

Consumer Preference for Three Selected *Musa* Hybrids in Ghana

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Abstract: An agronomic study was conducted to evaluate three *Musa* hybrids (BITA-3, a cooking banana, FHIA-21 and CRBP-39 both hybrid plantains) with 500 farmers in the two Assin districts in the Central region of Ghana. At harvest sensory evaluation was carried out on the three hybrids to access their acceptability at four locations in the two districts. The study was conducted to assess the consumer acceptability of the hybrids for use as *fufu*, *ampesi* and fried ripe plantain. A total of 360 untrained taste panelists from four communities (Assin Foso, Adiembra, Bremang and Amoanin) all in the two Assin districts of the Central region of Ghana comprising both males and females were used in the study. At each location, panelists were presented with two coded samples (A and B) of *fufu*, *ampesi* and fried plantain comprising of Apantu (for *fufu* and fried plantain), Apem (for *ampesi*) and *Musa* hybrids (FHIA-21, BITA-3 and CRBP-39). Assessors were asked to compare the two coded samples on the bases of texture, taste, colour and overall acceptability, using the hedonic descriptive scale of 1-5. The results indicated that there were no significant differences ($p < 0.01$) between FHIA-21 and CRBP-39 and the local Apantu across the location, across the parameters and the recipes assessed. FHIA-21 and CRBP-39 were the most preferred and compared favourably with the local triploids (Apantu and Apem) with BITA-3 the least preferred. The hybrids were accepted for ripe fried at stages 3 and 4 of ripening. Beyond these stages of ripening, the hybrids could only be used for other processed food recipes. Some panelists who claimed to be diabetic indicated their preference for the hybrids especially BITA-3 as their glucose level was normal after eating meals made from the hybrids. The results showed that the food habits of the people are important in the introduction of new hybrids.

Key words: Plantain, hybrid, cooking banana, sensory evaluation

INTRODUCTION

As starchy foods, plantains and bananas (*Musa* sp.) are important sources of high-calorie energy in the entire West African sub-region (Stover and Simmonds, 1987). Plantains and bananas are also of great socio-economic importance in the producing countries. Plantain and banana are also very important sources of rural income (Ortiz and Vuylsteke, 1996). Of the total world production of 100 million tons over 30 million people depend on plantain and bananas for their dairy energy.

Plantains are predominant in West and Central Africa where they are cultivated either in perennial backyard production system or for a few years (1-3 production cycles) in plots intercropped with cocoa, cocoyam, maize, vegetables, cassava and citrus. Along with bananas (*Musa* sp., AAA and ABB groups), plantains are considered the world's largest perennial herbs. Plantains can be replanted after harvest or a sucker (offshoot) of each of the previous mother plant can be allowed to develop. Plantains (*Musa* sp., AAB group) are grown mainly by smallholders in sub-Saharan Africa and tropical America (Stover and Simmonds, 1987).

Millions of farm households in the subtropics and tropics of the world produce bananas in backyard gardens, in mixed field cropping, in association with trees and also in intensive monocrops (<http://bananas.bioversityinternational.org/content/view/full/6797/lang,fr/> (Accessed on May 7, 2007). They may consume bananas as a staple food, or sell them as fresh fruit or for processing, to boost farm income.

Plantains are known to be a great source of calcium, vitamins A, B₁, B₂, B₃, B₆, C and minerals such as potassium and phosphorous. Ripe mashed plantain is an excellent food for babies after the 6 month exclusive breast feeding. This advantage is due to the easy digestibility and the mineral and vitamin contents. For elderly people, the fruit can be consumed in large quantities without being fattening or causing digestive disturbances (<http://www.turbana.com/index.htm>, Accessed August 14, 2003).

Plantain is known to be low in sodium (Chandler, 1995). It contains very little fat and no cholesterol; therefore it is useful in managing patients with high blood pressure and heart disease. They are free from substances that give rise to uric acid therefore, they are ideal for patients with gout or arthritis. Due to the low sodium and protein content, plantain is used in special diets for kidney disease sufferers. The capacity of the plantain to neutralize free hydrochloric acid suggests its use in peptic ulcer therapy (<http://www.turbana.com/index.htm>, Accessed August 14, 2003).

