Factors Influencing Compliance to Agrochemical Safety and Health Practices Among Maize Farmers in Kogi State Nigeria

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Abstract— *The modern industrial agriculture has created an array of ecological and equity problem through the introduction of agrochemical. Agrochemical use has been on in use in both developing and developed nation with unsafe and indiscriminate practices which pose major risk to the environment and human health globally, the purpose of this study was to determine determine the factors influencing the levels of compliance to agrochemical safety and health practices among maize farmers in Kogi State Nigeria. In order to achieve the study objectives, 4- stage sampling procedure was used to select 166 maize farmers. Data were collected using semi-structured questionnaire, complimented with interview schedules, and analyzed using descriptive statistics, and Ordered Probit regression model. Based on the findings of the research, it was found that maize cultivation was a male dominated enterprise (83.73%), and mean household size was 6 persons. About 91.3% of the maize farmers use fertilizer during the cause of farming with radio and extension agents as their major source of information on available agrochemical. Result of the Ordered Probit regression model shows that marital status, education, farm size membership of association, credit and labour where the factors influencing level of maize farmers compliance to agrochemical safety and health practices in the study area. The study recommends that women should be encouraged by government and non-governmental organizations and should be given equal opportunities in accessing production inputs in order to excel in their maize farming activities. Maize farmers should be motivated by government and non-governmental organizations to join farmer's associations in order to increase their access to loan facilities while extension agents which are the major sources of information on agrochemical safety practices should educate maize farmers in the study on the risks associated with agrochemical use and how to prevent such risk..*

Keywords— *Compliance, Agrochemical, Safety and health practices and Maize farmers*.

I. INTRODUCTION

The need to feed the ever-increasing population in the world has been a major issue especially in the third world countries who are backward in terms of modern agriculture. The United Nations Population Division (UNPD) in 2007 has reported that the World has witnessed population growth over the last 100 years by nearly fourfold and it is projected to increase from 6.7 billion to 9.2 billion by the year 2050. Consequently; the demand for cereal is expected to increase by almost 50% by 2030 as reported by Food and Agriculture Organization (FAO) (2007). The decrease in food production can be attributed to the effect of flooding, desert encroachment, climate change and increase in communal and religious conflict which has paralyzed food production and has dislocated millions of refuges. However, increase in food production cannot be achieved without the use of improved farm inputs like agrochemical (United Nations, (UN), 2015). Maize has been regarded as one of the most important cereals in the world as a result of its high economic importance and numerous uses In addition to its utilization by flour mills, breweries, confectioneries, and animal feed manufacturers, this text is intended for domestic consumption. In the world, it has been ranked third after rice and wheat while in Nigeria, it is one of the most important cereal crops especially in the middle belt of Nigeria (Kaisa et al., 2022; Mani, et al., 2022). Ironically, maize as a result of the various domestic uses shows a domestic demand of 3.5 million metric tonnes which outstrips supply production of 2 million metric tonnes while maize area forecast for the year 2020 was 9229.74 thousand hectares with lower and upper limit of 7087.67 and 11371.81 thousand hectares respectively (Harlold, 2015; Muhammed and Biola, 2019). Forecast of maize production revealed an increasing trend due to its importance to the ever-increasing population. As a result of increase in the activities of bandits and insurgents, farmer-herder's conflicts in the rural areas and natural phenomena like climate change, flooding and desert encroachment, (Muhammed et al., 2021: Mani et al., 2022). Maize and other food products are gradually becoming less affordable for poor households, thus the need for its increased production can never be over emphasized and invariably, the use of agrochemical (Offiah, (2015); FAO (2017) Department for External Relations (DER)(2021)). Agrochemical implies all chemical products which are manufactured or processed for use at work in agricultural production and agro-allied industries to increase productivity and control pest and diseases (Omari, 2014). The use of agrochemical for crop production has been on the increase and an estimated 2.5 million tonnes of pesticides are applied to agricultural crops worldwide each year (Nnamonu and Onekutu, 2015), while in Nigeria, an estimated amount of 125,000-130,000 metric tonnes of pesticides are applied each year (Aderonke *et al*., 2009). In Nigeria, the unsafe use of agrochemicals is on the rise especially in areas where the level of education is low and higher participation in agriculturally

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based activities, such as rainfed season and dry season farming, is on the increase (Ndaghu, *et al*., 2017). The general objective of the study was to study was to determine the factors influencing the levels of compliance to agrochemical safety and health practices among maize farmers in Kogi State Nigeria., while the specific objectives were to describe the socio-economic characteristics of maize farmers in the study area; determine the levels of awareness and compliance to agrochemical safety and health practices among farmers in the study area and identify the sources of information and point of agrochemical purchase among maize farmers in the study area.

