Consumer acceptability of introduced bananas in Uganda

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Banana productivity in Uganda has been declining since the 1970's (Hartmanns 1989), mainly due to low soil fertility, pest and disease build up, low germplasm diversity and a host of socioeconomic constraints (Rubaihayo and Gold 1991). All the AAA-EA cooking bananas are susceptible to black Sigatoka, banana weevils and nematodes (Tushemereirwe 1996).

The use of disease and pest resistant banana cultivars has been suggested as the most feasible solution to these problems (Ortiz and Vuylsteke 1998), and consequently, a number of banana hybrids and landraces resistant or tolerant to mainly black Sigatoka and/or Fusarium wilt have been introduced into Uganda.

The physical, chemical and sensory characteristics of these cultivars were determined to establish their quality profile. The agronomic attributes of importance to banana end-users included maturity period and attainment of acceptable eating quality at an early stage of development.

This paper reports the results of consumer acceptability of 14 introduced banana and plantain cultivars for cooking and juice production.

Materials and methods

The characteristics of the 14 cultivars together with East African Highland banana landraces used in the study are presented in Table 1. The most common landrace cultivars Mbwazirume, Kisansa (AAA-EA) cooking bananas, Ndizi (AB), Musa-Kayinja (ABB) and Entundu (AAA-EA) beer banana were used as controls in a completely randomized block design experiment.

The fruit filling period was recorded as the period from shooting to the day when at least one finger indicated signs of ripening at which stage the bunch was harvested (Palmer 1971). The bunch weight (in kg) was taken at harvest using a weighing scale (BFK-265-030B, 60, Fisher, UK). The finger weight was determined by weighing five individual fingers from the second of the bunch on a Mettler (P1200, Fisher, UK) electronic balance. The same fingers were used for finger length, girth and peel and pulp weights. Peel and pulp weights were determined by separating the peel and pulp by hand peeling with a stainless steel knife and weighing the peel and pulp separately. Green-life was determined by difference in days between harvesting and when the second hand showed first signs of ripening by colour change from deep green to light green (Dadzie and Orchard 1997). The samples for green-life monitoring were harvested one week to the expected physiological maturity as defined by Palmer (1971). Tannin levels were determined using the Vanillin based assay as described by Broadhurst and Jones (1978).

Sensory characteristics and acceptability were determined by boiling peeled bananas in 1L of water. Six grams of table salt were added to the bananas and boiled until they were well cooked. This method of preparation was preferred to the traditional steaming and mashing (*muwumbo*) to avoid presentation bias.

Fifteen panellists were selected on the basis of functional taste buds using dilute solutions of basic tastes: Sweet (Sucrose at 8 g/l), Salty (Sodium chloride, 1.5 g/l), Sourness (Citric acid, 0.25 g/l), Bitterness (caffeine, 0.05 g/l) (Bainbridge *et al*. 1996).

The selected panellists were taken through a series of tests involving non-experimental bananas to allow them to learn the various descriptors of banana quality characteristics. Experimental samples were coded with four digits to eliminate name bias and presented to the panellists. The panellists were requested to score the samples using a 6-point hedonic scale with 1 = extreme approval and 6 = extreme disapproval of a given attribute (Larmond 1987, Jellinek 1985) for the following characteristics: taste, texture, colour and acceptability. Juice extraction was done using methods described by Kyamuhangire (1990).

The data were analyzed by the Generalized Linear Model (GLM) and analysis of variance (Mead *et al*. 1993). The means were separated using the Fisher's Unprotected LSD test at 0.05 level of significance (Anon. 1994). The correlation matrices were obtained using the Minitab correlation programme.

Results and discussion

Yield characteristics

The results of yield characteristics are presented in Table 2. The FHIA hybrids had similar maturing time as the AAA-East African highland landrace cultivars, which gave FHIA hybrids an ad-

Table 1. Characteristics of cultivars/hybrids used in the study.

