

## Rice (*Oryza Sativa* L.) Production in Nigeria: Challenges and Prospects

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### Abstract

*Rice as one of the major staple food in Nigeria can help boost the economy in this trying time. Currently, Nigeria is not self-sufficient in rice production, but it has the capacity to produce the quantity it needs and even more for export. Five major rice ecologies have been identified in the country, which include upland, hydromorphic, lowland, deep inland water and mangrove swamps. If these rice ecologies are utilized optimally there will be no need to import rice again in to the country. Various NGOs and international organisations have contribute immensely in rice farming in collaboration with agricultural development programmes in Nigeria and these has increase rice production even though the increase is not enough to make the country self-sufficient. Rice varieties with high yield potentials that have the capacity to withstand some environmental stress factors have been developed by WARDA under African Rice Center, which includes; FARO 44, NERICA 1 and NERICA 2. These varieties are recommended to farmers due to their high yield potentials and ability to withstand environmental stress.*

**Keywords:** Environmental Stress, Rice Ecology and Rice varieties.

### INTRODUCTION

Rice is the staple food for over half the world's population and the most important among all the cereal crops (Khush, 1997; Dogara & Jumare, 2014). Approximately 480 million metric tons of milled rice is produced annually. China and India alone account for 50% of the rice grown and consumed.

In Nigeria rice has consumption per capita of 32kg indicating 4.7% increase in the past decade making the total consumption to be 6.4 million tonnes in 2017 as against 3.7 million tonnes produced per year (Erhie *et al.*, 2018).

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Two species of rice named *Oryza sativa* and *Oryzaglaberrima* are known, for which the former is cultivated throughout the world while the latter is grown partially in western part of Africa (Von and Kole, 2006). Rice belongs to the order Poales and the grass family Poaceae formally Gramineae (Kirk *et al.*, 1998).

Rice is very important in Nigeria, based on the various ways it can be used. The capability to produce more rice has aided in development of numerous communities, while its failure has led to the spread of starvation, death and political uncertainty in many countries including Nigeria (Seck *et al.*, 2012; Oludare, 2014). The acceptance of rice as food has witnessed an upsurge lately by becoming a major crop in many countries in America and Africa (Seck *et al.*, 2012).

Local dishes prepared with rice in Nigeria most especially the northern part include “Masa”, or “Waina”, “Tuwo”, and “Alkakki”, while the most common form of food prepared with rice all over the country include pudding and boiled form eaten with stew or combined with potatoes, yam, beans and pears (Oludare, 2014).

**ECOLOGY OF RICE**

Six rice growing environments (RGEs) have been adopted in Nigeria by (Longtau, 2003): Upland, Hydromorphic, Rainfed Lowland, Irrigated Lowland, Deep Inland Water and Mangrove Swamp. Table 1 provides a summary guide of the systems.

**Table 1. Rice ecology summary**

Types	Characteristics	Geographical spread
Upland	Rainfed rice grown on free-draining fertile soils. This is also called dry uplands.	Widespread, except coasts, high rain forests and Sahel.
Hydromorphic	Rainfed rice grown on soils with shallow ground water table or an impermeable layer. This is also called wet uplands.	Very widespread at the fringes of streams and intermediate zone between upland and swamps of rivers in the Savannah.
Lowland	Rainfed or irrigated rice in aquatic conditions or medium ground water table. Water covers the soil completely at some stage during the cropping season. These are called shallow swamps or fadama.	Very widespread from high rain forest to Sahel.
Deep inland water	Rainfed rice grown on soils with deep water tables. The rice crop floats at some stage and harvesting may be done from a canoe. These are also called deep fadamas or floodplains	Found in the Sokoto-Rima Basin and Chad Basin, floodplains of the Niger, Benue, Kaduna, Gbako, Hadejia and Komadugu-Yobe.
Mangrove swamps	Rice grown at the coast or swamps of the high rain forest.	Coastal areas and Warri area in Delta state.

Source: Longtau, (2003).

**CHALLENGES ASSOCIATED WITH RICE PRODUCTION**

There are a lot of challenges associated with rice production worldwide, although every geographic area has major issues to deal with. However, the issues common to almost all places are; drought, availability of fertilizer, soil salinity, pest and diseases, mechanization, availability of land and support from government, NGOs and international organisation.

**DROUGHT**

Decreased rain fall coupled with intermittent drought is a common feature in the tropical and sub-tropical savannas (Mohammed *et al.*, 2015). It has been estimated that 25% of the

fields used for upland crop production are prone to yield reductions as a consequence of drought (Jeong *et al.*, 2010). Drought tolerant varieties developed through plant breeding are more accessible to farmers than costly agronomic practices or irrigation enhancements that might require large investments by farmers (Jeong *et al.*, 2010; Zheng *et al.*, 2010; Hu & Xiong, 2014;).

