

NATIONAL AGRICULTURAL RESEARCH ORGANIZATION

ANNEX 3

Rice preferences among the Ugandan Consumers

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1 INTRODUCTION

Rice is the seed of the monocot plant *Oryza sativa*. As a cereal grain, it is the most important staple food for a large part of the world's human population which includes South East Asia, the Middle East, Latin America, and the West Indies. World production of rice has risen steadily from about 200 million tonnes of paddy rice in 1960 to over 607.9 million tonnes in 2004, 634.5 million tonnes in 2005, and 685 million tonnes in 2008. Milled rice should be about 68% of paddy by weight, although use of antiquated milling equipment in many countries means this conversion factor can sometimes be much lower. In 2004, the top four producers were China (26% of world production), India (20%), Indonesia (9%) and Bangladesh (5%). World trade figures are very different, as only about 5–6% of rice produced is traded internationally. The largest three exporting countries are Thailand, Vietnam, and the United States. Although China and India are the two largest producers of rice in the world, both countries consume the majority of the rice produced domestically, leaving little to be traded internationally.

Rice has since become the fourth most important cereal in sub-Saharan Africa in terms of production, behind sorghum, maize and millet. Approximately 20 million farmers in sub-Saharan Africa grow rice while about 100 million people depend on it for their livelihood. The demand for rice in Africa is growing at about 6 percent per annum, faster than anywhere else in the world, with the latest available statistics suggesting that sub-Saharan Africa now accounts for 20 percent of the total world rice imports. Eighteen sub-Saharan African countries consume more than 100,000 tons of rice per year each, for a total of 19 million tons. In 2004, some 13.2 million tons of rice were produced locally whereas 5.9 million tons had to be imported from elsewhere, costing the sub-Saharan African region some 1.2 billion U.S. dollars. Egypt is the leading rice producing country, followed by Nigeria and Madagascar. Other countries include Ivory Coast and Guinea. But of all the 17 rice-producing countries in Africa, very few are self sufficient in rice production.

The demand for rice in Uganda is increasing with ever increasing urban population who provide the main market for rice. The current estimated demand for rice is about 200 metric tons of which 20% worth US \$ 35 million is met by imports from mainly Asia. Despite this impressive demand, there is no clear documented information on what type of rice is required by the local consumers. A study was therefore necessary to generate information on the characteristics of rice varieties and brands required by the Ugandan consumers with view to helping in taking investment decisions in the rice industry.

2 OBJECTIVES OF THE STUDY

The objective of the study was to determine the type(s) of rice Ugandan consumers want to eat.

3 MATERIALS AND METHODS

3.1 GENERAL DESIGN OF THE STUDY

The methodology for determining the rice preferences among the Ugandan consumers was divided into two broad studies: rice consumers' survey and sensory evaluation in the laboratory.

3.2 RICE CONSUMERS' SURVEY

Rice consumers' survey was carried in eight districts of Uganda, strategically selected to represent the entire country and the niche markets of rice. Of the eight districts four were the core project districts where most of the project activities were conducted. The core projects were Butaleja and Lira representing eastern and northern regions respectively, Nakaseke and Hoima representing the central and western regions respectively. The other districts involved included Amuru in the north, Jinja in the east, Kampala and Mityana in the central. During the study a total of 475 consumers were interviewed of whom 60.5% were women. In addition, discussions were held with managers/operators of 49 cottage rice milling plants and 50 key informants. Participatory survey based on Participatory Rural Appraisal (PRA) principles was used to implement the study. A non-formal participatory research technique based on interactive focus group discussions was used for obtaining relevant information. Some of the data that was not pre-coded was coded after collection, cleaned and entered in Epidata version 3.0 and later exported to SPSS Version 16.0 for analysis. Means, frequencies Chi-square and bi-variables were used to analyze the survey data.

3.3 SENSORY EVALUATION

3.3.1 The culinary attributes

Culinary attributes perceived by potential consumers of all the rice varieties available in the markets at the time of the study was used in the sensory evaluation. The culinary attributes used included appearance, taste, aroma, texture, stickiness, cleanliness and overall acceptability.

