Journal of Research in Forestry, Wildlife & Environment Vol. 12(3) September, 2020
E-mail: jrfwe2019@gmail.com; jfewr@yahoo.com
http://www.ajol.info/index.php/jrfwe

ISBN: 2141 – 1778
Ladapo et al., 2020

DETERMINANTS OF THE EFFECTS OF PESTICIDE USE ON THE HEALTH OF RICE FARMERS IN KWARA STATE, NIGERIA

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ABSTRACT

This study determined the main factors responsible for the effects of pesticide use on the health of rice farmers in Kwara State. Multistage sampling procedure was used to select 120 rice farmers. Data were collected via the use of questionnaire and analysed using descriptive statistics and binary logistic regression model. Findings showed that, the rice farmers' average age was 38 years, most were male (87.5%) and married (74.2%) with an average family size of 10 persons. Majority (85%) of the rice farmers used pesticide frequently on their farms while 72% had been trained on pesticide application in the study area. The major health challenges faced by the rice farmers as a result of pesticide use on their farms were skin irritation, eye irritation, breathing difficulty, headache, food and water poisoning and dizziness. Pesticide dosage, farm size, weather, reading and adherence to instructions on pesticide labels, wearing of boot, nose guard, hand gloves and full PPE were the significant factors determining the effects of pesticide use on the health of the rice farmers in the study area. It is therefore recommended that; rice farmers should be trained regularly on the importance of the use of full personal protective equipment (PPEs) during spraying to reduce their level of exposure to pesticide during application in the study area.

Keywords: Pesticides application, health hazards, rice production, personal protective equipment

INTRODUCTION

Rice is a significant, staple and security crop that meets the food consumption needs globally (Falola *et al.,* 2014). It is a vital food crop in Nigeria because of its large contribution to both internal and sub-regional trade. Local farmers desire to cultivate rice more than maize because of declining soil fertility and availability of diverse varieties (Matanmi *et al.,* 2011; Olabode 2011). The crop is cultivated nearly in all the agro-ecological zones of the nation (Ogunniyi *et al.,* 2015). In 1994 Nigeria produced 2.4 million metric tonnes and it rose to 3.9 million metric tonnes in 2005 (FAO, 2003: CBN, 2006). However, annual production increased from 5.5 million tonnes in 2015 to 5.8 million tonnes in 2017 (Udemezue, 2018). Nigeria has 923,768 square kilometres land area with a total of 79 million hectares of cultivable land. An estimated 4.6 million hectares of this land is suitable for rice production but only about 1.8 million hectares or 39% is currently developed for rice cultivation (NFRA 2009). Kwara State alone has over 400,000 hectares of land suitable for rice production but about 50,050 hectares were cultivated in 2006 (Kwara ADP, CAYS reports, 2010). The state also contributes about 11% of the nation's total rice output (NBS, 2002).

Rice production in Nigeria has so many limitations of which the paramount is low yield caused by

insect pests. In the country, rice plant is attacked by about 138 insect pest species and 22 species of parasitoids and predators (Ogah and Nwilene 2017). Without using pesticides for both rice and cocoa production, there would be about 45% loss of the total production to pests and diseases (Tijani 2006a). In Nigeria, pesticides are essential tools to combat pests' attacks, damages and ensure viable food productivity, improved yield and huge food availability year round (Oluwole and Cheke 2009). Poorly regulated and unsafe use of pesticides and absence of adequate and proper education has increased pesticide impact on public health and, especially, on the health of farm workers (Tijani, 2006b). Rice farmers are the first set of people exposed to hazards when treating their crops with pesticides. Some of the adverse health effects of pesticide use according to Mück (2015) are acute intoxication by uptake via inhalation, through the skin (dermal) or by accidental swallowing, skin irritation or even chemical burn of the skin, sensitization, allergic potential, immunotoxicity, neurotoxicity, hormonal and endocrine-disrupting effects, chronic toxicity, carcinogenic and mutagenic action, and reproductive toxicity.