#### **AVAILABILITY OF FERTILIZER**

Fertilizer availability has been a pressing issue for a long time, most especially in Nigeria, where the prices keep skyrocketing despite government intervention. In 2016 both NPK 15:15:15 and Urea 50 kg bag was sold for up to six thousand Naira. This can lead to a decline in the production of rice (Mohammed *et al.*, 2015). Farmers are mindful of the significance of fertilizers that is both organic and inorganic in farming activity (Ezui *et al.*, 2010).

#### **SOIL SALINITY**

The value of crops and yield of soils with high contents of salts are reduced significantly, thereby causing serious socioeconomic and environmental problems in the long term (Munns, 2002; Chesworth, 2008). The amassing of salts from inappropriate soil and water management is a very serious problem worldwide (Chesworth, 2008). To stop the loss of arable land due to salt accumulation it is necessary to use appropriate soil and water management practices (Chesworth, 2008).

#### **PEST AND DISEASES**

Most of the local varieties of rice are vulnerable to pest and diseases. The common diseases associated with rice include blast, rice yellow mottle virus (RYMV) and brown spot while common rice pest include *Diopsis species*, African Rice gall midge, short horned grasshopper (*Oxya sp.*) birds, rice rats, and grain sucking insect pests (e.g. stink bug) (Sié *et al.*, 2008).

Using disease resistant rice varieties and good cultural practices often limit infection to most of the diseases. High nitrogen in the soil associated with little potassium can increase blast damage. It is also advisable to split the application of nitrogen to reduce blast damage. Removal of surrounding weeds can destroy the alternate host of RYMV (Sié *et al.*, 2008).

Cultural practices such as early sowing, narrow spacing of plants, using scarecrow and maintaining weed free field and the use of bio pesticides (Decis™ at 1liter/hain 500 liters of water) can minimize pest damage. Others include rouging of infected plants and immediate replanting, manually scaring the birds, tying old VHS tapes diagonally, installation of bird nets when available, the use catapults and fencing with bamboo or chicken wire mesh or polythene sheet to prevent rats and grass cutters from encroaching (Sié *et al.*, 2008).

#### **MECHANISATION**

Farm mechanization is a process of introduction and development of mechanized support of all kinds at various levels of agricultural production in order to reduce manual labour (IFPRI, 2010; Lamidi and Akande, 2013). Large scale farms in Nigeria are faced with the following constraints to mechanization include: credit accessibility, inability of entrepreneurs to set up manufacturing and repair services, lack of improved infrastructure, inadequate complementary inputs due to high cost, such as electricity and fuel, inadequate legal capacity to protect the rights of owners of machinery, and poor implementation of policies. Addressing this issues should be the policy objectives of the federal government (IFPRI, 2010; Lamidi and Akande, 2013).

#### **AVAILABILITY OF LAND**

Land is a very important factor in rice production despite the fact that rice can be cultivated in shallow water. It has a significant role to play in increasing the quantity of rice production

as well as sustaining it (Ezra and Yahaya, 2012). In 2000, out of about 25 million hectares of land cultivated to various food crops, only about 6.37% was to rice giving an average national yield of 1.47 tons per hectare (Ezra and Yahaya, 2012). A significant increase of area used for the cultivation of rice was recorded between 2010 and 2017, from about 2.4 million ha to 3.2 million ha respectively (Erhie *et al.*, 2018).

#### **SUPPORT FROM GOVERNMENT, NGOS AND INTERNATIONAL ORGANISATIONS.**

The Federal government of Nigeria tries to solve these problem through the ADP (Agricultural development organisation), the River Basin and Rural Development Authorities (RBRDA), and Nigerian Agricultural Co-operative and Rural Development Banking which are present in almost if not every state of the federation with subsidiaries in some local governments (Omofonmwan and Kadiri, 2007). The ADPs collaboration with NGOs (non-governmental organisation) such as Information and Communication Support for Agricultural Growth in Nigeria (ICS-Nigeria) increase the quantity and quality of information available that will increase agricultural production, its processing and marketing of the end products and also strengthen the capabilities of assistance organisation for farmers to package and disseminate information and agricultural technologies to farmers for rural poverty alleviation (ICS-Nigeria, 2010).