3.3.2 Rice samples and other materials

A total of 17 milled rice varieties and brands both imported and local were used in the study. The imported brands were: Prime harvest premium quality, Pure mweya Pishori, SWT Pakistan Basmati, King's Long Grain, Dawaat Long Grain, Pearl Kenya Pishori, Pakistan and Brown Rice. The local varieties included Tilda Basmati, Tilda Aromatic, Tilda Crystal Long grain, Tilda Rice halves, NERICA varieties 1, 4 and 10 (N1, N4 and N10), Kaiso and Supa. The imported rice samples were purchased from Uchumi Supermarket. To ensure variety purity, the NERICA varieties were collected from Cereal Program of National Crops Resources Research Institute, Namulonge and Supa was purchased from Lira town while the other local varieties were bought from shops around Kampala. Each sample used in the experiment was 5kg. Other materials, also purchased from Uchumi Supermarket, were; Saucepans, Disposable plates, Rubbers, Pencils, cups and forks, Serviettes and neutral solution (mineral water).

3.3.3 Sample Preparation

Three coded saucepans, each containing 2 cups of water (1L), were put on fire and water allowed to boil. One cup each of the rice samples weighing 1/2kg was put in the saucepans with a corresponding code, covered and allowed to boil while monitoring the water absorption of the rice and how long it takes to cook. Salt was not added because it alters the taste of food and would in this case bias the panelists.

3.3.4 Sample Presentation

The ready samples were put on a partitioned plate that had been coded with numbers corresponding to the samples. They were placed before the panelists with a glass of water for rinsing their mouths after tasting each sample and a score sheet (Annex 1) for recording their observations. Panelists were also presented with a brief definition of the sensory parameters in use (Annex 2).

3.3.5 Panellists

Food Bio-sciences Research Centre has a pool of well trained and experienced panellists for undertaking sensory evaluation of the products under development. A total of 25 of these panellists were used in the sensory evaluation

4 RESULTS

4.1 RICE CONSUMERS' SURVEY

4.1.1 Rice consumption at household level

The households interviewed on average spent 7,480 +/- 8,222 Uganda shillings on food per day although the range was 49,000 (1,000 and 50,000 as minimum and maximum respectively). A cross section of the food types consumed at household level revealed that plantain or matooke (37%) was consumed more than other foods followed by rice (27%), posho/maize and millet (Figure 1). Other foods consumed were cassava, sweet potatoes, yams and sorghum. However, because most of the consumers interviewed were from urban and peri-urban dwellings (especially Jinja and Kampala), the households consumed more than one food type per meal rather than the general picture in rural dwellings where one type is relied on. The study focussed much on the urban and peri-urban centres because, they provide niche markets for rice. It was therefore important to know the rice preference among these consumers who offer stable market for rice.