In view of the above, this study investigates the determinants of health effects of pesticide use on rice farmers in Kwara State, Nigeria. Specifically, the study described the socioeconomic characteristics of the rice farmers, described the prevalent health symptoms associated with pesticides and determined the effect of pesticides on the rice farmers' health in the study area.

MATERIALS AND METHODS

Study Area

The study was carried out in Kwara State, North central Nigeria. The state covers a landmass of 32,500km^2 and lies between latitudes 7° 45' and 9°30'North and longitudes 2° 30' and 6° 35' East. The state has 16 Local Government Areas (LGA) with the population estimate of 2.3 million people. It shares boundaries with Oyo, Ondo and Osun States to the South; Kebbi and Niger States to the North, Kogi State to the East and Republic of Benin on the West. The daily temperature ranges between 21^{0}C to 33^{0}C, annual rainfall ranges between 1000 mm and 1500 mm while average annual temperature ranges between 30^{0}C and 35^{0}C. The state has two distinct climate seasons, the wet or rainy (April to October) and the dry or harmattan (November to March) seasons. The land and climate favour the cultivation of arable crops like rice, millet, yam and cowpea.

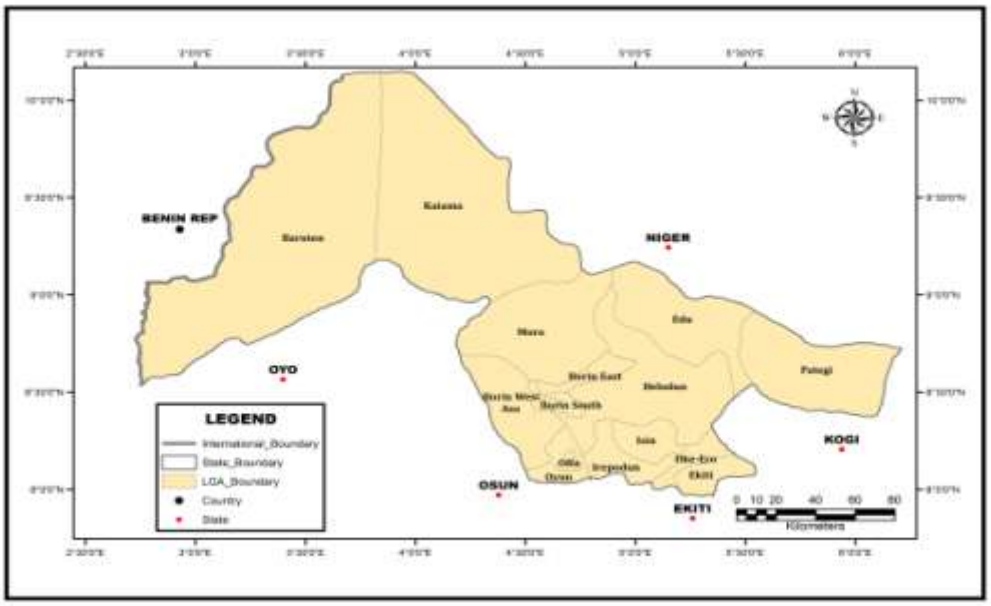

Figure 1: Map showing the Local Government Areas of Kwara State, Nigeria
Source: Geospatial Analysis Mapping and Environmental Research (2018)

Sampling Procedure and Data Collection

Multistage sampling procedure was employed to obtain the data for the study. The first stage involved a purposive selection of Edu and Patigi Local Government Areas of the state, being the major rice producing areas in the state. The second stage was the random selection of 6 villages from each of the local LGA making 12 villages. The third stage involved the random selection of 10 rice farmers from each village making a total sample of 120 respondents.

Analytical Techniques

Descriptive statistics such as mean, frequencies and percentages, was used to summarize the socio-economic characteristics of the respondents and the major health problems experienced by the farmers as a result of pesticide use in their rice farms. Logit regression analysis was used to determine the effects of pesticide use on the health of rice farmers in the study area. The model is specified as:

$$Zi = bo + b1x1 + b2x2 + b3x3 + \ldots\ldots\ldots + bnxn \quad \ldots\ldots\ldots [1]$$

Where:

Z_i is a binary dependent variable that takes the value of 1 if the rice farmer experienced any health issues and 0 otherwise.