II. METHODOLOGY

The Study Area

The study was conducted in Kogi State, Nigeria. The State is located between latitudes 6^0 30' N and 8^0 48' N and longitude 5^0 23' E and 7^0 48' E (Kogi State Ministry of Agriculture, 2020). It is bordered to the South by Anambra and Edo States, to the North by Niger, Nasarawa and the Federal Capital territory, to the East by Benue and Enugu States. On the Western flank, it shares a common border with Ondo, Ekiti and Kwara States (Stella, 2019. The major ethnic groups in the area are Igala, Ebira and Okun. Other groups include Nupe, Bassa, Ogori-mangogo, Hausa and others. Lokoja is the State capital of Kogi State and it is located at the confluence of the two largest rivers in Nigeria which are River Niger and Benue. (Kogi State Ministry of Agriculture, 2020).The mean temperature ranges between 24^0C and 27^0C. (Kogi State Ministry of Agriculture, 2020). The State covers an estimated land area of 28,313.53 square kilometers. (National Bureau of Statistics, 2009) and a projected population of 4,466,800 in 2022 using 1.9 % growth rate. Kogi State is divided into four agricultural zones namely Koton-Karfe, Ayingba, Aloma and Aiyetoro Zones (Kogi State Ministry of Agriculture, 2020). It consists of 21 Local Government Areas (L.G.A). The people of the State are predominantly farmers, different kinds of arable crops are been grown in the State such as maize, cassava, cocoa yam, groundnuts and millet and cowpea. Livestock such as goat, sheep and poultry are also reared in the State (Kogi State Ministry of Commerce and Industry, 2009).

Sampling Techniques and Sample Size

Four stage random sampling procedure was employed in selecting respondents for this study. In the first stage, three agricultural zones were randomly selected from Kogi State out of the four (4) agricultural zones. In the second stage, two (2) Local Government Areas (LGA) were randomly selected from each of the three agricultural zones making a total of six (6) LGAs. Third stage involved selection of two (2) communities/villages from each of the six (6) LGAs making a total of twelve (12) villages. The fourth stage involved sampling of maize farmers proportionately using Yamane's sample determination formula (1967). The same approach was used by Jibrin, *et al.* (2021); so, a sample size of 166 was obtained for the study

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

where; n = sample size, N = finite population, e = limit of tolerable error (level of significance = (0.07*), 1* = constant.

Method of Data Collection

Primary sources were utilized to gather data for this research project. The primary data were obtained using questionnaire and complimented with interview schedules for the non-literate respondents.

Analytical Techniques

Data collected included information on socio economic characteristics (age, sex, marital status, and years of farming experience). An index score was generated in measuring the levels of compliance to safety and health practices of agrochemical use among maize farmers (j symbol was used to indicate farmers' level of compliance to agrochemical safety and health practices/information), a total of 24 indicative questions were posed to the farmers as modified from Franklin *et al.* (2017). They were then scored 1 for Yes and 0 otherwise. Farmers' score indicating the level of compliance is specified in the equation:

$$ji = \frac{\text{Total number safety and health practices/information used recorded by } ith \text{ farmer}}{24} \quad (2)$$

Where *ji* denotes the level of compliance of safety and health practices of agrochemical by j^{th} farmer.

TABLE 1. Level of compliance of safety and health practices of agrochemical

Level of compliance (j)	Ranges of indices	Ordered indicators of j
Low	$0 \leq j \leq 0.49$	1
Moderate	$0.5 \leq j \leq 0.69$	2
High	$0.7 \leq j \leq 1$	3

To determine the factors influencing the levels of compliance of agrochemical safety and health practices among maize farmers, Ordered Probit regression model as the same approach was employed by Franklin *et al.* (2017). The dependent variable was the level of compliance of safety and health practice/information of agrochemical by the maize farmers.