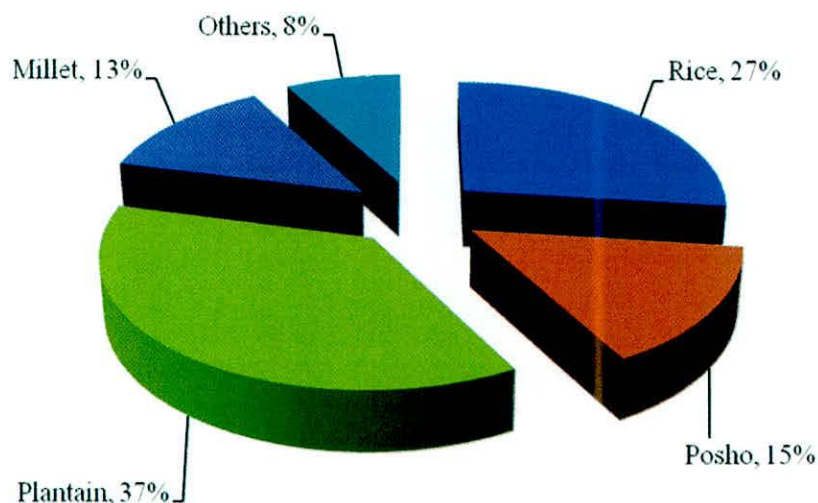


Figure 1: Starchy food types consumed at household levels by the respondents

4.1.2 Preferred rice varieties/brands

All the respondents interviewed had consumed rice in the past one week. However, 77.4% ate mainly local varieties while 22.6% ate mainly imported rice. This has correlated closely with the estimates that 20% of local rice demand is met by imports. In addition, some households who consumed imported varieties but did not reliably depend on them and thus reported more local rice variety consumption. “*Supa*” was the most (77.8%) preferred local rice variety followed by *Kaiso* (10.7%) and *NERICA* lines (6.5%). The long history of *Supa* being the best variety and low promotion of *NERICA* lines among the urban and peri-urban consumers might have been some of the reasons for the high rate of *Supa*. Tilda brands which are locally grown and processed were not much talked about. This could mainly be attributed to sampling problem or most consumers not being aware of the Tilda brands.

The main reasons why some consumers preferred eating imported rice were; clean without stones, full grain and good aroma (Table 1). There was an overlap of reasons with an individual giving more than one. There were also several reasons why some consumers preferred eating local varieties. Affordable price (63.4%) and good aroma and freshness (47%) were the most important reasons of preferring local varieties (Table 1). The main negative comment about local varieties was presence of stones while for imported variety/brand was high costs. There is therefore need to address these issues especially cleanliness of local rice in order to increase its competitiveness.

Table 1: Reasons of eating either imported or local rice among respondents

Variable	Reasons	Frequency (%)
Reasons for preference of imported rice	Clean without stones	82.7
	Full grain	82.0
	Good aroma	61.7
	Easy to cook and non sticky	10.7
Reasons for preference of locally grown and processed rice	Affordable price	63.4
	Good aroma and fresh	47
	Easy to cook	39
	Good whiteness degree	26
	Non sticky and full grain	2

Under ideal situations consumers said that they would prefer milled rice brand with the attributes summarised in Table 2. Good aroma, level of full grain, cleanliness and affordable price are the main characteristics wanted by most consumers who were interviewed. The overlap is because there were multiple responses about the desired rice variety characteristics.

Table 2: Qualities of preferred rice variety

Attribute	Frequency (%)
Good aroma and freshness	44.6
Rice without stones	33
Affordable price	30
Easy to cook	28
Full grain	40.3
Non sticky	15
Good whiteness degree	14

4.2 SENSORY EVALUATION

The responses of the trained sensory panel to the culinary attributes of cooked rice types found on the local market essentially represented the preference of consumers mainly found around Kampala. Admittedly, consumers rarely differentiate between the various descriptive culinary attributes but for purposes of this report, the responses of each culinary attribute as it varied across the various rice types has been singularly evaluated. The attributes included appearance, taste, aroma, texture, stickiness, cleanliness and overall acceptability.

4.2.1 Appearance

The appearance of all the rice types was evaluated. The panelists' results were compiled and the average score was plotted against the rice types as shown in Figure 3. With regard to appearance (Figure 2), consumer preference was, in descending order; N10 (5.76), King's Long Grain (5.54), Pearl Kenya Pishori (5.52), Dawaat Long Grain (5.5), Tilda rice halves (5.35), Tilda crystal Long (5.22), Tilda classic aromatic (5.02), Pure Mweya Pishori (5.0), Pakistan (4.56), Kaiso (4.56), N4 (4.48), SWT Pakistan Basmati (4.36), Supa (4.34), Prime Harvest Premium Quality (4.05), Tilda Basmati (3.6), Brown Rice (2.86) and N1 (2.76).. Evaluation in this case was made basing on color, shape and size among other aesthetic parameters. Contrasting results were obtained for example Pakistan grains which are whole scored better than Supa and Kaiso which had some broken grains whereas on the contrary, Tilda rice halves scored better than Tilda crystal Long which are whole. In addition, white rice was generally preferred to brown rice. Brown Rice is kernels of rice from which only the hull (husk) has been removed. The light brown color is caused by the presence of bran layer, which is rich in minerals and vitamins.

