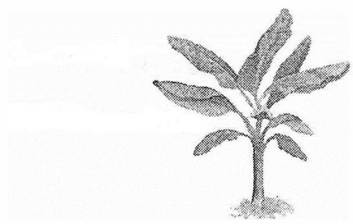
Banana and the rational agriculture concept



The technical development concepts widely disseminated in intensive banana growing are based on the perfecting of increasingly high-performance rational agriculture. The objective announced is clearly that of maintaining or improving yields while limiting pesticide and fertiliser inputs. Beyond the ordinary approach of wishing to justify each application of fertiliser or pesticide (reducing inputs by eliminating systematic application), CIRAD-FLHOR has developed agricultural diagnosis tools, technologies and cultural techniques that can be used at field or production area scale.

This set of facilities makes it possible to progress towards sustainable cropping systems and even sometimes to correct situations with seemingly inexorable falls in yield: solving soil exhaustion problems (physical problems and/or accumulation of soil pests), preventing or correcting acquisition of resistance of a pest to a pesticide and developing integrated or alternative control methods in the case of the limiting of the range of pesticides available.

The combining of these technologies is aimed at making progress in cropping systems that are varied because they rigorously match the environmental conditions (e.g. soil + climate and farm structures) in the context of a search for economic performance. The implementation of the cultural techniques and the associated control and diagnosis techniques should lead to savings in labour and inputs and/or gains in productivity compatible with the competitiveness objectives.

The scientific orientations aimed at improving cropping systems are such as to manage agricultural risks or may be in the precautionary principle category.

To give just one example of this, the creation of crop management sequences based on the use of healthy plant material in land cleansed by fallow or crop rotation is founded on the development of tissue culture plants, with the abandoning of the other techniques for obtaining healthy plant material: rebrotes, plants grown from buds, puddled suckers, etc.. The initial objectives of control of *Radopholus similis* and the solving of soil exhaustion problems caused by the accumulation of the pest, and the limiting of the use of nematicides, etc. are better attained. The technically difficult tissue culture plant option has made it possible to develop cropping systems in which the risk of introduction of new diseases or of the spread of existing diseases via plant material can be avoided. This concerns all viruses and soil pests and diseases—nematodes, fungi and bacteria—and combines laboratory and nursery technologies in each case, forming a quality chain.

In this context, the replies to the key questions of the banana profession concerning crop sustainability do not form a magic solution of just seeking a high-performance pesticide or even just the development of a resistant banana variety, but consist rather of a change in cropping systems with the improvement of complete crop management sequences, possibly including these innovations. Three out of a fair number of examples are shown here.

Panama disease

It has been shown that Panama disease is spread by the transfer of plant material or soil. The condemning of the intensive cultivation of Gros Michel, replaced by resistant Grande Naine, was the result of the intensive dissemination of FOC Race 1 (*Fusarium oxysporum* sp. *cubense*, the causal agent of Panama disease) during transfers of suckers or corms, the only material available for replanting at the time. In fact, susceptible varieties such as Petite Naine and Grande Naine are still grown in cultivation areas in which FOC race 4 is present, in the Canary Islands since 1931 for example. The spread of the disease is controlled by a temporary halting of use (fallow) of infested sites. Here, crop management sequences based on using tissue culture plants on land cleansed by fallow and whose economic competitiveness has been widely demonstrated can control the disease and hence stabilise production.

Sigatoka leaf streak diseases

The crop management sequence developed by CIRAD to control leaf streak diseases consists of a battery of complementary measures:

- elimination of necrotic areas of leaf laminae in the field (to control inoculum);
- spray decisions taken using a biological warning system. The growth rates of the plant and of the fungus are compared schematically;
- in some cases (for Yellow Sigatoka), the decision to spray is completed by a climatic warning

(periods favourable for the development of the fungus);

- alternating of pesticides to prevent enhancement of resistance in the fungus;
- regular monitoring (control of the effectiveness of the substances used to limit the use of the products to which resistance could appear until a return to normal susceptibility levels.

