conducted in different production areas indicate that 'FHIA-01-V1' has a high production potential due to its high number of hands, similar to FHIA-03 which produced between 10 and 11 hands with very thick fingers and good filling. A similar situation was observed in FHIA-18 which produced more hands and a higher average bunch weight in the second cycle.

In the commercial production areas of the Guantanamo Province, it has been possible to obtain up to 99 kg bunches from 'FHIA-01-V1' and 84.5 kg bunches from FHIA-03. The latter was produced in 'La Maravilla' Farm on saline recovered soils, which still have more than 2,000 ppm salts.

During the first evaluation year, several taste tests were conducted in a number of areas of the country, giving the following qualitative results regarding fresh consumption. In order of preference, the first place was awarded to FHIA-02 and FHIA-18 followed by 'FHIA-01-V1' and FHIA-03 and the last choice was SH-3436. Regarding cooked bananas (green), FHIA-03 was compared to 'Burro CEMSA' and most people agreed that FHIA-03 was superior due to its softness, consistency and flavour.

Two years after these preliminary evaluations were conducted, and as production and sales increase in the local and tourism markets, the preferences shown by producers and consumers about a particular hybrid are notable. For example, 'FHIA-01-V1' is increasingly preferred over Cavendish bananas, not only because of its black Sigatoka resistance, high yields and excellent vigour, but also due to its attractive yellow colour (natural ripening), its flavour and consistency.

[2] patacon : piece of banana flattened and then fried.

One result of the introduction of these hybrids is the reduction in chemical applications used to control black Sigatoka, which represented for Cuba a cost of US$500/ha. This has occurred mainly in the areas where hybrids have replaced Cavendish types, and this is expected to reach 3,000 ha during 1998. FHIA hybrids have also become an alternative for plantain areas where FHIA-03 now covers 4,000 ha. The current plans are to introduce FHIA hybrids to all areas in which it is not profitable to cultivate banana and plantain due to the damage caused by black Sigatoka. By the end of 1998, it is expected to double the area currently planted with FHIA hybrids, which is presently approximately 5,600 ha. ■

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**Proposal for *Musa* distribution system**

# A delivery system of improved banana and plantain propagules

*Rodomiro Ortiz*

INIBAP has made available improved plantains and bananas which have past through phytosanitary testing. These bred hybrids are available for worldwide distribution and further testing by National Agricultural Research and Extension Systems (NARES) of *Musa* producing countries. NARES are keen to evaluate this material for selection and potential cultivar release. New cultivars, either hybrids or exotic landraces for *Musa*, should be admitted to a national propagule multiplication scheme only after official trials (multilocational, advanced and on-farm testing) have shown them to be valuable for cultivation and use, and to have distinguishing characteristics (Fenwick Kelly 1988).

Rapid multiplication of *Musa* planting materials by national programmes will require a farming delivery system for plantain and banana. For example, Gatsby Charitable Foundation (UK) supports such germplasm dissemination activity in Ghana and Uganda with the technical backstopping of the International Institute of Tropical Agriculture (IITA) (Quin *et al.* 1997).

Certified seed production schemes are common in sexually propagated crops (Poehlman & Sleper 1995). This scheme consists of **pre-basic seed** from a specific selection cycle, **basic seed** for multiplication in the breeding station or **breeder's seed**, **foundation seed** and **registered seed** in the multiplication center, and **certified seed** in farmers' multiplication plots. We must adapt the seed production terminology for improved propagules of a vegetatively propagated crop such as *Musa* (Table 1).

The *Musa* "seed" production systems starts when the indexed stock is received from a Germplasm Transit Center. The selections of improved germplasm have been done after preliminary testing by the breeding programme (e.g. IITA). Indexed stock in the tissue culture laboratory are called **pre-basic propagules**, while those sucker propagules in the field nursery (e.g. a small orchard) are named **basic propagules**. This dual system is required to minimize the risk of losing the true-to-type after micropropagation. This is very important in the breeding programme but also should be considered in the multiplication scheme by NARES, which may obtain their indexed propagules via INIBAP or another authorized germplasm center. *In vitro* and sucker propagules must be indexed for all known viruses with recommended protocols (Diekmann and Putter 1996).