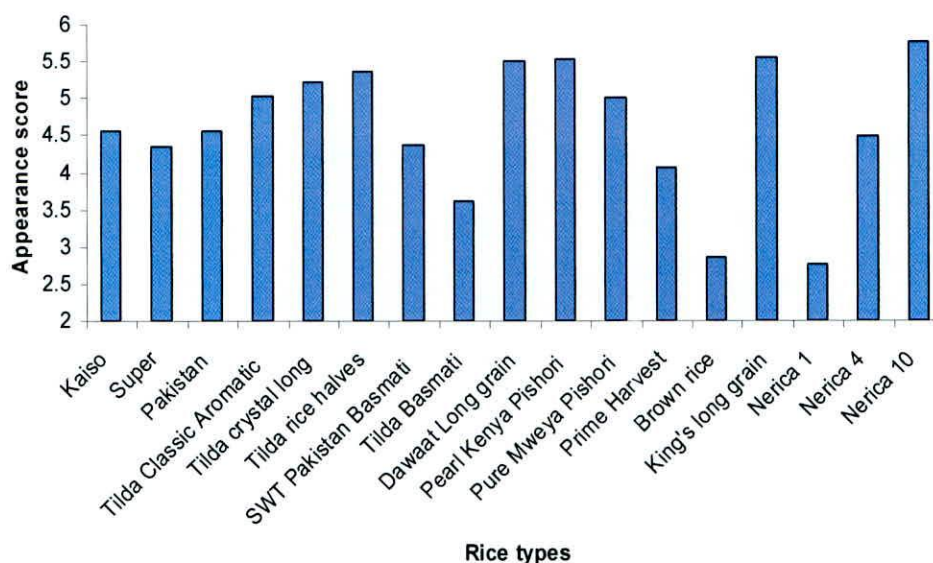


Figure 2: Consumer preference of rice types based on appearance

4.2.2 Taste

Taste of all the rice types was assessed as shown in Figure 3. The most tasty rice types were Tilda rice halves (5.42), Supa (5.39), N4 (5.28) and Tilda crystal long (5.27). However among the least preferred were Tilda Basmati (3.96) and N1 (3.84) (Figure 3). Nevertheless these results show that the local varieties were comparatively tastier. There's a correlation between taste and amylose content of the grains. Sweet taste is perceived in grains containing higher amounts of amylose and the opposite is true for sour and astringent tastes (Champagne, 2004).

