GRADING AND PACKAGING OF NIGERIAN RICE FOR EXPORT: ISSUES, CHALLENGES AND PROSPECTS

E. A. Echiegu
Department of Agricultural and Bioresources Engineering,
University of Nigeria Nsukka, Nsukka, Nigeria
E-mail: eaechiegu@yahoo.com

ABSTRACT
Rice, a major staple food in Nigeria is currently enjoying a lot of attention from the public and private sectors of the Nigerian economy. Some rice processing plants are springing up in many parts of the country. These mills are processing not only for the Nigerian market but for exports. Reviewed in this paper are the requirements to be met in processing rice not only for local consumption but for export.

The requirements include good source of raw material, proper processing and grading to standard and adoption of best practices in packaging. The challenges in meeting these requirements were identified to include: poor agronomic practices, poor handling or raw materials, lack of technology, poor investment, poor branding, high cost of production, unfair competition by imported rice, poor value chain. The current efforts being made to solve these problems through the value chain approach has great potentials and prospects for producing export quality rice in Nigeria. The efforts of the Federal Ministry of Agriculture through the Agricultural Transformation Agenda (ATA) should be sustained.

KEYWORDS: Rice, processing, grading, packaging, export.

1. INTRODUCTION

Rice (Oryza sativa) is an arable crop cultivated in almost all parts of the world. It is the staple food of more than 3 billion people in the world especially in Asia, Latin America, and Africa. It is envisaged that by 2015 more than half of the world population will depend on rice as their principal foodstuff.

In Nigeria, the demand for rice has been soaring, especially with the rapidly increasing urbanization. By year 2002, the demand for rice was estimated at 5.0 million metric tonnes while production level stood at 3.0 million tonnes. The nation's rice import bill rose from US$ 259.0 million in 1999 to US$759.0 in 2002 (Bello, 2005). At the then exchange rate, that translated to ₦22.015 and ₦96.012 billion, respectively. The situation, in addition, led to a drastic fall in the degree of participation of the local farmers. It is heart-warming, however, to note that with the various interventions by the previous and present administration, many state governments have taken the production of rice very seriously. And with the global food security problem, particularly the increased demand for rice, Nigeria may soon be exporting rice to other countries. (Idu et al, 2011)

Export quality rice must not only be well processed but must be graded and packaged to meet international standard quality. This paper seeks to address some of the important issues in grading and packaging rice for export.

2. RAW MATERIAL FOR PROCESSING

For any particular variety of rice, there is little or no difference in their nutritional quality irrespective of where the rice is grown. The difference only lies in the method of processing. The problem with most of our locally processed rice (usually from small rice processing plants) is that, most of the time, the varieties being processed (some of which have different cooking qualities) are mixed with the result that the uniformity of the processed product is often not ensured. It is important that the paddy to be processed must be of the same variety and free from impurities. Ebonyi state has taken the lead in trying to standardize the raw materials (paddy) being processed in their rice processing clusters by promoting the

production of only limited varieties of improved high yielding varieties of rice in the state. Currently the state is promoting the cultivation of only Faro 44, 52 and 55.

The preference of the end user is also of importance in choosing what to process. Long grain rice such as faro 52 are usually separate, light and fluffy when cooked and are usually ideal for recipes requiring a distinct shape and texture. It is traditionally eaten in Western Hemispheres, Eastern Europe, Middle East, India, Pakistan, Bangladesh and most of Africa (Usarice.com, 2009). Medium grain rice are mostly moist and slender and have a tendency to cling together when cooked. This type of rice which cooks to a somewhat creamy consistency is traditionally eaten in Central and North Asia and the Mediterranean and Aegean regions. Short grain rice are soft and cling together when cooked. It is the preferred variety for those that consume *tuwo sinkafa* and similar cuisine.

