

Banana Research and Development in the Pacific Status Report 2002 INIBAP/ BAPNET

Tom Osborn, Agriculture Adviser
Secretariat of the Pacific Community
Suva, Fiji

Banana Industry Status

Bananas rank as one of the most widely grown and consumed crops in the Pacific. They are produced in all of the ecologies of the Pacific Island countries, from the large volcanic islands to the small coral atoll countries. Bananas are significant for the nutrition of Pacific Islanders as green cooking bananas, semi ripe cooking bananas, ripe cooking bananas, desert bananas and mixed with other foods. Bananas are grown for household consumption and on small commercial farms for the local markets. There is also deep cultural significance associated with bananas for traditional rituals in many countries. Bananas are used for medicine, fiber, leaves for cooking, and livestock feed.

There is a wide diversity of banana lines in the Pacific. Papua Guinea, Solomon Islands and Vanuatu have the greatest diversity. The regional diversity includes AA diploids, the very popular AAA Cavendish types, and the AAB cooking plantains. The Fe'i group of bananas- in the *Australimusa* section rather than the *Eumusa* section of the genus - is unique to the Pacific. Most of the Fe'i bananas have erect bunches and purple sap. For example the *karat* variety of Fe'i bananas of Pohnpei in the Federated States of Micronesia has short plump fruits with orange flesh that require cooking. They are very high in beta-carotene, the vitamin A precursor, and have been used as a weaning food. Unfortunately, the Fe'i bananas are rapidly disappearing in the Pacific.

FAO production data indicated production of 53,402 tons in 2001 on 9155 hectares, suggesting an average production of 5 tons per hectare for the Pacific excluding Papua New Guinea (see annex 1). Additional information from the agriculture census of Samoa, and reports from other countries, suggests that the FAO figures under-estimate banana production in the Pacific.

- Estimates from New Caledonia indicate yields of 20-40T/H for desert bananas and 9-12T/H for cooking bananas
- Agriculture census data from Samoa indicates 10,000 equivalent acres of banana production and consumption of 3 bunches per family per week (mostly as cooked green bananas)

Despite their nutritional importance, bananas are not a priority crop for national agricultural research and extension programmes in most Pacific islands countries because it is currently not an important cash crop. As a result, funding for banana research and development is limited.

Production Constraints

There are a variety of constraints to banana production in the Pacific Island countries. Normally bananas are part of the traditional multicropping system of the Pacific Islands that can include some or all of the following crops: coconuts, taro, sweet potatoes, kava, yams, cassava, cacao, breadfruit and many other crops. There are also small monocrop plantations of bananas in some countries.

Pests & Diseases

- Black leaf streak (*Mycosphaerella fijiensis*) is probably the most destructive pathogen of bananas in the Pacific. Farmers seldom spray for this disease and therefore there is a substantial reduction in yield.
- Banana Bunchy top virus is widespread, creating problems for producers where it is spread by the banana aphid (*Pentalonia nigronervosa*). Recently, New Caledonia conducted a campaign to eradicate BBTV and so far 200,000 plants have been destroyed. However, it very difficult to succeed in such an endeavor when bananas are so widely grown in traditional systems.
- Nematodes are destructive in many locations.
- Banana weevils (*Cosmopolites sordidus*) cause damage in some countries.
- Banana Scab moth (*Nacoleia octasema*) is widespread and results in low quality bananas and reduced yields in some cases.

Environmental stresses

- Cyclones and high wind are damaging to bananas, particularly the taller varieties.
- Drought, particularly on atolls, greatly reduces banana production.
- Salt spray on small islands damages bananas.
- Poor soil fertility reduces yield, fruit size and quality. Fertilizer is seldom used on banana, however the tradition is to use animal manure and organic matter.

Markets

Bananas were a major exporter earner for the Pacific Islands until the 1970s with exports going to New Zealand and other developed country markets. However, the large transnational banana producers then captured these markets based on price and quality, so the Pacific countries' profitable export markets quickly disappeared. There are still a few small banana exporters in the region, based on niche exports such as organic banana. The major constraint to banana production is thus a lack of an export market to absorb higher levels of production. The result is that farmers are limited to the small local market or producing from home consumption. They lack the incentive to

invest in increased production and improving the quality of bananas. This also means that NARES do not target bananas as a priority crop for research and extension.