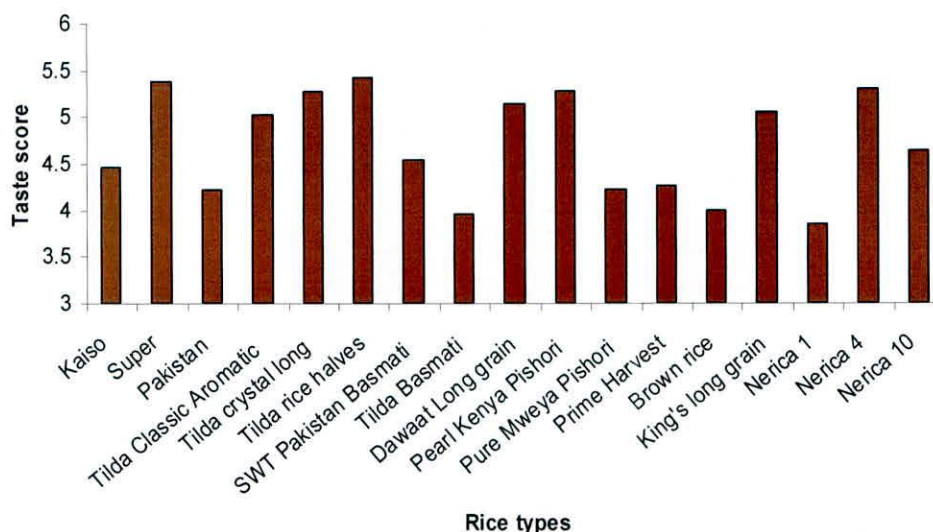


Figure 3: Consumer preference of rice types based on taste

4.2.3 Aroma

The outcome of aroma evaluation of all the rice types is shown in Figure 4. The rice types that had the best aroma were; Tilda rice halves (5.51), Dawaat Long grain (5.4), Tilda crystal long (5.32) and Tilda classic aromatic (5.07) with Pakistan (3.69) and Tilda Basmati (3.5) scoring least (Figure 4). The compound 2-acetyl-1-pyrroline has been predominantly associated with rice aroma which is popcorn-like (Schieberle, 1991). The perceived aroma of the different varieties can be attributed to different content of one or more volatile compounds contributing to rice aroma. Brown rice has a nut-like flavour which was scored satisfactorily at 4.36. It is also important to note that the genotype as well as specific pre and post-harvest treatments variably influence the perceived aroma (Champagne, 2008).

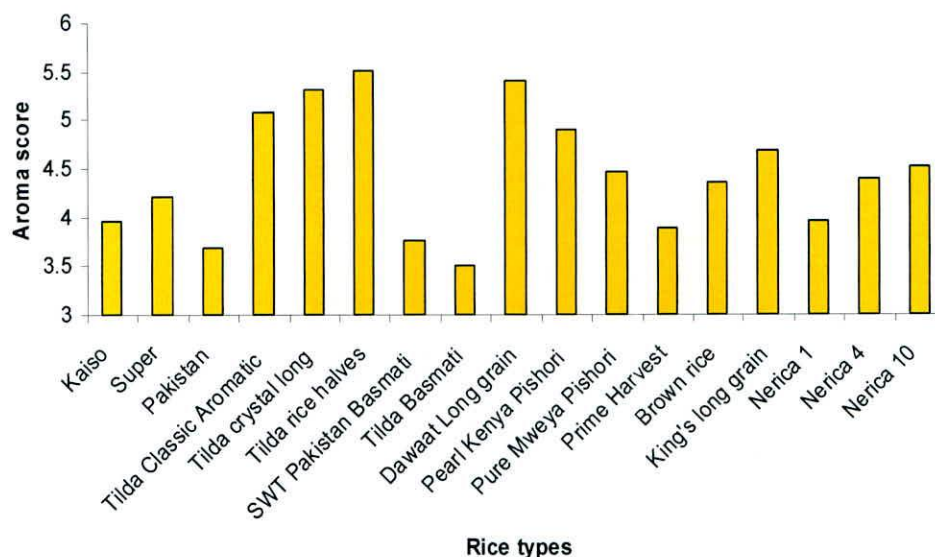


Figure 4: Consumer preference of rice types based on aroma

4.2.4 Texture

The texture of all rice types was evaluated, the results of which are shown in Figure 5. For texture (Figure 5), Tilda rice halves had the highest score of 5.61, followed by N10 (5.24) and Tilda crystal long (5.36). Low texture scores were obtained for N1 (3.24) and Supa (3.17). Cooked brown rice has a slightly chewy texture however it scored favourably at 4.31. Rice texture is dependent on amylose and to a lesser extent protein content. Dry and firm rice grains after cooking is an indication of high amylose with moist and sticky grains representing low amylose and thus high amylopectin (Webb, 1985). Rough and hard texture is attributed to high amylose and protein content of the grain (Champagne, 2004).