Plantains can be fried, boiled, mashed, stuffed and used for stuffing, baked, pickled and grilled. Green plantains are very hard and starchy; they have little banana flavor and no sweetness. They may also be boiled or fried or added to soups and stews. Yellow-ripe plantains are tenderer, but can be used in these same ways and will have a creamier texture. Black-ripe plantains are also delicious prepared in any of these methods but have a sweeter flavor and a banana aroma (<http://www.truestarhealth.com/Notes/3616008.html> (Accessed on June 13, 2007).

In Ghana, plantain and bananas belong to the non-traditional sector of the rural economy, where they are used mainly to shade cocoa and are essential component of the diet. More than 90% of the cultivated area in Ghana belongs to small holder farmers. In the agricultural sector, plantain is ranked fourth in Ghana (FAO, 2005) and contributes about 13.1% to the Agricultural Gross Domestic Product (AGDP). The total annual national production is 2.0 million metric tones (SRID-MOFA, 2006) with a per capita consumption of 101.8 kg ((SRID-MOFA, 2006; FAO, 2005; Lescot, 2000) which is higher than all other starchy staples. Because they are unpalatable when raw, plantain fruits are usually cooked, roasted, fried, steamed, boiled, or pounded before consumption. A fully ripe plantain mixed with milk powder is especially recommended for ulcer patients. For patients with gastritis and gastro-enteritis, banana is one of the first foods to be introduced after nausea and vomiting are brought under control. The low lipid/high palatability combination is ideal for the diet of obese people (<http://www.turbana.com/index.htm>, Accessed August 14, 2003). The plantain plant has also some medical properties. The leaves can be pounded and applied to the wound to suppress bleeding.

Despite the high value of plantain and banana, growing pest and disease pressures have adversely affected production (IITA, 1992; Stover and Simmonds, 1987; Swennen, 1990). Yield losses due to the pests and diseases are highly significant ranging from 20 to 50%. As a long term solution to address these problems, new hybrids, resistant/tolerant to these pests and diseases have been introduced from International Institute for Tropical Agriculture (IITA), Nigeria, Central Africa Banana Research Centre (CARBAP), Cameroun and Honduran Agricultural Foundation (FHIA), Honduras for evaluation for their agronomic performance and consumer acceptability. Most of the introduced hybrids have been studied to be agronomically stable, high-yielding and disease and pest resistant or tolerant. However, their food quality and consumer acceptability is important if any meaningful achievement could be made with the hybrids. The food habits differ from one ethnic group to the other. However often breeders evaluate new varieties across locations to substantiate the performance and acceptability of the variety across locations before their release. It is sometimes obvious that a variety that may perform well at a location may not be accepted by another ethnic group as a result of the food habit. It is therefore relevant to consider the food characteristics of the various groups and if possible release some varieties as ecotypes. This study was therefore conducted to evaluate the food qualities and

consumer acceptability of three hybrids (FHIA-21, BITA-3 and CRBP-39) when used for *fufu*, *ampesi* and fried plantain in two typical plantain producing districts of the Central region of Ghana.

MATERIALS AND METHODS

The hybrids were evaluated by 500 farmers from ten communities in the two districts (Assin North and Assin South) of the Central region of Ghana. Physiologically matured unripe bunches of the hybrids, FHIA-21, BITA-3, CRBP-39 and standard cultivars, Apantu and Apem were harvested from some participating farmers' fields in the districts and transported to four communities (Assin Foso, Adiembra and Bremang in the Assin North and Amoaning in the Assin South). The samples were given to a local food vendor at the four locations to prepare *ampesi* and *fufu*. Apem was used to prepare *ampesi* while Apantu was used to prepare *fufu*. Four separate consumer acceptability tests were held in Assin Fosu, Adiembra, Bremang and Amoaning. At Assin Foso, 60 panelists selected from various departments such as National Disaster Management Organization (NADMO), Ministry of Food and Agriculture (MOFA), Ghana Health Service, plantain farmers and plantain sellers. At Adiembra, 110 people participated whereas at Bremang 100 people took part in the sensory evaluation. At Amoaning, 90 farmers and plantain sellers from six surrounding communities participated.

The local dishes prepared were: *ampesi* is prepared by boiling the pulp of green fruits. As the firmness of the raw pulp of introduced accessions was low, the fruits were boiled for between ten and fifteen minutes only whereas the local cultivar, apem, with very firm pulp was cooked for 30 min. The *ampesi* was offered to the panelist with a vegetable sauce

Fufu is prepared by boiling the pulp of green fruits and cassava. In this case, the pulp of the hybrids was boiled with the cassava for fifteen minutes while the cassava and the pulp of Apantu were boiled for 30 min. The cassava and the plantain pulp are pounded into a paste and eaten with soup, fish, chicken and meat. The *fufu* was offered to the panelists with soup.