III. RESULTS AND DISCUSSION

TABLE 2. Distribution of maize farmers based on socio-economic characteristics

Variable	Kogi (n=166) Freq (%)
Age (Years)	
≤30	13(7.83)
31 – 40	51(30.72)
41 – 50	58(34.93)
51- 60	38(22.89)
Above 60	6(3.61)
Mean (Std dev)	40(10.30)
Sex	
Male	139(83.73)
Female	27(16.26)
Household size	
1- 5	60(36.14)
6 – 10	86(51.80)
11 – 15	14(8.43)
Above 15	6(3.61)
Mean (Std dev)	6 (3.6)
Level of Education	
None	18(10.84)
Primary	32(19.27)

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Secondary	62(37.34)
Diploma	16(9.63)
NCE	10 (6.02)
HND	8(4.81)
PGD	1(0.60)
Farm size (hect)	
0.1-1.0	49(29.51)
1. 1- 2.0	70(42.16)
2.1- 3.0	22(13.25)
3.1 and above	25(15.06)
Years of farming experience	
1-5	37(22.28)
6-10	36(21.68)
11-15	25(15.06)
16-20	36(21.68)
21 and above	32(19.27)
Mean (std)	14(10.3)

Source: Field survey, 2019 Figures in parenthesis are percentages (%)

Data in Table 2 showed the mean age of the farmers was 43 years with majority of them been male. About 83,73% of the maize farmers sampled in Kogi State where male with an average household size of six persons The result is in disagreement with the findings of Jibrin *et al.* (2016) who reported that maize farmers in Niger State were within the age of 31 – 40 years and Franklin *et al.* (2017) who opined that the mean household size of maize farmers was 6.

Indicative Questions for Measuring Level of Compliance of Agrochemical Safety Practices/Information

The result on Table 3 shows that 5.22% of the maize farmers agreed to have read agrochemical label before use, 5.66% said they are aware of agrochemical hazards while only 4.56% understand the level of hazard by reading the label. This implies that there exists a gap in the level between reading and understanding of information and such could lead to mishandling of the agrochemical. The result disagrees with the findings of Tijjani et al. (2018) who reported that 64% of the farmers were aware of pesticide safety. This implies that there exists a gap in the level between reading and understanding of information and such could lead to mishandling of the agrochemical. The result disagrees with the findings of Tijjani et al. (2018) who reported that 64% of the farmers were aware of pesticide safety

TABLE 3. Indicative questions for measuring level of compliance of agrochemical safety practices/information

Indicators of compliance of agrochemical safety practices/information	**n=166 Freq (%)**
Do you read label before opening agrochemical bottle?	142 (5.22)
If you cannot read, do you seek for help from others?	96 (3.53)
Do you follow the instructions on the label?	160 (5.88)
Are you aware of agrochemical hazards	154 (5.66)
Are you able to understand the level of hazard by reading the label	124 (4.56)
Do you drink, eat or smoke while applying or mixing agrochemical	4 (0.15)
Do you keep bottles/packages of agrochemical along with other food items	11 (0.40)
Do you store agrochemical properly/ keep away from children?	154 (5.67)
Do you apply two or more pesticides 'type together?	31 (1.14)
Do you wash the sprayer/bottle in pond/canal/river/others?	61 (2.24)
Do you dispose unused container properly?	134 (4.92)
Do you spray when it is windy?	41 (1.51)
Do you determine the wind direction first before spraying?	135 (4.96)
Do you use agrochemical for the purpose they are meant for?	163 (5.99)
Do you apply recommended dosage to prevent environmental contamination and human health hazards?	146 (5.37)
Do you use personal protective gears such as gloves and overall clothing during agro-chemical mixing or spraying?	91 (3.35)
Does overdose affect plants?	130 (4.78)
Do you wash your hands with soap right after applying or mixing agro-chemical?	153 (5.63)
Do you take your bath after spraying?	160 (5.88)
Do you revisit the farm within 24hours of spraying?	95 (3.49)
Do you avoid the use of agro-chemical when advise not to work with such component?	140 (5.15)
Do you keep unprotected persons out of treatment area for at least 12hours?	102 (3.75)
Do you ensure proper ventilation before re-entry?	148 (5.44)
Do you seek immediate attention in case of accident?	145 (5.33)

Source: Field survey, 2019 Note: *Multiple responses were recorded

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TABLE 4. Distribution of maize farmers based on level of compliance to agrochemical safety and health practices.

Level of compliance	**n=166 Frequency (%)**
Low	7(4.21)
Moderate	54 (32.53)
High	105(63.25)

Source: Field survey, 2019

Results on Table 4 revealed that 63.25% of the sampled maize farmers in Kogi State are at high level of compliance of agrochemical safety and health practices. While 32.53% and 4.21% of them are at moderate and low level of agrochemical safety and health practices respectively**.** The result contour with the findings of Xiaomei (2016) who reported that the practices of agrochemical use are determined by the level of knowledge of the local farmers to safety information

The result on Table 5 revealed that 69.61% and 16.62% of the maize farmers in Kogi State, had the open market and input supplier as their major point of buying agrochemical. The result implies that majority of the respondents in this context depend on the open market for their agrochemical who might not have

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the requisite knowledge and training on agrochemical utilization.

