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Determinants of consumers' willingness to purchase East African Highland cooking banana hybrids in Uganda

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This paper uses a survey of 908 consumers that participated in farmer field days to evaluate various hybrid banana varieties from across four regions of Uganda. Sensory attributes such as taste, flavour, texture, colour of the food when cooked and bunch weight were considered. Descriptive statistics and analysis of variance were used to compare the sensory attributes of different banana hybrids and the prices consumers would be willing to pay for these varieties. Logit models were then estimated to determine the consumption characteristics and sensory attributes that are most important in predicting the likelihood of consumers' purchase of hybrid banana varieties when found on markets. The results from the analysis of variance suggest that hybrids M9 and M2 were not significantly different in terms of taste, flavour, texture and colour, while differences were observed in M14 and M17. In terms of overall acceptability, there were no significant differences between M2, M9 and M14. The results show that the Eastern region would pay significantly higher prices for the hybrid bananas compared to other regions of Uganda. Consumer characteristics (such as age and education) and attributes (such as good taste, texture and colour) are likely to positively influence the likely purchase of most of the hybrids, while gender and regional location of the respondents were the major factors to negatively influence the likely purchase of hybrid bananas when found on the market. The results also suggest that while promoting these hybrids, the Eastern region of Uganda could be given priority, especially with hybrids M9 and M14.

Key words: Cooking qualities, consumption characteristics, highland banana hybrids, logit model, Uganda.

INTRODUCTION

Although the rates of poverty in Africa are declining, the continent is still the poorest region in the world (Hope, 2009). By 2005, sub-Saharan Africa still had 51 and 73% of its total population living on only US$1.25 and US$2.00 per day, respectively (WorldBank, 2008). Approximately 59% of the continent's poor people live in rural areas and depend primarily on agriculture for food and livelihoods; agriculture representing the single largest economic activity on the continent. The bulk of Uganda's population (85%) resides in rural areas and depends on agriculture

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for income and subsistence (Ssewanyana and Bategeka, 2007, Gollin and Rogerson, 2010), and yet the low levels of productivity in the sector have deepened in recent years (Nkonya et al., 2004). Moreover, the high population growth rate (approximately 3% per year), declining soil fertility and increases in urban migration have increased demand for food (Dorelien, 2008; Spilsbury et al., 2002). This has put pressure on land and other resources for food production in different farming systems.

To satisfy the growing demand for food, there is need for improving productivity on existing farmland, among other things, by enhancing the yield level of food crops per unit area, through advancing science and technology (Edgerton, 2009). Therefore, an increase in banana productivity will play a very important role in food security and poverty alleviation. Banana production in Uganda has great yield potential to be tapped and there are many ways to raise banana yield, of which improving soil conditions and breeding high-yielding varieties are the most important.

In Uganda, bananas occupy the largest cultivated area among staple food crops with more than 75% of all farmers growing bananas (NARO, 2001). The crop is mainly cultivated for subsistence purposes and it is increasingly becoming an important source of income for resource poor farmers (Karamura et al., 1998). In addition to being a source of income for poor farmers, it is the main staple food for urban consumers (Karamura et al., 1998; Asten et al., 2005). Despite its importance, the crop is currently facing major challenges due to soil exhaustion, pests and diseases (such as weevils, nematodes, and black sigatoka), socio-economic constraints (such as high costs of production) and population pressure (Bagamba et al., 1998). This has culminated in the slowly declining banana supply as a result of declining yields.

The declining yields could also be associated with the use of local varieties (Idrisa et al., 2010). Recognising the importance of increasing banana productivity amidst all the above challenges, NARO's National Banana Research Programme (NBRP) in Uganda has developed new hybrid banana varieties (M2, M9, M14, and M17). These are currently being evaluated in different agro-ecological regions with the local variety (Mbwazirume) as a control. Despite the introduction of the hybrid bananas among the farming communities since 2008, no research has so far been conducted to determine the factors (such as attribute preferences) that could influence consumers' purchasing decisions and their likelihood of purchasing these hybrid banana varieties.

Previous studies, for instance Kikulwe et al. (2011a), investigated consumer willingness to purchase GM bananas and analysed the factors affecting consumers' intentions to purchase GM bananas in Uganda. In addition, Edmeades (2007) and Edmeades and Smale (2006) investigated the determinants of the potential demand and supply for improved traits of banana varieties (e.g., GM bananas) in Uganda. These studies focus on the demand side examining revealed preferences. In the present study, the focus is on the supply side to determine the consumer's likely purchase of the improved (Matooke) hybrid bananas that have been developed through conventional breeding in Uganda, based on consumers' stated preferences. The crucial question that needs to be addressed before making commercialisation decisions is how end users, especially farmers and consumers, will react to the products of the newly developed hybrid bananas. The demand for hybrid bananas is likely to be better if, among others, varieties are developed to include producers' and consumers' preferred cooking traits. According to Quah and Tan (2010), the products must be evaluated to understand the critical sensory qualities that drive consumer acceptance and purchase decisions.

