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FARMER ACCEPTANCE OF INTRODUCED BANANA GENOTYPES IN UGANDA

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ABSTRACT

Five IITA hybrids (Bita-2, Bita-3, Pita-8, Pita-14, Pita 17), five FHIA hybrids (FHIA 01, FHIA 03, FHIA 17, FHIA 21 FHIA 23) and *Yangambi KM5*, were planted on farmers' fields at 20 sites (with four replicates) representing various agro-ecological zones and cultures of Uganda, along with five AAA-EA cooking bananas as local checks. Their uses and acceptability were assessed using a participatory approach involving both farmers and the researchers. All the genotypes were tested for the uses of banana known to the farmers. Results indicated that the introduced genotypes were rated inferior to the AAA-EA cooking bananas when cooked. However, FHIA 17, FHIA 23 and FHIA 01 were, respectively rated acceptable as cooking bananas in the Northern, North-Eastern and Eastern parts of the country, which are largely non-traditional banana growing areas. The same cultivars were acceptable mainly as dessert but also as cooking bananas during food shortages in central and western parts, especially, in areas where the growing of traditional cultivars is progressively declining. There was little interest in the new bananas in western parts of the country. Major considerations for cooking qualities were taste, texture and appearance. Many of the hybrids had an astringent taste when cooked. Pita-14, *Yangambi KM5*, FHIA 01 and FHIA 03 were classified as juice bananas. They all yielded higher quantities of juice whose brix content was in same range as that of AAA-EA *mbidde* cultivars. Pita-17 and FHIA 21 were classified as plantains at all the sites. The introduced genotypes, which are most popular with farmers, are FHIA 17, FHIA 23 for cooking and dessert while FHIA 01 and KM5 are popular as juice/brewing cultivars in areas where brewing is an important economic activity.

Key Words: Acceptability, FHIA, introduced genotypes, *Musa* spp.

RÉSUMÉ

Cinq hybrides d' IITA (Bita-2, Bita-3, Pita-8, Pita-14, Pita 17), de FHIA (FHIA 03, FHIA 17, FHIA 21, FHIA 23), *Yangambi KM5* avec cinq variétés locales AAA-EA, étaient plantés dans de champs des fermiers en 20 endroits (avec quatre répétitions) représentants plusieurs zones agro écologiques et culturales de l'Ouganda. Leurs usages et acceptabilités étaient évalués dans une approche impliquant les fermiers et les chercheurs. Tous les génotypes étaient testés pour les usages de la banane connus par les fermiers. Les résultats ont indiqué les variétés introduites étaient classées inférieures au AAA-EA quand elles sont cuites. Cependant, FHIA17, FHIA23 et FHIA01 étaient classées acceptables comme banane à cuire au nord, nord-est et l'est du pays, traditionnellement où la banane n'est pas cultivée. Ces variétés ont été acceptées principalement comme dessert et comme banane à cuire seulement dans des conditions de carence alimentaire au centre et à l'ouest région de culture de la banane mais où les variétés traditionnelles sont en diminution. Il y avait peu d'intérêt aux nouvelles variétés à l'ouest du pays. Les considérations majeures pour les qualités de cuisson étaient le goût, la texture et l'apparence. Nombreux hybrides cuits avaient un goût étrange. Pita-14, *Yangambi KM5*, FHIA01 et FHIA03 étaient classés comme des bananes juteuses. Toutes ont produit des quantités des jus dont le contenu en brix était de la même gamme que les variétés AAA - EA *mbidde*. Pita-17 et FHIA 21 étaient classés comme plantain dans toutes les zones. Les plus

populaires des génotypes introduits chez les fermiers étaient FHIA17, FHIA23 pour la cuisson et dessert alors que FHIA01 et KM5 étaient connues comme des variétés juteuses/brassage en des endroits où le brassage de la bière est une activité économique importante.

Mots Clés: Acceptation, FHIA, génotypes introduits, *Musa* spp.

