

Environmental Influence and Modern Rice Production Technology in Nigeria: Lesson from Natural and Synthetic Pest Incidence

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Abstract: *Wastage in rice production as a result of environmental threats, natural and synthetic pest had been a bane and misery of poor resource based small scale rice producer in Nigeria. This massive lost in harvest had over the years responsible for shortage in market supply with the attendant adverse multiplier effect. The upshot is exacerbated incessation of rice farming enterprise by run-down resource-based farmers and market disparity subsequent in food insecurity. This study divulges and overview numerous techniques that can be employed by the farmers to lessen the quality and quantity of rice output from the onset of production process and also showcase the routine field practice that can be engaged to attain higher production efficiency. The review discloses that current techniques used to minimize lost in quality and quantity such as tube well, bole hole, bird scarer, knapsack sprayer, improved variety (FARO44, ITA150), fertilizer (NPK 20:20:20), herbicide (mixture; stamF34, delmin, Ron star), pesticide (Furadan, Basudin, Marsha), and rodenticide. These techniques are commonly used in rice producing countries and have yielded outstanding result. The study concludes that there have not been a wide-spread provision and usage of these technics among the small scale rice farmers in Nigeria. The study recommends that policy framework that will enlighten rice producer and assist them to contest against these threats and safeguard their farm produce should be introduced by the interest groups and trade organization.*

Keywords: Adoption; Rice production; Improved technologies

1. Introduction

Agriculture remains a key component of Nigerian economy. Currently, agriculture contributes about 40% of the Nigerian GDP and employs about 70% of the active population. The sector has however significantly performed below its potential. Nigeria with a population of over 200 million people and a land area of 923,768 square kilometers has a total of over 79 million hectares of cultivable land. Out of this, between 4.6 million hectares are suitable for rice production. Meanwhile, only about 1.8 million hectares or 39% is currently utilized for rice cultivation. Rice is a food security commodity in Nigeria as well as being the fourth major cereal crop after sorghum, millet and maize both in terms of output and cultivated land areas (National Rice Development Strategy, 2009).

Domestic production of rice is below the demand in Nigeria and rising per capita is now complemented with huge import. Estimated national demand for rice is put at 5.2 million ton per annum, production is estimated at 3.3 million tons leaving a demand gap of 1.9 million tons which is imported with the attendant drain on foreign reserve, making Nigeria the largest importer in West Africa (Onyeneke, 2017).

Agricultural development programs in Nigeria over the past two decades have included several improved rice production technologies. Among the most recently introduced are tube well, bole hole, bird scarer, knapsack sprayer, improved variety (FARO44, ITA150), fertilizer (NPK 20:20:20), herbicide (mixture; stamF34, delmin, Ron star), pesticide (Furadan, Basudin, Marsha), and rodenticide. However,

there has not been a wide-spread provision and adoption of these technologies in Nigeria. Various socio-economic factors and the degree of risk aversion may be the causes of adoption rates.

Increased agricultural productivity depends primarily upon the acceptance of cultural and technological changes at the rural farm level. Thus, for Nigerian agriculture to improve, our farmers have no alternative but to learn and adopt recommended scientific farming techniques in place of their traditional practices. (Adisa, Ahmed, Ebenehi and Oyibo, 2019). One way of improving agricultural productivity, in particular and rural livelihood in general, is through the introduction of improved agricultural production technologies to farmers. Most importantly, adoption of improved technologies remain the viable means to increase the productivity of small holder agriculture, thereby fostering economic growth and improved wellbeing for millions of the poor households (Abubakar, Garba, Gana and Jacob, 2019).

To increase and attain the production frontier in rice sector, we need to scrutinize the environmental issues that affect the promotion of rice production. This review therefore seeks to divulge and relate sundry environmental issues and conditions affecting rice production technologies among small-scale farmers in Nigeria. Specifically, the study reviewed the production trends, factors associated with the cultivation of rice and the environmental factors inhibiting the attainment of production frontier of the rice farmers in Nigeria

2. Conceptual Frame work

According to Rogers (1995) Adoption is regarded as a decision to make full use of an innovation or technology as the best course of action available. Adoption can also be defined as the decision to continue full use of an innovation (Ekong, 2010). Adoption is a decision to continue full use of an innovation after an individual has passed through certain mental processes. Adoption is the acceptance of continued use of an innovation after individuals or groups have gone through certain mental processes.