TABLE 5. Distribution of maize farmers based on point of purchase of agrochemical

Point of Purchase of Agrochemical	n=166 Freq (%)
Open market	126(69.61)
Input supplier	29(16.62)
Sales representative	12(6.62)
Mixed	14(7.73)

Source: Field survey, 2019

Table 6 revealed that extension agent was the most effective means of receiving agrochemical safety and health information with a cut-off mean of 2.62. Furthermore, radio and television ranked 2nd and 3rd with mean of 2.48 and 2.37 respectively. The result implies that the maize farmers prefer the use sense of seeing and hearing in receiving information. The result is in disagreement with the with the findings of Gitahi (2014) who reported that television is among the minor sources of information.

TABLE 6. Distribution of maize farmers based on sources of information and safety practices on available agrochemical and safety practices on agrochemical handling

Media	NE	E	VE	WS	WM	D	Rank
Extension agent	5(5)	53(106)	108(324)	435	2.62	E	1st
Radio	23(23)	33(66)	110(330)	419	2.52	E	2nd
Television	3(3)	80(160)	83(249)	412	2.48	E	3rd
Other farmers	10(10)	83(166)	73(219)	395	2.37	E	4th
Social media	40(40)	76(152)	50(150)	342	2.06	E	5th
Sales representative	24(24)	109(218)	33(99)	341	2.05	E	6th
Co-operative society	36(36)	86(172)	44(132)	340	2.04	E	7th
Phone	39(39)	96(192)	31(93)	324	1.95	NE	8th
Internet	56(56)	80(160)	30(90)	306	1.84	NE	9th
Non-Governmental Organization (NGO)	61(61)	81(162)	24(72)	295	1.77	NE	10th
Electronic mail	107(107)	47(94)	12(36)	237	1.42	NE	11th
Fax	110(110)	47(94)	9(27)	231	1.39	NE	12th

Source: Field Survey, 2019. Note NE=Not Effective, E= Effective, VE= Very effective, WS=Weighted sum, WM=Weighted mean D=Decision Cut Off Mean = 2.0

TABLE 7. Distribution of maize farmers based on reasons why farmers do not use PPE

PPE	Too hot Freq (%)	Not comfortable Freq (%)	Cannot afford Freq (%)	Not available Freq (%)	Slows one down Freq (%)	Don't see need for one Freq (%)
Safety overall	20(12.04)	31(18.67)	57(34.33)	43(25.90)	4(2.40)	11(6.62)
Safety boot	12(7.22)	29(17.46)	49(29.51)	31(18.67)	33(19.87)	12(7.22)
Safety goggles/glasses	5(3.01)	23(13.85)	37(22.28)	68(40.96)	5(3.01)	28(16.86)
Safety hat/scarf	11(6.62)	18(10.84)	32(19.27)	69(41.56)	10(6.02)	26(15.66)
Safety nose guide	8(4.81)	26(15.66)	38(22.89)	55(33.13)	12()7.22	27(16.26)
Safety hand gloves	7(4.21)	29(17.46)	35(21.08)	50(30.12)	11(6.62)	34(20.48)
Safety face mask	6(3.61)	29(17.46)	34(20.48)	55(33.13)	14(8.48)	28(16.86)

Source: Field Survey, 2019. Personal Protective Equipment (PPE)

Table 7 shows that 12% of Kogi State maize farmers do not use PPE because its too hot, 18%, said they don't feel comfortable working with it, 34% complained that it is too expensive, 25% ,2% and 6% said it is not available, slows them down and do not see the need for one respectively. This result finds support in the study of Adesuyi *et al*. (2018) who reported that farmers reasons for not using PPE include too expensive (45.0%), not comfortable in the tropical hot climate (85.0) %) and not available when needed (30/0%).

Factors influencing the level of compliance to agrochemical safety and health practices

The Ordered Probit regression model's parameter estimates solely indicate the direction of the independent variables' impact on the response variable, without providing the actual probabilities or magnitude of change. Thus, the marginal effects from the model which measure the expected change in the probability of factors influencing maize farmers level of compliance to agrochemical safety and health practices with respect to a unit change in an independent variable are presented in Table 8.

The result on Table 8 revealed that Marital status, Education, Farm size, Membership of association, Credit and Labour where some of the factors influencing the level of compliance to agrochemical safety and health practices in the study area. The coefficient of marital status (0.521) was positive and significant at 10% level of probability, implying that farmers who are married adhere to safety practices than single farmers. Furthermore, the result shows that being married decreases the odds of a farmer being in the low and moderate level of compliance by -0.025% and -0.160% while increases the odds of a farmer being in the high level of compliance by 0.185% respectively.

