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EVALUATION OF MILLING CHARACTERISTICS OF SOME VARIETIES OF PADDY RICE IN COTTAGE INDUSTRIES OF ONDO AND EKITI STATES IN SOUTH WEST NIGERIA

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ABSTRACT

This study was carried out to evaluate the milling characteristics of six varieties of paddy that were processed at cottage industries in Ondo and Ekiti states of Nigeria. The result indicated that rice milled at moisture content below 14.5% has higher percentage of breakages that ranged from 21.39 to 24.39%, while those above it were from 8.65 to 10.23%. Grain characteristics were obtained and shpericity was found to varied between 41 to 44% for Faro varieties and 47 to 49% for *Igbemo* (a local cultivar). The length width ratio of the Faro varieties were higher than *Igbemo* varieties being 3.0 to 3.26 and 2.6 to 2.69 respectively. The width / thickness in all the varieties was less than 1.43, a vital threshold value above which kernel breakage is less rampant. The data gathered were processed using analysis of variance (ANOVA) and means separated with Duncan multiple range test. Faro 52 exhibits significant differences among all the six varieties in the milled rice yield (MRY); while the head rice yield (HRY) had significant differences in all the Faro varieties. The dockages were not significant in all the Faro Varieties and *Igbemo* / Milled rice characteristics is vital for optimal machine design to effect adequate milled rice separation from impurities

Keywords: Rice variety, grain characteristics, sphericity, milled rice and breakages

INTRODUCTION

Rice (*Oriza Sativa L.*) has been a staple food in Nigeria and forms a structural component of Nigerian diet. Its consumption has increased steadily over the years due to population growth and rapid urbanization. The crop is grown in most ecological zones in the country and had a near self- sufficiency in production of 98.8% in the post Independent era till 1974; the buoyant economy during the oil boom of 1970s and early 80s raised standard of living and preference for imported rice, which eventually reduced self- sufficiency level to 51.4%. Several government effort and research has boosted production to over 3 Million metric tons and self-sufficiency to about 80% since 2000. Rice importation makes up an important share of Nigeria's food imports as reported in a survey of rice processing in Nigeria, as reported by. The major constraints affecting the development of the rice sector in Nigeria as observed is the low quality of local rice in comparison with the imported one and the inability of the local variety to match up to the physical quality of the imported rice. The techniques involved in the processing of paddy rice, is an important determinant of rice quality. The poor (impaired) quality of the local rice variety and the high occurrences of grain losses is a major concern for the prospect of Nigeria's rice sector. Rice is regarded as one of the cheapest source of food energy and protein as it contains 79.86 carbohydrates, 7.18% protein, 0.26% fat and 0.4% fiber. Considerable quantity of rice produced in Nigeria are parboiled during processing except for raw milled rice which according to "are grounded into flour for many uses such as making of beverages, rice flour or noodles among others). Processed rice grains may be boiled, steamed or further fried in cooking oil before eating. Rice desserts are produced, when it is combined with milk, honey / sugar". Locally produced

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rice has high nutritive value; however, the physical attributes of the milled rice is impaired with broken, undersized grains and some impurities which makes it difficult to compete favourably with the imported ones; hence its economic value depreciates. Observed that rural farmers mostly employ traditional means of processing rice which is labourious and promotes drudgery. With the use of improved technology, farmers can achieve higher volume of yields with better quality of products by reducing the rate of breakage and elimination of contaminants. This will go a long way to enhance consumer preference for locally processed rice. The subsistence-level of technology input in rice processing has contributed to rampant grain breakages with attendance poor quality, thereby limiting sustainable food chain.