3. OVERVIEW OF EXPORT QUALITY COMMERCIAL RICE PROCESSING

3.1 Unit Operations in Rice Processing

Commercial rice processing systems mill paddy in stages and are often referred to as multi-pass or multistage rice mills. The objective of commercial rice milling is to reduce mechanical stresses and heat build-up in the grain, thereby minimizing grain breakages and producing uniformly polished grains (Anonymous, 2009).

Rice milling facility comes in various configurations (how the components are sequenced), and the milling components vary in design and performance. Generally modern rice milling process consists of the following:

- *Pre-cleaning* – Removal of all impurities such as stones and all unfilled grains from the paddy.
- *Husking* – Removal of the husk from the paddy.
- *Husk Aspiration* – Separating the husk from the brown rice/unhusked paddy.
- *Paddy Separation* – Separating the unhusked paddy from the brown rice.
- *De-stoning* – Separating small stones from the brown rice.
- *Whitening* – Removing all or part of the bran layer and germ from the brown rice.
- *Polishing* – Improving the appearance of milled rice by removing all remaining bran particles and by polishing the exterior of the milled rice.
- *Sifting* – Separating small impurities or chips from the milled rice.
- *Length Grading* – Separating small and large broken grains from the head rice.
- *Colour Sorting* – Separating milled rice according to colour.
- *Blending* – Mixing head rice with predetermined amount of broken grains as required by the customer.
- *Weighing and Bagging* – preparing milled rice for transport to customer.

In commercial modern rice mills, standard machines are used for each of the unit operations above. The rice is moved from one machine to another by conveyors and bucket elevators. Most of the machines are automated. Thus there is room for errors or introduction of impurities. This results in the end product coming out with uniform and high quality. In Nigeria, most of the traditional processing systems do not use these automated machines and this affects the quality of the end product adversely. As Nigeria is moving from production for only local market to production for exports, there is need to ensure that those involved in rice processing use the right type of equipment to ensure high quality.

3.2 Grading Terms

There are certain terms which are commonly used in international and local markets to describe different types of processed rice (Nwakpu, 2003; National Food Authority; USDA, 2005,). They include the following:

Well milled Rice: Whole or broken kernels of rice from which the hulls and practically all of the germs and the bran layers have been removed.

Brown Rice: This is often referred to as shelled rice, husked rice or cargo rice. Brown rice is milled rice kernels in which only the husk is removed without the removal of the bran and germs.

Head Rice: This is defined as milled rice kernel whose length is approximately equal to or greater than 80 % of the length of the average length of the unbroken kernel. Some producers and importers consider kernels of length greater than or equal to 50 % of the length of the unbroken kernel as head rice.

Broken Rice: These are milled rice kernel of length greater that 25 % but less that 50 % of the average length of unbroken kernel.

Brewers: This is also known as *Tips* or *Chips* and refers to milled rice kernels of length less than 25 % of the average length of unbroken kernels.

Damaged Rice: Whole or broken kernels of rice which are distinctly discolored or damaged by water, insects, heat, fungi or any other means. This term also refers to parboiled kernels in non-parboiled rice.

Heat-damaged: Kernels are whole or broken kernels of rice which are materially discolored and damaged as a result of heating and parboiled kernels in non-parboiled rice which are as dark as, or darker in color than, the interpretive line for heat-damaged kernels. "Heat-damaged kernels" shall not function as damaged kernels.

Paddy Kernels. Whole or broken unhulled kernels of rice; whole or broken kernels of brown rice, and whole or broken kernels of milled rice having a portion or portions of the hull remaining which cover one-eighth (1/8) or more of the whole or broken kernel. In order words, this is improperly milled rice.

Red Rice: Whole or broken kernels of rice on which there is an appreciable amount of red bran (i.e. with about 25 % of the surface red in colour).

Chalky Rice: Whole or broken rice kernels one half or more of which is white (or creamy) like the colour of chalk or brittle.