Fried Ripe Plantain

The ripe fruits were peeled and sliced transversely of about two centimeter thickness. The slices were dipped into salty water and fried in vegetable oil.

Sensory Evaluation

Untrained taste panelists from four communities Assin Foso, Adiembra, Bremang and Amoanin all in the Assin districts of the Central region of Ghana comprising both and females were used in the study. Assessors were not selected or trained to produce a panel showing definite preference but rather one which consistently reflected the range of preferences likely to be typical of Ghanaian consumers. At each time, panelists were presented with two coded samples (A and B) of *fufu* and *ampesi* comprising of Apantu, Apem and Musa hybrids, FHIA-21, BITA-3 and CRBP-39. Assessors were asked to compare the two coded samples on the bases of texture, taste, colour and overall acceptability, using the hedonic descriptive scale of 1-5 (Table 1). In addition, panelists were asked to state which of the two samples they preferred most. All assessors were instructed in basic taste panel procedures: To make their own individual judgments after a moderate amount of consideration. They were instructed to take a sip of water and pause briefly before tasting each sample and to re-taste if they are not sure of their decisions.

Table 1: Hedonic scoring for the assessment of consumer acceptability of unripe plantain

Scale	Texture	Taste	Colour	Poundability	Overall acceptability
1	Too hard	Excellent	Excellent	Too hard	Excellent
2	Very hard	Very acceptable	Like very much	Very hard	Very good
3	Good	Good	Good	Easy to pound	Good
4	Fair	Fair	Fair	Fair	Fair
5	Poor	Poor	Poor	Poor	Poor

RESULTS AND DISCUSSION

The results showed that there was no significant difference ($p>0.01$) between *fufu* (pounded plantain with cassava) from FHIA-21 and CRBP-39 and that of the local Apantu (Table 2). BITA-3 though was less preferred for its softness was accepted for use in the preparation of *fufu* (Table 2). BITA-3 is a cooking banana and thus has high characteristic of banana than plantain. FHIA-21 though resembles the triploid French plantain could be used for *fufu*. The taste, flavour, colour and poundability of FHIA-21 compared favourably with the local triploid Apantu.

There was no significant difference between *ampesi* (boiled green sliced plantain) of FHIA 21 and CRBP 39 in terms of tasted, texture, flavour and colour and the Apem (local French plantain) (Table 3). The triploid French plantain when boiled green is crunchy whereas the tetraploids become slightly soft when boiled green. It was the *ampesi* of the BITA 3 which was a bit soft and was less preferred. It was observed that all the hybrids required less time for boiling. BITA-3 taste better as *ampesi* when boiled for about 10 min and allowed to cool before eaten. It is significant to mention that, cooked samples of FHIA-21 and CRBP 39 tasted similar to Apantu and Apem. The attractive pulp colour of cooked FHIA-21 and CRBP 39 was similar to that of Apem. It came to light that the hybrids do not boil for long before cooked (Table 3). Work by other researchers indicated that loss of firmness or softness in fruits as a result of cooking or heating, involves the loss of turgor, a series of chemical changes in the cell matrix polysaccharides and the swelling and gelatinization of starch (Van Buren and Pitifer, 1992).

All the hybrids were accepted when processed into ripe fried at ripening stages 3 and 4. FHIA-21 and CRBP 39 were highly preferred and BITA-3 less preferred (Table 4). Taste was a key characteristic that determined the acceptability of the hybrid. The results compared favourably with a similar study by Dzomeku *et al.* (2006) and Dadzie (1998).

In most countries in West and Central Africa where green plantains are consumed as a major part of the meal, the predominant method of cooking matured green unripe plantains include, boiling or steaming and served as a cooked vegetable with stew or sauce. Sometimes, the green plantain is roasted or baked and frequently the green plantain is also pounded after cooking into a paste or dough, often

Table 2: Comparative sensory evaluation of selected hybrids evaluated for *fufu* at four locations in the Assin districts

Hybrid/cultivar	Texture	Taste	Flavour	Colour	Poundability	Overall acceptance
FHIA-21	4.24a	4.24a	4.24a	4.24a	4.01a	4.67a
BITA-3	2.98	2.62	2.01	2.01	2.67	3.02
CRBP-39	3.43b	3.98b	3.23	3.89b	3.06b	4.32a
Apantu	4.24a	4.24a	4.32a	4.24a	4.01a	4.67a

