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Use of Integrated Pest Management Practice (IPM) on the Yield of Rice in Abia State, Nigeria.

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Abstract
The study assessed the effect of use of Integrated Pest Management (IPM) practice on yield of rice in Abia State, Nigeria. The specific objectives of the study included, to; ascertain farmers' awareness of IPM, determine the level of utilization of IPM practice by the respondents and estimate the yield of rice farmers after the use of IPM. The hypothesis states that use of IPM practice had no significant effect on the yield of rice in the study area. A multi-stage sampling technique was used to select 120 respondents from Abia State, Nigeria. Questionnaire and interview schedule were used for data collection, and data collected were analyzed using descriptive and inferential statistics such as frequency count, percentages, mean scores and regression model. The results showed that most (67.5%) of the farmers were aware of IPM practice. The estimated yield of rice farmers was low (1,229.19kg/ha) before they started using IPM but became high (3,067.08kg/ha) after the use of IPM practice. The grand mean score ($\bar{x}$ = 3.11) showed that there was high utilization of IPM in Abia State. The farmers' use of IPM had significant effect on yield of rice at 1% probability level. The study therefore, concluded that the use of IPM practice had a positive effect on yield of rice in Abia State. It, therefore, recommended that, farm shows/exhibition programmes should be organized by agricultural agencies and cooperatives to enable rice farmers showcase their high yields from IPM practice and encourage more farmers to utilize IPM practice.
Keywords: Effect, Utilization, Integrated Pest Management Practice and Yield.

Introduction

Nigeria is endowed with favorable environment for cereal cultivation. Cereals are the major dietary energy suppliers which provide significant amount of protein, minerals (potassium and calcium), vitamins (Vitamins A and C). They are consumed in a variety of forms, including pastes, noodles, cakes, breads, drinks etc. The bran, husk, plant parts and other residues (after processing) are useful as animal feeds and in the culture of micro-organisms, while wax syrup and gum extracted from cereals are used for industrial purposes. Major cereals produced in Nigeria are rice, sorghum, maize, and millet.

Rice (*Oriza sativa*) is a very important food crop globally. Virtually all the rice growing ecologies (the upland irrigated, inland valley swamp, deep water floating and tidal mangrove swamp) abound in Nigeria. Globally, rice consumption increased from 437.18 million metric tons in 2008/2009 crop year to about 486.62 million metric tons in 2018/2019 crop year (Shahbandeh, 2020). Sustainability is, therefore, paramount in rice production for the nation to fill the gap required for the increasing population. Unfortunately, the production of this all-important food crop is not reaching demands of the people and consequently, there is increase in price beyond the reach of many Nigerians (Ajala and Gana, 2015).

Research has shown that Africa faces great challenges in the production of cereal crops of which rice is among the largest (Macauley and Ramadjita, 2015). The African continent emerged as a major rice importer because rice emerged as the fastest developing food in sub-Saharan Africa in the last decade, and as a result, there is considerable increase in demand for rice in Africa than other places round the world (Nasrin, Lodin, Jirsrom, Holmqist, Djurfeldt and Djurfeldt, 2015). Rice is one of the most consumed staples in Nigeria, with a consumption capita of 32Kg and within the past decade, consumption has increased 47%, almost four times the global consumption and reached 6.4 million tons in 2017 (Edafe, 2017). These challenges in Abia State, where agricultural activities are predominant, includes harsh climatic factors and the prevalence of pest infestation. IITA (2019) indicated that climate-induced cereal production is associated with certain constraints which include heat, drought stress and emerging invasive insect pests and diseases. The common pests of cereal crops in Nigeria, according to Harrison, Thierfelder, Baudron, Chinwada, Midega, Schaffner and VandenBerg (2019), include termites, stem borer, weevils, armyworm, birds, grasshopper, butterfly, etc. As a result of the above constraints, cereal crops yield in Africa is generally low (Edmeades, Trevisan, Prasanna, and Campos, 2017). The negative influence of pest invasion on food/nutrition security has been made worse due to insufficient resistant/tolerant varieties, poor control measures and management of pests (Harrison, *et al.,* 2019).

Currently, researchers are working on immediate and long-term solutions to these problems, and the available control strategies include use of pesticides, cultural practices, use of natural enemies, the use of resistance variety, and Integrated Pest Management (IPM) strategy.

Most farmers rely on synthetic pesticides because intensive synthetic pesticides can support rice productivity though some still rely on mechanical control methods, indigenous method, farmer-to-farmer advice, and recommendations from extension services (Baudron, Zaman-Allah, Chaipa, Chari, and Chinwada, 2019).