Name	Genome	Origin	Characteristics			
			Sigatoka	Fusarium	Weevils	Mean bunch weight (kg)
FHIA-01	AAAA	FHIA	R	R	T	45.6
FHIA-02	AAAA	FHIA	R	R	T	25.8
FHIA-03	AAAA	FHIA	R	R	T	35.1
FHIA-17	AAAA	FHIA	R	R	T	43.9
FHIA-23	AAAA	FHIA	R	R	T	45.4
TMPx582/4	AAAB	IITA	T	R	T	16.9
TMPx5511/2	AABB	IITA	T	R	T	17.9
TMPx548/9	AAAB	IITA	T	R	T	20.8
PV 03-44	-	IITA	T	R	T	25.7
TMPx548/4	AAAB	IITA	T	R	T	15.2
TMPx7002/1	AAAB	IITA	T	R	T	25.4
Pisang Ceylan	AA	IITA	T	R	T	17.2
Yangambi km5	AAA	IITA	R	R	T	25.1
Saba	ABB	IITA	T	R	T	16.7
*Mbwazirume	AAA	Landrace	S	R	S	15.6
*Kisansa	AAA	Landrace	S	R	S	16.5
+Entundu	AAA	Landrace	S	R	S	16.1
+Kisubi	AB	Landrace	S	S	T	12.6
+Pisang awak	ABB	Landrace	S	S	T	14.2

S = Susceptible, T = Tolerant, R = Resistant.
* Cultivars used as control for cooking tests.
+ Cultivars used as control for juice yield.

Table 2. Major physical characteristics of the banana cultivars under study.

Cultivar	Genome	HST (days)	BWT (kg)	Peel (%)	FC (cm)	FL (cm)	FW (gr)	DM (%)	SF (days)
FHIA-01	AAAA	133.0bc	33.9a	44.0a	14.3b	24.0b	121.7d	29.3e	7.6af
FHIA-02	AAAA	129.7c	28.3ab	32.0b	14.2b	21.7c	116.3gf	28.4ed	5.3ch
FHIA-03	AAAA	122.7c	31.8ab	44.0a	14.2b	22.0bc	113.0e	30.6dj	5.6ch
FHIA-17	AAAA	124.3c	32.1ab	41.6ab	14.3b	23.0b	120.7d	29.3e	7.6af
FHIA-23	AAAA	128.0c	33.0ab	44.5a	13.2bc	23.3b	123.3d	31.1d	7.6af
TMPx582-4	AAAB	144.0ab	16.0c	40.9ab	14.6b	25.7a	130.0c	35.4b	7.3ad
TMPx5511-2	AABB	147.7ab	20.9c	39.4abc	17.0a	25.6a	135.0b	33.2c	8.0a
TMPx548-9	AAAB	143.0ab	21.7bcd	39.0abc	14.7b	24.3ab	121.7d	33.0c	7.6af
PV03-44	AAAA	152.0a	19.5c	27.8d	14.2b	24.7ab	141.0a	29.0e	7.3ad
TMPx548-4	AAAB	150.7a	16.5c	39.0abc	13.0bc	24.7ab	139.0a	38.3a	7.3ad
TMPx7002-1	AAAB	150.7a	18.9c	42.8a	14.0b	24.0ab	106.7j	34.7c	7.0ad
Pisang Ceylan	AA	150.0a	23.1bcd	27.7d	13.0bc	19.9c	108.7j	27.6f	7.0ad
Yangambi km5	AAA	148.7ab	27.2ab	29.8d	13.1bc	19.6c	129.0c	25.9g	6.0cd
Saba	ABB	159.0a	19.5c	18.2e	16.0a	23.3b	114.3ef	29.6e	6.0cd
Mbwazirume	AAA-EA	122.0c	19.5c	37.8abc	14.7b	23.6b	114.0ef	17.8h	8.6a
Kisansa	AAA-EA	120.0c	20.0c	30.0d	14.3b	24.9ab	122.5d	18.3h	9.3e
LSD (0,05)		**16.4**	**6.3**	**4.2**	**1.7**	**2.4**	**2.9**	**1.9**	**1.53**
CV (%)		**17.02**	**15.50**	**22.59**	**7.43**	**8.52**	**2.85**	**4.00**	**9.38**

Means with same letters in a column are not significantly different (0.05%).
All the measurements were limited to the 2nd hand of the freshly harvested physiologically mature bunches.
Peels were measured as the total waste from a whole finger.
HST = harvest maturity date; BWT = bunch weight; FC = fruit circumference; FL = fruit length; FW = fruit weight; DM = dry matter weight; SF= shelf-life.
LSD = Standard error of the differences.
CV = Coefficient of variation.

vantage over the IITA hybrids. However, both the FHIA and IITA hybrids produced significantly ($P < 0.05$) heavier bunches than the East African highland cooking bananas suggesting a clear advantage over the East African highland banana cultivars in the study with respect to bunch sizes. Banana producers and consumers prefer cultivars with big bunches (Ssemwanga and Thompson 1994, Dadzie and Orchard 1997).