X_i is a vector of explanatory variables and is expressed as:

X_1 = Age of rice farmers (years);

X_2 = Education (years);

X_3 = Extension contacts (frequency of visits/year);

X_4 = Pesticide dose (gram a.i./ha);

X_5 = Pesticide application training (if trained = 1, 0 otherwise);

X_6 = Farm size (ha);

X_7 = Reading and adherence to instructions on pesticide labels (if read = 1, 0 otherwise);

X_8 = Weather condition (1 if windy, 0 otherwise);

X_{10} = Use of personal protective equipment;

X_{10a} = Use protective boot (1 if used, 0 otherwise);

X_{10b} = Use nose mask (1 if used, 0 otherwise);

X_{10c} = Use eye goggles (1 if used, 0 otherwise);

X_{10d} = Use hand glove (1 if used, 0 otherwise);

X_{10e} = Wear full protective garment (1 if used, 0 otherwise);

ε = random error

RESULTS

Socio-economic Characteristics of Rice Farmers in the Study Area

Table 1 presents the results of the socio-economic characteristics of the rice farmers. The result reveals that a larger proportion (38.3%) of the farmers was within the age range of 31-40 years with a mean age of 38 years. Majority (87.5%) of the respondents were male while 12.5% were female. Distribution by educational status reveals that primary school education level was the highest with 39.2%, 29.2% had no formal education and 20.8% had Secondary school education while 10.8% had tertiary education. Majority (74.2%) of respondents was married, 23.3% were single, while 1.7% was widowed and 0.8% divorced. About 58% of the rice farmers had between 11 and 15 people in their households, 10.8% had 5 people 0r less while 8.3% had household size of more than 16 people. The mean household size was 10 people.

Furthermore, 52.5% of the respondents were full-time rice farmers while others had other occupation aside rice farming such as artisans (22.5%) trading and business (16.7%) and paid employments (8.3%). Also, 30.8% of the respondents were members of cooperative societies while 69.2% were non-members. Those who sourced for loans from cooperative societies were 42.5%, 33.5% made use of personal savings, while 21.7% relied on friends and family for finance and only 2% got bank loans to finance their rice farming business.

Distribution of Rice Farmers by Some Farming Characteristics in the Study Area

Table 2 shows that very few (28.3%) of the respondents have had extension contact, with 17.6%, and 20.6% coming weekly and fortnightly respectively. Majority of the rice farmers have had training on pesticide application (60%) while 70.8% made use of pesticides frequently on their rice farms. Distribution by farming experience reveals that 29.2% of the rice farmers had between 11 and 20 years' rice farming experience with an average rice farming experience of 17 years.

Major Health Challenges Associated with Pesticide Use in Rice Production in the Study Area

Results on the major health challenges associated with pesticide use by rice farmers are presented in Table 3. The result reveals that majority (87.5%) of the respondents had suffered health challenges occasioned by pesticide application on their rice farms in the last production season. Majority (82.9%) of the rice farmers had experienced skin irritation as a result of pesticide use on their farmers; this was followed by eye irritation, experienced by 79% of the respondents. Other health challenges experienced by the rice farmers were breathing difficulty (73.3%), headache (67.6%), poisoning (62.9%) and dizziness (60%).

