

Full Length Research Paper

Sensory evaluation response as a selection tool in African eggplant (*Solanum aethiopicum*) production and breeding

Eze, S. C.^{1*}, K. P. Baiyeri¹ and C. U. Agbo¹, G. I. Ameh² and E. S. Osahele³

¹Department of Crop Science, University of Nigeria, Nsukka, Nigeria.

²Department of Applied Biology and Biotechnology, Enugu State University of Science and Technology, Enugu, Nigeria.

³Department of Teaching and Research Farm, Faculty of Agriculture, Ambrose Alli University Ekpoma, Nigeria.

Accepted 9 August, 2012

Garden egg also known as African eggplant is one of the most important vegetables that is widely cultivated across the African continent especially in West and East Africa. Sensory evaluation of the eggplant fruits as a selection tool for eggplant breeding was carried out at the Crop physiology laboratory of the Department of Crop Science, University of Nigeria, Nsukka, Nigeria. Four cultivars of eggplant, namely: Pink lady, Asa Campus, White green label and Ngwa local were collected from the Department of Crop Science Farm and Nsukka main market. Samples of egg plant fruits were prepared. A nine-member panel of judges was constituted from academic staff and postgraduate students of the Department of Crop Science, University of Nigeria, Nsukka who are regular consumers of eggplants. Each member was provided with questionnaires for both objective and subjective sensory evaluations. The objective evaluation (overall assessment) enabled each judge to describe the products while the subjective evaluation (scoring) requested them to give information on the degree of like or dislike of the products. Among the objective sensory variables, colour accounted for over 60% of the total variation. Glossy appearance, taste and texture made significant but much smaller contributions to the total variation. Glossy appearance, flavour and taste were positively related to the general acceptability of the evaluated cultivars. The scatter plots re-affirmed that texture bore little or no relation to the general acceptability for all the eggplant. Sensory evaluation can be a valuable addition to the breeder's selection criteria.

Key words: African eggplant, *Solanum aethiopicum*, sensory evaluation, fruit quality, colour, taste, flavour, texture, glossiness.

INTRODUCTION

The garden egg (*Solanum aethiopicum* Gilo group) originated in tropical Africa (Norman, 1992; Grubben and Denton, 2004). Grubben and Denton (2004) explain that garden egg is the result of the domestication of one wild and one semi-domesticated *Solanum* species that grow and more intensively in West and East Africa. Garden egg is also produced in Brazil (known as 'jilo') and

in tropical Africa (*Solanum anguivi* and *Solanum distichum*). The crop is widely cultivated across most of the African continent, occasionally in Southern Italy (Grubben and Denton, 2004). In Ghana garden egg is locally abundant, lacks significant knowledge and research investment, and has significant public and private value that has not been fully realized (Horna and Gruère, 2006).

Garden egg, also known as African eggplant is one of the most important vegetable crops in West Africa (Owusu-Ansah et al., 2001; Grubben and Denton, 2004).

*Corresponding author. E-mail: simoneze2002@yahoo.com.

Not only is this crop consumed on an almost daily basis by rural and urban families but it also represents the main source of income for many rural households in the forest zone of the country (Owusu-Ansah et al., 2001). Despite its local importance, there are limited knowledge and research efforts involving garden egg. Garden egg's perceivable quality attributes: such as colour, shape, size and taste vary widely. Garden egg can be deep green, green, white, cream, or yellow at the physiologically immature stage. In southeastern Nigeria, garden egg is accorded high cultural value. It is served to a visitor as a symbol of warm reception and also used as the first entertainment in functions such as wedding ceremonies, traditional marriages, town meetings, swearing in ceremonies etc. Sensory evaluation of vegetables brings about very valuable information on their quality characteristics, level of acceptability with a consequence on adoption potential and sensory traits of vegetables are the main factors that determine consumer's satisfaction (Abbot, 1999). The objective of this study therefore was to determine good quality traits in eggplants based on consumers' preferences and general acceptability.

MATERIALS AND METHODS

The study was carried out at the crop physiology laboratory of the Department of Crop Science, University of Nigeria, Nsukka. Nsukka is located at latitude 6° 52' N and longitude 7° 23' E, with altitude 400 m above sea level and has a humid tropical climate. Four cultivars of egg plant namely: Pink lady, Asa campus, Local and White green label commonly consumed in southeastern Nigeria were used for the study. Local and Asa campus were grown and harvested from the Department of Crop Science, University of Nigeria, Nsukka research farm while Pink lady and White green label that usually thrive better in Northern part of Nigeria were grown and moved down to the South. The Local and Asa campus were harvested and kept for two days before the sensory evaluation date. This was the estimated time period required for the harvest of Pink lady and White green label in the North and their transportation down to the South so as to place all of them on the same time of harvest and consequently reduce random error.