This paper studies the effect of banana cooking qualities and consumption characteristics on purchase decisions for the newly developed hybrid banana varieties in Uganda. With many varieties being developed by breeding programmes of the National Banana Research Programme, it is important for farmers to select varieties most suitable for their conditions and likely to meet the demand for other end users and with better returns. According to David et al. (2002), farmers' adoption decisions are influenced by both production and consumption characteristics of crop varieties. Therefore, the knowledge of traits preferred by consumers is valuable for this important crop improvement programme and provides the market signals for producers. The study considered consumer and agronomic desired attributes in a consumer demand model and their effect on the likely purchase of the hybrid bananas when found in the market.

Conceptual framework

The study analyses the likely consumer purchase of new hybrid banana varieties, borrowing from the theory of the Lancaster (1966) consumer demand model instead of the traditional theory of consumer demand. The fundamental idea behind this model is that consumers choose attributes of goods rather than the goods themselves. In the Lancaster approach, a consumer chooses a product that possesses a combination of attributes that maximises his/her utility. In other words, utility is provided by the attributes a good possesses and the good is as good as its attributes. The approach is based on the framework of random utility theory (Luce, 1959; McFadden, 1974). Rosen (1974) argued that consumers value goods based on their utility-generating attributes and product characteristics when making a purchase decision. The approach has been applied in related studies (Smale and DeGroote, 2003; Bonti-Ankomah and Yiridoe, 2006; Horna

et al., 2007; Burton et al., 2001; Christensen et al., 2011; Veettil et al., 2011; Kikulwe et al., 2011a).Under normal circumstances, an individual consumer chooses the good that satisfies better his needs or expectations, or that provides him with a higher utility (McFadden, 1973). In reality, a consumer's choice in favour of a banana variety is made by comparing a bundle of (observable and unobservable) characteristics of the product (Bonti-Ankomah and Yiridoe, 2006). In this case, an individual consumer chooses between alternative hybrid banana varieties that contain a number of attributes with different levels while making his/her decisions based on the previous experience in banana consumption. The hybrid banana varieties are likely to be demanded for the utility they will provide, which, in turn, is a function of the characteristics of these hybrid banana varieties. Consumers are assumed to make their decisions by choosing the alternative that maximizes their perceived utility (Fernandez-Cornejo et al., 2005). Thus, a consumer is likely to buy a banana variety if the utility of purchase Ui_1 is larger than the utility of not purchasing, Ui_0; that is, if $U^* = Ui_1 - Ui_0 > 0$.

Econometric model

In this study, we apply a model that deals with the dichotomous dependent variable: Willingness to purchase or not. Frequently used approaches in estimating such models include linear probability models (LPM), logit model and probit models (Gujarati, 2003). To evaluate farmers' likely purchase of a 30 kg hybrid banana variety when found on the market, logit models (Gujarati, 2003) were estimated for each variety. The model has been applied in similar studies in the past (Quah and Tan, 2010; Onyango et al., 2004; Gockowski and Ndoumbéb, 2004) and has been found to be efficient in explaining such dichotomous decision variables.

For simplicity, let P_i be the willingness to purchase or not purchase a specific banana variety and X be a vector of explanatory variables related to purchase. Vector X is assumed to be a function of various factors including consumer socioeconomic characteristics, sensory attributes, agronomic characteristics and the geographic location of the respondent. The likelihood purchase decision of a consumer is specified as;

$$Pi = f(X.\ \varepsilon) \quad (1)$$

Where ε is an error term with a logistic distribution. The conceptual model is given as:

$$ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \sum_{j=1}^{n} \beta_j \chi_{ji} + \varepsilon \quad (2)$$

The empirical model specifying the purchase of a banana variety is implicitly stated in Equation (2) where ***P***i=*prop*(y=1) is the conditional probability that a consumer purchases a hybrid banana variety 1-Pi = prob(y=0) is the conditional probability that a consumer does not purchase a variety; ***βj's*** are parameters to be estimated; X***j***i's are the set of explanatory variables; and ε is the error term.The following logit model is estimated per banana variety to analyse the effect of sensory characteristics, consumer characteristics, regional location and the agronomic attributes on consumers' likely purchase of a 30 kg mature bunch of the banana variety and the price they would pay when found in the market;

$$\mathrm{Ln}\left(\frac{P_i}{1-P_i}\right) = (\alpha 0 + \beta 1 * \mathrm{gender} + \beta 2 * \mathrm{educ} + \beta 3 * \mathrm{age} + \beta 4 * \mathrm{hhsize} + \beta 5 * \mathrm{taste} + \beta 6 * \mathrm{texture} + \beta 7 * \mathrm{colour\ of\ food} + \beta 8 * Central + \beta 9 * Easten + \beta 10\ Western + \beta 11 * midwestern + \beta 12 * \mathrm{logbunchweight} + \beta 13 * \mathrm{acceptability} + \beta 14 * HHassets)\ \varepsilon;$$

According to Drewnowski (1997) and Clark (1998), sensory parameters (in particular, taste, flavour, appearance and texture) determine food preferences and influence the product purchase decisions of the buyer. Previous studies (Dadzie and Orchard, 1997; Kikulwe et al., 2011a) show that colour of food, taste and texture and bunch size are some of the important attributes consumers consider for banana variety purchase decisions. In our study, these attributes have been measured by the importance that consumers attach to taste, flavour, texture, colour of the food and overall acceptability on a scale of 1 to 5, where 5 means the highest level of importance. We expect that positive perceptions for the good quality of the above attributes will have a positive effect on the likelihood of purchase decisions for the hybrid banana varieties. Consumers' purchasing behaviour may also be based on external factors such as socio-demographic profiles like gender, education and age (Phuah et al., 2011b). The characteristics of the individual consumer have a bearing on how the individual decides food choice (Bower et al., 2003). These are hypothesised to affect the likely purchase of the banana varieties as they are important theoretical determinants of tastes and preferences. We also included regional location dummies that take the value of 1 when the respondent is located in a given region and zero otherwise. According to Edmeades et al. (2005), farmers' selection among banana varieties depends on the regional location and whether the farmer is oriented towards subsistence or commercial production.