The soil type and rainfall conditions prevalent in humid climates of Ondo and Ekiti states; has made rice cultivation viable in many areas. The states are known for its famous *Igbemo* (a local cultivar) which has high nutritional quality as well as Faro varieties distributed by International Institute of Tropical Agriculture and National Cereals Research Institute. The gap between the productions of the local rice variety to the imported rice is about 2 million tons per annum; this gap has encouraged more importation of rice as well as smuggling, as reported by. The major constraint to increased local rice production is largely dependent on preference to imported rice because of the impaired quality of the locally processed rice usually characterized with high percentage of breakages, small pebbles and other contaminants, observed that a single machine is used in the processing of various varieties of rice in Nigeria by local processors which resulted in high mechanical damages to the milled rice. Efforts are therefore required to investigate the milling characteristics of some varieties of locally produced rice and improve milling process to produce good quality rice acceptable to consumers.

MATERIALS AND METHODS

Survey Area

A survey was conducted to some of the identified areas where rice is being processed in Ondo and Ekiti states; Selected areas includes Iju-Itaogbolu, Aule /Army barracks Akure, Ogbese in Ondo state and Aare and Igbemo in Ekiti state.

Sample Preparation

Samples of paddy rice were collected and parboiled under the same conditions as stated by. The wet paddy was drained and dried in the sun for a duration of 10 hours. After drying, the paddy was packed in woven sacks and stored in a well-ventilated room until it is taken out to be milled. Milled rice samples of three each of *Igbemo* and Faro varieties were collected and analyzed for head rice yield, breakages and contaminants. Moisture content (wet basis) of three replicates of the samples at the point of milling was obtained using rapid oven method as described by. 30 samples of milled rice longer than ¾ of the original length were randomly selected from the various rice varieties and the axial dimension of three axes (major, intermediate and minor axes) were measured using a digital vernier caliper with 0.01 mm sensitivity. The data was used to calculate, surface area (A), spherical mean and sphericity (S) of the rice varieties, as reported by.

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Milling Characteristics

The evaluation of the quality of rice was based on a measure of the head rice yield (%) after milling in a rice processing outfit.

(i) Determination of milled rice yield

$$\text{Milled rice Yield} = \frac{\text{Weight of kernel after milling} \times 100}{\text{Weight of paddy}} \quad (1)$$

(ii) Determination of head rice yield

$$\text{Head rice yield} = \frac{\text{Weight of whole kernel after milling} \times 100}{\text{Weight of paddy}} \quad (2)$$

(iii) Determination of breakages

$$\text{Breakage yield} = \frac{\text{Weight of breakage in milled rice} \times 100}{\text{Total weight of milled rice}} \quad (3)$$

(iv) Determination of dockages

$$\text{Dockages} = \frac{\text{Weight of dockages in milled rice} \times 100}{\text{Total weight of milled rice}} \quad (4)$$

Data Analysis

The data gathered was processed using analysis of variance (ANOVA) and means separated with Duncan multiple range test.

RESULTS AND DISCUSSION

Data obtained on the physical properties (mean and standard deviation) of the six varieties of the milled rice are shown in the Table 1, Moisture content-wet basis at the point of milling varied from 13.9 to 15.2 % in all the rice varieties.

Table 1. Physical properties of milled rice varieties

Parameters	Faro 44		Faro 52		Faro 55		*Igbemo I*		*Igbemo II*		*Igbemo III*	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
M.C. (%)	14.1	0.90	13.9	0.16	14.2	1.44	14.7	0.58	15.2	0.29	14.7	0.58
Length (mm)	6.82	0.23	6.70	0.44	6.57	0.39	7.55	0.50	7.21	0.42	7.33	0.57
Width (mm)	2.27	0.10	2.24	0.11	2.02	0.34	2.81	0.18	2.80	0.21	2.61	0.19
Length/Width	3.00	0.17	2.99	0.27	3.25	0.37	2.69	0.34	2.60	0.32	2.81	0.38
Thickness (mm)	1.77	0.10	1.71	0.14	1.48	0.34	2.12	0.11	2.14	0.16	2.14	0.14
Surface Area (mm^2)	12.15	0.83	11.79	1.23	10.41	2.81	16.68	1.67	15.84	1.89	16.19	1.47
Spherical Mean(m)	3.02	0.07	2.95	0.13	2.71	0.39	3.56	0.12	3.50	0.18	3.53	0.12
Sphericity (%)	44	0.02	44	0.02	41	0.05	47	0.03	49	0.03	48	0.03