INTRODUCTION

The banana (*Musa* spp.) is one of the most important starchy staples in Uganda. Annual production was estimated at 9.84 million tons, the second largest in the World, the first being India with 9.9 million tons. More than 85% of the bananas grown in Uganda are East African Highland banana types (*Musa* spp. AAA genotype, "matooke" and "mbidde"). The bananas are grown by 75% of the farmers covering an area of over 1.4 million hectares, an equivalent of 38% of land under crops. Consumption of bananas and plantains in Uganda has been estimated at 243Kg/capita/year, the highest in the world. It is also an important source of income and has a high industrial potential through juice, wine and assorted post-harvest foodstuffs.

Despite the importance, banana productivity has been going down since the 1970's. Banana pests (weevils and nematodes) and diseases (Black Sigatoka, Fusarium Wilt and Banana Streak Virus) have been identified to be among the major constraints that have contributed to banana production decline in Uganda (Tushemereirwe, 1996). Low germplasm diversity of the AAA-East African Highland bananas has been linked to the pest and disease problem. The use of resistant/tolerant banana cultivars is viewed to be the most feasible solution to the problems. In order to shorten the time taken to get promising germplasm to end users, a system which enables farmers to participate in the testing of the promising lines has been adopted by the National Banana Research Programme. In this system, the main evaluator is the farmer, assisted by extensionists and researchers.

The genotypes are evaluated for the disease/pest response, agronomic performance and end-user acceptability on farmers' fields at various locations. This paper reports results of use classifications by farmers and the levels of acceptance of the genotypes in various locations and therefore the potential niches for the introduced germplasm.

MATERIALS AND METHODS

The evaluation trials were established during the first rains (March-May) of 1998, second rains (September-December) of 1998, first rains (March-May) of 1999 and second rains (September-December) of 1999. The materials included Five IITA hybrids Pita-14 (TMPx 7152-2), Pita-17 (TMPx 4479-1), Pita-8 (TMPx 7002-1), Bita-3 (TMBx 5295-1) and Bita-2 (TMBx 1378), five FHIA hybrids (FHIA 01, FHIA 03, FHIA 17, FHIA 23, FHIA 21), one exotic landrace (Yangambi KM5) and five landrace AAA-East African highland cooking bananas as local checks. They were planted on farmers' fields selected from the North-Eastern, Eastern, Central and Western Parts of the country representing various agro-ecological zones and cultures of Uganda in lines of ten plants per cultivar, at four sites (plots) in each district (replicate). The plots were farmer managed with advice from extension workers and backstopping from researchers. The data on uses was recorded by farmers and consumer acceptability (affective) tests were conducted by researchers. Some of the genotypes were rouged earlier by farmers due to poor performance. A minimum of 30 people participated in the affective tests per site. Most important and easily understood sensory parameters thus taste, texture and colour (Semwanga and Thompson, 1994) were considered. Three major uses of bananas recommended by farmers as cooking, juice and dessert were tested for each of the new bananas during the research conducted consumer tests. Data were analysed by the Generalised Linear Model (GLM) and analysis of variance (ANOVA) and means separated by the Fisher's Unprotected LSD test (Anon., 1994).

RESULTS AND DISCUSSION

The combined results of affective tests on cooked bananas indicated that the AAA-EA cooking bananas were significantly ($P < 0.05$) superior to all the introduced cultivars. This was true for all the regions implying that the local bananas are still being preferred for cooking (Table 1). At all the sites, the consumers complained of an astringent taste in many of the hybrids when cooked (Table 2). Consumers felt a puckering sensation in the mouth after tasting most of the cooked introduced genotypes. The puckering sensation was more intense in FHIA 03, all the IITA hybrids and *Yangambi KM5*. The results were in conformity with the analytical tests' results obtained on-station which had indicated that the hybrid bananas had higher tannin intensity compared to the AAA-EA cooking bananas and were therefore astringent (Nowakunda *et al.*, 2000; Nowakunda, 2001).

The other characteristic that consumers did not like in many of the new bananas was texture(Table 1) .The results indicated that the texture of most of the introduced bananas were unacceptable. The textural attribute in bananas has been classified in sensory terms as 'hard', 'medium' or 'soft' (Semwanga *et al.*, 1996). The consumer panels rejected the textural attributes of most of the hybrids describing it as "hard" and therefore 'unacceptable'. Ugandan consumers dislike cooked bananas, which lack an adequately 'soft' texture (Semwanga and Thompson,1994). It is, however, important to note that bananas, which become too soft when cooked are not liked either. However, the textural characteristics of FHIA 03, FHIA 17 and FHIA 23 were scored as acceptable though significantly ($P < 0.05$) inferior to that of *Kisansa*, an AAA-EA cooking banana.