Farmers' decision for or against the use of an agricultural innovation or new technology has been described as a mental process, consisting of several stages. According to Ekong (2010) Adoption process is the mental process through which an individual passes from first hearing about an innovation to the final decision to use it. The adoption of a practice is not a unit act and instantaneous. The farmer's decision to accept or reject adoption of science based production technology consists of several stages and involves sequence of thoughts and decisions. Adoption is a process consists of three stages namely pre-adoption, adoption and post- adoption. At the pre-adoption stage, people may examine a new technology and consider adopting it. At the adoption stage, they form an intention to adopt the technology, and they eventually purchase and use it. At the post-adoption stage, people can either continue or discontinue using the technology (Alemayehu, 2019).

Rice Farmer's Level of Adoption of Improved Rice Technologies in Nigeria

Empirical review of the literature on level of adoption of improved rice technologies reveals that the various improved rice technologies can be grouped into the following four broad categories (1) improved rice production facilities; (2) rice farming inputs (3) field preparation/planting distance and (4) harvesting/ processing (Adisa *et al.*, 2019). The improved rice technologies related to the improved rice production facilities include tube well, bole hole, bird scarer, knapsack sprayer. The improved rice technologies related to the rice farming inputs include improved variety (FARO44, ITA150), fertilizer (NPK 20:20:20), herbicide (mixture; stamF34, delmin, Ron star), pesticide (Furadan, Basudin, Marsha), and rodenticide. The improved rice technologies related to the field preparation/planting distance include 25 by 25 planting method, ploughing, harrowing, water management, seed selection and seed testing. The improved rice technologies related to the harvesting/processing include combine harvester, per boiler, dryer, de-stoner and packing equipment (Bag, sewing and hot sealing machines) (Adisa *et al.*, 2019). According to Adisa (2019), study result shows that the adoption of improved rice production facilities, rice farming inputs and field preparation/planting distance by the farmers were above average level, indicating that most farmer were at the trail stage of adoption while only harvesting/ processing technologies were adopted below average. It

shows the low rate of adoption and processing facilities by the farmers. This could be as a result of the high cost of these facilities, beyond what small scale rice farmers can afford. Similarly, in another study by Ibrahim, Mustapha and Nuhu (2012) revealed that seed selection, planting depth, plant spacing, pesticide application, seed variety, land preparation, herbicide application, fertilizer application and use of combined harvester were the improved rice production technologies that were adopted at high level of adoption, while table well and modern storage system were adopted at medium level and finally water management and Irrigation system were adopted at low level of adoption.

Generally, it is evident from this reviewed paper that farmers adopted majority of the improved rice production technologies at higher level but was noticed that most of the improved technologies were grouped as improved package.

Many studies conducted in different parts of Nigeria showed that household size, farm size, income of farmers, farming experience and membership of farmers' association were found to be positive and significantly related to adoption of improved rice production technologies.

3. Material and Methods

Method of Data Collection and Interpretation

For this review paper, a variety of documents were reviewed, and the secondary data were collected from records, articles, journals and original research papers. The collated data were analysed and compiled for interpretation. The arguments of different researchers were taken, and the reviewer supports accordingly and made interpretation.

Review of Rice Production in Nigeria (Metric tonne)

Rice production in Nigeria had taken an upward trend since Nigeria gained independence. The first two decades witnessed upward resurgence with 52.04 percent although this could not in anyway match population increase within these twenty years. The spontaneous growth in rice production witnessed between 1981 to 2020 is very exciting and exhilarating. This was as a result of auspicious agricultural policy in favor of rice farmers especially ban in importation. The annual production ranges from 579 metric tonnes from 1981 to 1500 metric tonne in 1990. The annual average of 963.8 metric tonne giving an astounding increase 159% in that decade. The flagging and waning encountered from 1991 to 2000 revealed that there was increase of 3.56%. This was a setback to the industry compared with the preceding decade and alarming. The transformation of the last two decades was a reflection of government efforts to transform the rice sector. The production grew from 1651 metric tonne to 5040 metric tonne with the average production of 2165.6 metric tone and 3851 metric tone for the period of 2011-2020 respectively. Thus, there was 70.68% and 32.51% increase for that fifth and sixth decades respectively.