RESEARCH METHODOLOGY

The study was conducted in four regions of Uganda (Mid-Western, Central, Western and Eastern) representing six major agroecological zones: Lake Albert crescent area, Lake Victoria crescent, Western highlands, Southern Highlands, South-East and Eastern agro-ecologic zones (Wortmann and Eledu, 1999). These are the regions where The National Banana Research Programme (NBRP)

of The National Agricultural Research Organization (NARO) is evaluating the new hybrid banana varieties (namely, M2, M9, M14 and M17). While selecting the above regions and agro-ecological zones of the project, the Programme considered high disease/pest susceptibility as a major factor. This is mainly because the prime objective of hybrid banana development was to produce banana varieties resistant to Black-Sigatoka, which has negatively affected banana production in these major areas.

The new varieties and Mbwazirume were introduced to farmers' fields. Mbwazirume was included so that farmers can have complete choice and make fully informed decisions by comparing the old variety with the new varieties. These varieties are being evaluated under farmer-managed conditions across all the above agro-ecologic zones in the four regions of Uganda. The four banana hybrids were introduced to 312 farmers in 39 Districts covering all the above agro-ecological zones.

The study is based on primary data collected in two steps. The first step involved farmers who attended farmer field days that were conducted in 15 Districts of Uganda representing the Central region (Mityana, Wakiso, and Mukono), Eastern region (Butaleija, Jinja, Kaliro, Mayuge, Iganga, and Palisa), Mid-Western region (Bullisa and Masindi) and Western region (Kyejojo and Mubende). The farmer field days were organised to evaluate the consumption traits of the new varieties and provide information on consumption characteristics and sensory tests for the hybrid bananas. The second step involved agronomic data, collected from the on-farm hybrid trials being hosted by the farmers. This captured, among other things, yield parameters, pseudo stem girth at base, 100 cm height, and the number of leaves on the plant (Weirengi et al., 2009).

Farmer field days

One farmer field day was conducted in each of the above mentioned Districts at a host farmer's plot. A minimum of 40 representative farmers were invited to field days in all regions of Uganda and participated as consumers. The field day activities involved consumer acceptability tests and a field tour of the hybrid banana plot. Participants included producer consumers (consumers that produce, consume and sell the surplus) and those who purely buy bananas from the markets.

The experimental protocol consisted of a written survey, and taste evaluations of hybrid banana varieties, with Mbwazirume as a control. Participants were given a data sheet to collect data on consumers' personal and household characteristics that included age, gender, number of years spent in school, household size, and other characteristics.

At each site, all the varieties were harvested at maturity stage and cooked for evaluation. Participants were presented with cooked banana variety samples (presented in random order and coded with random numbers) and were asked to do visual and taste evaluations while filling out a two-page data sheet. Participants were asked to evaluate one sample at a time in the order of their appearance on the questionnaire, which was designed to avoid the effect of order of presentation.

Participating consumers assessed and scored their perception for sensory parameters, namely flavour, taste, texture and colour of the food when cooked based on a five point Likert scale (5=Excellent, 4=Good, 3=Fair, 2=Bad, 1=Very bad) (Dadzie and Orchard, 1997). These were later collapsed into three categories as (Bad, Fair, Good) at analytical level. This was followed by a field visit during which participants were allowed to do a visual inspection of the physical appearance like bunch size and other plant characteristics such as finger shape and the leaves for each variety. The aim of this field visit was for the participants to know the appearance of the varieties they had tested and make informed decisions as to whether they would purchase them when found on the market. The hypothesis was that the sensory and agronomic characteristics of a variety could have a greater impact on consumers' perception and influence their purchase decision when the variety is found on the market. A close-ended question was presented to participants assuming that they had gone to the market where there are many different cooking banana varieties on display as to whether they would buy a 30 kg bunch of each variety and how much they would pay for it (Carlsson et al., 2004). This question was used to create the dependent variable used in this study. A discrete (binary) variable was created which takes the value of 1 if the consumer would purchase a 30 kg bunch of a specific hybrid banana and 0 otherwise.

RESULTS AND DISCUSSION

The majority of the participants (70%) were female. As women are the household members mainly involved in cooking, it is expected that they will inform the study on consumption and cooking attributes of the new banana varieties. The average age of the participants was 40.7 years, and had an education of about 8.7 years. On average, each participant represented a household of about 8.4 members. When asked about their intention to purchase hybrid banana varieties when found in the market, the majority indicated they would buy hybrid M9, M2, M14 and M17 (their propensity to buy in that decreasing order) (Table 1). The majority of the respondents who showed interest to buy hybrids were located in the Eastern region followed by the Central region, while the least were in the Mid-Western region of Uganda.

