

## **Banana R&D in Malaysia: Updates and highlights**

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### **Introduction**

Banana remains the second most important fruit crop (after durian) in Malaysia, amounting to about 15% of the total acreage under fruits. Traditionally, it is planted as a cash crop or temporarily intercropped with oil palm, rubber and other perennial crops. There are only a few large banana plantations in Malaysia. The popular dessert cultivars are Pisang Mas, P. Berangan, P. Rastali, P. Embun and Cavendish; while the popular cooking cultivars are P. Nangka, P. Raja, P. Awak, P. Abu and P. Tanduk (plantain).

Most of the bananas produced were consumed locally and about 10% are exported, mainly to Singapore, Brunei, Hong Kong and the Middle East.

### **Production constraints**

Banana production by smallholders involving small farm sizes are not well organized and with low inputs and poor quality planting materials, thus resulting to lower yield and fruit quality. The large-scale growers uses better quality planting materials (disease-free tissue-cultured plantlets) and higher inputs; and adopt more modern technologies, good agricultural practices and better pest and disease management, thus, higher yield and better quality fruits.

Diseases are the most important and major constraint to the production of bananas, resulting to loss of yield and areas rendered unsuitable for production. The most devastating disease is fusarium wilt caused by *Fusarium oxysporum* f.sp. *cubense*. Most of the common cultivars are susceptible to the disease. Foliar diseases are also important in reducing the potential yield.

### **Research and development activities in Malaysia**

In order to address the various constraints on the production of bananas, several R&D activities were conducted to help the industry, including collaborations with INIBAP-BAPNET. Some of the activities

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are listed below:

### **National Banana Repository Centre**

The Malaysian Agricultural Research and Development Institute (MARDI) had signed the LOA on the Material Transfer Agreement with INIBAP, on September 2002. Under this agreement, planting materials from 25 types/variety of selected banana has been handed over to MARDI (Table 1). These materials are also closely related to the IMTP-3 trials being conducted. Any requests by any research institutions and universities will be entertained upon signing of MTA. Some of these materials will be multiplied *in vitro* and will be evaluated and compared with other local cultivars. Any material showing economic potential will be introduced to the farmers.

**Table 1.** Planting materials from 25 types/variety of selected bananas from INIBAP.

Varieties	Date of Subculture	Varieties	Date of Subculture
Calcutta 4	23/1/03	FHIA-25	27/1/03
P. Jari Buaya	27/1/03	TMB2x 9128-3	20/9/02
Lidi	7/2/03	P. Ceylan	28/9/02
Williams (B, ST)	13/8/02	AA cv Rose	25/1/03
P. Berlin	23/8/02	Gran Enano	11/9/02
Cachaco	6/1/03	Yangambi Km 5	4/10/02
TMP2x 1297-3	27/1/03	Gros Michel	14/1/03
GCTCV-119	22/1/03	GCTCV-215	16/9/02
TMBx 5295-1	23/9/02	TMBx 1378	14/1/03
SH 3640	31/12/02	GCTCV-247	6/2/03
PV 42-53	7/2/03	GCTCV-106	6/2/03
FHIA-21 (#68)	13/12/02	FHIA-18 (KUL)	23/1/03
CRBP 39	31/10/02		

### **Status of IMTP-III trials**

All materials sent by INIBAP are being multiplied *in vitro* and these will be evaluated in 5 sites:

- 1) MARDI, Serdang, Selangor
- 2) MARDI, Kluang, Johor
- 3) United Plantations, Perak
- 4) Synergy Farm, Penang
- 5) EPA Farm, Johor

Planting on the first test site will be carried out by September/October 2003, to be followed by United Plantation, while the rest will be carried out by mid-2004. The Material Transfer Agreement (MTA) will be signed accordingly by United Plantations, Synergy Farms and EPA Farm when the materials are transferred to their respective farms as agreed by INIBAP.

### **Status of Musa germplasm management**

The banana germplasm collection at MARDI has about 200 banana accessions. However, more than 50% are duplicates or triple entries due to synonymy. The main banana groups are as summarized below:

**Table 2.** Banana germplasm collection at MARDI.

<b>Banana group</b>	<b>No. of accessions/species</b>
Ornamental Banana	6
AA Group (seeded)	7
AA Group (edible)	16
AAA Group	16
AAB Group	12
AABB Group	3
AABBB Group	2
BB Group	1

These accessions were collected mainly from Peninsular Malaysia with several introductions from the neighbouring countries of Thailand, Philippines and Indonesia. About 80% of the accessions from the local collection have been characterized and documented using the recommended IBPGR Descriptors for Banana (1986). The germplasm collection is under the care of Dr Siti Hawa Jamaluddin. In collaboration with the regional curators, efforts at identifying the synonyms of the banana cultivars in the region have been carried out. Nevertheless, banana collection is an on-going and continuous exercise. The banana collection located at MARDI is made available to other research institutions, universities and private sectors, to assist and support them in their respective areas of research.