Fruits of uniform sizes and colours were sorted and selected from the lots for the evaluation. This was done in order not to introduce bias with differences in fruit sizes and colours within the same cultivar which is very common in fruits and vegetables. A sample consisting of 27 fruits was washed and placed in white plastic tray. They were tagged with three digit random number and placed on a laboratory bench. The trays were covered with lids to prevent cross-comparison of the coded samples.

Taste panel

A nine-member panel of judges was constituted from academic staff and postgraduate students of the Department of Crop Science, University of Nigeria, Nsukka who are regular consumers of eggplants. Two judges were directly involved in breeding programme, two in Food Science and Technology while others were from other fields and were unfamiliar with breeding selection. Each member was provided with questionnaires for both objective (overall assessment) and subjective (value attachment) sensory evaluations. The objective evaluation enables each judge to

describe the products while the subjective evaluation requests them to give information on the degree of like or dislike of the products. A preliminary test which served as a training class was conducted a day before the main evaluation. The purpose was to make the members of the panel familiar with both hedonic and descriptor scales. Light refreshments of snacks and soft drinks were provided to appreciate the judges and keep up their interests and morale and also to improve consistency in the main evaluation. Sample order was randomized among the judges to avoid position biases. Tasting was done in a quiet room with a mixture of natural light and fluorescent light with no interaction between or among the judges. In addition, the judges were checked into the room at 10 min interval to further forestall interaction among the judges. Each judge was provided with slices of bread and a cup of water to rinse his or her mouth before tasting the next sample to avoid carrying residual taste of the previous sample to the next one. The different cultivars of eggplants were evaluated for colour, glossy appearance, texture, taste, flavour and acceptability using a hedonic scale thus:

Colour: 1 = whitish green, 2 = deep green, 3 = pinkish yellow, 4 = yellowish red, 5 = off-colour.

Glossy appearance 1 = dull looking, 2 = slightly glossy, 3 = glossy, 4 = very glossy, 5 = highly glossy.

Texture: 1 = slightly soft, 2 = soft, 3 = slightly hard, 4 = slightly hard, 5 = hard.

Taste: 1 = bland, 2 = slightly bitter, 3 = bitter, 4 = slightly sweet, 5 = sweet.

Flavour: 1 = good flavour, 2 = very good flavour, 3 = off-flavour, 4 = bad flavour, 5 = very bad.

Acceptability: 1 = Like extremely, 2 = like moderately, 3 = neither like nor dislike, 4 = dislike, 5 = dislike extremely.

Statistical analysis of the taste panel data

Data from tasting sessions were analyzed as a randomized complete block design (RCBD) using the general linear model (GLM) of the statistical analysis system (SAS) procedure (SAS, 1999), with judges as blocks and selections as treatments. This design assumes no interaction between judges and selections. Mean separation was done by the least significant difference (LSD). Multiple linear step wise regression analysis was done to ascertain the importance of each component attributes on over all liking of colour, glossy appearance, texture, taste and flavour. The degree/intensity of each attribute score was determined using a polar plot.

RESULTS

From the objective evaluation, the skin colour of Pink lady was pinkish yellow with score 3.0, and Asa campus was deep green with score 2.0 while others varied between whitish green and green (Table 1). Pink lady also had glossy appearance with score 2.38 while others were slightly glossy with score 1.25-2.75, except Asa campus that rated between dull looking and slightly glossy. All the cultivars had traces of bitterness in the taste with local having the strongest bitterness. Asa campus and Local had very good flavour respectively with score 2.25 and 2.0, while Pink lady and White green label each scored less than +2 representing good flavour. Texture profile ranged from slightly soft to soft across the cultivars. Among the sensory variables, colour accounted for over 60% of the total variation (Table 2). Glossy appearance,

Table 1. Objective evaluation of four eggplant cultivars for sensory quality.

Egg plant cultivars	Scores for sensory quality attributes of eggplants				
	Colour	Glossy appearance	Texture	Taste	Flavour
Asa campus	2.0	1.63	2.25	2.13	2.25
Local	1.75	2.37	2.38	2.25	2.0
Pink lady	3.0	2.38	1.25	2.75	1.75
Green label	1.89	2.0	1.75	2.13	1.75
LSD _{0.05}	0.41	0.31	0.23	0.31	0.33

Result is based on the mode of score for each attribute on the scale specified in the methods.