*M.C.- Moisture content; S.D. Standard deviation

The *Igbemo* varieties has bigger sizes as its surface area ranged from 15.84 to 16.68 mm^2 while the Faro occurred with 10.4 to 12.2 mm^2; as well as the spherical mean from 3.50 to 3.56 and 2.71 to 3.02 mm respectively. Table 2 shows the milling characteristic of six rice varieties

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at the moisture content, at the point of milling. From Table 2, moisture content in all the Faro varieties were less than 14.5% and HRY ranged between 41.71 to 47.61%, while the *Igbemo* that had over 14.5% exhibited higher HRY of 59.6 to 62.37%.

Table 2 Milling characteristics of some rice varieties and their moisture content.

Rice variety	Grain type	M.C. %	H.R.Y. %	Broken %	Dockages %
Faro 44	Slender long	14.01a	44.59d	24.39a	1.05a
Faro 52	Bold long	13.9a	41.71c	22.23b	1.06a
Faro 55	Slender long	14.2b	47.61e	21.39b	1.00a
Igbemo I	Bold extra long	14.7c	60.9ab	9.26c	0.84b
Igbemo II	Bold extra long	15.2d	62.37a	8.65c	0.98ab
Igbemo III	Bold extra long	14.7c	59.6b	10.23c	1.12a

*values with same alphabet along the column are not significantly different from each other

Faro I and Faro II were slender long grains having their geometric mean length/width ratio approximately 3.0 while, Faro III were bold long grains with length/width ratio much greater than 3.0. The Faros' spherical mean ranged between 2.71 to 3.02 mm and mean sphericity was from 0.41 to 0.44. Width / Thickness mean was from 1.28 to 1.36 which is less than 1.43 and could be responsible for high percentage of broken grains during milling. All the three varieties of *Igbemo* were bold extra-long grains as their geometric mean length/width ratio was less than 3.0 their spherical mean exhibit small variation that ranges from 3.50 to 3.56 mm; mean sphericity varies from 0.47 to 0.49. Width / Thickness mean also have slight variation from 1.31 to 1.32. Figure 1 below shows that as the moisture content increases the head rice yield increases.

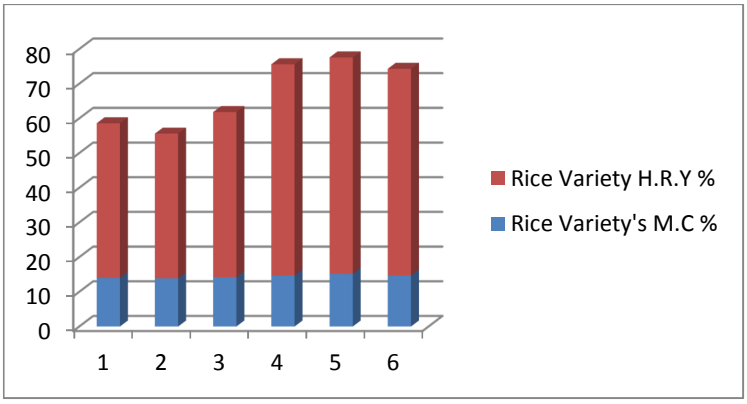

Fig. 1: Graph showing the relationship between moisture content and rice head yield.

CONCLUSION

Higher values of HRY were obtained when rice was milled at moisture content above 14.5% however drying will be required to reduce it to between 12 to 13% for long storage. All the *Igbemo* varieties had higher spherical means and had reduced broken grains. Secondary processing equipment is required for further cleaning / grading of milled rice to obtain enhanced rice quality.

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