Table 1: Rice Production In Nigeria from 1960 to 2020.

Table 1: Rice Production in Nigeria (Metric tonne)						
S/n	1960-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011 -2020
1	229	307	579	1911	1651	2906
2	246	310	648	1956	1757	3423
3	202	342	607	1839	1870	3038
4	269	348	579	1456	2000	3782
5	236	390	680	1752	2140	3941
6	270	406	630	1873	2546	3780
7	260	412	1184	1961	2008	3780
8	249	394	1249	1965	2632	3780
9	257	372	1982	1966	2234	5040
10	284	523	1500	1979	2818	5040
Average	250.2	380.4	963.8	1865.8	2165.6	3851

Source: USDA 1960-2019

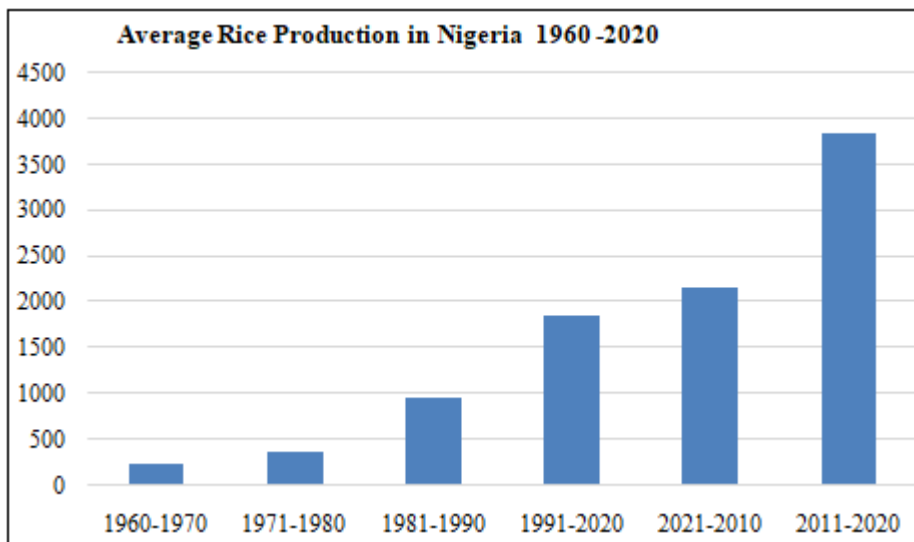


Figure 1

Constraints to Adoption of Improved Rice Technologies in Nigeria

Several factors are militating against the adoption of improved rice production technologies in Nigeria. Adisa *et al.*, (2019) reported that inadequate finance and credit facilities, poor soil fertility, inadequate size of farm land, lack of adequate and timely information, and excessive weed are some of the constraints to adoption of improved rice production technologies. Kagbu *et al.*, (2016) iterated the unavailability of loan facilities, poor marketing system and unstable price as well as inadequate extension contacts were the major constraint to adoption of improved rice production technologies. Besides this, the high cost of inputs, and adulteration of inputs. Other factors include fluctuation of climatic conditions, lack of infrastructural facilities, illiteracy, lack of tractor hiring service and lack of extension services.

Environmental Factor Limiting Rice Production Frontier

Nigeria has ecologies that favor rain-fed lowland, irrigated lowland as well as upland rice production. Production is dominated by smallholder farmers who use crude implement

because of their financial status and difficulty in getting credit aids from financial institution.