Fruit characteristics

The results of peel weights indicated that FHIA-01, FHIA-03, FHIA-23 and the IITA hybrids were not significantly ($P < 0.05$) different from Mbwazirume, a local AAA-EA cooking banana landrace. Saba, Yangambi Km5 and Kisansa respectively had the lowest percentage of peels indicating more pulp which is a clear advantage for cooking, juice, dessert and roasting bananas. All the IITA hybrids had longer fingers and lower peel percentages compared to the rest of the bananas.

Data from fruit girth measurements showed that the fruit circumference of Saba and TMPx 5511-2 was significantly ($P < 0.05$) larger than those of the AAA-EA cooking bananas. Yangambi km5, Pisang Ceylan, TMPx 548-4 and FHIA-23 had the smallest circumference. Large fingers are a preferred banana characteristic (Dadzie and Orchard 1997) and therefore an advantage.

Shelf life

The results of shelf life study for the banana cultivars harvested at one week before their expected physiological maturity as defined by Palmer (1971) indicated that Kisansa had significantly ($P < 0.05$) longer shelf life than the other cultivars studied. Bananas are usually harvested when they are a mature green for ease of transportation to the markets. The consumers also use the bananas piecemeal over time ensuring a clear advantage for banana cultivars with a long shelf life.

The EA-AAA cooking banana landraces had significantly ($P < 0.05$) lower dry matter than the other cultivars studied suggesting considerable disadvantage in terms of yield improvement during breeding (Anon. 1993). The results of tannin (polyphenols) and sensory analyses of the cultivars indicated that the EA-AAA cooking banana landraces had significantly ($P < 0.05$) lower tannin than the introduced cultivars which had an unacceptable astringent taste (Table 3).

Table 3. Scores of the sensory characteristics and acceptability of the cooked newly introduced banana cultivars.

Cultivar	Genotype	Tannin	Taste	Flavour	Colour	Texture	Acceptability
FHIA-01	AAAA	0.207e	3.0e	4.0ce	3.9cd	4.0f	3.0g
FHIA-02	AAAA	0.444ab	4.0d	4.0ce	4.0cd	5.0b	5.0l
FHIA-03	AAAA	0.598a	5.7a	4.7b	5.6a	2.8c	5.9a
FHIA-17	AAAA	0.302b	3.4e	4.4be	4.8b	2.6c	4.0c
FHIA-23	AAAA	0.399b	3.0e	4.0ce	4.8b	2.7c	4.0c
TMPx582-2	AAAB	0.600ac	4.6bc	4.6be	3.9cd	5.4a	5.2bi
TMPx5511-2	AABB	0.490b	4.9b	4.9b	3.5c	5.6a	5.6ab
TMPx548-9	AAAB	0.500ad	4.9b	5.9a	4.3bd	5.3a	5.3bi
PV03-44	-	0.522ab	4.3cd	5.3a	4.9b	5.4a	5.6ab
TMPx548-4	AAAB	0.404b	3.5af	4.5b	4.8b	5.3a	5.2bi
TMPx7002-1	AAAB	0.408b	4.6b	4.6b	3.7c	5.0b	5.3bi
Pisang Ceylan	AA	0.570a	5.6a	5.6a	4.5b	5.4a	5.9a
Yangambi km5	AAA	0.670a	4.3a	4.6b	4.4b	5.5a	4.7hi
Saba	ABB	0.670a	5.3a	5.3a	4.9b	5.5a	5.6a
Mbwazirume	AAA-EA	0.008d	1.4f	1.4d	1.9e	2.0d	2.1e
Kisansa	AAA-EA	0.010d	1.5f	1.5d	1.6e	1.6d	1.3f
LSD (0.05)		**0.1582**	**0.5049**	**0.7049**	**0.5329**	**0.5095**	**0.5736**
CV (%)		**24.02**	**17.42**	**18.42**	**20.24**	**16.34**	**17.33**

Means with same letters in a column are not significantly different (at 0.05).
Scale: 1 = extremely good; 6 = extremely poor.