Current Banana Research and Development

SPC Regional Germplasm Centre

The SPC Regional Germplasm Centre distributes accessions of bananas, taro, yams, sweet potatoes, and other vegetatively propagated crops to the 22 SPC member countries and territories. INIBAP has provided FHIA lines and modest funding for the multiplication and distribution of new banana lines in the region. FHIA 1, 2, 3, 17, 18, 23 and 25 have been distributed to American Samoa, Cook Islands, Federated States of Micronesia, Marshall Islands, New Caledonia, Palau, Samoa, Solomon Islands, Tonga, and Wallis and Futuna. Distribution of thousands of accessions of the FHIA lines has been completed and distribution is continuing. Reports indicate interest in the material, but in most cases the new lines have not reached farmers' fields yet.

- Recent results from New Caledonia indicate FHIA 17, 18, and 23 had excellent BLS resistance but grew very slowly during and after the cool dry season. Earlier results of organoleptic testing indicate that FHIA 1 is acceptable as a dessert banana and FHIA 2 is acceptable as a cooking banana. These lines are being distributed to farmers for testing.
- In the Federated States of Micronesia the FHIA trials being conducted by the community college indicate the resistance to BLS is excellent but organoleptic tests have not been conducted yet.
- American Samoa reported that FHIA 25 produces well and is resistant to BLS, but Samoans prefer a cooking banana with a harder texture. Suckers are being distributed to farmers for further testing.
- FHIA 1 has been distributed in Samoa for many years. An INIBAP funded survey in Samoa through the University of the South Pacific indicates acceptance of FHIA 1.
- In Wallis and Futuna the FHIA lines are being distributed to farmers.

There have been problems with confusion over the identification of the 7 FHIA lines. What is needed is a guide to the identification and characteristics of the lines. We hope that this will be available soon.

New Caledonia Since 1990, the Pocquereux Fruit Research Station of the Institute of New Caledonian Agriculture (with links to CIRAD) has had a banana research programme to control BLS through chemical methods, selection of BLS tolerant banana cultivars, and epidemiological studies to better understand the interaction between the pathogen, the plant and the climate. These efforts are linked with extension efforts with both subsistence and commercial banana producers. Pocquereux also participates in the Musa Germplasm Information System (MGIS). The station is one of the BLS evaluation sites for the Banana Improvement Project (BIP), which evaluates 80 different cultivars with the aim of selecting diploids as parents for breeding programmes. This is our leading center of banana research in the region.

ACIAR/QDPI Banana Improvement Project

This project conducted important banana research in the Pacific from 1987-1996, with collaborating Ministries of Agriculture in the Cook Islands, Samoa and Tonga. Trials were conducted to screen improved banana lines for pest and disease resistance as well as to better understand these pests. Training, support and technical advice were provided in banana research and tissue culture. It is important to note that QDPI and other Australian banana researchers are an important source of technical assistance for the Pacific Islands on banana-related problems.

Future Directions for Bananas in the Pacific with INIBAP

Multiplication and Distribution of improved banana lines

The SPC Regional Germplasm Centre will continue to multiply and distribute improved banana lines to the Pacific countries. At the present, this includes mostly the FHIA lines, but we hope that other new lines with characteristics that are appropriate for the Pacific will be coming from INIBAP.

- We hope that there will be a publication of a FHIA identification guide through INIBAP

Diversity analysis for banana: The action plan developed in September 2001 for the newly established Pacific Agricultural Plant Genetic Resources Network (PAPGREN) included mention of the need for diversity analysis of bananas. This would be carried out in close collaboration with IPGRI/INIBAP, using a variety of tools and information sources. The newer techniques will complement the more traditional indicators of diversity, such as morpho-agronomic and ethno botanical studies. As a result of this study several activities could be developed.

Targeted collecting, e.g.