The presentation of the rest of the results is further split in two parts: First, the findings with respect to the participants' evaluation of the relevant hybrid banana varieties (with respect to sensory and agronomic attributes and the prices they would be willing to pay for the hybrid banana varieties) are presented. Second, the impact of the consumer characteristics and variety attributes (both sensory and agronomic) as determinants of consumers' purchase intention of the banana varieties are statistically analysed, the results presented and discussed.

Agronomic performance of the hybrid bananas in all regions of Uganda

The acceptability of a new banana hybrid by consumers is dependent on a combination of bunch attributes such as bunch weight (Kikulwe et al., 2011a), number of hands, fingers and sensory attributes. Bananas are mainly sold as bunches and, to a lesser extent, as fingers (Odeke et al., 1999). The bunch attributes are dependent on agronomic attributes such as number of leaves and pseudo stem girth (Uazire et al., 2008).

Analysis of variance was performed to test whether there are significant differences in agronomic performance across varieties that seem to influence consumer preferences for the hybrid banana varieties (Table 2). The

Table 1. Demographic characteristic of consumers that attended banana field days (n = 908) (Uganda, 2010).

Variable	Variable description	Mean	SD
Dependent variable			
M2buying	(1 if a respondent would purchase hybrid M2; 0 otherwise)	0.35	0.48
M9buying	(1 if a respondent would purchase hybrid M9; 0 otherwise)	0.43	0.50
M17buying	(1 if a respondent would purchase hybrid M17; 0 otherwise)	0.16	0.37
M14buying	(1 if a respondent would purchase hybrid M14; 0 otherwise)	0.25	0.43
Mbwazbuying	(1 if a respondent would purchase Mbwazirume; 0 otherwise)	0.42	0.49
Independent variable			
Gender	Gender(1=Male; 0=Female)	0.30	0.40
Educ	Respondent education in number of years of schooling	8.70	4.60
Age	Respondent age	40.7	13.50
Hhsize	Total number of household members	8.40	3.20
M9taste	If M9 taste (0=Bad 1=Fair 2=Good)	3.60	0.70
M9flavour	If M9 flavour (0=Bad 1=Fair 2=Good)	3.50	0.70
M9texture	If M9 texture (0=Bad 1=Fair 2=Good)	3.70	0.50
M9colourwhen cooked	If M9 colour (0=Bad 1=Fair 2=Good)	3.60	0.70
M9overall acceptability	If 0=not acceptable 1=Fairly acceptable 2= Acceptable)	3.60	0.70
M17taste	If M14 taste is (0=Bad 1=Fair 2=Good)	2.90	0.80
M17flavour	If M 17 flavour (0=Bad 1=Fair 2=Good)	2.90	0.80
M17texture	If M 17 texture (0=Bad 1=Fair 2=Good)	2.80	0.80
M17 colour when cooked	If M 17 colour (0=Bad 1=Fair 2=Good)	2.880	0.87
M17overall acceptability	If M17 0=Not acceptable 1=Fairly acceptable 2=Acceptable)	2.912	0.76
Mbwazirume Taste	If Mbwazirume Taste (0=Bad 1=Fair 2=Good)	3.75	0.57
Mbwazirume Flavour	If Mbwazirume Flavour (0=Bad 1=Fair 2=Good)	3.65	0.63
Mbwazirume Texture	If Mbwazirume Texture (0=Bad 1=Fair 2=Good)	3.80	0.48
Mbwazirume colour when cooked	If Mbwazirume colour (0=Bad 1=Fair 2=Good)	3.76	0.54
Mbwazirume overall acceptability	If (0=Not acceptable 1=Fairly acceptable 2=Acceptable)	3.72	0.61
M2taste	If M2 taste is (0=Bad 1=Fair 2=Good)	3.56	0.70
M2flavour	If M2 flavour is (0=Bad 1=Fair 2=Good)	3.48	0.72
M2texture	If M2 texture is (0=Bad 1=Fair 2=Good)	3.52	0.73
M2colour of the food when cooked	If M2 colour (0=Bad 1=Fair 2=Good)	3.53	0.74
M2overall acceptability	If m2 (0=Not acceptable 1=Fairly acceptable 2=Acceptable)	3.60	0.69
M14taste	If M14 taste is (0=Bad 1=Fair 2=Good)	3.21	0.83
M14flavour	If M14 flavour is (0=Bad 1=Fair 2=Good)	3.12	0.84
M14texture	If M14 texture (0=Bad 1=Fair 2=Good)	3.02	0.83
M14colour of food when cooked	If M14 colour of the food when cooked is (0=Bad 1=Fair 2=Good)	3.00	0.87
M14overallacceptability	If M14 (0=Not acceptable 1=Fairly acceptable 2=Acceptable)	3.32	0.80
Central	Central region (1 if respondent resides in Central; 0 otherwise)	0.28	0.45
Eastern	Eastern region (1 if respondent resides in East ; 0 otherwise)	0.40	0.49
West	Western region (1 if respondent resides in West, 0 otherwise)	0.22	0.41
Mid-West	Mid-western (1 if respondent resides in Mid-west; 0 otherwise)	0.09	0.29
logbunchweightM9	Size of the banana bunch (kg)	3.19	0.53
Logbunch	Size of the banana bunch (kg)	2.72	0.52
HHassets	Value of the assets owned by the household (in Ugandan shillings)	726907.6	2240748

