will say that it is not important because we are not directly concerned. Nevertheless, I believe that we have a certain responsibility and that we should ask the question of what should be done with regard to these crops that are still very large, feed enormous populations and are the subject of international trade. There is no genetic improvement programme in Asia today. We have no answer to the problem and it is spreading. It is also important to pay attention to these global issues ■



## Increasing the value of West Indian banana production through the promotion of a new commercial segment: 'bananas not treated after harvesting'

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Segmentation has been mentioned today, especially by François Dalle (cf. *Fruitrop* 73) who mentioned the various possibilities open to the banana market. They mainly concern new products but also bananas produced differently. I am going to talk to you about a different segment consisting of eliminating post-harvest treatment. These are not organic bananas, because the rest of the crop management sequence is normal. Neither is it a rational procedure. It consists simply of not applying post-harvest pesticides.

The context of banana production and especially the question of quality in the French West Indies is as follows: strong international economic competition, poor competitiveness of West Indian banana because of high production costs, and also blemishing caused by the severity of storage diseases. This leads to the need to differentiate these bananas in order to make them more competitive on the international and European markets.

## The main storage defects

Storage diseases of banana are related mainly to the development of a pathogen, *Colletotrichum musae*. This becomes established rapidly on fruits in the field at an early date. The conidia form a conservation structure known as the appressorium, which expresses its parasitic potential when the fruits ripen, when they are usually still green. Three types of pathological infection are observed:

- quiescent anthracnose: *Colletotrichum musae* spreads in the field and, when the fruits ripen, forms lesions that grow and often appear either during ripening, in the shop or after purchase by the consumer;
- wound anthracnose or canker. In some cases, if wounding occurs during harvesting and packing the fruits display large necrotic areas and earlier, when they enter the ripening facility;
- crown rots which develop where the crowns have been cut during packing.

The different features affecting the development of these infections are as follows:

- the quantity of pathogen on the fruits (contamination level),
- the ability of the disease to spread, which may in turn be affected by two types of factor: external factors such as wounding, which is particularly important for the development of cankers, and internal factors that will, in particular, govern the rate of expression of quiescent infection and canker and also fruit physiological senescence that in turn governs the speed of appearance of crown rots.

## Objective of the quality programme

The aim of our work is to provide the banana profession with new control techniques making it

possible to do without post-harvest treatments for the control of these storage diseases. Because this chemical control is running up against certain technical difficulties owing to resistance to the fungicides used:

- fungicides with the same mode of action as the latter are used in aerial spraying to control Black Sigatoka disease and there is good correlation between the number of sprayings performed and the appearance of strains resistant to *Colletotrichum*. Hence, even if the active substance is changed regularly, this approach is finally doomed to failure;
- this chemical control method lacks efficacy in certain soil-climate zones and at certain times of the year.

In addition, consumers and the public authorities are increasingly concerned by food safety and hence the harmlessness of products and respect of the environment. Large quantities of preparations are used in packing sheds to treat fruits and are released into the environment.

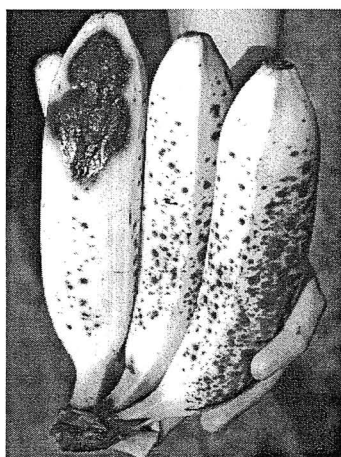
The approach that we have used to attempt to eliminate this chemical control is based on better knowledge of the bioecology of the pathogen *Colletotrichum musae*. Various recent research works performed in Guadeloupe under humid tropical conditions—particularly favourable for the development of the pathogen—has provided precious information for control using the determinism of the mode of contamination of the fruits.