### **Trials of germplasm materials**

- Bananas hybrids and somaclones' performance and reaction to fusarium wilt (Jamaluddin 2002).

The evaluation was carried out on 8 hybrids and somaclones (FHIA-01, FHIA-03, FHIA-17, FHIA-23, PV-03.44, PA03-22, GCTCV-119 and GCTCV-215), which were obtained through INIBAP, and compared with local clones (Pisang Mas, P. Berangan and P. Nangka), as well as the reference clones for fusarium wilt (Gros Michel, Bluggoe, Williams, Cv Rose and P. Jari Buaya). Gros Michel, P. Mas and P. Berangan were completely wiped out by 15 months. For P. Jari Buaya and Cv Rose, the resistant checks showed that they remain resistant. The FHIA hybrids showed resistance with 5-20% infection and high yield, except for FHIA-17, which is susceptible to fusarium wilt. The somaclones (GCTCV-119 and

GCTCV-215) showed good tolerance to fusarium wilt but poor vigour and yield.

- Performance of FHIA-02, FHIA-03 and Novaria under different growth conditions

The performance of these banana cultivars was evaluated in two locations, Serdang Station and Kluang Station. FHIA-23 produced high yield in Serdang compared to Kluang. However, the yield of FHIA-02 and Novaria were better in Kluang.

### **Mutation breeding**

Mutation breeding has become another approach towards banana improvement. Chemical mutagens and physical mutagen have been used to generate variations. Induction of variants using gamma rays at various dosages has been attempted on P. Rastali, Cavendish and P. Berangan. Variants from P. Rastali have showed good tolerance to fusarium wilt but has poor agronomic traits. Variants from Cavendish have showed good agronomic traits (good yield, earliness to shooting, short stature) but showed no increased tolerance to fusarium wilt. Attempts to improve P. Berangan have not produced any potential variants.

### **Somaclonal variation**

Somaclonal variation is another useful and potential approach towards banana improvement. This is a term referring to the genetic variability generated from tissue-cultured materials. Producers of tissue-cultured plantlets are normally concerned about these variants. But the Taiwan Banana Research Institute had used somaclonal variation to their advantage in selecting superior clones with good agronomic traits and more importantly, with resistance to fusarium wilt. With the success in Taiwan, Malaysian researchers are also attempting this approach. The somaclonal variants were selected from *Fusarium* 'hot spots'. Variants were also developed from meristem cultures. These plants are now being screened at the nursery stage using the double tray method. RAPD analysis was also being carried out using random primers, which have been selected to be potential markers for fusarium wilt resistance.

### **Biotechnological research**

Applications of biotechnological methods are gaining momentum in banana research. The use of random fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD), polymerase

chain reaction (PCR) and other method have been used to determine or evaluate genetic diversity or genetic relationship. Long primer random amplified polymorphic DNA (LP-RAPD) analysis was carried out to evaluate the genetic relationship of several fresh-eating and cooking varieties from various locations.

As fusarium wilt is the biggest threat in the banana industry, most of the biotechnological researches are concentrated towards developing resistance to fusarium wilt. Some of the research topics are as follows:

- Identification of resistant genes from the wild banana species
- Transformation of resistant genes
- Development of regenerable cell suspension as target tissues for transformation
- Whole genome analysis, marker studies and gene isolation studies

### Biological control of fusarium wilt

Another attempt towards the management of fusarium wilt of banana is to look for antagonists. Initial search for potential bio-control agents have identified *Actinomyces* sp., which showed *in vitro* inhibition of *Fusarium* and has great potential for *in vivo* controls. Another bio-control agent showing good potential has been identified as *Bacillus sphaerius*, which has showed complete inhibition of *Foc in vitro*. These bio-control agents required further tests in potted or field experiments.

### Seminar/Training programmes

- The 3<sup>rd</sup> National Banana Seminar entitled: 'Positioning the Malaysian Banana Industry for the 21<sup>st</sup> Century' was held in Avillion Village Resort, Port Dickson, Negeri Sembilan, Malaysia on 29-30 August 2002. This event was attended by about 100 participants mainly researchers, agriculturists and those involved in the banana industry.
- Tissue culture training course held in Taiwan. One participant of the training course was from Malaysia.
- Banana virus indexing course, Taiwan. A scientist from Malaysia had also participated in this virus indexing course.
- MGIS Workshop. This workshop will be conducted in MARDI, Malaysia from 8-12 December 2003.
- International Congress of Banana. Malaysia will be hosting an International Congress of *Musa*: Towards a Sustainable Production which will be held on 6-9 July 2004 in Penang, Malaysia. This will be the first congress that will address various aspects of banana.