It would be required that breeding programme provides detailed description of improved germplasm to monitor its growth during the multiplication of the basic seed by NARES. Such descriptors are those recently listed in the publication *Descriptors for Banana* (IPGRI/INIBAP/CIRAD 1997), or at least those characteristics commonly used in *Musa* germplasm registration papers in *HortScience*. Also molecular markers such as simple sequence length polymorphism (SSLP) or random arbitrary polymorphic DNA (RAPD) could be useful for germplasm characterization but this will depend on NARES capability.

**Table 1.** Proposed *Musa* propagule multiplication scheme.

| Step | Type | Name | Grow in |
|---|---|---|---|
| I | *in vitro* | pre-basic | tissue culture laboratory |
| II | sucker | basic | orchard or field nursery |
| III | sucker | foundation | NARES multiplication plots |
| IV | sucker | registered | NARES descentralized multiplication centers |
| V | sucker | certified | propagation plots in public or private farms |

Indexed sucker propagules (also known as **foundation propagules**) are the planting materials in NARES multiplication plots which are grown in isolated clean fields. Foundation propagules are the source of planting materials for plots of indexed and clean sucker propagules (or **registered propagules**) in decentralized NARES multiplication centers. Registered propagules are grown in fields with easy access to farmers. These registered propagules are the source of planting materials for certified propagation plots in public or farmers' fields.

Propagation plots from registered propagules are checked by NARES seed inspectors. These fields are used for the sole purpose of propagation of registered stocks. Inspectors will verify the true-to-type (i.e., assessment of cultivar purity) and the sanitary status (i.e., health quality) of mother plants to be used for sucker propagation. Multiplication techniques such as false decapitation, split-corm, and bit-corm are recommended for rapid field propagation. Inspectors must check the physical and health quality (i.e., clean planting material) of the propagules to be distributed to other farmers from this public or private field. After a satisfactory inspection the suckers are regarded as **certified propagules**. Also, where further generations of certified stocks are to be grown, checking of mother plants and sucker propagules should be mandatory. An official tag, supplied by the multiplication-certifying agency, could be shown in sign boards in the public or private distribution center. This tag shows that the suckers being produced meet the required standards for the crop and the approved regulations for planting materials of *Musa.*

The production, conditioning, and marketing of certified suckers is exclusive responsibility of the public or private grower, as occur with true seed propagated crops (Poehlman and Sleper 1995). However, the propagule certifying agency must verify that farmers follow the approved regulations outlined by the national authority and that the *Musa* suckers meet the required standards for certification.

Any off-type or unhealthy plant must be rogued. However, there should be a maximum of such plants to be eliminated before the whole field is rejected for sucker distribution. Hence, the process of certification by NARES inspectors requires that thresholds for off-types as well as unhealthy plants to be accepted in farmers propagation plots are established. However, this will depend on the genotype and on the disease and pest. For example the rates of somaclonal variation after micropropagation differs between and within *Musa* groups (Vuylsteke 1989). Also virus spread varies and depends on virus systemicity and its vectors. For example, field spread of Banana streak virus (BSV) by its mealybug vectors appears to be minimal in *Musa* (G. Dahal, IITA, pers. comm.). Nevertheless, BSV should be carefully monitored on planting material. Similarly, eradication of Banana bunchy top virus from production areas rely on the assumptiom that the virus is present only in *Musa*, that symptomless strains of the virus do not exist, and that the virus has only a limited latent or 'dormant' phase of infection (Thomas *et al.* 1996). Therefore, the above factors should be considered to determine the acceptable threshold for specific viruses in *Musa.* Tissue culturists and virologists may have the answers to determine the thresholds for offtypes and virus incidence in *Musa* multiplication fields. ■

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**Helpful hints for researchers**

# A simple and convenient one person banana harvesting data collecting system


*Jeff Daniells*


A new bunch weighing system for agronomic field trials has been in operation at South Johnstone Research Station for the past 12 months. A tripod used for many years was slightly modified (new feet plus t-bar for utility tailgate attachment) and 3 'slots' for attachment to the utility were fabricated. The new system has been found to be particularly convenient and time-saving. Other banana researchers may find the system useful in their trials.

### System features

The pseudostem on bunches to be harvested is cut and the bunch lowered

***1.*** *Forward tripod legs are pivoted near rear wheel wells.*