This system must be combined with rapid striking force performing high-quality spraying. Its effectiveness has been demonstrated for many years, even in zones with very high pest pressure. It has also made it possible to overcome critical situations of acquisition of resistance to triazoles. However, it is essential to apply it at the scale of the production area. Furthermore, its economic performance is achieved by a considerable decrease in the number of sprays, which might be contrary to the interests of the spraying companies. The system is therefore difficult to set up in established banana plantations but it is an essential step towards sustainability in this domain.

Improvement of bananas

The banana genetic base currently used in intensive production is very narrow. CIRAD has worked for many years on breeding conventional hybrids with a better response to the imperatives of sustainability within the context of present knowledge. The first generations of dessert and cooking banana hybrids are thus being validated at the moment. The most keenly sought-after resistance is to Sigatoka leaf spot diseases but we have succeeded in breeding resistance to several diseases.

This method gives polygenic resistance that is difficulty for pathogens to overcome. The varieties will be introduced in cropping systems specifically adapted to prevent the circumventing of resistance. These new varieties should give better economic competitiveness in terms of a response better suited to consumer expectations and segmentation of a market currently dominated by a single variety. In contrast, the genetic base of bananas for local consumption in the southern countries is fairly varied. Improvement of bananas is of prime importance. This research is well advanced but must be continued by the breeding of numerous hybrids for the varied requirements of users and sustainability and diseases resistance requirements. Making this innovative material available should be the occasion for improved phytosanitary security during transfers of plant material in the countries concerned.

Responses to the question of the sustainability of banana cultivation are complex. Few research centres have the capacity or the critical mass required to conduct these overall approaches that are nonetheless necessary. The funding awarded for research on banana is tiny in relation to its food and economic importance. Awareness of the sector and of development donors should be constant and intensified to stabilise this very important crop ■

The main banana groups and subgroups

Group	Subgroup	Cultivar	Fruit type	Distribution
AA				
	Sucrier	Pisang Mas, Frayssinette, Figue Sucrée	dessert-sweet	World-wide
		Pisang Lilin	dessert	Indonesia, Malaysia
		Pisang Berangan, Lakatan	dessert	Indonesia, Malaysia, Philippines
AAA				
	Cavendish	Lacatan, Poyo, Williams, Grande Naine, Petite Naine	dessert	World-wide, exporting countries
	Gros-Michel	Gros-Michel, Highgate, Cocos	dessert	World-wide
	Figue-Rose	Figue-Rose rose, Figue-Rose verte	dessert	World-wide
	Mutika Lujugira	Intuntu, Mujuba	beer - cooking	Central and E. Africa, Colombia
	Ibota	Yangambi km5	dessert	Indonesia, Africa
AB				
	Ney Poovan	Safet Velchi, Sukari	dessert - acidulous	India, East Africa
AAB				
	Figue-Pomme	Maçà, Silk	dessert - acidulous	World-wide
	Pome	Prata	dessert - acidulous	India, Malaysia, Australia, W. Africa, Brazil
	Mysore	Pisang Ceylan	dessert - acidulous	India
	Pisang Kelat	Pisang Kelat	dessert	India, Malaysia
	Pisang Rajah	Pisang Rajah Bulu	cooking	Malaysia, Indonesia
	Plantain	French, Horn, False Horn	cooking	Central and W. Africa, Latin Am., Caribbean
	Popoulou	Popoulou	cooking	Pacific
	Laknao	Laknao	cooking	Philippines
	Pisang Nangka	Pisang Nangka	cooking	Malaysia
ABB				
	Bluggoe	Bluggoe, Matavia, Poteau, Cacambou	cooking	World-wide
	Pelipita	Pelipita	cooking	Philippines, Latin America
	Pisang Awak	Fougamou	dessert	India, Thailand, Philippines, E. Africa
	Peyan		cooking	Philippines, Thailand
	Saba	Saba	cooking	Philippines, Indonesia, Malaysia

Source: Cirad