Table 2. Regression of egg plant quality attributes on general acceptability.

Quality attributes	Estimate	Standard error of estimate	R ²	Partial R ²
Intercept	-0.26	0.30		
Colour	0.58	0.09	0.64	0.64***
Taste	0.25	0.07	0.71	0.07**
Texture	0.24	0.11	0.74	0.03**
Glossy appearance	0.22	0.12	0.06	0.09**
Total				0.93

** , Significant at $p \leq 0.01$; *** , significant at $p \leq 0.001$.

taste and texture made significant but much smaller contributions to the total variation. Glossy appearance (Figure 1a), flavour (Figure 1b) and taste (Figure 1c) were positively related to the general acceptability of the evaluated cultivars (Figure 1). The scatter plots re-affirmed that texture bore little or no relation to the general acceptability for all the African eggplant cultivars.

Based on subjective evaluation, the highest percentage of eggplants with the best score was obtained for colour, texture and flavour (Table 3). The sensory profiles are shown in polar plot (Figure 2). Local had the highest rating for bitterness and flavour but lowest for texture, colour and glossy appearance. White green label had the highest rating for colour and lowest for bitterness. Generally, no two eggplant cultivars had exactly the same ratings of intensity of these traits. Local had the highest rating for bitterness and flavour but lowest for hardness, colour and glossy appearance. Similarly, White green label had the highest rating for colour and lowest for bitterness.

DISCUSSION

The sensory evaluation of vegetables brings very valuable information on the quality characteristics of eggplant fruits desired by consumers. According to Abbott (1999), sensory traits of vegetables are usually the main factors that determine consumer's satisfaction. Among the various sensory evaluation methods reported literature, the quantitative descriptive analysis (QDA) is

often applied for detailed description of the sensory characteristics of a product. Quantitative descriptive analysis and the subjective quality analysis of the eggplant cultivars evaluated in this study clearly identified the relative importance of each trait to the consumers.

Varieties generally differ in their fruits characteristics that influence consumers' judgement for quality. In the present study, colour had the utmost influence on the judges. The cultivars displayed different colours due to inherent genetic characteristics (whitish green, deep green) or to the physiological stage of the fruits (pinkish yellow, yellowish red) of the cultivars used in the study. However, greenish and pinkish yellow colours appealed to the panellists most because there ratings were significantly ($P \leq 0.05$) higher than others in the judges assessment. DuBose et al. (1980) reported that colour is a very important sensory attribute of most fruits/foods and it influences the consumers' first judgement. Francis (1980) also remarked that when the colour is unappealing, consumers are unlikely to be able to judge the flavour or texture as favourable.

Glossy appearance and taste varied significantly among the cultivars and contributed most (after colour) to the overall quality and acceptability of egg plant fruits. Pink lady and Local had best of these attributes in this study. High variations occurred in sensory profiles such as degree or value ratings in flavour attribute or hardness in texture attributes. This may be related to the different maturity stages of the fruits at harvest because African eggplant is not a determinate plant that flowers and fruit once. Marek and Daria (2004) had earlier reported that