Source: Data from field day activities (sensory and field visits) collected from February to June 2010. The average exchange rate between February to Junes 2010 was US$ =UGX 2192.5.

results suggest that hybrid banana varieties do not differ significantly (P > 0.05) between the pseudo stem girth at base, girth at 1 m, hands, fingers, total number of leaves, the youngest leaf spotted and the bunch weight (Table 2). Variations were also observed in the plant girth across all the varieties (with the average girth at base of M9 (74.7

Table 2. Mean squares of analysis of variance of agronomic performance for hybrid bananas in all regions of Uganda, 2010.

Variety type	Pseudo stem Girth at base	Girth at 1 m	Hands	Fingers	Total leaves	Youngest leaf spotted	Bunch weight
M2	74.68(0.720)	54.93(0.571)	9.25(0.113)	8.04(0.067)	7.10(0.120)	6.01(0.134)	25.84(0.627)
M9	79.78(0.452)	58.26(0.358)	9.45(0.071)	8.15(0.041)	7.53(0.075)	6.47(0.084)	27.59(0.393)
M14	67.09(0.752)	49.37(0.596)	8.48(0.118)	8.24(0.069)	5.95(0.125)	5.06(0.131)	22.52(0.655)
M17	76.46(1.065)	56.84(0.845)	8.96(0.166)	9.06(0.097)	7.07(0.178)	6.63(0.199)	26.19(0.928)
Mbwazirume	75.93(0.671)	59.19(0.533)	7.65(0.105)	7.81(0.062)	6.37(0.112)	3.97(0.125)	17.37(0.586)
LSD (0.05)	3.30	2.4	0.5	0.2	0.5	0.6	1.7
CV (%)	17.77	18.99	23.72	15.15	32.23	43.99	48.05

Figures in parenthesis show the standard deviations. Source: Table 1

Table 3. Mean scores of the sensory attributes of different banana hybrids in Uganda, 2010.

Cultivar type	Taste	Flavour	Texture	Colour of food	Overall acceptability
M2	3.84^{b}	3.70^{b}	3.77^{b}	3.81^{b}	3.52^{b}
M9	3.75^{b}	3.68^{b}	3.77^{b}	3.80^{b}	3.63^{b}
M14	3.12^{c}	3.03^{c}	2.87^{c}	2.94^{c}	3.43^{b}
M17	2.76^{d}	2.82^{d}	2.66^{d}	2.79^{c}	2.64^{c}
Mbwazirume	4.10^{a}	3.99^{a}	4.22^{a}	4.15^{a}	3.88^{a}
LSD(0.05)	0.36	0.21	0.22	0.9	0.26

Source: Table 1. Values followed by the same letter within a column are not significantly different at P=0.05 with respect to the least significant difference test. Scale: 1=Very bad, 2=Bad, 3=Fair, 4=Good, 5=Excellent. LSD = Least Significant difference.

cm), M17 (76.5 cm),Mbwazirume (75.9 cm), M2 (74.7 cm), and M14 the smallest girth (67.1 cm) (Table 3).Bigger pseudo stem (girth) reflects a healthy plant and increases the potential for production of heavier bunches with many clusters which attracts better prices in the market.

According to Uazire et al. (2008), greater circumference of pseudostem increases the potential for production of heavier bunches. Considering the total number of leaves (Tl), all the hybrid banana varieties produced a higher total number of leaves than Mbwazirume (Table 2). The number of leaves produced by a plant and its functional leaf area are critical factors in determining the yield potential (Sheela and Nair, 2001; Uazire et al., 2008). The higher the number of youngest leaf spotted, the more the functional leaves on the plant and the lower the disease pressure. More functional leaves on the banana plant increase the production of heavier bunches that attract consumers and better prices in the market.

The results show that all four hybrid banana varieties produced significantly heavier bunches (M2 = 25.8 kg, M9 = 27.6 kg, M14 = 22.5 kg and M17 = 26.2 kg) than Mbwazirume (17.4 kg) (Table 2). The increase in bunch weight for Hybrids M9 and M17 compared with the local variety may be attributed to increased number of leaves and pseudo stem girth at base (Table 2). According to Gold et al. (2002), bunch size largely determines marketability of a cultivar. In most cases, consumers consider bunch size, among other traits, when buying bananas from the market.

Evaluating the role of hybrid variety attributes to variety preferences

Product attributes are considered as evaluative criteria from which consumers form beliefs, develop attitudes and build up intentions to buy a product (Sabbe et al., 2009).Table 3 reports the participants' mean scores of the sensory attributes between the hybrid bananas and the local variety samples in terms of their visual and test evaluations. A higher score indicates a stronger preference for an attribute. Considering the sensory characteristics of the new hybrid banana varieties, there was no significant difference between Hybrid M9 and M2 (P>0.05) (Table 3). However, there were significant differences between M14, M17 and Mbwazirume. M17 was the least preferred variety with respect to all attributes. The local variety Mbwazirume was perceived to be better than all new varieties in all sensory attributes (Table 3). In terms of colour of the food, Mbwazirume had the most preferred colour (Yellow), followed by M2 and M9. There was no significant difference between the colours of M14 and M17 although both were significantly inferior to Mbwazirume. According to Dadzie and Orchard (1997) and Nowakunda and Tushemereirwe (2004), the preferred colour of the cooked banana product is yellow,

Table 4. Average prices (in Uganda Shillings) for a 30 kg bunch of hybrid bananas consumers are willing to pay in Uganda, 2010.