Table 1: Distribution of Rice Farmers by Socio-economic Characteristics (N = 120)

Description	Frequency	Percentage	Mean
Age (years)			
≤ 30	17	14.2	
31-40	46	38.3	
41-50	33	27.5	**38years**
51-60	18	15	
> 60	6	5	
Sex			
Female	15	12.5	
Male	105	87.5	
Educational Status			
No formal Education	35	29.2	
Primary	47	39.2	
Secondary	25	20.8	
Tertiary	13	10.8	
Marital Status			
Single	28	23.3	
Married	89	74.2	
Widowed	2	1.7	
Divorced	1	0.8	
Household Size (No of people)			
≤5	13	10.8	
6-10	28	23.3	**10**
11-15	69	57.5	
>16	10	8.3	
Major Occupation			
Rice farming only	63	52.5	
Paid Employment	10	8.3	
Artisan	27	22.5	
Trading/Business	20	16.7	
Membership of Cooperative			
Yes	37	30.8	
No	83	69.2	
Source of Funds			
Bank Loan	3	2.0	
Personal savings	40	33.3	
Cooperative	51	42.5	
Friends and Family	26	21.7	

Table 2: Distribution of Rice Farmers by Some Farming Characteristics (N = 120)

Description	Frequency	Percentage
Extension Contacts		
No	86	71.7
Yes	34	28.3
Frequency of Visits		
Weekly	6	17.6
Fortnightly	7	20.6
Monthly	7	20.6
Quarterly	11	32.4
Yearly	3	8.8
Trained on Pesticide Application		
No	48	40.0
Yes	72	60.0
Use of Pesticide		
Occasionally	35	29.2
Frequently	85	70.8
Rice Farming Experience		
≤10	25	19.2
11-20	35	29.2
21-30	28	23.3
31-40	15	12.5
>40	7	5.8

Table 3: Major Health Challenges Associated with Pesticide Use in Rice Production in the Study Area

Suffered Health challenges	Frequency	Percentage
Yes	105	87.5
Poisoning	66	62.9
Skin Irritation	87	82.9
Eye Irritation	83	79.0
Dizziness	63	60.0
Headache	71	67.6
Breathing Difficulty	77	73.3

** Multiple Responses*

Determinants of Effects of Pesticide Use on the Health of Rice Farmers in the Study Area

Table 4 presents the result on the determinants of effects of pesticide use on the health of rice farmers in the study area. The chi-square (LR-statistics) value of 19.913 was statistically significant at 1% level. This implies that the model fits the data well. The result reveals that total pesticide dosage used ($p<0.01$), farm size ($p<0.05$), weather ($p<0.01$), wearing of boot ($p<0.01$), nose guard ($p<0.05$), hand gloves ($p<0.05$) and full PPE ($p<0.01$) were the significant factors determining the effects of pesticide use on the health of the rice farmers in the study area.

Table 4: Determinants of Effects of Pesticide Use on the Health of Rice Farmers in the Study Area

Variables	Coefficients	t-ratio	Sig.
Constant	2.194*	1.828	0.076
Age (years)	0.031	2.208	0.022
Education (years)	-0.188	0.938	0.333
Extension contact (frequency)	0.186	0.164	0.685
Total pesticide dose used (gmai/ha)	0.000***	4.621	0.001
Training	0.673	0.042	0.837
Farm size (ha)	0.031**	2.112	0.042
Reading and adherence	-0.486**	2.382	0.024
Weather	0.591***	2.988	0.004
Boot (dummy) (dummy)	-1.245***	5.442	0.000
Nose guard (dummy)	-0.489**	2.114	0.021
Eye goggle (dummy)	-0.441	3.989	0.001
Hand gloves (dummy)	-0.051**	-2.347	0.041
Full PPE (dummy)	-0.584***	3.108	0.006
-2 Log likelihood	213.104		
Cox & Snell R Square	0.360		
Nagelkerke R Square	0.661		
Chi-square	19.913		

DISCUSSION

From Table 1 results, the age distribution of the rice farmers implies that most of the farmers were still in their economic active ages. This is in line with Nwalieji and Uzuegbunam (2012), that majority of rice producers in Anambra and Ebonyi states were still within their middle, active and productive ages. Rice farming was dominated by male in the study area. The labour intensive nature of rice production could be responsible for male dominance in the study area. The educational level of the respondents reveals that a larger proportion of the respondents had low level of education. This result corroborates the findings of Oluwole and Cheke (2009) that farmers suffered discomforts ranging from skin irritation, headache, vomiting, eye irritation and nausea after using pesticides because of low level of education, lack of formal training in pesticide use and poor extension services. The large percentage of married respondents and large household size is an indication of availability of family labour in the study area. The results on membership of cooperative society and source of finance suggests that, the rice farmers could encounter some difficulties in assessing funds and other inputs which will result in reduced production in the study area. This will prove costly especially for an essential commodity like rice.