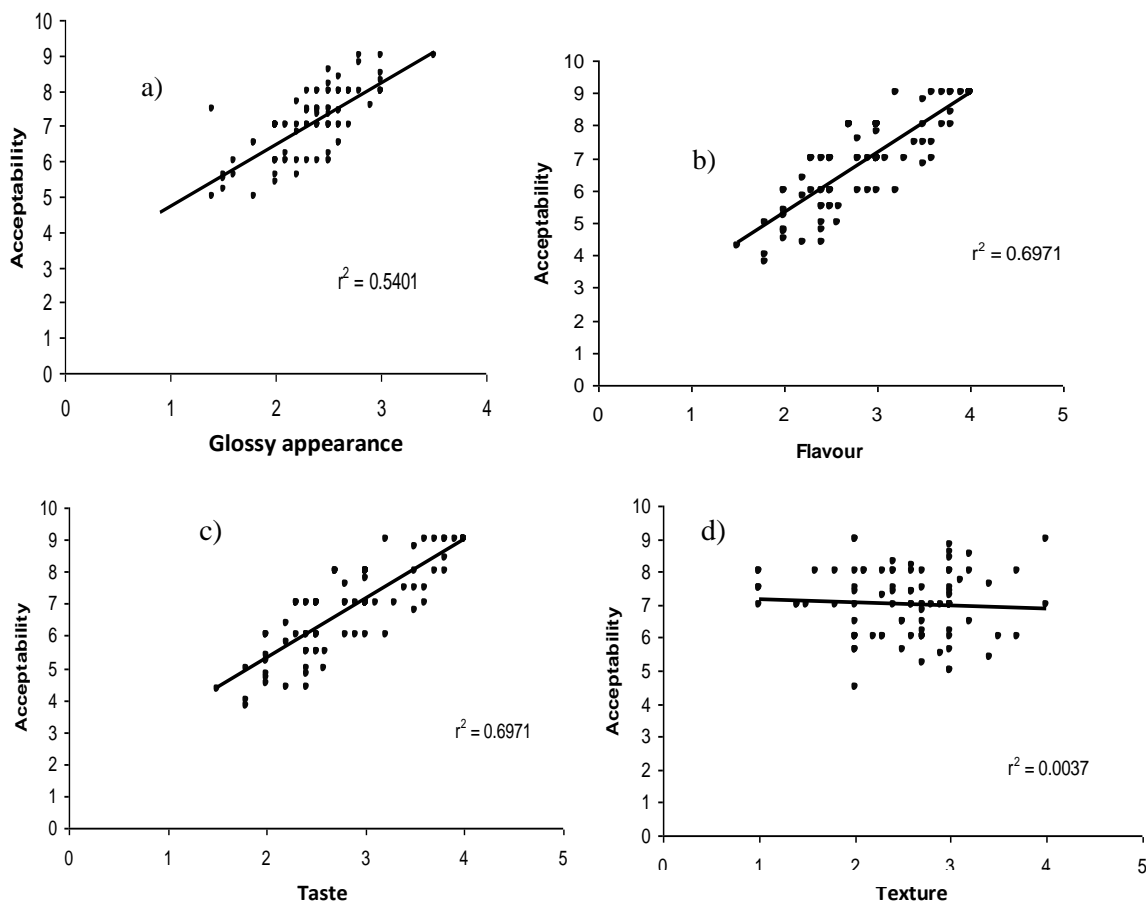


Figure 1. Relation of acceptability to (a) glossy appearance, (b) flavour, (c) taste and (d) texture.

Table 3. Subjective evaluation of sensory quality of eggplants.

Sensory quality attributes	Percent of egg plants with the following scores				
	1	2	3	4	5
Colour	37.5 (37.5)	31.3(68.8)	15.6(84.4)	9.4 (93.8)	6.3(100)
Glossy appearance	28.1 (28.1)	43.8(71.9)	13.8(90.6)	9.4 (100)	0 (0)
Texture	34.4 (34.4)	28.1(62.5)	37.5 (100)	0 (0)	0 (0)
Taste	21.9 (21.9)	43.8(65.8)	9.4 (84.4)	12.5(96.9)	3.1(100)
Flavour	65.1 (65.1)	18.9(84.0)	16.0 (100)	0 (0)	0 (0)

Result is based on the mode of score for each attribute on a scale specified in the method; * Values in parenthesis = cumulative percent.

the overall sensory quality scores in eggplants were affected by both cultivar and maturity stage of fruits. Agbo and Nwaosu (2009) showed that stage of fruit maturity at harvest influences the level of seed development which directly affects fruit texture and hardness attributes. Again, Meilgaard et al. (1999) earlier reported that sensory quality was not a single attribute but it was a complex of many descriptors which can be individually estimated by a panel.

The subjective evaluation showed a score of zero for dislike or extremely dislike of texture and flavour liking. This suggests that all the cultivars tested are cherished vegetables yet there is need for genetic improvement on their sensory quality attributes particularly colour and flavour where high variations were obtained. A taste profile obtained in this study can be used to identify genotypes that would be promising to test on consumer sub-groups whose preferences have been characterised