Red streaked: Whole or broken milled rice kernels having red streaks on the total length or on one half or more of the length of the kernel.

Immature kernels: Kernels which are light green and chalky with soft texture.

Seeds: Whole or broken seeds of any plant other than rice included with the rice.

Ungelatinized kernels: Whole or broken kernels of parboiled rice with distinct white or chalky areas due to incomplete gelatinization of the starch.

Coated Milled Rice: Coated milled rice is rice which is coated, in whole or in part, with substances that are safe and suitable as defined by the appropriate National Agency for Food and Drug Control regulation.

Granulated brewers milled rice: Granulated brewers milled rice is milled rice which has been crushed or granulated so that 95.0 percent or more will pass through a 5 sieve, 70.0 percent or more will pass through a 4 sieve, and not more than 15.0 percent will pass through a $2^1/_2$ sieve.

Parboiled milled rice: Parboiled milled rice is milled rice in which the starch has been gelatinized by soaking, steaming, and drying.

Whole kernels. Unbroken kernels of rice and broken kernels of rice which are at least 75 % the length of an unbroken kernel.

Undermilled milled rice: Undermilled milled rice shall be milled rice which is not equal to the milling requirements for "well milled," and "reasonably well milled." rice

Glutinous milled rice: Glutinous milled rice shall be special varieties of rice (*Oryza sativa L. glutinosa*) which contain more than 50 percent chalky kernels.

Aromatic milled rice: Aromatic milled rice shall be special varieties of rice (*Oryza sativa L. scented*) that have a distinctive and characteristic aroma; e.g., basmati and jasmine rice.

3.3 Grading Parameters

Rice grading takes into account several parameters. They include the length of the grains, the length/width ratio of the grain, the colour of grains, the percentage of broken or damaged rice and so on. Based on the length of the grain, rice can be classified as (Ibrahim 1997, Nwakpu, 2003):

Extra long grains: rice varieties with length above 7.5 mm.
Long grains: varieties with grain length of 6.61 to 7.50,
Medium grain: grains with lengths of between 5.51 to 6.60 mm, while
Short grains: grains with lengths below 5.51 mm.

Based on length and width ratio, rice may be:

Slender: (L/W > 3.0),
Medium: (L/W between 2.1 and 3.0),
Bold: (L/W between 1.1 and 2.0), or
Round: (L/W < 1.1).

Based on colour and the degree of milling, rice can be white rice, chalky or brown rice. Rice can also be parboiled or whole milled rice. Based on the percentage of broken or damaged rice, milled rice can be head rice, broken rice, brewers rice or mixed milled as defined above.

It is important to note that the fact that milled rice is head rice or broken rice or brewers rice does not mean that it is not of export quality as they are used for different purposes; and there are demands for the various grades in the international market. What is important is that the grades are uniform.

3.4 Grading Standards

It is not often possible to mill rice such that there will be 100 % of a particular grading factor, for example rice that has no single broken kernel, or no single coloured grain. It is for this reason that some countries

have adopted some standards for describing milled rice such that when a particular grade is mentioned, it will be clear what the rice will look like. The Nigerian Rice Grade Standard has four grades of processed rice namely, Premium, Grade 1, Grade 2 and Grade 3. The USA Standard for Milled Rice gave six grades (USA Nos. 1 – 6) for Long Grain, Medium Grain, Short Grain and Mixed Milled Rice. The same standard gave five grades (USA Nos. 1 – 5) for Second Head Milled Rice, Screening Milled Rice and Brewers Milled Rice respectively.

It is the standard practice by rice millers to use different colours of bags or different trade names for the various grades. For example, *Ebony Rice* in Ikwo Ebonyi state uses the trade names Ebony Gold for premium, etc.

Nigerian Grading Standard for milled rice is shown in Table 1.