Cultivar	Central (N=261)	Eastern (N=364)	Western (N=200)	Mid Western (N=83)	Overall Mean (N=908)	F-statistic
M2	6115.0(2768.6)	10098.7(6069.2)	5311.0(3534.3)	7705.3(5260.1)	7832.5(5275.9)	21.83***
M9	7082.3(4299.2)	9537.7(4552.8)	7696.2(5293.6)	7314.3(5363.4)	8465.9(4871.7)	7.44**
M14	-	6867.5(4751.4)	3225.8(2015.9)	11236.8(4571.5)	6695.0(4819.1)	13.32***
M71	6833.3(3336.7)	7887.5(3300.1)	2773.7(1725.9)	5812.5(4550.8)	6343.2(3699.6)	11.41***
Mbwazirume	7379.2(4892.1)	10154.0(4798.9)	7125.0(4509.6)	6964.3(4484.4)	8570.7(4931.7)	12.33***

Figures in parenthesis show the standard deviations. Source: Table 1.

an attribute that was not observed in the hybrids M17 and M14. Considering consumers' overall acceptance, the trend was similar to the sensory attributes assessment. The results suggest that there was no significant difference ($P > 0.05$) in overall acceptability scores for hybrids M2, M9 and M14, implying that they were scored the same for acceptability.

Purchase intentions and participants' willingness to pay for hybrid bananas

The results from one way analysis of variance (ANOVA) of the prices consumers would be willing to pay for the hybrid banana varieties across regions show that participants would pay significantly higher prices for all the banana varieties in the Eastern region compared to other regions of Uganda (Table 4). This result could be attributed to the limited availability of cooking bananas in this region.The results show that hybrid M2 would fetch significantly higher prices in the Eastern region compared to the Mid-western region while consumers from the Western region would pay the least price for this hybrid. With respect to hybrid M9, participants in the Eastern region would pay a significantly higher price for this variety, followed by the Western region, with the Central region being the lowest (Table 4). Among all the hybrid varieties, the results show that consumers were willing to pay a significantly higher price for Hybrid M9 compared with Hybrid M17. This could be due to its desirable attributes like taste, flavour, texture and colour of the food for these two varieties (Table 3). Also a comparison of willingness to buy values and the consumer' socioeconomic characteristics (Appendix Table a1) suggest that there were significant differences for all the characteristics with the exception of respondent gender and willingness to purchase M14

Determinants of consumers' purchase intentions

Table 5 shows the consumer buying intentions for the five banana varieties under study and the characteristics that made the hybrids appealing to the participants. The participants in the field days evaluated specific sensory attributes for each hybrid variety. Logit model analysis was then conducted taking the binary response variable (1 if a respondent would purchase a variety; 0 otherwise), to identify the impact of these evaluations on the purchase intentions for each of the hybrid banana varieties. Consumer characteristics such as age, education, place of residence, income and gender, among others (Moser et al., 2011; Phuah et al., 2011), are important variables in explaining the likely consumer demand for the hybrid bananas in Uganda. The results show that respondent's age is statistically significant and positive for Hybrids M9 and M17. The age effect suggests that older consumers that participated in the field days were more likely to purchase these hybrid bananas when found in the market (Table 5). This could perhaps be explained by the observation that older and more experienced consumers are better able to judge the variation in taste (Lyly et al., 2007) and are able to identify their preferred banana variety. The variable education is statistically significant and positive at the 5% level for hybrids M2 and M17 implying that consumers with higher education levels are more likely to purchase these varieties. Also, household size has a significant positive effect on the likely purchase for hybrid M9 among the hybrid varieties. The positive and significant sign for this variable suggests that the larger the household size, the more the likelihood for purchasing hybrid M9. A possible explanation could be that the hybrid is perceived to produce good bunch sizes that are likely to attract households with larger families for food security.

The study has demonstrated that different consumers will respond differently with respect to varietal attributes such as texture, taste, flavour and colour of the food. The taste attribute was found to be positively related to the likelihood of purchasing all the hybrid banana varieties with a significant effect on hybrids M2, M14 and M17. The importance of taste in food choice has been proven in other studies. According to Sabbe et al. (2009), the first impression of taste determines whether a consumer tries the consumption of a product for a second time or not. Taste was also found to be important in influencing consumers' willingness to use beverages and ready-to-eat frozen soups containing oat b-glucan in Finland, France and Sweden (Lyly et al., 2007). Similarly, with the exception of hybrid M14, the coefficient for flavour was

Table 5. Logit models of hybrid banana purchase decisions by farmers/consumers, Uganda, 2010**.**