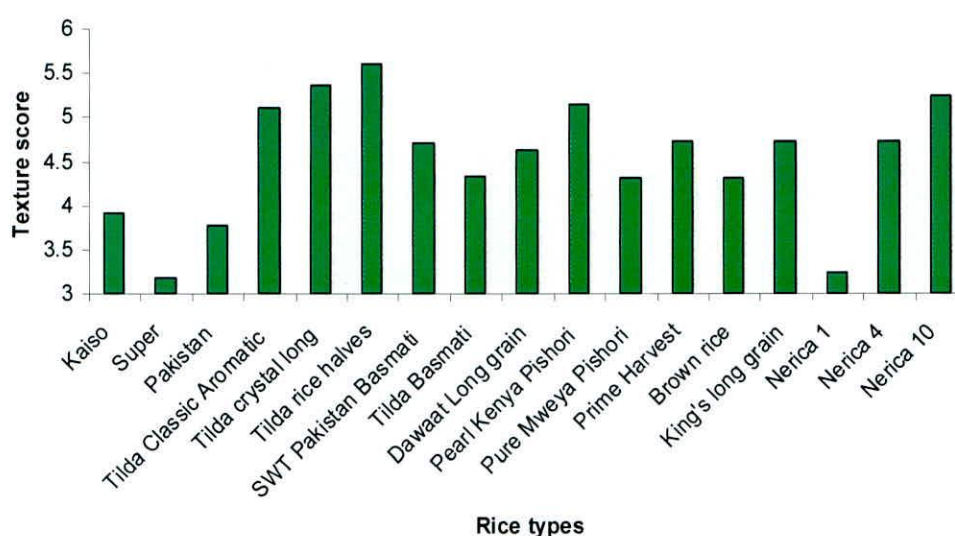


Figure 5: Consumer preference of rice types based on texture

4.2.5 Stickiness

Stickiness, as a culinary attribute of all the rice types was assessed as shown in Figure 6. The stickiest rice type was Tilda rice halves with an average score of 5.70, followed by Tilda crystal long (5.4) and Tilda classic aromatic (5.16). The least sticky type of rice was Supa (3.78) and SWT Pakistan Basmati (3.53) as indicated in Figure 6. Stickiness of rice is linked to the amylose-amylopectin ratio making up the starch component. Rice varieties high in amylose content remain intact after cooking while those high in amylopectin are comparatively sticky after the same treatment. In addition, long-grain rice is reported to contain more amylose while medium/short-grain rice types are high in amylopectin (Wikipedia, 2011).

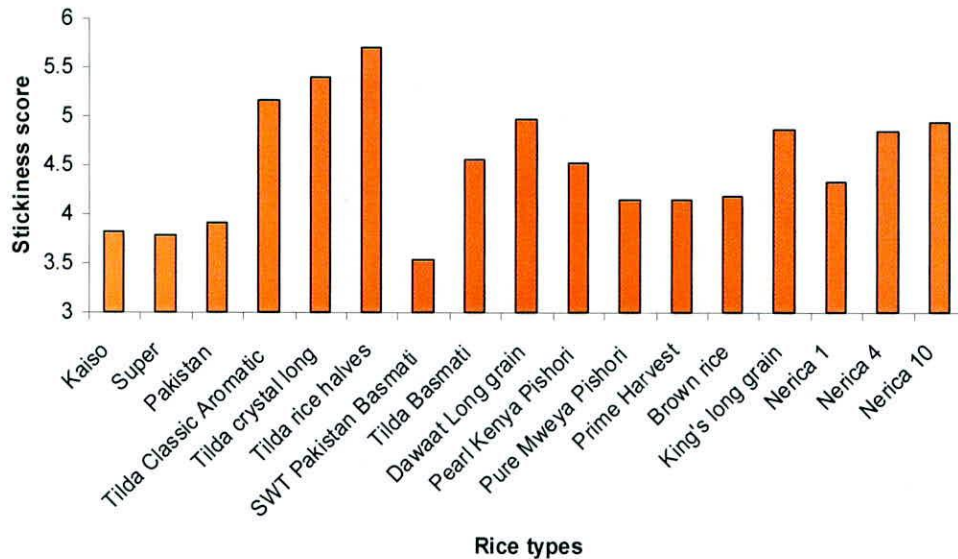
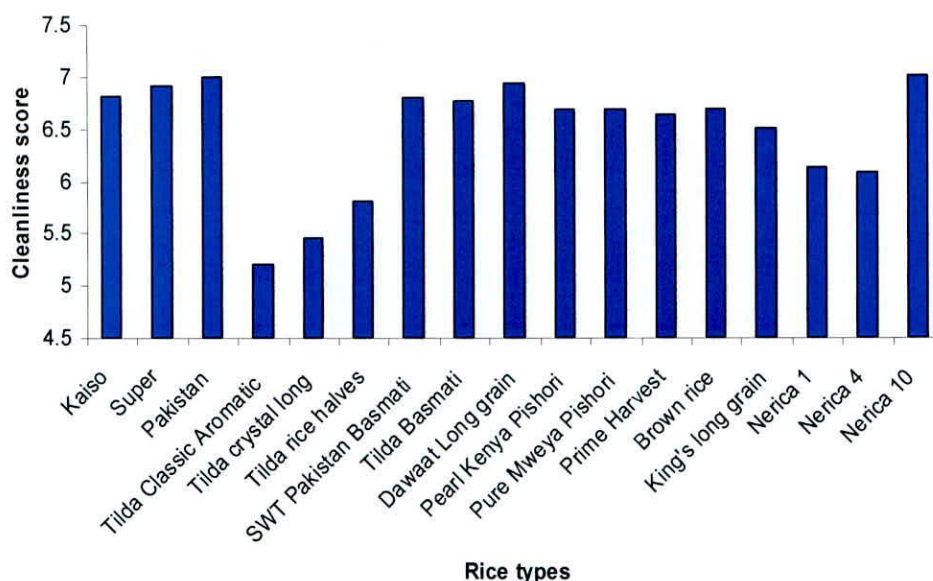