Table 1: Grades and Quality Characteristics for Nigeria Graded Milled Rice (Ibrahim, 1997)

Grading Factor (Maximum %)	Grades			
	Premium	1	2	3
Head Rice	95.00	80.00	65.00	50.00
Big Broken	3.00	10.00	10.00	20.00
Brewers	0.10	0.25	0.50	1.00
Damaged Kernels	0.25	0.50	2.00	3.50
Discoloured Kernels	0.50	2.00	4.00	8.00
Chalky & Immature Kernels	2.00	5.00	10.00	15.00
Red Kernels	-	0.10	0.20	0.50
Red Streaked Kernels	1.00	3.00	5.00	10.00
Foreign Matters	-	0.10	0.20	0.50
Paddy (Max. no per 1000 grains)	1.00	8.00	10.00	15.00
Moisture Content	14.00	14.00	14.00	14.00

Note: Any milled rice that does not meet the requirement of the above grades are regarded as sub-standard grades.

The grades and grade requirements for different classes of milled rice according to USA standard for milled rice are shown in Table 2.

Table 2: U.S. Grade, Grade Requirements and Grade Designation for Milled Rice (USARice.com, 2009)

Grade	Maximum Limit of-											Colour Require-ment	Milling Requir e-ment
	Seeds, heat damaged, and paddy kernels (single or combined)		Red rice or damaged kernels (singly or combined)	Chalky kernels		Broken kernels				Other types[4]			
	Total (No. in 500 gm)	Heat-damaged kernels and objection-able seeds (No. in 500 gm)	(%)	In long grain rice (%)	In medium grain rice (%)	Total (%)	Remo-ved by a 5 plate (%)	Remo-ved by a 6 plate (%)	Thro' a 6 sieve (%)	Whole kernels (%)	Whole and broken kernels (%)	(minimum)	(minimum)
U.S.												Shall be	Well

No. 1	2	1	0.5	1.0	2.0	4.0	0.04	0.1	0.1	-	1.0	white or creamy	milled
U.S. No. 2	4	2	1.5	2.0	4.0	7.0	0.06	0.2	0.2	-	2.0	May be slightly grey	Well milled
U.S. No. 3	7	5	2.5	4.0	6.0	15.0	0.1	0.8	0.8	-	3.0	May be light grey	Reason ably well milled
U.S. No. 4	20	15	4.0	6.0	8.0	25.0	0.4	1.0	1.0	-	5.0	May be grey or slightly grey	Reason ably well milled
U.S. No. 5	30	25	6.0	10.0	10.0	35.0	0.7	3.0	3.0	10.0	-	May be dark grey or rosy	Reason ably well milled
U.S. No. 6	75	75	15.0	15.0	15.0	50.0	1.0	4.0	4.0	10.0	-	May be dark grey or rosy	Reason ably well milled

4. PACKAGING OF RICE FOR EXPORT

Adequate packaging protects milled rice against contaminations and all types of deterioration or spoilage throughout the useful shelf life of the product. Milled rice for exports should be packed in carbon-free, water resistant jute or plastic bags. The bags must be durable enough to give maximum protection from the normal hazards of transportation and handling.

In Nigeria, rice is conventionally packaged and sold in 25 or 50 kg bags. Rice for export is either shipped in bulk for possible further re-packaging at its destination or in packs of 2.0 kg, 5.0 kg, 10.0 kg, 20.0 kg, 25.0 kg or 50.0 kg. Each standardized sack of milled rice for export shall be properly labeled to provide the following information: Country of Origin; Type of rice; Grade; Date of Milling; Name and contact information of the exporter; Net Weight of the product and Nutritional information (optional).