Research and extension are advising farmers to use Integrated Pest Management (IPM) to manage cereal crop pests because it is targeted at minimizing chemical damage to humans and the environment, while targeting effective pest control (Day, Phil, Melanie, Tim. & Anne, 2017). According to Kabir and Rainis, (2015), Integrated Pest Management (IPM) is a combined use of chemical, cultural, biological and mechanical methods to control pest in a farm. This technique has been developed by Farmers Field School (FFS) and it is an effective, environmentally-sound approach to pest management, with the aim of also protecting the air, water and soil resources, while meeting specific production objectives (National Pesticides information Centre in USA, 2015).

A study of IPM on Lepidopteran pest in rice, carried out by Babendreier, Hou, Tang, Zhang, Vongsabouth, Win, Kang, Peng, Song, Annamalai, Horgan (2020), reported that pest had been a major problem in rice farms in Asia but the implementation of the IPM strategy reduced the infestation of pest, resulting to higher rice yields. More so, Muck (2015) noted in his study that by the practice of IPM, pest problem in Nigeria can be reasonably mitigated in a sustainable manner which may eventually reflect on the crop yield.

The paper therefore assessed the effect of use of Integrated Pest Management (IPM) practice on yield of rice in Abia State with the following objectives, to;

i. ascertain farmers' awareness of IPM
ii. determine the level of utilization of IPM practice by the respondents
iii. estimate the yield of rice farmers after the use of IPM.

METHODOLOGY

The study was carried out in Abia State, Nigeria. The State is one of the prominent South-Eastern States Region in Nigeria. The State whose capital is Umuahia, was carved out from Imo State. The State has 17 Local Government Council areas occupies a land area of 5,834 km^2. Its major commercial nerve is Aba, which is located south of the State. A multi-stage sampling technique was employed in selecting 120 respondents for the study. In the first stage, two agricultural zones were randomly selected from the three agricultural zones of the State namely; Umuahia and Ohafia agricultural zones. Secondly, two blocks were randomly selected from each of the agricultural zones, making a total of four blocks namely; Umuahia North and Ikwuano (Umuahia zone), Bende and Isuikwuato (Ohafia zone). Thirdly, three circles were

randomly selected from each of the blocks to give a total of twelve (12) circles. Finally, ten (10) rice farmers were randomly selected from each the circles to give a total of one hundred and twenty respondents which constituted the study sample. Data for this study were obtained through questionnaire/structured interview and the data obtained were analyzed using descriptive statistical tools and tested using simple Regression Model.

Results and Discussion

Awareness of IPM Practices

Result in Table 1 shows that most farmers (93.3%) in the study area were aware of the use of D-D Force (Chemical method) to control pest, while 95.8% are aware of the use of grinded chilli pepper (Cultural Method). More so, 100% were aware of the application of biopesticide (biological method) and 94.2% are aware of the use of trap (mechanical method). Furthermore, majority (67.5%) of the farmers in the study area were aware of combination of different methods to control pest. This is an indication that farmers in the study area were aware of Integrated Pest Management (IPM) practices as a means of pest management. Awareness is a fundamental step in utilization of a technology and ones that has been created, adoption is no longer far-fetched. The finding is in agreement with Umeh and Ekwenyene (2017) who noted that farmers in South-East are aware of farm innovations that will improve their farm yield and add value to their outputs.

Table 1: Distribution of respondents according to their awareness about IPM practices

IPM Practices	Frequency	Percentage
Chemical Method:		
Application of Attacke (inorganic pesticide)	81	67.5
Best (inorganic pesticide)	98	81.7
D-D Force (inorganic pesticide)	112	93.3
Sniper (inorganic pesticide)	77	64.2
Cultural Method:		
Spraying of Wood ash	111	92.5
Grinded chilli pepper	115	95.8
Neem leaves	76	63.3
Intercropping	66	55.0
Adjusting planting time	102	85.0
Biological Method:		
Planting resistance varieties (Faro 44/IR 36)	109	90.8
Natural enemies/Predators	115	95.8
Application of Tetratichus (biopesticide)	120	100.0
AG-Zyme (biopesticide)	98	81.7
Mechanical/Physical Method:		
Use of Scarecrow	87	72.5
Carbide guns/catapult	67	55.8
Trap	113	94.2
Net	12	10.0
Hand picking/Crushing	41	34.2
Combination of Methods above	81	67.5

Source: Field Survey, 2023 ***Multiple responses recorded***

Level of Utilization of IPM Practices

Results in Table 2 show farmers' utilization level of IPM practices on a four-point rating scale in Abia State. Finding reveals that utilization of chemical method had a mean score of ($\bar{x}$ =3.77 while cultural and biological methods had mean scores ($\bar{x}$ =3.15 and 3.05) respectively but mechanical/physical method had

a mean score ($\bar{x}$ =2.54). More so, the combination of different methods had a mean score ($\bar{x}$ =3.38). This implied that the use of chemical, cultural and biological methods were high, while the utilization of mechanical/physical method was low. But the use of IPM (combination of more than one method) was high in the study area. Further finding revealed that the utilization of IPM practices had a grand mean score ($\bar{x}$ =3.11). This implied that the utilization level of IPM practice in Abia States was high. The high utilization level may be attributed to their awareness about the usefulness of IPM. The finding is in agreement with Nwaobiala (2018) who posited that utilization level of agronomic practices that boost production is high in South-East. The result also agrees with Odoemelam, Onuekwusi and Alocha (2016) who asserted that farmers will be ready to utilize agricultural innovations, especially when they are aware of its existence and usefulness.