Figure 6: Consumer preference of rice types based on stickiness

4.2.6 Cleanliness and general appearance

The degree of cleanliness of all rice types was evaluated as shown in Figure 7. The cleanest rice types were N10 (7.0), Pakistan (7.0), Dawaat Long grain (6.93), Supa 6.91), Kaiso (6.82) and SWT Pakistan Basmati (6.8) while Tilda rice halves (5.81), Tilda crystal long (5.46) and Tilda classic aromatic (5.2) were rated least in terms of cleanliness (Figure 7). Cleanliness can be described as the absence of chaff, flakes of bran residue as well as stones and other extraneous matter. These reflect on the degree of post-harvest handling. There was a delicate balance between the imported and local varieties in this category with the former comparatively preferred. Imported rice is deemed to have undergone more rigorous post-harvest handling compared to the local types thus the result.



Figure

Consumer preference of rice types based on cleanliness

7:

4.2.7 Overall preference of rice in local markets according to the culinary attributes

An illustration of the overall preference of all the rice types evaluated is presented in Figure 8. Of all the 17 different varieties and types of rice in Ugandan market, overall sensory acceptability showed that *NERICA 10* (5.56), *Tilda classic aromatic* (5.51), *Pearl Kenya Pishori* (5.44), *Dawaat long grain* (5.43) and *Tilda crystal long* (5.42) were the best rice varieties wanted by the market (Figure 8). These varieties scored highly in all the culinary attributes required by the consumers described above. The least acceptable varieties were *Kaiso* (4.2), *Brown rice* (3.95) and *NERICA 1* (3.44). There was no marked difference among the most preferred rice types. *Supa* is believed to be the most liked local rice variety in the Ugandan market. However according to these results its rating is below the expectation. Fairly dull colour and high level of stickiness might have contributed to its middle level rating. Contrary *NERICA 10* which is less aromatic than *Supa* and *NERICA 1* ranked the best. *NERICA 10* when milled well and cooked properly is white, not very sticky and looks very attractive to the eye. *NERICA 1* and *Supa* who are aromatic lack some of these characteristics of *NERICA 10*. Overall, imported varieties were more acceptable compared to local ones although insignificantly owing to inherent culinary attributes and superior cleanliness in terms of absence of sand and other extraneous matter.