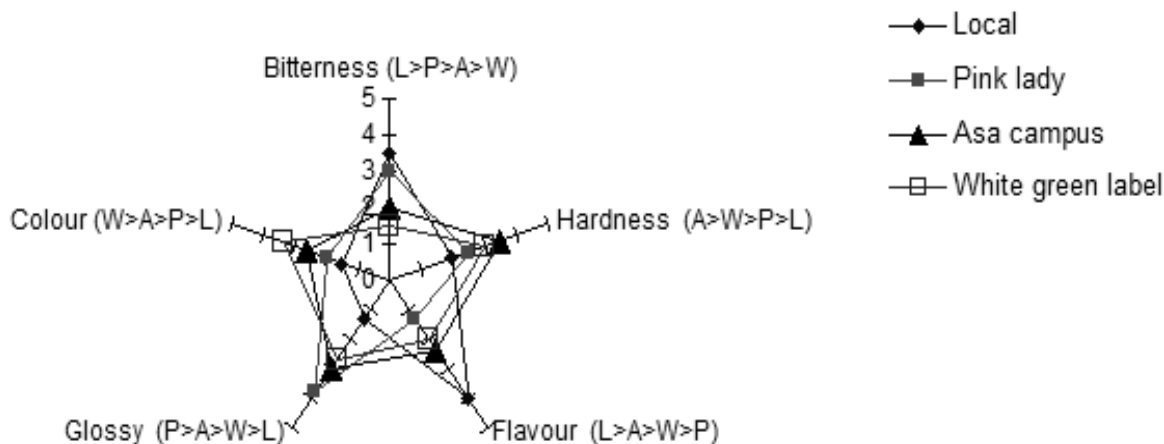


Figure 2. Polar plot for comparison of sensory profiles. L = Local, P = Pink lady, A = Asa campus, W = White green label.

(Stebbins, 1994; Daillant-aspinnler et al., 1996).

Conclusion

The methods of sensory evaluation described here have provided reproducible and quantitative data for choice of consumers in determined selection indices relative to standard programme. A minimum panel size of 9 provided statistical discrimination on a 1 to 5 scale for liking of glossy appearance, texture, flavour and taste and on the degree/intensity of skin colouration, textural and flavour profiles. Panel mean score appeared to be more reliable than the opinions of one or two tasters.

The inclusion of intensity ratings for attributes of colour and flavour provided additional advantages: (1) Sensory ratings of sweetness and bitterness were useful in predicting flavour liking; (2) it permitted regression analysis for elucidation of importance of different attributes. However, desert quality is clearly not the only considerations in advancing breeding selection, yield and disease susceptibility/resistance remain important. Sensory evaluation can be a valuable addition to the breeder's selection criteria. The panel result for colour and flavour liking could be representative of ratings done by a sample of consumers. Fruit colour and flavour are strongly suggested as additional selection indices for eggplants production and breeding.

REFERENCES

- Abbot J (1999). Quality measurements of fruits and vegetables. *Postharvest. Biol. Technol.* 15:207-222.
- Agbo CU, Nwaosu PU (2009). The influence of seed processing and techniques at varying maturity stages of *Solanum melongena* fruits on their germination and dormancy. *Afr. J. Biotechnol.* 8(18):4529-4538.
- Daillant-Spinnler B, MacFie HJ, Beyts HDK, Hedderley D (1996). Relationship between perceived sensory properties and major preference directions of 12 varieties of apples from the southern Hemisphere. *Food Qual. Prefer.* 7:113-126.
- DuBose CN, Cardello AV, Maaller O (1980). Effects of colorants and flavourants on identification, perceived flavour intensity and hedonic quality of fruit flavoured beverages and cake. *J. Food Sci.* 45:1393-1415.
- Francis FJ (1980). Colour quality evaluation of horticultural crops. *Hortic. Sci.* 15:4-15.
- Grubben GJH, Denton OA (2004). *Plant Resources of Tropical Africa II. Vegetables*, Leiden, Wageningen: Backhuys Publishers. pp. 48-57.
- Horna JD, Gruère G (2006). Marketing Underutilized Crops for Biodiversity: The case of the african garden egg (*Solanum aethiopicum*) in Ghana: 8th International BIOECON Conference, 29-30 August 2006, Kings College Cambridge.
- Norman JC (1992). Tropical vegetable crops. Devon: Arthur Stockwell Ltd. L.) with aqueous neem seed extracts. *J. Ghana Sci. Assoc.* 3:70-84.
- Owusu-Ansah FK, Afreh-Nuamah D, Obeng-Ofori, Ofosu-Budu KG (2001). 'Managing infestation levels of major insect pests of garden eggs (*Solanum integrifolium*). *J. Ghana Sci. Assoc.* 3:70-84.
- Stebbins RL (1994). Consumer's tastes in apple varieties profiled. *Good fruit Grower* October: pp. 32-33.