Table 2: Distribution of respondents according to their level of utilization of IPM practices n = 120

IPM Practices	$\sum f(x)$	$\bar{x}$
Chemical Method:		
Application of Attack (inorganic pesticide)	446	3.72
Best (inorganic pesticide)	439	3.66
D-D Force (inorganic pesticide)	469	3.91
Snipper (inorganic pesticide)	455	3.79
Mean		**3.77**
Cultural Method:		
Spraying of Wood ash	274	2.28
Grinded chili pepper	263	2.19
Neem leaves	468	3.90
Intercropping	444	3.70
Adjusting planting time	442	3.68
Mean		**3.15**
Biological Method:		
Planting resistance varieties (Faro44/IR36)	374	3.12
Natural enemies/Predators	460	3.83
Application of Tetratichus (biopesticide)	267	2.23
AG-Zyme (biopesticide)	363	3.01
Mean		**3.05**
Mechanical/Physical Method:		
Use of Scarecrow	365	3.04
Carbide guns/catapult	447	2.73
Trap	387	3.23
Net	193	2.02
Hand picking/Crushing	156	1.62
Mean		**2.54**
Combination of Methods above	405	3.38
Total mean		**59.04**
Grand mean	**3.11**	

Source: Field Survey, 2023

Keys: *Always = 4, Often = 3, Occasionally =2, Never = 1*

Decision: $\bar{x}$ *> 2.5 implies high level of utilization* $\bar{x}$ *≤ 2.5 implies low level of utilization*

Figures in $\sum f(x)$ *(sum) are nominal Likert values multiplied by frequencies*

Yield Estimate of Rice Farmers before and after the Adoption of IPM

The result in Table 3 shows that the estimated mean yield of rice before the use of IPM in Abia State was 1,229.19kg/ha. (grain + bran). This implied that yield of rice was low before the use of IPM. This low yield can be attributed to the effect of pest which might have adapted to the continuous use of traditional pest control measures. The result is in consonance with Kamai, N, Omoigui, L.O, Yamara A. Y and Ekeleme F

(2020) who asserts that most rice farmers rely on traditional technologies which accounts for the low yield that ranges between 1,000-3,000kg/ha, as against the standard average yield range between 3,000-6,000kg/ha. Furthermore, the result in the table indicates that the estimated mean yield score of rice after the use of IPM in Abia State was 3,115kg/ha (grain + bran). This implied that yield of rice was high after the use of IPM in the study area. This high yield can be attributed to the effect of IPM which might have addressed the concern of pest that hitherto affected the growth and yield of rice crop in the farmers' farms. The result agrees with Agbarevo and Okringbo (2020) who noted that the effective use of agricultural technologies and agronomic practices will increase farm yield and farmers' income.

Table 3: Distribution of respondents according to yield estimate before and after the use of IPM

Rice output before IPM use (n = 120)			**Rice output after IPM use (n = 120)**	
	Quantity (Kg/ha)	**Sales (Naira)**	**Quantity (Kg/ha)**	**Sales (Naira)**
Rice grains	841.67	505,000	2144.17	1283708.07
Rice bran	387.50	7750	922.92	9229.17
Total	**1229.19**	**512750**	**3067.08**	**1295953.78**

Field Survey, 2023

Hypotheses Testing

Table 4 shows that the R-square value was 0.637 indicating that about 63.7% of the variation in the dependent (yield of rice) was accounted for, while others were due to error. The coefficient of use of IPM practice was statistically significant at 1% probability level and positively related. The result implied that an increase use of IPM practice will lead to a corresponding increase in yield of rice farmers in the study area.

Table 4: Simple linear regression influence of use of IPM on yield of rice in the study area.

Parameters	**Coefficient**	**Standard error**	**t-value**
Constant	219.323	0.610	6.953***
Use of IPM	0.227	0.148	2.952**
R-square	0.637		
R-adjusted	0.585		
F-ratio	11.679***		

Source: *Computed from Field Survey Data 2023*

** = significant at 5% and *** = significant at 1%

Conclusion and Recommendations

Based on the findings of the study, it was concluded that the use of IPM practice by farmers in Abia State, had a positive effect on yield of rice, because the yield of rice farmers in the study area increased after the use of IPM practices. Agricultural agencies and cooperatives should continually organize farm show/exhibition programmes where farmers' yields from IPM practice can be showcased, as that will encourage more farmers to adopt IPM practice and enjoy high yield like others. More so, farmers from all parts of South-East should endeavor to effectively utilize IPM practices.

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