Results in Table 2 revels that majority of the respondent did not have contacts with extension agents in the study area. This highlights the weakness of extension service in Nigeria and suggests a need for immediate revamping of the service in order to give farmers improved training and adequate assistance. Majority of the farmers are well experienced in rice farming, have had training on pesticide application and made use of pesticides frequently on their rice farms. This implies that the rice farmers were able to reduce the incidence of pests and diseases with frequent application of pesticide which could translate to increased output in the study area.

Results in Table 3 indicate that majority of the respondents had suffered health challenges occasioned by pesticide application on their rice farms in the last production season. The biggest health challenge faced by the rice farmers was skin irritation, which could be as a result of the pesticides having direct contact on the skin during the spraying exercise. Another main challenge faced by the farmers is eye irritation. This could also be as a result of wind action which can blow the pesticide into the eyes during spraying. Other health challenges include, breathing difficulty and

dizziness as a result of inhaling the pesticides; headache, food and water poisoning as a result of contamination of water bodies due to run-offs and bioaccumulation of pesticide on the food chain.

Total pesticide dose ($p<0.01$) used by the rice farmers had a positive significant effect on their health. This implies that, the higher the dosage of pesticide used by the farmers, the more their exposures to pesticide and the more the health challenges experienced by the farmers in the study area. This result agrees with the findings of Aminu *et al.,* (2019) that total pesticide dose increased the probability of cocoa farmers experiencing health symptoms as a result of pesticide use in their farms. Farm size ($p<0.05$) was positive and significant. This indicates that, the larger the farm size, the higher the pesticide dose applied and the more the health challenges experienced. Weather ($p<0.01$) also had a positive significant effect on the health of the farmers as spraying in a sunny or windy condition could increase the chances of health challenge to the farmers in the study area. However, reading and adherence to instructions on pesticide labels ($p<0.05$), wearing of boot ($p<0.01$), nose guard ($p<0.05$), hand gloves ($p<0.05$) and full PPE ($p<0.01$) had negative significance, which implies that reading and adherence to instructions on pesticide labels, wearing of boots, hand gloves and full PPE during spraying, reduces the risk of health challenge. Agricultural extension services do not play any significant role in reducing the effect of pesticides on the health of rice farmers as indicated by a lack of significance of the coefficient on training. This result is in line with Rahman and Chima, (2018) who reported that, Agricultural extension services do not play any significant role in pesticide use in Southeastern Nigeria. However, the result disagrees with Anang and Amikuzuno (2015) who noted significantly positive influence of extension contacts on pesticide use in rice farms in Northern Ghana.

CONCLUSION

From the findings of this study, it can be concluded that pesticide use in rice production had negative effects on the health of the farmers in Kwara State, Nigeria. Pesticide dosage, farm size, weather, reading and adherence to instructions on pesticide labels, wearing of boot and full PPE were the significant factors determining the health effects of pesticide use on the rice farmers in the study area.

Recommendations

Therefore, farmers should be encouraged to pay adequate attention to, and adhere to the instructions on pesticide labels before use. Also, farmers should be exposed to regular training on importance of wearing full personal protective equipment (PPEs) and use of improved spraying methods during spraying, so as to reduce the effect of pesticides on their health by the extension agents in the study area.

