THE FEDERAL GOVERNMENT OF NIGERIA PROPOSED BAN ON RICE IMPORTS IN 2015: A TASK FOR RICE BREEDERS

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Abstract
For several decades now, Nigeria has depended on rice imports to supplement domestic production. Local production of the commodity has declined and in some places completely abandoned due to erratic policy, "dumping" by foreign producers, over-dependence on petroleum for foreign exchange, lack of essential structures for field production, poor processing and marketing systems and a general preference for imported rice by Nigerians. To this end, the Federal Government was spending more than 365 billion Naira annually on rice importation into the country, which could have benefitted the Nigerian farmers. This situation has resulted in abandonment of rice fields and a shift to other arable crops by farmers. The ban on rice importation as in other times in history is geared towards revamping rice production to meet local consumption as well as produce surplus for export. However, this may not be achieved if adequate rice breeding policies are not formulated and implemented to provide the farmer with high yielding, pest-disease resistant and highly adaptable varieties to local ecologies. It therefore requires strengthening the structure within the Rice Research Institutes and other collaborating agricultural institutions, germplasm collection and cataloguing, multilocational trials, field demonstration, and provision of good processing and marketing facilities for efficient production and high quality rice for local consumption and export.

Keywords: Federal Government of Nigeria, "dumping", ban on rice importation, local production, rice breeders, high yielding varieties.

Introduction

Rice (*Oryza sativa* L) is the main staple food for more than a half of the world's population and is produced in at least 95 countries (Zhang, 2007). Rice is vital for the nutrition of much of the population in Asia as well as in Latin America, and the Caribbean and in Africa. It is the second most important food crop of the world. Over 150 million hectares are planted with rice worldwide with a production of about 375 million tonnes annually. Over 65% of the world's output of rice comes from China, India, Bangladesh, Japan, Pakistan and the adjoining islands in the pacific. The West African sub-region accounts for 56% of the total rice produced in Africa and Nigeria alone contributes about 23.5% of the total rice production in Africa (Edet, 2012). In general, developing countries accounts for about 95% of global rice production with China leading, followed by India. About one billion households in Asia, Africa and the Americas depend on rice cultivation for employment and source of livelihood (Childs, 2004).

Rapid population growth and economic development pose growing pressures on increasing food production. Rice production is also facing challenges from global warming, water shortages and other factors that limit the capacity of farmers to grow the crop (Krishnan *et al*., 2007; Ainsworth, 2008). Demand for rice will grow to an estimated 2000 million metric tonnes by 2030 (FAO, 2002). In recognition of the food value of rice, the United Nations declared 1966 and 2004 as International Years of Rice (UNO, 2004). Similarly, the Philippine president declared 2013 as national year of rice through a proclamation in anticipation of attaining rice sufficiency that year. The month of November of every year is also affirmed as National Rice Awareness Month for the country (IRRI, 2013). In 1995, rice was grown on about 148.7 million hectares in 117 countries, with the highest recorded national yield of 8,544kg/ha and the lowest one of 719kg/ha, showing a wide variation in yield performance from country to country. The annual rate of rice yield increase in the world declined from 2.7% in the 1980 to 1.1 in 1990s. The continued world population increase requires resumption of the previous rate (Horie *et al*., 2004).

Rice Production in Nigeria

In Nigeria, rice is the sixth major staple food crop in cultivable area after sorghum, millet, cowpeas, cassava and yam. It is the only crop that is grown nationwide and in all agro-ecological zones, from the sahel to the coastal swamps (Ukwungwu, 2000). The cultivation of rice is undertaken in four main types of environments in Nigeria: rainfed, uplands, especially in southern Nigeria, tidal fresh water mangrove swamps, naturally flooded areas, such as the fadamas of northern Nigeria and irrigated lands (Vange, 2006). Since these environments are found in many parts of the country, rice is produced in virtually all the ecological zones. Chaudhary and Nanda (1986) estimated 4.6 million hectares as potential areas for rice cultivation in Nigeria.

Nigeria is the largest producer of rice in West Africa and the 17^{th} major producer in the world, and it accounts for about 20% of sub-saharan Africa's rice imports (Omotola and Ikechukwu, 2006). In order to increase domestic rice production, it was estimated that 4.6 million hectares of land should be put to rice cultivation in the country, but only an estimated 1.9 million hectares are currently utilized (Ukwangwu *et al*., 2004). The demand for rice has been on the increase in Nigeria at a faster rate than other West African countries since the mid-1970s. There was an astronomical increase in rice consumption from about 11kg per capita per annum in 1980 to 25kg per capita per annum in 1990. This arises from the fact that rice is widely regarded in Nigeria as a superior foodstuff, which until recently was mainly consumed by city dwellers and the middle and higher income groups. However, due to considerable expansion in production and imports during the past decades, it is increasingly eaten in rural areas (Edet, 2012).