Variable	M2 coefficient estimate	M9 coefficient estimate	M14 coefficient estimate	M17 coefficient estimate	Mbwazirume coefficient estimate
Gender	-0.053(0.270)	0.480(0.306)	-0.071(0.323)	-1.676(0.472) ***	-0.184(0.299)
Age	0.009(0.007)	0.028(0.008)**	0.014(0.009)	0.031(0.011)**	0.004(0.008)
HHsize	0.014(0.034)	0.001(0.036)**	-0.062(0.038)	-0.009(0.052)	0.001(0.036)***
Educ	0.350(0.101) **	0.017(0.027)	0.117(0.114)	0.541(0.161)**	0.441(0.117)
HHAssets	6.56E-08 (4.52E-08)	2.45e-08(5.13e-08)	-1.56e-07(1.09e-07)	-1.41e-07(2.11e-07)	-3.57e-08(7.51e-08)
Taste	0.390(0.207)*	0.112(0.231)	0.673(0.222)**	0.586(0.281)**	0.622(0.196)**
Flavour	0.536(0.198)**	0.459(0.231)**	-0.368(0.239)	0.397(0.384)	0.056(0.215)
Texture	0.426(0.180)**	0.100(0.090)	0.369(0.270)	0.439(0.312)	0.285(0.228)
Colour	0.087(0.109)	0.233(0.169)	0.073(0.220)	0.021(0.178)	0.156(0.220)
Acceptability	0.121(0.080)	0.320(0.104)**	-0.123(0.144)	0.4640.178	0.129(0.091)
Central region	-0.088(0.550)	-0.349(0.382)	-	-0.803(0.643)	0.067(0.471)
Eastern region	-0.650(0.520)	0.380(0.363)	2.657(0.585)***	-0.236(0.878)	-0.337(0.350)
Western region	-1.208** (0.518)	-	-	-0.686 (0.497)	-
Mid-western region	-	-0.461(0.235)	-	-	-0.742(0.589)
Logbunch weight	-0.122(0.092)	-0.120(0.235)	-0.045(0.290)	-0.011(0.291)	0.265(0.113)**
Constant	-4.759(0.589)***	-3.372(0.889)***	-3.555(1.098)**	-4.608(0.696)***	-4.274(0.386)***
Number of observations	908	880	315	567	829
Wald chi^2	237.52	463.42	78.05	166.43	331.12
Prob > chi^2	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.5961	0.6049	0.3216	0.7089	0.6216
Log pseudo likelihood	-238.2327	-239.57183	-147.643	-92.903613	-215.35727

***, **, * = Significant at 1, 5, and 10% probability levels, respectively. Standard errors are shown in parentheses. Source: Table 1.

more important in explaining the likelihood of consumer's purchase for all the hybrid bananas and statistically significant for hybrids M2 and M9, implying that these two varieties are considered to have a better flavour. This result suggests that the participants who attended field day evaluation activities indicated a more positive buying intention for hybrids M2 and M9 because of their preferred flavour. In a similar study, Moser et al. (2011) reported that organic fruit and vegetables that have less environmental impact are commonly bought because they are thought to be superior in terms of "flavour". Flavour is one of the components commonly used as indicators about the overall product quality. Thevariable for colour of the cooked food for the hybrid bananas suggests that consumers that participated in the evaluation field days were likely to purchase hybrid M9 because of its attractive colour when cooked. Colour is a very important sensory attribute of most foods because it influences the consumer's first judgment that determines the overall acceptability of foods (Sangketkit et al., 2000). In Uganda, most consumers prefer bananas with a yellow pulp colour when cooked. According to Dadzie and Orchard (1997), if the pulp colour is white, consumers feel that the fruit is immature and it may not be accepted.

In terms of overall acceptability, hybrid M9 was significant and positive with consumer likelihood of purchase when found in the market.

This could be because of its desirable attributes, particularly in flavour, colour of the food when cooked and the relatively heavy bunch size as manifested in the bunch weight (Table 3).This study has demonstrated that the majority of

Table 6. Marginal effects from the Logit models of hybrid banana purchase decisions by farmers/consumers, Uganda, 2010**.**

Variable	M2 Dy/dx(Z)	M9 Dy/dx(Z)	M14 D y/dx(Z)	M17 y/dx(Z)	Mbwazirume Dy/dx(Z)
Gender	-0.005(-0.20)	0.107(1.53)	-0.018(-0.22)	-0.057(-3.44)	-0.035(-0.63)
Age	0.001(1.25)	0.006(3.25)	0.004(1.49)	0.002(2.80)	0.001(0.51)
HHsize	0.001(0.39)	0.000(0.02)	-0.015(-1.63)	0.000(-0.18)	0.000(0.02)
Educ	0.035(3.15)	0.004(0.64)	0.029(1.02)	0.027(2.74)	0.084(3.47)
HHAssets	6.65e-09(1.45)	5.29e-09(0.48)	-3.88e-08(-1.43)	-7.15e-09(-0.70)	-6.83e-09(-0.48)
Taste	0.040(1.97)	0.024(0.48)	0.168(3.03)	0.030(2.04)	0.119(3.12)
Flavour	0.054(2.61)	0.099(2.00)	-0.092(-1.54)	0.020(1.00)	0.011(0.26)
Texture	0.043(0.02)	0.022(1.12)	0.092(1.37)	0.022(1.45)	0.055(1.26)
Colour	0.009(0.79)	0.050(1.39)	0.018(0.33)	0.001(0.12)	0.030(0.71)
Acceptability	0.012(1.48)	0.069(3.01)	-0.031(-0.86)	0.023(2.51)	0.025(1.39)
Central region	-0.009(-0.16)	-0.073(-0.94)	-	-0.034(-1.36)	0.013(0.14)
Eastern region	-0.063(-1.26)	0.083(1.04)	0.528(7.19)	-0.012(-0.27)	-0.064(-0.99)
Western region	-0.096(-2.68)	-	-	-0.030(-1.43)	-
Mid-western region	-	-0.092(-0.96)	-	-	-0.121(-1.57)
Logbunch weight	-0.012(-1.32)	-0.026(-0.51)	-0.011(-0.15)	-0.001(-0.04)	0.051(2.27)