Sensory analysis

The results of the sensory analysis for taste, texture, colour, flavour and acceptability of the cooked bananas indicated that the introduced bananas and plantains had significantly ($P < 0.05$) poorer scores than the East African highland bananas (Table 3). The tex-

Table 4. Correlation of the physical, chemical and sensory characteristics of the study cultivars.

	MD	BW	FW	FL	FC	PP %	DM %	TSS %	TNN	PR	AS	FB	TT	FV	CL	TX	AC
MDBW	-0.533*	-															
FW	0.263	-0.241	-														
FL	0.019	-0.463	0.447	-													
FC	0.104	-0.229	0.064	0.506*	-												
PL %	-0.446	0.358	0.013	0.297	-0.113	-											
DM %	0.532*	-0.108	0.292	0.268	0.008	0.357	-										
TSS %	-0.121	0.186	-0.016	0.171	0.306	0.151	0.394	-									
TNN	0.663*	-0.087	0.282	-0.180	0.130	-0.230	0.640*	0.274	-								
PR	-0.566	0.104	0.074	0.392	0.102	0.139	-0.432	0.174	-0.528*	-							
AS	-0.371	0.061	0.187	0.146	-0.227	0.213	-0.326	-0.408	-0.307	0.233	-						
FB	0.601*	-0.432	0.219	0.260	0.304	-0.093	0.567*	0.034	0.754*	-0.365	-0.008	-					
TT	0.614*	-0.046	-0.098	-0.267	0.151	-0.171	0.598*	0.263	0.832*	-0.587*	-0.408	0.603*	-				
FV	0.699*	0.008	0.131	-0.162	0.035	-0.112	0.725*	0.220	0.793*	-0.636*	-0.310	0.508*	0.891*	-			
CL	0.499	-0.007	-0.098	-0.377	-0.076	-0.120	0.595*	0.230	0.810*	-0.535*	-0.424	0.560*	0.839*	0.719*	-		
TX	0.901*	-0.391	0.292	-0.052	0.115	-0.329	0.614*	0.095	0.728*	-0.556*	-0.431	0.489	0.700*	0.771*	0.595*	-	
AC	0.678*	-0.135	0.086	-0.184	0.064	-0.123	0.725*	0.376	0.861*	-0.580*	-0.438	0.594*	0.938*	0.901*	0.818*	0.766*	-

MD = Maturity date (fruit filling period); BW = Bunch weight; FW = Fruit weight; FL = Fruit length; FC = Fruit circumference; PL % = Percentage peels; DM % = Percentage dry matter; TSS % = Percentage total soluble solids; TNN = Tannin (absorbance values); PR = Protein; AS = Total Ash; FB = Crude fibre; TT = Taste; FV = Flavour; TX = Texture; CL = colour; AC = Acceptability.

* Significant coefficients.

tural attribute in bananas has been classified in sensory terms as 'hard', 'medium' or 'soft' (Ssemwanga *et al*. 1996). The panellists rejected the textural attributes of the hybrids describing it as 'hard' and therefore 'unacceptable'. Ugandan consumers dislike cooked bananas, which lack a 'soft' texture (Ssemwanga and Thompson 1994).

Results also indicated that colour and taste attributes in the introduced bananas were significantly ($P < 0.05$) poorer than the AAA-EA cooking bananas. The panellists complained of a puckering sensation in the mouth caused by the introduced cultivars and poor flavour implying that they are inferior as cooking bananas.

General acceptability

General acceptability, the final judgement of the panellists for the cultivars, summing up all the perceptions 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. FHIA-01 had an acceptability score of 3.0 which was the closest to the AAA-EA cooking bananas. The acceptability results were in conformity with the reports 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 (Anon. 1993, Ssemwanga and Thompson 1994, Sebasigari 1996, Mwenebanda and Banda 1996).

The results of correlation matrix among the studied characteristics of the cultivars indicated that the relationship between tannin and colour was close ($r = 0.81$) as reported by Macheix *et al.* (1990) (Table 4). The highly positive correlation value for tannin and colour suggests that the high tannin negatively affects the appearance of the cooked bananas. The correlation coefficient between texture and acceptability ($r = 0.77$) suggested that the cultivars with hard texture would be unacceptable to the consumers. The correlation coefficient between taste and acceptability was 0.89, suggesting that taste significantly ($P < 0.05$) influences acceptability as observed by Ssemwanga and Thompson (1994) and Sebasigari (1996).

