# RICE FARMING CHALLENGES INDUCED BY FIELD PESTS ACTIVITIES IN ANAMBRA STATE: A STEP TOWARDS PRECISION AGRICULTURE

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***ABSTRACT***

*Precision agriculture has been identified as one of the most important approaches to provide food security and reduce the poverty rate of sub-saharan African countries with precision pest control being a major component of precision agriculture. This paper discusses the results of a preliminary field study carried-out to ascertain the prevalence of pests as well as the current methods of pest control in Rice Farming fields across Anambra State Nigeria. Specifically, the paper discusses the implications of pests in rice farming activities around the Nnamdi Azikiwe University Campus, Anambra State of Nigeria. Preliminary field studies reveal that pest damage accounts for major pre-harvest losses in rice production, thereby constituting a challenge to sustainable rice production and food security. Furthermore, studies reveal that current pest control methods of passive a blind application of pesticides as farmers are increasingly looking for more economic/healthier approaches to pesticide application.*

***KEYWORDS***

*Rice Farming, Field Pests, Precision Agriculture, Pest Control, Anambra, Nigeria.*

## 1. INTRODUCTION

Rice is the most important staple food eaten by about half of the human race (Hawksworth, 1985). It ranks third after wheat and maize in terms of worldwide production (Imolehin and Wada, nd). Global consumption of rice has seen a slight increase over the last several years. In the 2020/2021 crop year, about 504.3 million metric tons of rice was consumed worldwide, up from 437.18 million metric tons in the 2008/2009 crop year (Shahbandeh, 2021). From the literature and consultations, field pests activities constitute one of the major yield losses.

Precision agriculture (PA) is the science of improving crop yields and assisting management decisions using high technology sensor and analysis tools. PA is a new concept adopted throughout the world to increase production, reduce labour time, and ensure the effective management of fertilizers and irrigation processes. It uses a large amount of data and information to improve the use of agricultural resources, yields, and the quality of crops (Singh et al., 2020).

In this paper, a preliminary field study and analysis of rice production in Anambra State, Nigeria is carried-out. Specifically, the paper discusses how field pests activities contribute to

the physical, economic, and health losses of farmers. The opportunities of PA in proffering solutions for the above mentioned losses is also discussed.

## 2. RICE PRODUCTION IN NIGERIA

Rice is one of the major staple foods in Nigeria, consumed across all geopolitical zones and socioeconomic classes in Nigeria. It is indigenous to Nigeria and has been cultivated for the past 3500 years (Hardcastle, 1959). With expansion of the cultivated land area to rice, there has been a steady increase in rice production and consumption in Nigeria. The production increase has, however, not been enough to meet the consumption demand of the rapidly growing urban population, who has a great preference for parboiled rice (Singh *ET AL.*, 1997). This situation led to acute demand for parboiled rice in the 1990s, which contrasted with Nigeria's self-sufficiency in rice during the 1960s. In the 1960s, 360 000 tonnes of rice produced was enough to meet local demand, but the 1.45 million tonnes produced in the 1990s was not (IRRI, 1991; 1995). Thus, importation of rice rose from 7 000 tonnes in the 1960s to 657 000 tonnes in the 1990s (IRRI, 1991; 1995). This created a serious drain on Nigeria's foreign exchange reserve, which stood at US$407.5 million in the 1960s but dropped to US$58 million in the 1990s (IRRI, 1991). The drain on the foreign reserve led the Nigerian Government to ban rice imports in October 1985. Over the year, Nigeria rice consumption has been massively increasing (FAO, 2013), with a consumption per capita of 32 kg (Pwc, 2017). Annually, Nigerians consume about 5.5 million tons of rice, with only 3.6 million tons of these 5.5 million tons produced locally (Steve, 2016). The average national yield of rice has been fluctuating around a mean of 2 tons/ha. This implies an urgent need for improvement of average yield of rice obtained on farmers' fields to match the current population growth in Nigeria (Tiamiyu et al., 2019).

The following states in Nigeria are where rice planting and production is much more (than other states); Kano, Gombe, Niger, Kebbi, Ebonyi, Anambra, Nasarawa, Ogun, and Ekiti (Steve, 2016).