The results of colour (appearance) assessment for the cooked bananas indicated that the appearance of all the introduced bananas was significantly ($P < 0.05$) inferior to those of the AAA-EA cooking bananas. The preferred colour of a cooked banana product is yellow whereas the hybrids were dark brown or grey when cooked.

General acceptability, the final judgement of the consumers indicated that all the introduced banana cultivars were significantly ($P < 0.05$) inferior to the AAA-EA cooking bananas. All the IITA hybrids and FHIA 03 scored 5 and above indicating total rejection. However, FHIA 17, FHIA 23 and FHIA 01 were fairly acceptable with consumer ratings next to those of the AAA-EA

TABLE 1. Combined sensory scores fro the genotypes when cooked

Genotype	Taste	Texture	Colour	General acceptability
Kisansa	1.5e	1.6e	1.4d	1.2d
Pita-14	5.7a	4.9b	5.0ab	5.8a
Pita-17	5.6a	4.8b	4.2b	5.4a
FHIA 01	3.0c	3.9c	3.5bc	4.0b
FHIA 03	3.4c	2.9d	5.9a	5.8a
FHIA 17	3.0c	3.5c	3.4bc	3.8b
FHIA 21	4.5b	4.0bc	3.9bc	5.0a
FHIA 23	3.2c	3.2d	3.2c	3.6b
KM5	3.8db	5.5a	5.9a	5.8a

TABLE 2. Intensity of astringency in the new bananas rated by farmers

Genotype	Astringency
Kisansa	None
Pita-14	High
Pita-17	High
FHIA 01	Medium
FHIA 03	High
FHIA 17	Medium
FHIA 21	High
FHIA 23	Medium
KM 5	High

cooking bananas. Earlier studies had indicated that the hybrid bananas were superior to landraces with respect to fruit and bunch physical characteristics but inferior to them with respect to use quality (Nowakunda *et al.*, 2000; Nowakunda, 2001).

The combined results of juice extraction using traditional methods (Kyamuhangire, 1990) indicated that only FHIA 03, FHIA 01, *Yangambi* KM5 and Pita-17 (TMPx4495-1) yielded juice (Table 3). This was true at all the sites. The hybrids produced juice with acceptable mouth feel (not slimy). Mouth feel is a measure of smoothness of the juice hence an important quality characteristic (Koffi *et al.*, 1991). The good yield and characteristics of the juice combined with big bunches, Black Sigatoka and Fusarium wilt resistance make FHIA 01, *Yangambi* KM5 good candidates for juice/beer production in places of the country where brewing is an important economic activity and the traditional cultivars are being wiped out by pests and diseases (Kangire *et al.* 1999).

Results of consumer tests for introduced genotypes as dessert bananas indicated that the FHIA 17, FHIA 23 and KM5 were significantly ($P < 0.05$) better than the rest of the introduced bananas genotypes and were scored as acceptable (Table 4). They were, however, significantly inferior ($P < 0.05$) to Gros Michel. General acceptability for dessert tests indicated that FHIA17, FHIA 23 were significantly ($P < 0.05$) more acceptable than all the other introduced bananas (Table 4). They were singled out as good dessert bananas and are increasingly becoming popular among the farming communities especially in parts of Central, Eastern and North-eastern Uganda

The acceptability patterns for the introduced bananas varied from area to area. Cultivars FHIA 17 and FHIA 23 were preferred for both cooking and dessert, respectively in the Northeastern and Eastern parts of the country (Table 5). Most of the areas in these regions are non-traditional banana growers. The same cultivars were preferred for mainly dessert but also cooking in many parts of

TABLE 3. Juice Yield and juice characteristics of the recently introduced banana cultivars per cultivar

Cultivar	Pulp wieght (kg)	Juice yields (%)	Brix (%)	pH	Taste	Colour	Mouthfeel
FHIA 01	2.0	63.4	20.08	5.1	2.5	2.0	1.8
FHIA 02	2.0	0.0	-	-	-	-	-
FHIA 03	2.0	76.5	21.70	4.7	2.8	2.3	2.8
Yangambi KM5	2.0	67.1	20.92	4.8	2.3	2.3	2.0
Pisang awak	2.0	60.5	24.00	4.8	2.3	2.3	2.5