Z values are shown in parentheses. Source: Table 1

consumers that participated in the field day activities are likely to purchase Hybrid M2 when found on the market because of its desired attributes: Taste, flavour and texture. This indicates that there are good marketing possibilities for this hybrid when introduced to a wider community.

The regional location of the participants that attended the field days was found to reduce the likely purchase of the hybrid banana varieties, with participants located in the Western region not likely to purchase hybrid M2 when compared with those from the Mid-western region (Table 5). The marginal effect results indicate that the participants in the Central region are 10% less likely to purchase Hybrid M2 compared with those from Mid-western region (Table 6). Moreover, consumers located in Eastern region of Uganda are more likely to purchase Hybrid M9 compared with those located in Western region and significantly more likely to purchase Hybrid M14 compared with those consumers in the Central and Western regions. The marginal analysis shows that consumers in Eastern region are more likely to purchase hybrid M9 by 8% compared with those in the Western region, and by 53% of M14 compared with those in the Western and Mid-western regions of the country (Table 6).

CONCLUSIONS AND IMPLICATION FOR POLICY

Despite the introduction of hybrid banana varieties among the farming communities in different agro-ecological regions of Uganda, no study has attempted to investigate the effect of banana cooking desirable traits and consumption characteristics on the likelihood of consumers' purchasing of the hybrid bananas. This has been the focus of the current study. Sensory atttributes such as taste, flavour, texture, colour of the food when cooked and bunch weight are known to attract consumers. The analysis of variance and Logit models were then estimated to determine the consumption characteristics and sensory attributes that are most important in predicting the likelihood of consumers' purchasing of hybrid banana varieties when found on markets.

Sensory evaluation showed that hybrid bananas differed significantly with regard to different sensory attributes. With respect to the prices, participants from Eastern region would pay significantly higher prices for all the banana varieties compared to other regions of Uganda. The consumers that participated differed considerably with regard to the likelihood of purchasing the hybrid bananas when found on the market. The results suggest that age, education, good taste, flavour and texture were the most important factors that are likely to positively influence the purchase of most of the hybrid banana varieties. In terms of overall acceptability, hybrid M9 scored significantly higher compared with other hybrid varieties. The results of this study suggest that the consumer evaluation of the hybrid banana varieties based on their attributes can predict their acceptance on the market. This means that breeders of the varieties should focus on taste, flavour and colour because these features are regarded as important to consumers.

Moreover, marketing efforts for these bananas could focus on reaching consumers who are older and have a relatively higher education, particularly when promoting M9, M17 and M2. In this study, the dependent variable was consumers' intention to purchase a hybrid banana variety when found on the market. Although this measure

involved the actual varieties presented to consumers, it may have been difficult for the participants to evaluate their purchase intentions for the bananas that were not yet introduced to the market. Further studies could target investigating consumers' actual purchase behaviour for these varieties targeting regions where the project introduced them.

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APPENDIX

Table A1. A comparison of willingness to buy values and consumers' socioeconomic characteristics.

Consumer characteristics/willingness to pay	Mean (Std. error mean)	t-test
Resgender - BuyM2	-0.079 (0.017)	-4.640***
Respage - BuyM2	200.006(0.731)	27.378***
Education - BuyM2	30.573(0.168)	21.273***
Hhsize - BuyM2	30.765(0.148)	25.444***
Resgender - m9buying	-0.165(0.016)	-10.409***
Education - m9buying	30.487(0.167)	20.866***
Respage - m9buying	190.921(0.729)	27.340***
Hhsize - m9buying	30.680(0.147)	25.096***
Resgender - buyingm14	0.019(0.018)	1.092
Education - buyingm14	30.671(0.172)	21.405***
Respage - buyingm14	200.105(0.734)	27.406***
Hhsize - m17buying	30.950(0.154)	25.676***
Resgender - m17buying	0.106(0.017)	6.079***
Education - m17buying	30.758(0.172)	21.830***
Respage - m17buying	200.192(0.736)	27.445***
Education - BuyMbwaz	30.503(0.166)	21.090***
Respage - BuyMbwaz	190.937(0.730)	27.327***
Hhsize - BuyMbwaz	30.696(0.147)	25.136***

***, **, * = Significant at 1, 5, and 10% probability levels, respectively. Standard errors are shown in parentheses. Source: see Table 1.