At international level, various organisations contribute information on how to tackle the challenges facing rice farming. These includes development of handbooks on best cultural practices used in tackling pest, issues with soil fertility, storing products and even marketing. Others include development of resistance varieties and sponsoring of research projects that will provide useful information to rice farmers. These organisations include African Rice Center and its subsidiaries such as West African Rice Development Association (WARDA) which are always collaborating with International Institute of Tropical Agriculture (IITA) and International Rice Research Institute (IRRI). Others include Food and Agricultural Organisation, International Food Policy Research Institute (IFPRI) and United States Agency for International Development.

#### **PROSPECTS IN RICE PRODUCTION IN NIGERIA**

##### **Food Security**

Food security is basically defined as the access to food at all time for healthy life (Ojo and Adebayo, 2012). A country can only be food-secured when more than half of its population have access to food in the required quantity and quality (Idachaba, 2004; Ojo and Adebayo, 2012). The food is expected to meet an acceptable level of nutritional standards in terms of the calorie, minerals and required by body, and people have to possess the means to acquire it in a consistent manner (Davies, 2009; Ojo and Adebayo, 2012).

##### **Economic Stability**

The Prediction for the demands of rice remains very strong. By 2035 an additional 116 million tons of rice will be required to feed growing populations. Rice is the most rapidly growing source of food, about 30 million tons more rice will be needed in Africa by 2035, which represents an increase of 130% in rice consumption from 2010. Nigeria alone will require one-third of this extra rice (Bamidele *et al.*, 2010).

Nigeria has witness an increase in rice production in recent years(9.3% per annum), mainly due to increase in rice area (7.9% per annum) and a small amount of yield increases (1.4% per annum)(Akpokodje and Erenstein, 2001). Nonetheless, the increase in rice production in

Nigeria is not sufficient enough to match our increase in consumption (Akpokodje and Erenstein, 2001; Bamidele, Abayomi and Esther, 2010).

The Nigerian government has been interfering actively in its rice economy for more than forty years, due to the strategic importance of the commodity. But these policies have not been consistent due to change in regimes and priority. Example, between 1986 and 1990s imports were declared illegal, but imports were allowed at 100% tariff in 1995. The tariff was subsequently reduced to 50% in 1996, then it was increased again in 2001 to 85% (Akpokodje and Erenstein, 2001). This increase and reduction in tariff continued till the government decided to ban the importation of rice in 2016 altogether, due to forex scarcity and economic recession, which made rice farming a priority to many business men in the country. Although rice is still imported through illegal trade, but the federal government through the Nigerian customs are currently taking the right measures to tackle that. If this policy is sustained, Nigeria can be self-sufficient in rice production and even export to other countries.

### **Job Opportunities**

Agriculture is an important sector that provides jobs to many individuals in Nigeria. About 70% of Nigerians get their sources of livelihood, either as local farmers, traders, labourers, manufacturers of fertilizer, manufacturers of farm tools and machineries etc. (FAO, 1999; Odoemenem and Inakwu, 2011).

### **HOW TO IMPROVE RICE PRODUCTION**

Nigeria can improve in rice production, if farmers take some necessary steps published by IRRI (2015). These are simple cultural practices designed to get better output rice production, which might include the following.

#### **The Use of Crop Calendar**

The picture of a typical growing season of rice is known as a crop calendar. This begins from fallow, preparation of land, establishment, and maintenance from planting to harvest and storage. Using a crop calendar makes planning farm activities, such as organizing labor and securing good seeds and fertilizer more efficient thus decrease cost of obtaining inputs and increase yields (IRRI, 2015).

#### **Using the Best Variety and Qualitative Seeds**

The best variety is the variety suitable to particular rice ecology. So farmers are advised to select a variety suitable to their farmland ecology that is using an upland rice variety in an upland area or using a lowland variety in a low land area. And it is best to use the variety that is popular with the consumers in the area, which has a good yield potential and is resistant to diseases.

Seeds of high quality reduces the number of seeds to be planted, due to their viability and they tend to produce healthy and strong seedlings with high yields. A qualitative seed is very clean with no weed seed and stones. It contains grains of a particular variety with no obvious cracks. Improved rice varieties such as FARO 44, NERICA 1 and NERICA 2 have showing promising results in some studies carried out recently (Tollens *et al.*, 2013)

#### **Field Preparation**

Before planting fields should be leveled properly because level fields tend to give high yield with lower cost and healthy uniform crops that have the ability to withstand competition with weeds. It is good to use moldboard or disc plow that kills weed with a depth of 10 cm,

if possible 6 – 8 weeks before planting. A tine harrow with a small size clod should be used at least in twofold two or three weeks before planting. Bunds should be prepared to retain water where necessary (IRRI, 2015).