The correlation between fibre and acceptability ($r = 59$) was significant ($P < 0.05$) suggesting that the amount of crude fibre was important for acceptability. The correlation between dry matter and texture was significant ($P < 0.05$) ($r = 0.61$) suggesting that cultivars with high dry matter would have a hard texture and hence become unacceptable. This may account for the low acceptability and hard texture of the IITA hybrids since they were found to have high dry matter. The relationship between tannin and texture suggested that cultivars with high tannin had unacceptable texture. The relationship between maturity date and acceptability was also significant ($P < 0.05$) ($r = 68$) suggesting that the cultivars that take longer to mature were less acceptable.

The results of juice yield indicated that only FHIA-03, FHIA-01, Yangambi km5 and Saba yielded juice (Table 5). FHIA-03 yielded a significantly ($P < 0.05$) higher percentage of juice than the landrace Entundu and the locally adapted Musa-Kayinja and Kisubi. Yangambi km5, FHIA-01, and Saba had similar juice yields as Entundu, a traditional AAA-EA juice banana. The low juice yielders produced juice of significantly ($P < 0.05$) higher brix than the high juice yielders. Normally, juice is consumed or processed further after dilution to acceptable sweetness. Acceptable sweetness has been established to coincide with a brix of between 12%-14% (Pekke, personal communication) which explains why banana juice is normally diluted before drinking. What appears to be a disadvantage of having lower brix is compensated for by higher juice yields. The pH of the juices from FHIA-01 and Entundu was similar and significantly ($P < 0.05$) higher than that of other cultivars that could produce juice. The pH is an important attribute of juices because it influences the levels and type of contamination and therefore the kind of preservation necessary (Jay 1987). Low pH has lower levels of microbial contamination and, therefore, less need of stringent preservation methods (Jay 1987).

The taste of Kisubi juice was scored as significantly ($P < 0.05$) better than the juices from most of the other cultivars studied. This cultivar also had the lowest pH (4.5). Saba and FHIA-01 produced juice with significantly ($P < 0.05$) better mouthfeel than local beer banana cultivars. Mouthfeel 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, FHIA-03, Yangambi km5 and Saba good candidates for juice/beer production in places of the country where brewing is an important

Table 5. Juice Yield and juice characteristics of the recently introduced banana cultivars.

Cultivar	GEnotype	Pulp weight (kg)	Juice yields (%)	Brix (%)	pH	Taste	Colour	Mouthfeel
FHIA-01	AAAA	2.0	63.4bc	20.08c	5.1a	2.5a	2.0	1.8cd
FHIA-02	AAAA	2.0	0.0	-	-	-	-	-
FHIA-03	AAAA	2.0	76.5a	21.70bc	4.7bc	2.8a	2.3	2.8ab
FHIA-17	AAAA	2.0	0.0	-	-	-	-	-
FHIA-23	AAAA	2.0	0.0	-	-	-	-	-
TMPx582-2	AAAB	2.0	0.0	-	-	-	-	-
TMPx5511-2	AABB	2.0	0.0	-	-	-	-	-
TMPx548-9	AAAB	2.0	0.0	-	-	-	-	-
TMPx548-4	AAAB	2.0	0.0	-	-	-	-	-
TMPx7002-1	AAAB	2.0	0.0	-	-	-	-	-
Pisang Ceylan	AA	2.0	0.0	-	-	-	-	-
Yangambi km5	AAA	2.0	67.1b	20.92c	4.8b	2.3ab	2.3	2.0c
Saba	ABB	2.0	65.3bc	22.00bc	4.6cd	2.5a	2.3	1.5d
Kisubi	AB	2.0	52.7d	25.58a	4.5d	1.5b	2.3	2.8ab
Entundu	AAA-EA	2.0	68.5b	19.83c	5.1a	2.8a	2.8	3.0b
Musa-Kayinja	ABB	2.0	60.5c	24.00ab	4.8b	2.3ab	2.3	2.5b
LSD (0.05)			5.77	2.808	0.02	0.85	NS	0.46
CV (%)			33.7	0.76	2.86	24.78	21.17	44.59

* Data analysed was that from the seven cultivars which produced juice.

economic activity and the traditional cultivars are being wiped out by pests and diseases.