In the past two decades, Nigeria rice sector has witnessed some remarkable development. Between 2001 and 2003, rice production was estimated at 2.03 million metric tonnes, while consumption was 3.96 million metric tonnes. The balance of 1.90 million metric tonnes was obtained by imports. It is disheartening that while rice consumption level was rising at 5% per year, there existed a widening gap between demand and local supply. The current level of production cannot still meet the estimated national requirement of over 4.0 million metric tonnes of rough rice (Ukwungwu *et al.*, 2004), hence the continued import to meet the deficit and proposed reserve. The demand for rice in Nigeria presently increases at a rate faster than other African countries, even at 8% per annum.

The limited capacity of the Nigerian rice production to match the domestic consumption demand also raises a number of pertinent questions both in policy circle and research. This situation does not only question the quality of agricultural policy in respect of rice production but also the nation's commitment to its implementation. Studies have persistently focused on the low yield of the crop in Nigeria, which is often 1.8 tonnes per hectare, which is lower compared to 3.0 tonnes per hectare obtained from Cote d'Ivoire and Senegal. There is also lack of adequate suitable flood plain and affordable irrigation facilities to the local farmers, limiting lowland rice expansion, in addition to other biophysical constraints (Vange, 2006).

The Ban on Rice Import and its Implications on Domestic Production and Food Supply System

The ban on importation of rice came as a means of protecting local producers and millers from economic frustration and "dumping" of rice into the country and stimulating the domestic market. For example, Nigeria accounts for 20% of sub-saharan's Africa rice imports. South Africa accounts for 11% of imports into the region, mainly high quality parboiled rice from India and Thailand. Senegal also accounts for about 11% of import, mainly broken rice. Similarly, Ghana with only 5% of the region's import is also increasing production by raising yields. Guinea and Mozambique have similar levels of imports, while Madagascar imports 100,000 tonnes, despite being the region second largest rice producer (Omotola and Ikechukwu, 2006).

The presidential initiative on rice production, processing and export is one of the committees designed to attain self sufficiency in local production of rice in the short term and to produce for export. It was expected to produce 6 million tonnes of milled rice from 10.3 million metric tonnes of paddy by 2005. By the year 2007, three million hectares were expected to be put under rice cultivation for the production of about 15 million metric tonnes of paddy or 9.0 million metric tonnes of milled rice (Abdullahi, 2006). In spite of all these initiatives, rice importation was still on the increase because the local production could not meet demand and the local rice was not patronized by the people.

Nigeria has used various trade policy instruments such as import restrictions and outright ban on rice import at various times from 1978 to 1995 without achieving any success. From 1978 to April, 1979, Nigeria military government banned importation of rice in containers under 50kg. In April, 1979, the same Nigeria government introduced rice import under restricted licence for only government agencies. Later in September, 1979, a six month ban on all rice import was introduced but in 1980, the policy was changed and license was issued for importation of 200,000 tonnes of rice. The policy was later modified to no quantitative restriction on rice under general import licence. Later in 1980, the Presidential Task Force on Rice named Nigeria National Supply Company to issue allocations to customers and traders. In 1984, the Military regime disbanded the Presidential Task Force on rice and rice importation was placed under general licence restrictions in 1985, yet rice was smuggled into the country through "porous" country's boarders. In 1995, the import ban on rice was removed because local producers could not meet demand. Since then, the Nigerian government has engaged in various import restrictions on rice without success (Abdullahi, 2006).

In October, 2011, apparently to increase domestic production and stimulate export, the Federal Government of Nigeria announced a ban on rice with effect from 2014. Some observers however viewed the policy to be monumental failure because the agricultural structures for increased rice production were not established and strengthened to meet the domestic rice demand of about 5 million metric tonnes. Nigeria currently is importing more than one-third of its total rice requirement to meet the consumers demand in urban areas. The local milled rice is of poor quality, mainly consumed by the local areas. Most Nigerians still prefer the imported rice in spite of the effort so far made to destone and even polish it (Omotola and Ikechukwu, 2006). Presently, Nigeria is losing an average of N1 billion daily to importation of rice. To encourage high production, the government is promoting the adoption of new hybrid rice varieties which are high yielding, early maturing, disease resistant and high in protein content. To ensure self sufficiency in rice the government has advanced loans for millers to obtain modern milling machines and also provide irrigation facilities for upland rice cultivation.