### **Time of Planting**

Early planting makes the crop to compete better with weeds, avoid some pests and grow fast with high yields. Nonetheless the appropriate time to start planting depends on various factors, such as the ecology of the area, the availability of water in the case of irrigation, variety and the ideal time of harvest (IRRI, 2015).

### **Weed Management**

Weeds are capable of reducing yield as a result of the competition they provide to rice plants. For a weed to accumulate 1 kg of dry matter, it means it has reduce 1 kg of potential grain to be produced. The yield loss caused by weeds mostly occur within 20 – 50 days after establishment of the crop, which is why early weeding is necessary. It is also important to weed immediately after initiation of panicle to prevent shedding caused by weeds (IRRI, 2015).

When using herbicides, it is important to identify correctly the weed in order to use the right herbicide base on the label recommendation. Herbicides are more effective when they are applied to small weeds. Nonetheless pre-emergence herbicides can be applied before weeds are established and post-emergence after weeds are established, but care must be taking to avoid crop damage. It is necessary to wear protective clothing before spraying herbicides (IRRI, 2015).

### **Fertilizer Application**

Almost all soil types provide little quantity of nutrients to crops, which make fertilizer application necessary to increase yield. Fertilizers have the ability to improve the physical conditions of the soil. It is assumed that a ton of crop grain will take away about 15 kg of nitrogen (N), 2-3kg of phosphorus (P) and 15 -20 kg of potassium (K), although this could be modified according to the type of soil, the condition of the crop, the season, efficiency of application and weather conditions. The use of organic manure, straw, husk, compost and plant leaves as fertilizer is encourage most especially at the nursery stage (Oikeh *et al.*, 2008; IRRI, 2015).

The recommended rate of fertilizer application ranges from 120 kg – 200 kg/ha of NPK 15:15:15 28 days after seedling emergence and 50 – 100kg of Urea/ha after panicle initiation. However, upland rice ecology rice require more fertilizer application, that is 200kg of NPK 15:15:15 and 100 kg of Urea/ha. Applying high rate of fertilizer to local varieties is not encouraged, because it can cause lodging. The application of fertilizer is usually done by broadcasting method (ICS-Nigeria, 2010; IRRI, 2015).

### **Pest and Disease Management**

An estimate of 37% of rice grain yield is lost to pest and diseases annually. A part from accurate and timely diagnosis of diseases, good management of crop can reduce losses significantly. Prevention is the best way to control pest and diseases. Farmers can limit pest and diseases by cleaning equipment they use, using clean seeds and resistance varieties, planting within two weeks window as your neighbor to reduce disease, insects, rats and birds pressure on one field. Others ways includes encouraging pest natural enemies by

using pesticides conservatively, which include not applying within the first 40 days of planting and following the recommendation of fertilizer application (IRRI, 2015).

### Harvesting on Time

It is important harvest to rice on time in order to get maximum yield with good grain quality. On the other hand if rice crop is harvested too early, many of the grains will be unfilled or immature and immature grains easily break when milled and cannot be used as seeds because they do not germinate. Late harvest cause heavy loss through bird attacks and shattering of seeds. The best time to harvest rice is when 80 – 85% of the grains are coloured like the straw and the grain moisture that is required is 20 – 22% and this is usually 30 days after flower production. Ensure grains at the lower part of the panicle are not soft but hard. It is also good to separate the panicles from each other after cutting and dry the grains soon after threshing, preferably sun drying on tarpaulins (Oikeh *et al.*, 2008; IRRI, 2015).

### Storing and Milling

The best way to store rice is storing it with the husk, because it provides some form of protection to the grains from insects and it also prevent the deterioration of the grain quality. A good storing system ensures grains are protected from wet conditions, rodents, birds and insects. It is also necessary to maintain the temperature of the storage system to prolong seed life (IRRI, 2015).

Milling removes the husk and bran layer of rice to give the edible form. When grains with poor quality are milled the product will be edible rice with poor quality. 13 – 14% is the best moisture content for milling of grains with a temperature of 45°C. Various milling steps are used, such as one – step, two – step and multi-stage milling but hand pounding with mortar and pestle is discourage, because it produce a lot of broken rice (IRRI, 2015).

### CONCLUSION

Nigeria has the capacity to be self-reliant and even become a global rice exporter, if the right policies are implemented judiciously. International and local organisations with the aid of Agricultural Development Programmes (ADP) are doing a fantastic job in enlightening farmers about the cultural methods required to successively produce high rice grain yield, although government need to open more branches of the ADP's because they are required in areas where they have no branches to effectively spread the message. Improved rice varieties such as FARO 44, NERICA 1 and NERICA 2 have shown promising results in some studies carried out. If these varieties are adopted with better management practice the production of rice will surely increase in this country.

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