In determining the factors influencing rice production in Nigeria, Basorun and Fasakin (2012) found that the status of rice farmers, area of land cultivated, availability of market for the rice products, the number of laborers engaged in production and the use of agro-chemicals are crucial. Environmental factors that negatively impact on rice production are fuel, fertilizer, land rent, planting season, and land area are the factors that affect both production and technical efficiency of rice production. Drought and crop failure, global warming, climate change, water pollution, rising migration from rural to urban areas, as well as rising incomes from exploiting oil resources, which made it possible to reorient the tastes of the population to imported food, have led to industry stagnation.

The types and yield of rice is decisively influenced by the most crucial of the environmental factors such as terrain, climate, soil properties, and soil water. It is the combination of these four factors that allow specific variety of rice to be grown in certain areas.



Flood as a threats to Rice production in Nigeria

4. Conclusion

Improved rice production technology adoption is an essential strategy for increasing agricultural productivity, achieving food self-sufficiency and alleviating poverty and food insecurity among smallholder farmers in Nigeria. In Nigeria, farmers have been adopting and using different improved rice production technologies, the adoption rate of the technologies has not at good level when compared with another country. Farmer level of adoption of improved rice production technologies were grouped into four broad categories (1) improved rice production facilities; (2) rice farming inputs (3) field preparation/planting distance and (4) harvesting/processing. The variables significantly affect the adoption of agricultural new technologies by farmers are age, education level, house size, farm size, income of farmers, farming experience and membership of farmers' association. Inadequate finance and credit facilities, poor soil fertility, inadequate size of farm land, lack of adequate and timely information, and excessive weed are some of the constraints to adoption of improved rice production technologies.

Factors Affecting Attainment of Rice Production Frontier

Age of the rice farmer is one of the variable in explaining rice farmers' technology adoption behavior which plays an important position in influencing farmers' information access and shaping their ability to change the available information into action. According to Onyeneke (2017) Age of the farmers was negative across use of agrochemicals, mechanized harvesting, optimum seed rate, and modern rice milling, indicating adoption of these technologies decreased with age among rice farmers. This explains the negative relationship between adoption of these innovations and age. Older farmers may have experience and resource that would allow them more possibilities for trying improved rice production technology. On the other hand, younger farmers are more likely to adopt improved rice production

technology because they have had more education than the older age group. In other studies, Abubakar *et al.*, (2019) found that there was negative relationship between age and adoption of production practices by rice farmers, and was found statistically significant. The negative coefficient suggests a negative influence of the variable on the farmers' adoption decision. The finding implies that the adoption of improved practices for rice production is higher among youth than old farmers. Different improved rice production technologies adoption studies revealed conflicting results on the influence of age in adoption. Some of the findings confirmed that age negatively influencing adoption behavior of farmers. On the other hand, other improved rice production technologies adoption studies by other researchers indicated that age positively affected adoption. But, the reviewer supports the argument if age has a negative relationship with adoption of improved rice production technologies. When we see the adoption category of rice farmers in adoption of improved rice production technology, younger rice farmers categorized under the first category and they are characterized as innovative which enables them to make decision on adoption of improved rice production technologies. In addition, the reason probably due to their exposure to access to information than older rice farmers.

Educational status of the rice farmers is another important variable that is found to explain farmers' improved rice production technology adoption behavior. Various studies confirmed that it has a significant positive influence on adoption of improved rice production technology. For instance, Onyeneke studied determinants of adoption of improved technologies in rice production in Imo State, Nigeria. They have found out that more educated rice farmers are more likely to adopt improved rice production technologies in the study area. This finding is in line with other results. In other studies, Onumadu and Osahon, (2014) level of education was found to be positive and significantly related to adoption of improved rice production technology.

This implies that the more educated rice farmers are, the higher the adoption of improved rice technologies. I strongly agree that education has positive and significant relationship with the adoption of improved rice production technology. This is due to education has the power to change the knowledge, skill and attitude of rice farmers. It also enhances the analytical and problem-solving skills of rice farmers. In addition, Education enhances a locative ability of decision makers by enabling them to think critically and use information sources efficiently. Rice farmers with more education should be aware of more sources of information, and more efficient in evaluating and interpreting information about new agricultural technologies than those with less education. That is why I agree those rice farmers who have better education status have higher probability to adopt improved rice production technology than those we do not have.

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