- AAB cooking bananas with resistance to BLS.
- Identification of resistance to BBTV
- Dwarf plantains AAB for breeding
- Fe'i bananas

Nutritional studies for the Fe'i bananas: Importation research has been conducted in the Federated States of Micronesia led by the nutritionist Lois Englberger (see annex 2 and references). Additional work needs to be undertaken to understand the nutritional analysis in relation to the diversity. In this way this unique variety can be conserved and utilized to improve the nutritional status in areas with Vitamin A deficiency and other related nutritional problems.

Development of a regional collection for Pacific Bananas

The result of the diversity studies and targeted collection could result in a valuable collection of bananas for multiplication and distribution to the Pacific Island countries and territories. This would be an important output for PAPGREN and the Regional Germplasm Centre of SPC.

On farm conservation

There was useful input from INIBAP to the recent workshop on on-farm conservation in the Pacific, highlighting PNG, Fe'i bananas and Pacific plantains in New Caledonia as priorities for action. As PAPGREN develops plans for in situ conservation (both on-farm and in protected areas) in the region, bananas will no doubt feature prominently.

Niche Banana Exports

Attention needs to be given to exploring the banana exports for niche markets of fresh or processed banana products. Despite the constraints there is potential in this area based on some of the unique bananas of the Pacific and the demand for these products by Pacific Islanders and others.

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Annex 1

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	Area (Ha)	Production (Mt)	Yield (Hg/Ha)
PNG	50000	710000	142000
Rest of Region	9155	53402	61048
Total	59155	763402	66445

Annex 2

Banana Research in the Federated States of Micronesia (FSM)

Health research relating to banana has been conducted by the nutritionist Lois Englberger in Kosrae and Pohnpei, two of the four states of the Federated States of Micronesia (FSM). The overall aim of her research related to identification of foods which might contribute to vitamin A status, as vitamin A deficiency has been identified as a serious health problem in the country, both among children and women, affecting not only eye health and vision but increased morbidity and mortality. Her work on banana has included:

- An analysis for provitamin A and other carotenoids and selected minerals;
- An ethnographic study providing insight into the factors affecting production, acquisition, consumption, and acceptability of the different cultivars;
- A dietary study, which showed how banana, fits into the present daily diet.

Provitamin A carotenoids, most importantly beta-carotene, contribute to vitamin A status and protection against vitamin A deficiency. Epidemiological evidence indicates that consumption of carotenoids (including those which have no vitamin A activity) decreases risk to certain chronic diseases, such as cancer, heart disease, and diabetes, which have also become serious health problems in FSM. Yellow and orange coloration of the edible flesh was used for selecting those cultivars for analysis which might have the most potential for health benefits, based on the fact that carotenoids often may be identified by those color traits. Some common cultivars without yellow or orange coloration were analysed for purposes of comparison. Increased coloration was found to closely match with increased carotenoid content, with five distinct colors identified in the cultivars, white, creamy, yellow, yellow-orange, and orange.

In all, seventeen banana cultivars from Kosrae and Pohnpei were analysed and characterised. Among these, two, the *karat* and *uht en yap*, were Fe'i cultivars. There was a great range of carotenoid content, from 30 to 6360 ug/100 edible portion. The *karat* banana cultivar was found to contain over 25 times the beta-carotene content of the common Cavendish, and the *uht en yap* cultivar was found to contain 250 times the beta-carotene content of the common Cavendish. Thirteen Micronesian cultivars were identified which would provide the total or up to half of the estimated daily requirements for vitamin A, within normal eating patterns.

It was concluded that certain cultivars of banana have particular potential in FSM for providing important health benefits and decreasing risk to vitamin A deficiency and chronic diseases. On that basis, it was concluded that these cultivars should be promoted for family consumption, and possible commercialization. Lack of planting material is a major limitation at present. A study of Chuuk and Yap cultivars has not yet been carried out. It is suggested that nutritional projects, in conjunction with agricultural agencies, would have great benefit for both the health and agriculture sectors in FSM. It is also suggested that certain banana cultivars elsewhere may be identified for promotion and increased health and enjoyment.