- The flower organs located just above the fruits, and that become senescent during their growth, and the last bract of the bunch, which hangs and is senescent, are the main sources of *Colletotrichum musae* inoculum.
- Most fruit contamination occurs in the field during the first month following flowering. Effective

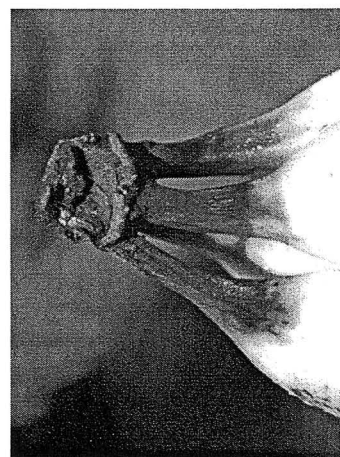
Quiescent anthracnose



Wound anthracnose



Crown rots



action to prevent fruit contamination must therefore be performed very early.

- Spore transport from inoculum sources to the surface of the fruits is mainly caused by rain water runoff. This transport does not take place when there is no rain. Placing plastic bagging on the bunches during the horizontal stages, without removing floral organs, decreases the contamination level from 100 to fewer than 20 necrotic lesions per fruit. This shows that bagging with plastic considerably limits fruit contamination, an effect that was not previously known. In addition, fruit grown in plastic tunnels, where the floral organs were inoculated abundantly, displayed no lesions at all.
- It is possible today to foresee fruit contamination level and therefore to perform an effective forecast of the risk of damage in the sixth week after flowering using a technique that we have developed.

## Actions to be undertaken

Our approach is based on different actions:

- we shall set up cultural practices in the field to limit fruit contamination. They concern more specifically the early elimination of sources of inoculum, removal of dried flowers in the field, bagging, monitoring of contamination levels and finally a warning unit to provide planters with precise information. However, two types of question remain concerning bagging. Might early bagging be effective in reducing fruit contamination? Can bagging material be further optimised to make it more impervious?
- reduction of bruising at packing stations, the quality of fruit washing water and the cleanliness of the station are factors that enable the reduction of crown rots;

- during transport, a modified or controlled atmosphere reduces crown senescence. We seek to reduce the oxygen level and increase that of CO<sub>2</sub> in order to enhance fruit conservation;
- at ripening facilities, it will be sought to optimise fruit maturation conditions, especially with regard to the ethylene doses and times of action that enhance expression of the parasite.

This approach is currently being undertaken at an experimental location at Neufchâteau (Guadeloupe) in a banana plantation of about 10 hectares for a period of one or two years. It is aimed to provide technical and economic validation of this crop management sequence by examining the impact on cost price and growers' incomes and also on the commercial image of the fruits. The Pomona company is strongly involved in this project since it enables us to perceive the produce in the downstream part of the chain. The final result will be the definition of a specification for a 'clean fruit' label.

**In conclusion**, this example shows that an agri-environmental approach avoiding the use of chemical control can be reconciled with market logic through the promotion of a new commercial quality label. For this, all the sub-sector stakeholders must pursue the same objective and gain from it. Growers will gain stability for their production on the market, ripeners and distributors will have less blemished fruit and consumers will be supplied with produce that is more respectful of human health and this will satisfy the requirements of the public authorities with regard to the impact on the environment. This approach can also be combined with other commercial segments, and especially the new bananas for which the same crop management sequence could be used ■

## Questions / Answers

### Jean Harzig, L'Echo

I would like François Dalle to give us a little more information about the way in which he plans to introduce this concept in his range.

### François Dalle, Pomona

It is a little difficult to reply for the moment, but it is certain that this will take time because we combine work in the field and work during packing and possibly even during transport. With regard to increased commercial value, it would surely be sufficient to do what is already done with other products, like many Spanish citrus

fruits on the French market, marked '*sans traitement après récolte*' ('not treated after harvesting'). A commercial segment thus already exists and it should be reproduced for banana.

### Jean Harzig

One can reasonably envisage the existence of an outlet for the product, but when? How much time do you think is needed for the remaining experimentation at the different levels of the chain to reach a mastered concept enabling regular supplies?

### François Dalle

Production conditions have already been fairly well validated. We have clear indications with regard to early bagging and flower removal in the field. However, all the work in the packing stations with regard to the washing water and transport conditions remains to be validated. But this also considerably depends on the environmental conditions. We do not have many problems during the dry season, but we shall have more difficulties when the critical period of the rainy season arrives. It is therefore very difficult to reply at the moment ■