The Task for Rice Breeders in Nigeria

Rice as an international crop has received some levels of attention in terms of breeding, production and protection by Nigeria government and international organizations and institutions. In Nigeria, there has been research collaborations at local and international levels directed towards self-sufficiency, import reduction and even export. There have been research collaborations among research institutes such as the International Institute of Tropical Agriculture (IITA), the West African Rice Development Agency (WARDA), National Cereal Research Institute and even International Rice Research Institute (IRRI). These institutions hold in trust large collections of rice genetic resources (Jackson, 1999).

More than 51 rice varieties have been released in Nigeria to date, only a few of these can be identified in farmer's fields. Some have lost their identity through mechanical mixture, deliberate adulteration and spontaneous mutations during the long period of cultivation and exchange of seeds by farmers. Some are not identifiable because they are known by so many different names in different localities (Ukwamgwu, 2000). The rate of adoption of new varieties in Nigeria is quite slow due to varietal characteristic preferences and ecological differences (Ukwungwu *et al*., 2004). WARDA has developed a range of germplasm, profiting from the African rice gene pool to address the diversity of African rice growing environment (Jones, 2013). The current breeding emphasis at International Rice Research Institute and a few other countries like China, Japan and India include (i) tailoring of new rice varieties capable of yielding 15 – 20% higher than the best variety available (ii) engineering future rice varieties with novel genes conferring resistance to major insects and diseases and (iii) improving nutritional value of rice through conventional and molecular breeding approaches. Broadly, the breeding approaches include introductions, pureline breeding, recombinant breeding, mutation breeding, heterosis breeding and cellular and molecular breeding. The breeding priority has changed over the decades from purification of landraces, placing emphasis on early maturity, consumer quality and blast resistance to recombining of desired traits through hybridization and recombinant DNA technology giving emphasis to high yield and value addition (Siddiq and Viraktamath, 2009). A wide array of physical and chemical mutagens has been evaluated on rice and based on their relative efficiency and effectiveness, x-rays, gamma rays and fast neutrons among physical mutagens and Ethyl Methane Sulphonate (EMS), Nitroso Methyl Urea (NMU) and Sodium azide among chemical mutagens have been found to be potent for inducing point mutations. With regards to chemical mutagens, EMS has proved more effective than radiation. Some rice mutants have been released directly as mutant varieties or used as donor sources for improving specific characters (Mickle *et al*., 1987).

It appears that in the developing country like Nigeria, resources for training of crop breeders in agricultural biotechnology are limited and so reliance has been on the use of conventional breeding techniques alone which are slow, requiring very long periods before a variety could be produced. Significant developments in crop improvement geared towards increasing crop productivity have been attained especially with the use of tissue culture, protoplast culture, molecular markers and recombinant DNA technology for accelerated gene transfer that was hitherto unattainable (Ubi, 2012). The application of genetic markers in rice breeding can significantly reduce the time and cost of developing new crop varieties. As molecular markers serve as genetic landmarks, and can be used as proxy to select for the desired form of a gene if the marker is located near the gene of interest. A plant breeder can use a DNA marker to identify plants that carry the form of the gene for a trait of interest. Morphological traits, isozyme loci, restriction fragment length polymorphisms (RFLPs), random amplified polymorphic DNAs (RAPDs), amplified fragment length polymorphisms (AFLPs) microsatellites or simple sequence repeats (SSRs) and more recently, single nucleotide polymorphisms (SNPs) which detects variation between individuals at certain nucleotide positions in the genome (Brooker, 2009) have been used for genetic mapping (Ubi, 2008).

DNA markers have several potential applications in rice improvement. These include germplasm characterization, assessment of genetic diversity, tracking the gene through segregating generation and marker assisted selection. Pyramiding of genes, conferring the same phenotype is important as the gene transfer by MAS is precise and faster, especially when the trait is difficult to select on the basis of phenotype (Siddiq and Viraktamath, 2009). Molecular mapping techniques provide a direct way to analyze the genes involved in grain yield.

Haploid plants have been developed from anther culture and the chromosome doubled via colchicines treatment, which is homozygous in all loci. Lines are produced from anther culture in less time and show greater variability than those obtained by selfing (Tomes, 1990).