## 3. RICE PRODUCTION IN ANAMBRA STATE

Rice farmers in Anambra are producing rice either for domestic consumption or as one of the major sources of cash income. Rice is produced under upland, swamp and irrigated lowland conditions, mainly by small holder farmers with one or two hectare holdings (Nwalieji, 2012). The State has twenty-one Local Government Areas (LGA) spread across the four agricultural zones namely Awka, Anambra, Aguata and Onitsha. Anambra State is located between longitude 6°36'E and 7°21'E and latitude 5°38'N and 6°47'N. It has an estimated population of 4,182,032 with male population of 50.9% and female 49.1% (National Population Commission, (NPC) 2006). Though according to Anambra State Government (ANSG) 2020, the state population is estimated 11,400,000 (wikipedia). The State is bounded in the North by Kogi State, in the West by Delta State, in the South by Imo State and in the East by Enugu State. It occupies an area of about 4,416km2, 70% of which is arable land (Nwalieji, 2012). The average land area used in South Eastern Nigeria for rice production is approximately 53.1ha with Ebonyi State having the largest land area followed by Anambra state (Okeke & Oluka, 2017).

## 4. CHALLENGES OF FIELD PESTS

National Cereals Research Institute, NCRI (2004) identified poor pests control as one of the constraints that limit rice production efforts by farmers. The consultations conducted in Anambra state as part of the research study in this paper reveal that rice production in the area is

majorly constrained by pests, diseases and weed infestations and high cost of labour. This is a fact corroborated by the research study of EBIDO et al. (2020).

To ascertain challenges farmers encountered in rice farming in Anambra state as a result of field pests activities, we visited two locations in Anambra state and consulted rice farmers within the locations. The two locations are Anambra West LGA and Nnamdi Azikiwe University, Awka. Anambra-West is best suited for agriculture because of the fertility of the soil and abundant fresh water supply. Local farmers produce plenty of yams, cassava, rice and other popular staple foods. Nnamdi Azikiwe University (also known by the acronym UNIZIK) is a Federal university in Nigeria. It has large hectares of lands for farming and a registered farmers association called UNIZIK Farmers Association with about 340 members.

Our consultations with rice farmers at these locations reveals that

1. Rice farming starting from weeding, nursery, transplantation, application of pest controls to harvesting occurs between March to November every season.
2. The time for harvesting some species of rice can occur in 3/4/5 months of planting.
3. rice is planted in swampy and upland areas, but upland area rice plantation encounter more field pests activities than swampy areas.
4. Common field pests are armyworm, black-pod pest, querver birds, rice leave roller/caterpillar/borer, rodents, etc.
5. They use chemicals (hard chemicals) to control pests by spraying it blindly across the farm land.
6. a plot can exhaust 1.5 cartons of pesticides.
7. spraying is done by labourers or use of tractors.
8. spraying a plot is usually done by 3-5 labourers, depending on the financial strength of the farmer. Labourers' usual pay is a-day job price, that is, 4000 NGN for men and 3500 NGN for women.
9. For bird control, they scare them manually by employing labourers to do this from 6 am to 7 pm the first two weeks after planting, and from heading to harvesting.
10. for Rodent control, they use snap traps to kill them.
11. for termites control, they try to destroy all dead woods and plant deposits by burning them. Also, they locate termite mounds and destroy them by spraying Nogos 50 at the rate of 30 ml per 4.51 (one gallon) of water.
12. For armyworm control and other pests, they spray Gammalin 20 or Carbaryl (Vetox 85) or paraforce at the rate of 1.68 kg in 225 litres gallons) of water per hectare.
13. The spray for pests control ranges from 1 to 9 per season. Some farmers said that 9 may be suitable for complete protection against pests. But as the cost of labour increases, spraying of pesticides/herbicides are mostly done once/twice from the start of plantation to harvesting.
14. Most farmers apply their first sprays in the first 40 days after crop establishment to control leaf-feeding insects. However, these pests do not occur in sufficiently high densities to cause yield loss. Instead, such early-season sprays may contribute towards the development of secondary pests, such as the brown planthopper.

15. the richer farmers used pesticides more frequently as compared to small and medium farmers that resort to mostly insecticides at the rate of 1 to 10 kg active ingredients per hectare of cropland and the time of application varied from 1 to 4 sprays per crop.
16. the major health challenges faced by the rice farmers as a result of pesticide application on their farms were skin irritation, eye irritation, breathing difficulty, headache, food, and water poisoning and dizziness.

Simple statistics when applying pesticides on a hectare of land reveal high cost of farm inputs such as the cost of labourers and pesticides/herbicides. A hectare of land is about sixteen (16) plots, that is, 16x(4×4000) = 256, 000 NGN for men per spray and 16x(4×3500) = 224, 000 NGN for women per spray.

In comparison to the above consultation reports in context from the literature on field pests, physical, economic, and health losses associated with field pests activities, we find the following literature findings as supportive proof.