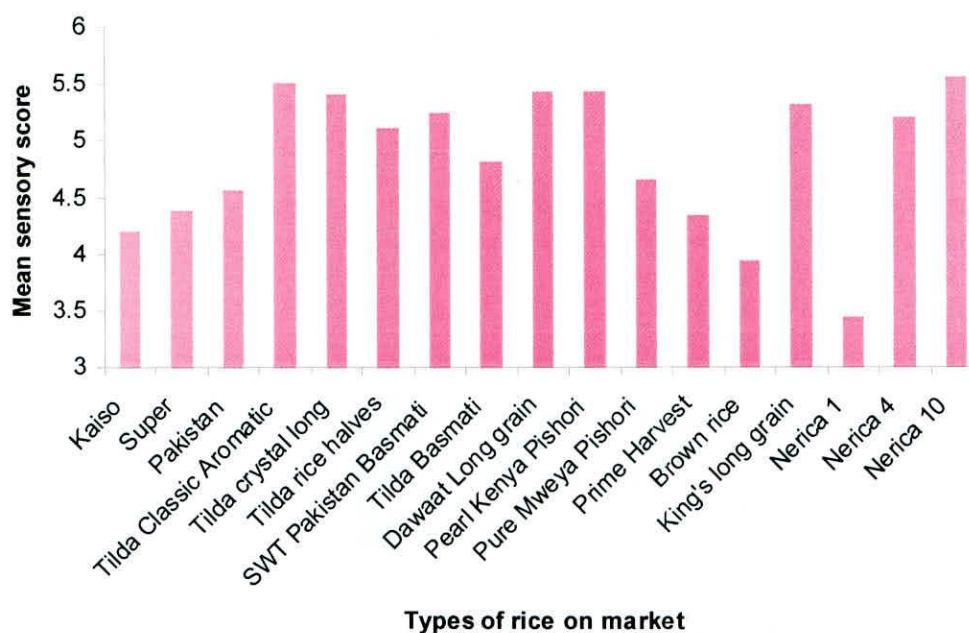


Figure 8: General Consumer acceptability of rice types based on all culinary attributes

5 CONCLUSION

Aroma, taste, colour, price, level of whole grain, cleanliness especially stones and stickiness have a lot of influence on consumers' choice for rice in the market. The consumer survey results showed that, the most acceptable rice has good score of these characteristics. These results have correlated well with sensory analysis. The Ugandan rice consumers therefore want rice that has good aroma and taste, clean without stones, affordable price, middle level of stickiness, high level of whole grain and white in colour. This therefore means that rice breeders, agronomists and processors should work together to meet most of the above characteristics of rice preferred by the Ugandan consumers.

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ANNEXES

ANNEX 1: SENSORY EVALUATION SCORE SHEET

Product: **Sample**

Panellist Code: _____

Date: _____ Time: _____

Please taste the samples on the plate in front of you. Each sample is identified by a code. Please write a code in the box and indicate it with a number corresponding to the sample from lowest to the highest in ranking.

Scores

	Very Bad	Bad	Fair	Satisfactory	Good	Very Good	Excellent
Parameter	1	2	3	4	5	6	7
Appearance/colour							
Taste							
Aroma							
Texture/granular							
Stickiness							
Overall acceptability							

Parameter	1	2	3	4	5	6	None
Cleanliness/stones							

General

Comments.....

ANNEX 2: DEFINITION OF THE PARAMETERS USED

Appearance

This is defined as the act or an instance of appearing, as to the eye.

Taste

Scientifically, taste refers to the sensations elicited by stimulation of the taste receptor cells.

Aroma

This is defined as a distinctive usually pleasant smell or the odor /scent of something.

Texture

The distinctive physical composition or structure of something, especially with respect to the size, shape, and arrangement of its parts.

Stickiness

This is having the property of adhering, as glue; adhesive. Nutritionally, the sticky rice is considered the best because stickiness shows presence of starch in the sample. Less sticky rice means it has been over milled hence having less starch.

Cleanliness

This is defined as the absence of stones and other foreign matter like husks in the rice samples.

Overall Acceptability

This is a combination of all the characteristics and general rating of the panelists' view.