Letter(s) in common within columns were not significantly different at the 1% level

Table 3: Comparative sensory evaluation of selected hybrids evaluated for *ampesi* at four locations in the Assin districts

Hybrid/cultivar	Texture	Taste	Flavour	Colour	Overall acceptance
FHIA-21	4.32a	4.56a	4.48a	4.54a	4.54
BITA-3	3.89	3.67	2.81	2.98	2.45
CRBP-39	4.12a	4.16a	4.32a	4.28a	4.28
Apem	4.32a	4.56a	4.48a	4.86a	4.89

Letter(s) in common within columns were not significantly different at the 1% level

Table 4: Comparative sensory evaluation of selected hybrids evaluated for fried ripe plantain at four locations in the Assin districts

Hybrid/cultivar	Texture	Taste	Colour	Sweetness	Overall acceptance
FHIA-21	4.12a	4.71a	4.45a	4.26a	4.71a
BITA-3	2.32	3.67	2.18	3.12	3.67
CRBP-39	4.12a	4.61a	4.36a	4.12a	4.61a
Apantu	4.62a	4.78a	4.67a	4.78a	4.78a

Letter(s) in common within columns were not significantly different at the 1% level

in combination with cassava (called *fufu*) and served with soups, sauces and meat or fish. Because of the varying methods of cooking and uses of plantains, the texture, particularly, the softness of the cooked plantain is very important in determining a good cooking plantain cultivar. The choice of a plantain cultivar for particular method of cooking or processing is therefore probably based largely on the textural properties of the tissues after cooking. Consumers often prefer plantain cultivars that have good textural qualities after cooking and should suit the various uses. BITA-3 became very soft after cooking compared to FHIA-21 and CRBP 39. However, all the hybrids were accepted for processing into ripe fried plantain. Some panelists who claimed to be diabetic however indicated their preference for BITA-3 as their sugar level was normal after eating any form of food from BITA-3.

CONCLUSION

In this study FHIA-21 and CRBP 39 compared favourably with Apantu at the four locations both for *fufu*, *ampesi* and fried ripe plantain. The cooking banana was preferred in the processed forms than in the raw state. In the introduction of new *Musa* hybrids to farmers, the food habits of the people must be considered.

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REFERENCES

- Chandler, S., 1995. The Nutritional Value of Bananas. In: Bananas and Plantains, Gowen, S. (Ed.). Chapman and Hall.
- Dadzie, B.K., 1998. Post-Harvest characteristics of black Sigatoka resistant banana, cooking banana and plantain hybrids. In: Inibap Technical Guidelines, pp: 75.
- Dzomeku, B.M., M. Osei-Owusu, A.A. Ankomah, E. Akyeampong and S.K. Darkey, 2006. Sensory evaluation of some cooking bananas in Ghana. *J. Applied Sci.*, 6: 835-837.
- FAO (Food and Agriculture Organization), 2005. Food and agriculture indicators ESSA Oct, 2005. <http://www.fao.org/es/ess/top/country.html> (Accessed on Aug 25, 2006).
- IITA (International Institute of Tropical Agriculture), 1992. Sustainable food production in Sub-Saharan Africa, 1. IITA, Ibadan, Nigeria, pp: 208.
- Lescot, T., 2000. The importance of plantains and cooking bananas in Africa: Outlets for the subtropical zones. *INFOMUSA*, 9: 25-28.
- Ortiz, R. and Vuylsteke, D., 1996. Improving Plantain and Banana-Based System. In: Plantain and Banana Production and Research in West and Central Africa. Ortiz, R. and M.O. Akoroda (Eds.). Proceedings of a Regional Workshop, 23-27 Sep 1995.
- SRID-MOFA, 2006. Statistics, Research and Information Directorate, Ministry of Food.
- Stover, R.H. and N.W. Simmonds, 1987. *Banana*. 3rd Edn. John Wiley and Sons, Inc. New York, pp: 468.
- Swennen, R., 1990. *Plantain Cultivation Under West African Conditions: A Reference Manual*. International Institute for Tropical Agriculture, Ibadan, Nigeria, Amarin Printing Group Co. Ltd., Thailand, pp: 24.
- Van Buren, J.P. and L.A. Pitifer, 1992. Retarding of vegetable softening by cold alkaline pectin esterification before cooking. *J. Food Sci.*, 57: 1022-1023.