EBIDO et al., (2020) conducted Relative Important Indices (RII) research on rice farming in Anambra state. The calculation RII identified problems of rice production in the State. From the results, pests, diseases and weed attacks were indicated by the respondents as the most serious constraint to rice production in the area with an RII value of 0.898. This result agrees with our consultation reports and another research conducted in Ekiti State, Nigeria by Osanyinlusi & Adenegan (2016) that pest infestation is the most serious constraint affecting rice production in the area. The high cost of labour was ranked second with an RII value of 0.823. Again, this result agrees with our consultation reports and the results recorded by Nwike and Ugwumba (2015) that the high cost of labour was a major concern encountered by rice farmers, affecting rice yield. The high cost of farm inputs was ranked third with an RII value of 0.75. This result agrees with our consultation reports on farm inputs such as chemicals for pest control and the research of Madu and Aniobi (2018) that the cost of farm inputs is also a major problem encountered by rice farmers in Niger State, Nigeria.

The use of tractors, for many rice farmers, is feasibility high. Tractors can break down and farmers abandoned them because they have not been trained in tractor operation and maintenance, and have no funds to purchase fuel or spare parts. The official cost of hiring a tractor from the Government is about 20, 000 NGN (50USD) per day, in addition to other expenses borne during land preparation. Recently, the Rice farmers' association in Delta has appealed to the Delta state government to reduce the cost of hiring tractors to enhance rice cultivation (Uchechukwumgemezu, 2021). This reveals why most rice farmers in Anambra cannot afford the use of tractors.

Ladapo et al., (2020) research on determinants of the effects of pesticide use on the health of rice farmers in Kwara State, Nigeria reveals that 87.5% of their research respondents had suffered health challenges as a result of pesticide application on their rice farms. The breakdown of the major health challenges according to their research is

- 82.9% of rice farmers experienced skin irritation.
- 79% of rice farmers experienced eye irritation.
- 73.3% of rice farmers experienced breathing difficulty.

- 67.6% of rice farmers experienced headaches.
- 62.9% of rice farmers experienced poisoning.
- 60% of rice farmers experienced dizziness.

In Sri Lanka, Costa Rica and Nicaragua, 4–7% of farmers suffer bad health from agricultural pesticides each year (Athukorala et al., 2010). Pingali and Roger (1995) estimated the human health costs of pesticide use in irrigated rice systems of the Philippines and compared the economics of three pest control strategies: complete protection comprising nine sprays per season, economic threshold decisions involving two sprays per season and Integrated Pest Management (IPM). It is recommended, "the value of crops lost to pests is invariably lower than the cost of treating pesticide-related illness and the associated loss in farmer productivity (Pingali and Roger, 1995).

The use of IPM suggests that rice fields need to be monitored at 7–10 days intervals for checking levels of pest infestation. Field monitoring helps farmers best control their rice pests. Refraining farmers from applying insecticides to rice fields before 30-40 days-after-transplanting enhance natural enemy activity to check the build-up of pest populations. Practising need-based application of insecticide also significantly reduces total pesticide usage in rice fields. IPM experiment recommended that farmers should avoid prophylactic measures, and rather farmers monitor their crop fields at 7–10 day intervals up to the flowering stage. These practices reduce pesticide use from agricultural landscapes and improve environmental quality.

## 5. Discussion and Conclusion

It can be deduced from the literature that Anambra state has fertile lands for rice farming, there are rice farmers both on small/medium/large scales and there are field pests activities in Anambra state. There are factors affecting rice farming as a result of the field pests activities which could result in physical, economic, and health losses. It can also be concluded that pest control accounts for a significant percentage of capital expenditures for the average rice farmer. The current pest control approaches are suboptimal, incur unnecessary farming costs and lead to excessive application of pesticides. Excessive application is harmful to farm produce as well as humans and contributes significantly to greenhouse emissions.

Integrated Pest Management (IPM) proposes practising the need-based application of insecticide, which involves monitoring rice fields. This suggests the need for an informed pesticide application. While IPM reduces the health and physical losses, it does not address the economic loss on the farmers, as monitoring may incur more labour charges.

Efficient field pests control systems can provide food security and lead to the economic growth of the country. The existing methodology for field pest control in Nigeria involves uninformed spraying to combat pest infestation. However, this methodology is inefficient, as farmers in many cases overuse these pesticides in a bid to avert pest infestation across all portions of the farm. In cases of limited resources, farmers would typically spray sparingly but uniformly across the farm, and there is no active utilization of real farm data in the application of these pesticides. This calls for the utilization of new digital technologies to provide an active pest control framework for farmers. This will provide the farmer pest risk maps dynamically. These maps will provide a visual representation of the distribution as well models of pests presence in the farm and provide a decision system for optimal pest control.

**References**

Athukorala, W., Wilson, C., and Robinson, T. (2010). "Determinants of health costs due to farmers' exposure to pesticides: An empirical analysis," in *Proceedings of the 85th Annual Conference of Western Economic Association*, Hilton Portland and Executive Tower, (Portland, OR)

Hawksworth, D.L., (1985). Foreword. *In* S.H. Ou, ed. *Rice diseases.* CMI Slough, UK, CAB. 380 pp.