5. CHALLENGES AND PROSPECTS

Before now, most of the operators in the industry (rice) were small scale operators. With the current Agricultural Transformation Agenda (ATA) of the Federal Government of Nigeria, emphasis is now on transforming the operations of the producers to modern mills where appropriate technology is used to produce rice that can compete in the international market both in quantity and quality (FMA&D, 2013; NISER 2013). The aim of the Programme is to first produce enough rice for local consumption and subsequently start export. This noble initiative is faced with a number of challenges:

5.1 Poor Agronomic Practices

Most rice grown in Nigeria is still done by peasant farmers (Diague et al 2011). This means that production is still done without scientific principles, resulting in use of methods that do not give high yields. The farmers are also characterized by small holdings which gives room for planting of different varieties which end up in one mill. With the current initiative, Good Agricultural Practice is being introduced to the farmers and in addition, large scale farmers are being encouraged and it is hoped that the paddy that will be produced subsequently will meet international standards. This can be achieved by use of modern inputs including improved varieties, improved cultural practices, use of machines for harvesting and threshing.

5.2 Poor Handling of Raw Materials for Processing

As noted earlier, different farmers were planting different varieties. Rice millers buy from the open market with the result that a particular batch of rice being processed will contain different varieties. Thus when they are subjected to one processing condition, some will be processed well while some will not. In addition, handling systems are poor as most rice paddy are packaged in jute bags in open trucks. Some are also spread on stony ground for pre-drying, thereby introducing impunities and stones. This can be solved by a new generation of bulk handlers who will do pre-processing grading to ensure uniformity (Onwualu and Ikechukwu, 2006).

5.3 Lack of Technology

For efficient rice processing, machines must be used to ensure controlled and uniform processing conditions that will not be dependent on human judgment (Longtan, 2003). Most of the machines for the unit operations in rice processing are not produced in Nigeria. This means that the machines are costly and in fact issues of proper use and maintenance are also important as spare parts can become major constraints. It is therefore important that as efforts are being channeled towards importation of more rice mills, greater effort should be made towards domesticating the technologies so that they can be produced locally.

5.4 Poor Investment

Closely related to lack of technology is poor investment in agriculture in general in Nigeria and rice production and processing in particular. To be able to achieve high quality rice production adequate investment must be made in acquiring regional inputs namely agronomic inputs (new varieties, nurseries, irrigation and drainage equipment, fertilizer, pest control, weed control, harvesting equipment), processing inputs (machines for each of the unit operations, quality control inputs (laboratories), storage facilities and transport systems (ODI, 2013, Omotola and Ikechukwu, 2006).

5.5 Research and Development and Extension Services

To sustain a viable rice processing system, there is need for continuous Research and Development (R&D). Already, a lot of work has been done by the National Cereals Research Institute (NCRI), Badeggi and other Research Centres in Nigeria. But more work needs to be done towards processing systems. Also the extension system needs to be overhauled to ensure that new technologies get to farmers and processors.

5.6 High Cost of Production

One major challenge processors face is the high cost of production. To start with the cost of the raw material (paddy) is high due to unsustainable cost of inputs and poor production system. Other cost inputs such as energy, water, transportation, communication, security, etc are relatively high. These can only be solved if stakeholders are encouraged to set up large scale mills or small mills are organized in clusters to enjoy economies of scale.

5.7 Poor Branding and Unfair Competition by Imported Rice

Before now, Nigerian rice are poorly branded. This made it easy for the imported alternatives which are better branded to displace the locally made rice in the market (Alawode, 2013). Efforts are currently being made to brand Nigerian rice to ensure high quality and uniformity and also to improve on market acceptance. It is also heartwarming to note that Nigeria plans to ban the importation of rice in the near future. This will go a long way in protecting local producers as people are now investing in processing mills.