Conclusions

Results of the study indicated that while the introduced cultivars had big bunches and fruits, their cooking qualities were unacceptable to consumers due to high tannin, hard texture and poor taste compared to AAA-EA cooking bananas.

Cultivars FHIA-01, FHIA-17 and FHIA-23, however, had ratings that could make them acceptable for cooking in parts of the country where the cooking banana landraces are disappearing. Cultivars FHIA-01, FHIA-03, Yangambi km5 and Saba with good quality juice can replace the traditional local juice producing cultivars where these are disappearing. ■

References

Anonymous. 1993. Plantain/Banana improvement. Annual Report, IITA.

Anonymous. 1994. SAS/STAT users' guide. Version 6, 4th ed., Vol. 2. Cary CN. SAS Institute Inc. 846 pp.

Bainbridge Z, K. Tomlins, K. Wellings & A. Westby. 1996. Methods for assessing quality characteristics of non-grain starchy staples. Part 3: Laboratory methods. NRI, UK. 70 pp.

Broadhurst R.B. & W.T. Jones. 1978. Analysis of condensed tannins using acidified Vanillin. Jour. Food Sc. & Agric. 29: 77-79.

Dadzie B.K. 1998. Postharvest characteristics of black Sigatoka resistant banana, cooking banana and plantain hybrids. Inibap technical guidelines No. 4. 75 pp.

Dadzie B.K. & J. E. Orchard. 1997. Routine postharvest screening of banana/plantain hybrids: criteria and methods. Inibap technical guidelines No. 2. 63 pp.

Hartmanns E. 1989. Five-year food crops research plan (1989-1994) and recommendations for strengthening research and extension linkages. MAAIF, Uganda.

Jay M. J. 1987. Modern food microbiology. 3rd ed., CBS Publ. India.

Jellinek G. 1985. Sensory evaluation of food. Theory and practice. Food Tech Journ. 14: 33-60.

Koffi E.K., C.A. Sims & R.P. Bates. 1991. Viscosity reduction and prevention of browning in the preparation of clarified banana juice. Journ. of food quality, University of Florida, Gainesville, USA. 14 (3): 209-218.

Kyamuhangire W. 1990. Banana juice extraction and processing. M.Sc. Thesis. University of New South Wales, Kingston, Australia.

Larmond E. 1987. Sensory evaluation can be objective. Pp. 3-14. *in* Objective methods in food quality assessment No. 1. CRC Press Inc., Boca Raton, Florida.

Macheix J.J., A. Fleuriet & J. Billot. 1990. Fruit phenolics. CRC Press Inc., Boca Raton, Florida. Pp 10-22.

Mead R., R.N. Curnow & A.M. Harsted. 1993. Statistical methods in agriculture and experimental biology. Chapman and Hall, London. 415 pp.

Mwenebanda B.M.L & D.L. Banda. 1996. Performance of the advanced *Musa* yield trial in Malawi. *Mus*Africa 10:11.

Ortiz R. and D. Vuylsteke. 1998. Bita-3, a starchy banana with a partial resistance to black Sigatoka and tolerant to streak virus. Hort. Sci. 33: 358-359.

Palmer J.K. 1971. The biochemistry of fruits and their products. 11: 65-105. Academic press, London.

Rubaihayo P.R. & C. Gold. 1991. A Report on Rapid Rural Appraisal Survey of Banana Production. Banana Cropping Systems Research. Dpt. of Crop Sci. Makerere University. Research Bulletin 2.

Sebasigari K. 1996. Characterisation of exotic bananas to determine their fruit utilisation according to food habits in East Africa. *Mus*Africa 10: 7.

Ssemwanga J.K., A.K. Thompson & J.A. Aked. 1996. Quality and acceptability studies of the banana hybrid FHIA-03 as compared to the indigenous cultivars for matooke preparation. Ph.D thesis presented to University of Reading, U.K.

Ssemwanga J.K. & A.K. Thompson. 1994. Investigation of postharvest and eating qualities likely to influence acceptability of matooke banana cultivars to be introduced in Uganda. Aspects of applied biol. 39: 207-213.

Tushmereirwe W. K. 1996. Factors influencing the expression of leafspot diseases of highland bananas in Uganda. A Ph.D thesis submitted to the University of Reading, Department of Agriculture, UK.

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