Imolehin E.D. and Wada A.C., (nd). Meeting the rice production and consumption demands of Nigeria with improved technologies. National Cereals Research Institute, Badeggi, PMB 8, Bida, Niger State, Nigeria. https://www.fao.org/3/x7164t/x7164t04.htm.

Hardcastle, J.E.Y., (1959). The Development of rice production and research in the Federation of Nigeria. *Trop. Agric.* (Trinidad), 36: 79-95.

Singh, B.N., Fagade, S., Ukwungwu, M.N., Williarn, C., Jagtap, S.S., Oladimeji, O., Effisue, A. & Okhidievbie, O., (1997). Rice growing environments and biophysical constraints in different agroecological zones of Nigeria. *Met. J.*, 2(1): 35-44.

Steve O. Courage. 2016. Rice Farming and Production in Nigeria and How to Make it Big. Business Classroom for Africans. https://www.africabusinessclassroom.com/rice-farming-nigeria/.

**IRRI.** 1991.*World Rice Statistics*, p. 34-42.

IRRI. 1995. *World Rice Statistics*, p. 34-42.

Shahbandeh M. 2021. Total global rice consumption 2008-2021. https://www.statista.com/statistics/255977/total-global-rice-consumption/.

pwc, 2017. Boosting rice production through increased mechanisation. pwc.com/ng/en/publications/boosting-rice-production-through-increased-mechanisation.html

FAO, (2013). FAOSTAT database: http://www.faostat.fao,org retrieved on 31 December, 2013.

Tiamiyu, S.A., Mohammed, B., Alawode, V.O. and Mohammed, G., (2019). Assessment of pest damage and its effects on rice income in southern guinea savanna zone of Nigeria. Invited paper presented at the 6th African Conference of Agricultural Economists, September 23-26, 2019, Abuja, Nigeria.

Singh, P., Pandey, P. C., Petropoulos, G. P., Pavlides, A., Srivastava, P. K., Koutsias, N., ... & Bao, Y., (2020). Hyperspectral remote sensing in precision agriculture: Present status, challenges, and future trends. In *Hyperspectral Remote Sensing* (pp. 121-146). Elsevier.

Nwalieji, H. U., & Uzuegbunam, C. O., (2012). Effect of climate change on rice production in Anambra State, Nigeria. *Journal of Agricultural Extension*, *16*(2), 81-91.

wikipedia. https://en.wikipedia.org/wiki/Anambra_State.

Okeke, C. G., & Oluka, S. I. (2017). A survey of rice production and processing in South East Nigeria. *Nigerian Journal of Technology*, *36*(1), 227-234.

EBIDO C.E, OKOLI T.O. & UGWUMBA C. O. A., (2020). Technical Efficiency and Profitability of Rice Production in Anambra State, Nigeria. International Journal of Innovative Agriculture & Biology Research 8(2):29-39, April-June, 2020, ISSN: 2354- 2934.

Obianefo, C. A., Nwigwe, C. A., Meludu, N. T., & Anyasie, I. C. (2020). Technical efficiency of rice farmers in Anambra State value chain development programme. *Issues in Agriculture*, 67-74.

Osanyinlusi, O.I. & Adenegan, K.O. (2016).The determinants of rice farmers' productivity in Ekiti State, Nigeria. Greener Journal of Agricultural Sciences, 6(2), 049-058.

Nwike, M.C. &Ugwumba, C.O.A. (2015). Profitability of rice production in Aguata Agricultural Zone of Anambra State, Nigeria: A Profit Function Approach. American Journal of Agricultural Science, 2(2), 24-28.

Madu, A.B., &Aniobi, U.J. (2018). Profitability analysis of paddy production: a case of agricultural zone 1, Niger State, Nigeria. Journal of Bangladesh Agricultural University, 16(1), 88-92.

Pingali, P. L., and Roger, P. A. (1995). *Impact of Pesticides on Farmers' Health and the Rice Environment*. Dordrecht: Kluwer Academic Press.

Ladapo, H. L., Aminu, F.O., Selesi, O. S. and Adelokun, I. A. (2020). DETERMINANTS OF THE EFFECTS OF PESTICIDE USE ON THE HEALTH OF RICE FARMERS IN KWARA STATE, NIGERIA. Journal of Research in Forestry, Wildlife & Environment Vol. 12(3) September, 2020. ISBN: 2141 – 1778.

Chidinma Uchechukwumgemezu (2021). Rice farmers appeal to Delta governor to reduce cost of hiring tractors. https://www.today.ng/news/nigeria/rice-farmers-appeal-delta-governor-reduce-cost-hiring-tractors-345682.