5.8 Prospects for Rice Value Chain Development

For very significant progress to be made, there is need to look at the entire value chain for rice. In the chain there are input suppliers, farmers/exporter, Research and Development people and Financial Institutions. In order to ensure production of high quality and exportable rice, each of these subsectors of the value chain must be improved. The current ATA of government addresses the entire value chain (FMARD, 2013). Potential investors are advised to approach the Federal Ministry of Agriculture and Rural Development (FMARD) on how they can be assisted in solving the problems affecting their link in the chain. Other stakeholders and related institutions that might be helpful include: Bank of Industry (BOI); Bank of Agriculture (BOA); National Cereals Research Institute (NCRI); Raw Materials Research and Development Council (RMRDC); Various State Ministries of Agriculture; Rice Farmers, Growers and Processors Association; Nigerian Investment Promotion Commission (NIPC); Nigeria Export Promotion Council (NEPC); Various State Agricultural Development Programmes and Fadama Groups.

With current efforts on developing rice value chain, the prospects for self sufficiency in rice production and processing in Nigeria and even for export is high.

6. CONCLUSIONS

Nigeria has enormous potentials for the production and processing of rice not only for domestic consumption but for export. With the current interventions and interest in rice in the country, it is expected that Nigeria will soon be exporting rice. Export quality rice must meet some international standard for it to be acceptable in the international market. Many countries and regions have developed standards for milled rice. A potential exporter of Nigerian rice must be familiar not only with the varietal demand but the grading standard for rice in the target country to ensure a market. It was not within the scope of this paper to describe the methods of determining the various grading factor as it is believed that an exporter who has or plans to set up a processing plant for milling export quality rice must provide a standard laboratory for the determination the needed grading parameters. I hope that this paper will stimulate interest among Nigerian investors in the business of processing Nigerian rice for export.

REFERENCES

Alawode, O. 2013. Cheap imports compete with local production in Nigeria's N1trn rice market. www.nigeriaintel.com

Anonymous 2009. Commercial rice milling system: an overview. http:/www.knowledgebank.irri.org/riceMilling/Milling_lesson07.htm retrieved on 21st July 2009.

Bello, A. 2005. New Frontiers in Agriculture and Food Security in Nigeria. Paper presented by the Hon Minister for Agriculture and Rural Development at the Presidential Retreat on Agriculture held at Hassan Usman Katsina House, Kawo Kaduna, 16th December, 2005.

Diagne, A, Bamba, I, Manful, J. and Ajayi, O. 2011. Historic opportunities for rice growers in Nigeria. www.inter-reseaux.org

FMARD 2013. Rice Value Chain, Agricultural Transformation Agenda. www.fmard.org

Ibrahim, T. 1997. Grain quality analysis and implications. A paper presented at an international training course on lowland rice improvement and production. IITA, Ibadan, April – May 1997.

Idu, E. E. Obinne, C.P.O, Jolaoso, M. A, Onwualu, A. P, Onjewu, S. S, Sheriff-Musa, M. and Olugbemi, B. O. 2011. Rice for Food, Market and Development, Proceedings of the First International Conference on Rice for Food Market and Development, organized by Rice-Africa, Abuja.

Longtau, S. R. 2013. Multi-Agency Partnerships for technical change in West African Agriculture: Nigeria case study report on rice production. Overseas Development Institute (ODI), London.

NISER 2013. Strategic options for promoting competitiveness of Nigeria rice sector. www.niseronline.org/downloadricecompetitiveness.pdf

Nwakpu, C. 2003. Practical Guide to Lowland Rice Production in Nigeria. Snapp Press Ltd. Enugu Nigeria.

ODI, 2013. Rice production in Nigeria: Country profile. www.odi.org.uk/resources/docs/3982.pdf.

Omotola, K. M. and Ikechukwu, A. 2006. Rice milling in Nigeria. www.ricenigeria.com

USAID 2006. Food for Peace. Section II: Food Commodity fact sheet. http:/www.usaid.gov/our_work/humanitarian_asistance/ffp/crg/friceparb.htm retrieved on 25th of July 2009.

USARice.com 2009. Rice Specifications. http:/www.usarice.com/index.php?option=com_content&view=article&id=623&Itmid=2 retrieved on 25th July, 2009.

USDA 2005. United States Standard for Milled Rice. United States Department of Agriculture.