These biotechnology tools hold great promise in expanding the scope of rice breeding for introgression of genes across barriers of sexual incompatibility and expediting the process of variety development. Some of the path-breaking developments in rice biotechnology include production of sporophytic plants with gametic chromosome number from microspore culture, plant regeneration from protoplasts of japonica and indica rices, transgenic rice using Agrobacterium mediated transformation, construction of comprehensive molecular maps of rice genome, mapping and tagging of genes of economic significance particularly for resistance to major diseases and insect pests of rice using DNA markers and application of marker assisted selection and molecular characterization of biodiversity in pest, pathogen and rice germplasm (Siddiq and Viraktamath, 2009).

The scientific breakthrough in the development of NERICA arose with the use of embryo rescue, anther culture and double-haploidization methods to overcome sterility and speed up the breeding process (Diagne *et al*., 2010).

It is estimated that rice consuming population will increase by additional 80 – 100 million every year and that the growth of total rice area is slowing down and that many of the favourable growth factors of the 70s and 80s have started shrinking, meeting the rice needs of the coming decades is going to be the most challenging task (Siddiq and Viraktamath, 2009). Raising the genetic yield level with desired level of stability and value addition would require using a combination of conventional and biotechnological tools. Rice breeders should be properly equipped with genetic engineering and cell and tissue culture techniques in addition to their conventional breeding methods in their drive towards developing superior rice varieties for the country.

Although many breeders are affiliated with biotechnology, hand-on biotechnology research is not an all comer's affair (Ubi, 2012). These new technologies should not only be seen as solving problems when traditional techniques have failed, but also as a way of generating a better understanding of the rice plant through the cooperation of scientists from different disciplines – molecular biologists, biochemists, physiologists and virologists. Working with genetics, pathologists and entomologists, the rice breeders can form research teams capable of bringing about a revolution (Monti, 1992) in rice production.

Rice breeders in Nigeria of course must keep pace with rice breeders in other countries, especially the top sixteen (16) rice producing countries which include China (202.6 million metric tonnes), India (155.7 million metric tonnes), Indonesia (65.7 million metric tonnes), Bangladesh (50.6 million metric tonnes), Vietnam (42.3 million metric tonnes), Thailand (34.5 million metric tonnes), Myanmar (32.8 million metric tonnes), Philippines (16.6 million metric tonnes), Brazil (13.4 million metric tonnes), Cambodia (8.7 million metric tonnes), Japan (8.4 million metric tonnes), USA (8.3 million metric tonnes), South Korea (6.3 million metric tonnes), Pakistan (6.1 million metric tonnes), Egypt (5.6 million metric tonnes) and Madagascar (5.0 million metric tonnes) (Wikipedia, 2013). Scientists in Nigerian universities and research centres (private and public) and in national and international organizations should join hands to ensure rice sufficiency in Nigeria. Such cooperation could foster rice technology transfer on global or regional basis especially in breeding and exchange of genetic resources of rice.

In most developing countries including Nigeria, public sector investments are still the main source of finance for rice biotechnology. There is need for greater public/private sector collaboration in relation to biotechnology and its application to rice breeding in Nigeria. This will require continued public sector investment from domestic sources, public/private sector partnerships, innovative funding mechanisms on the part of international development agencies and involvement of both local private sector companies and transnational companies (Persley, 1992).

Conclusion

Rice is one of the major staple foods in Nigeria. Although Nigeria produces much rice and ranked the largest producer of the crop in the sub-saharan Africa and the seventeenth in the world, she imports more than one-third of her requirements amounting to ₦365 billion annually. The inability of the Nigerian rice production to match the domestic consumption demand has been blamed on several factors. However, the major reason could be the over-reliance on the conventional breeding methods for the development of agronomical desirable varieties and foreign research institutes for improved varieties. The breeders are conversant with the conventional breeding techniques though mutation breeding has not been fully exploited. It is disheartening that the major rice producers have hit the yield plateau obtainable in Nigeria, while Nigeria is rather demanding for more land area for rice cultivation which may not be available due to increase in urbanization and other competing use of land. The Nigerian rice breeders need to further their breeding techniques with the use of cell and tissue culture and molecular techniques which have the capacity of shortening breeding procedures, facilitate characterization and development of desirable traits in rice. Molecular techniques could be used to extract and transfer desirable genes into promising types. The breeders require skills in molecular techniques to turn around rice production in Nigeria. There is need for local and international collaborations and hand-on skills on rice breeding in Nigeria.

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