REFERENCES

Aminu, F.O., Ayinde, I.A., Sanusi, R.A. and Edun, T.A. (2019). Environmental and Health Effects of Pesticide Use in Cocoa Production in Edo State, Nigeria. In Ayinde, I.A., Dipeolu, A.O. and Banmeke, T.O.A. (Eds.). *Revitalisation of Nigerian Agriculture to Meet the Sustainable Development Goals.* Proceeding of the 33rd Annual National Conference of the Farm Management Association of Nigeria (FAMAN), held at Federal University of Agriculture, Abeokuta, Ogun State, Nigeria 7th-10th Oct., 2019. Pp. 25-33

Anang, B.T. and Amikuzuno, J. (2015). Factors Influencing Pesticide Use in Smallholder Rice Production in Northern Ghana. *Agriculture, Forestry and Fisheries* 4(2): 77–82.

Central Bank of Nigeria (2006). Annual Report and Statement of Accounts, Central Bank of Nigeria, Abuja.

FAO (2003). FAO Production Year Book. Food and Agricultural Organization of United Nations, Rome.

Falola, A., Animashaun, J. O. and Olorunfemi, O. D. (2014). Determinants of Commercial Production of Rice in Rice-Producing Areas of Kwara State, Nigeria. *Albanian Journal of Agricultural Sciences* 13 (2): 59-65

Geospatial Analysis Mapping and Environmental Research Solutons [Gamers] (2018).

(Available on https://www.gamers.com.ng/map-of-kwara-state-nigeria/. Accessed June 28, 2020)

Kwara Agricultural Development Project (2010). Crop and Area Yield Survey Results, 1999-2009. Annual Report.

Matanmi, B. M., Adesiji, G. B., Owawusi, W.O. and Oladipo, F. O. (2011). Perceived Factors Limiting Rice Production in Patigi Local Government Area of Kwara State, Nigeria. *Journal of Agriculture and Social Research* 11(2): 40-45

Mück, Otto (2015). Integrated Pest Management for Rice Production in Nigeria Report on a Consultancy for the CARI program Abuja, Nigeria, February, 2015 GIZ PN 11.2241.5-001.00 (Retrieved from *https://www.cari-project.org/wp-content/uploads/2015/05/CARI-Rice-IPM-Nigeria-Draft-Study.pdf on March 3, 2020).*

National Bureau of Statistics (2002). Annual Abstract of Statistics, Federal Office of Statistics Publication, Abuja.

Nwalieji, H. U. and Uzuegbunam, C. O. (2012). Effects of Climatic Change on Rice Production in Anambra State, Nigeria. *Journal of Agricultural Extension.* 16(2):81 - 91.

Ogah, E. O. and Nwilene, F. E. (2017). Incidence of Insect Pests on Rice in Nigeria: A Review. *Journal of Entomology*. 14(2): 58-72. DOI: 10.3923/je.2017.58.72

Olabode, A. D. (2011). Determining Rice Productivity Level for Sustainable Agricultural Development In Patigi Local Government Area of Kwara State, Nigeria. *Journal of Sustainable Development in Africa.* 13(5):125-135

Oluwole, O. and Cheke, R.A. (2009). Health and Environmental impacts of Pesticide Use Practices: A Case Study of Farmers in Ekiti State, Nigeria. *International Journal of Agricultural Sustainability*. 7(3):153–163. doi:10.3763/ijas.2009.0431

Ogunniyi, L.T., Komolafe, O.D., Fanifosi G.E., and Rasaki, W.A. (2015). Production Efficiency of Rice Production in Kwara State, Nigeria. *International Journal of Agriculture and Crop Sciences.* 8 (3):339-345

Rahman, S. and Chima, C.D., (2018). Determinants of Pesticide Use in Food Crop Production in Southeastern Nigeria. *Agriculture* 8 (35):1–14. doi:10.3390/agriculture8030035

Tijani, A.A. (2006a). Economic Benefits of Fungicide Use among Cocoa farmers in Osun and Ondo States of Nigeria. *Journal of Social Sciences*, 12: 63–70.

Tijani, A. A. (2006b). Pesticide Use and Safety Issues: The Case of Cocoa Farmers in Ondo State, Nigeria. *Journal of Human Ecology* 19, 183–190.

Udemezue, J. C. (2018). Analysis of Rice Production and Consumption Trends in Nigeria. *Journal of Plant Sciences and Crop Protection* 1(3): 305