TABLE 4. Combined Sensory scores fro the genotypes tested as dessert

Genotype	Taste	Flavour	Colour	Texture	General acceptability
Gros Michel	1.7e	1.7e	1.5e	1.1d	1.1e
Pita-14	5.6a	5.0a	3.9b	5.6a	5.5a
Pita-17	5.5a	5.2a	4.0b	5.1a	5.3a
FHIA 01	2.8d	2.8c	2.8c	3.5bc	3.0cd
FHIA 03	3.4c	3.4c	2.8c	4.0b	5.0b
FHIA 17	2.5d	2.5cd	2.5dc	2.9c	2.8c
FHIA 21	4.8b	4.8ab	5.9a	5.8a	5.9a
FHIA 23	2.3d	2.2d	2.1d	3.0c	2.6c
KM 5	3.5c	3.5a	3.8b	3.5bc	3.5da

central Uganda (Table 6), which are traditional banana growing and consuming areas and as mainly dessert in western Uganda (Table 7). Cultivars FHIA 01, TMPx 4479-1 and KM5 were grouped among the juice bananas. While FHIA 01 was found to have acceptable dessert characteristics and could be cooked.

CONCLUSIONS

All the introduced bananas genotypes were inferior to AAA-EA cooking bananas in all sensory attributes. However, FHIA 17, FHIA 23 and FHIA 01 had acceptable cooking qualities. Cultivars FHIA 01, *Yangambi KM5*, FHIA 03 and

TABLE 5. The genotypes and their farmer recommended uses in North-East of Uganda

Genotype	Bw	Use(s)	Comments on the use
Kisansa	25.8	C	Very good food
Pita-14	12.2	J	Fair juice yield, good taste
Pita-17	10.0	R	Fair
FHIA 01	33.4	C, D	Fair food, good dessert
FHIA 03	25.7	J	Good juice yields
FHIA 17	56.7	C,D	Good food, good dessert
FHIA 21	15.7	R	Fair
FHIA 23	48.7	C,D	Good food, good dessert
KM 5	8.9	J,D	Good juice, fair dessert

TABLE 6. The genotypes and their farmer recommended uses in Central Uganda

Genotype	Bw	Use(s)	Comments on the use
Kisansa	25.8	C	Very good food
Pita-14	12.2	J	Fair juice yield, good taste
Pita-17	10.0	R	Fair
FHIA 01	33.4	D,C	Fair dessert, fair food
FHIA 03	25.7	J	Good juice yields
FHIA 17	56.7	D,C	Good dessert, fair food
FHIA 21	15.7	R	Fair
FHIA 23	48.7	D,C	Good dessert, fair food
KM 5	8.9	J,D	Good juice, fair dessert

TABLE 7. The genotypes and their farmer recommended uses in Western Uganda

Genotype	Bw	Use(s)	Comments on the use
Kisansa	25.8	C	Very good food
Pita-14	12.2	J	Fair juice yield, good taste
Pita-17	10.0	R	Fair
FHIA 01	33.4	D	Fair dessert
FHIA 03	25.7	J	Good juice yields
FHIA 17	56.7	D	Good dessert
FHIA 21	15.7	R	Fair
FHIA 23	48.7	D	Good dessert
KM 5	8.9	J,D	Good juice, fair dessert

Note: C = Cooking, D = Dessert, J = Juice, R = Roasting, BW = Bunch weight

Pita-17 yielded good juice with acceptable qualities while FHIA 17, FHIA 23 and KM5 had acceptable dessert qualities.

The new bananas may not replace the old cultivars. They are likely to settle for new niches. Involving farmers in the evaluation process makes it less costly, shortens the time involved in getting the selected hybrids to the end-users and improves on farmers' confidence in the new materials since they will have participated in selecting them. This system of evaluation is highly recommended because it has potential of solving the persistent problem of low acceptance of new crops by the end-users. It also offers an opportunity for researchers to build a permanent partnership through which any new genotypes could be passed, as an alternative uptake pathway.

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