

International breeding.

K. SHEPHERD

INTRODUCTION

The most significant disclosure at the current ACORBAT meeting must be the decision of the United Brands Company to withdraw its financial support for banana breeding, coming only a decade after the financial paralysis of the Jamaican programme, this policy change can only have disastrous consequences for the long term future of the export banana trade, unless immediate steps can be taken to safeguard the continuation of this field of research.

In this respect, scientists of both programmes have repeatedly pointed out the vulnerability of the monoculture of bananas of the Cavendish sub-group with an inevitably narrow genetic base. The last decade has given more dramatic warnings with the spread of Sigatoka negra in Latin America, also with the evident evolution of at least one new race of Panama disease, to which Cavendish bananas are susceptible. The matter needs the most urgent action.

No one should rush to seek re-assurance in the new programme starting in Brazil. As it has been made clear at this congress, the new programme does not have as a priority, the breeding of export bananas from the Gros Michel Subgroup. More over, this programme at present lacks advanced diploid germplasm.

In my opinion, long held, the only logical step in this area will be the internationalization of banana breeding, a view which has been gaining increasingly wide acceptance. It is regrettable that an earlier attempt at this, at a meeting in Jamaica, in 1977 (from memory, date to be verified) has not been confirmed after what had seemed to be virtual agreement between most of the major producers of this hemisphere.

What follows is a statement of personal opinion and ideas and is quite hastily composed this morning. Any errors or omissions must be excused, and can surely be compensated by further discussion and agreement.

THE PROCESSES OF BANANA BREEDING

There are two essential phases in banana breeding, and at least one other that is possible but on which we have yet insufficient knowledge. These are the following :

1. The hybridization of diploid germplasm and selection of improved types with good genetic combinations of fruit characteristics and disease resistances ;
2. The production and evaluation of tetraploid hybrids ;
3. Possibly, the production and evaluation of triploid hybrids from crosses of tetraploids with diploids ;
4. Possibly also, the synthesis and evaluation of triploids from crosses of diploids with diploids.

SIZE OF OPERATION

Between the two experienced programmes there has evolved enough knowledge of the mechanics and problems, of phases 1 and 2, to indicate that positive results should now well be correlated with the numbers of hybrids produced and evaluated. The upper limit will be determined only by the availability of competent staff and facilities for the production and the evaluation of plants and for the processing of data.

It is also my experience that a breeding programme even of smaller scale develops its own momentum, such that personnel need to run to keep up with it.

FACILITIES NEEDED

A) An area of about 3 ha for the production and evaluation, in two stages, of hybrid diploid germplasm.

B) An area or areas of up to 5 ha for the pollination of standard triploid parents, to field up to 2,000 tetraploids per year.

C) An embryo culture laboratory is needed with a capacity to handle 1,000 seeds per month, plus at least 300 m² of glasshouse space and 1,000 m² of covered and open floor for the growing and hardening of plants.

D) An area of up to 5 ha for the first evaluation of tetraploid hybrids in the seedling cycle and for a first cycle clonal evaluation of selected plants. This preliminary evaluation includes selection for bunch form, vigour resistance to *Mycosphaerella* and if possible resistance to race one of Panama disease, and it should be done in one central location.

E) Separate areas each of least 1 ha for the determination of resistance to each race of Panama disease: the inoculum potential has to be at a level to destroy all very susceptible plants in four months from planting and such a facility was in place in Jamaica.

F) Areas of indefinite size, which may be dispersed through the participating producer countries, for the evaluation of agronomic and post-harvest behaviour of the tetraploids: storage and ripening chambers are essential.

G) An area to detect resistance to Moko disease would be desirable.

H) Associated with or separate from C, there is needed a meristem culture facility to process up to 1,000 meristems at any one time: this will serve the dual purposes of proliferation and distribution of stocks.

LOCATION OF THE CENTRAL STATION

Despite an earlier proposal that Jamaica might suit the requirements it is now thought obligatory that the preliminary screening of hybrid materials should be in an area where Sigatoka negra is already prevalent.

In the choice of a site for the centre, national considerations ought to be forgotten. To avoid these, it is suggested that the facilities and possible cooperation of CATIE in Costa Rica should be investigated. Of these the writer has no personal knowledge.

STAFFING

The basic professional staff would include at least one plant breeder for each phase, of which phases 1 and 2 should utilise the only two experienced banana breeders now operating. There would also be a pathologist, an agronomist and a fruit physiologist, the two last as soon as the out-turn of selected hybrids should justify them, with

again the past-time availability of a tissue and cell culture physiologist. In addition there would be perhaps 10 assistants at a technical level in the fields, glasshouses and laboratories.

CONTROL OF THE PROGRAMME

The technical control of the entire programme would be the responsibility of the Director, who would be one of the plant breeders, in consultation with his professional staff. The Director could be in turn responsible to and report regularly to a research committee nominated for the special purposes, and with the full powers, of determining the general policies of the programme and the expenditure of its funds.

Where any aspect of the programme is conducted a way from the centre, whether or not by reason of special facilities available, any such sub-centre would have a duty to submit its data and conclusions to the centre for integration in the total perspective.

An example of such a sub-centre might be Jamaica, with its facility for the study of resistance to Panama disease. Others might be Bahia and Ecuador for the production of tetraploid seeds, Bahia again for the first evaluation of hybrids of plantains and sweet AAB cultivars.

I would be understood that all and any banana germplasm, now existing or yet to be produced, would be automatically available to the centre and for distribution at the discretion of the research committee, without interference from governments or producer groups.

FUNDING OF THE PROGRAMME

First of all we are not proposing a project: we are founding possibly a permanent institution and at least one of 20 years duration belonging to producers. In the writer's view a search for funding from existing international bodies is naive in such a long term.

Against this the total production of bananas of all kinds in the tropical and subtropical regions of the western hemisphere is certainly in excess of 10⁶ tonnes/year. A funding equivalent to 50 cts of US \$ per tonne might fund a well-staffed and equipped programme and is scarcely to be compared with the actual cost of disease control. It is probable that other banana producing countries in Africa and Asia would be willing to contribute, especially if the total approach is a multi-cultivar one. In this respect, phase 1 of breeding is broadly common to all breeding objectives and all types of cultivar.

In Jamaica a scale of contribution was suggested related to the square root of national production.