Furthermore, the coefficient for education (-0.202) was negative and statistically significant at 1% probability level. This indicates that increase in educational levels of a farmer decreases the probability of the farmer to comply with safety practices. Education from this result tends to increases the probability of a farmer being in the low and moderate level of compliance of agrochemical safety health practices by 0.852% and 6.260% and decreases the probability of being in the high level of awareness by -7.113 respectively. The reason could be that Kogi State farmers, though educated might not read agrochemical information and adhere to agrochemical safety

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practices but rather relay on their long-time experiences (mean experience of 14 years)

The coefficient of farm size (0.247) was positively significant at 5% level of probability and in agreement with *a prior* expectation. The results implies that increase in farm size decreases the odds of a farmer being in low and moderate awareness level by -1.042 % and -7.656% and increases the probability of being in high level of awareness by 8.699% respectively.

A plausible inference could be that as farm size decreases, farmers whose livelihoods solely rely on agriculture farmer whose might tend to use a higher level of agrochemical in order to protect crops, and increase yield. The result agrees with the finding of Danso-Abbeam and Baiyegunhi (2017) who reported that as farm size increases, there is higher likelihood that their investment in agrochemical and its safety practices might increase.

Table 8: Factors influencing the level of compliance to agrochemical safety and health practices

Covariant/ Variable	**Ordered probit Model**	**Low level (Marginal effects)**		**Moderate level (Marginal effects)**		**High level (Marginal effects)**	
	Coefficient	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Age	-0.012 (0.008)	-1.48	0.0005 (0.0003)	1.30	0.003 (0.002)	1.46	-0.004 (0.002)	-1.48
Gender	0.087 (0.264)	0.33	-0.003 (0.012)	-0.31	-0.0273 (0.082)	-0.33	0.031 (0.095)	0.33
Marital Status	0.520 (0.280)	1.85 *	-0.025 (0.017)	-1.45	-0.160 (0.084)	-1.89*	0.185 (0.098)	1.89**
Years of schooling	-0.202 (0.067)	-2.99 **	0.008 (0.004)	2.00**	0.062 (0.021)	2.89***	-0.071 (0.023)	-3.01***
Farming Experience	0.014 (0.010)	1.37	-0.0006 (0.0005)	-1.21	-0.004 (0.003)	-1.36	0.005 (0.003)	1.37
Farm size	0.247 (0.102)	2.42***	-0.0104 (0.005)	-1.77*	-0.076 (0.032)	-2.39**	0.086 (0.035)	2.44**
Extension contact	-0.176 (0.155)	-1.14	0.074 (0.007)	1.05	0.054 (0.048)	1.13	-0.062 (0.054)	-1.14
Sources of information	-0.051 (0.060)	-0.85	0.002 (0.002)	0.82	0.016 (0.018)	0.86	-0.018 (0.021)	-0.86
Membership of association	0.438 (0.231)	1.89**	-0.0191 (0.012)	-1.51*	-0.134 (0.070)	-1.90*	0.153 (0.079)	1.92*
Availability of credit	0.573 (0.230)	2.49***	0.021 (0.0117)	-1.86*	0.170 (0.065)	-2.60***	-0.192 (0.072)	2.67***
PPE cost	0.0001 (8.69e-06)	1.24	-4.54e-07 (0.00000)	-1.12	-3.34e-06 (0.00000)	-1.24	3.79e-06 (0.0000)	1.24
Availability of PPE	-0.329 (0.279)	-1.18	0.016 (0.018)	0.92	0.103 (0.088)	1.17	-0.120 (0.104)	-1.15
Labour	0.001 (0.008)	2.06 **	-0.0007 (0.00004)	-1.87*	-0.0005 (0.0002)	-2.09**	0.0006 (0.0002)	2.18**
Log likelihood	-111.668							
Chi square	38.46							
Pseudo R^2	0.1469							

Source: Field survey, 2019; [s=] variables that are significant at all levels Note: ***= significant at 1% ** = significant at 5% *= significant at 10% Figures in parentheses are the respective Std. Err

Result on Table 8 also revealed that the coefficient of membership of association (0.438) was positive significant at 10% level of probability, implying that farmers who are member of organizations might likely adhere to safety practices more than farmers who are not members of an organization. In addition, the result shows that being a member of an organization decreases the odds of a farmer being in the low and moderate level of compliance by 1.911% and 13.444% while increases the odds of being in the high level of compliance by15.356% respectively. A possible reason for the result could be that farmers who are member of organizations might likely get incentives (input, credit and training) from their organization which might help in the use and application of agrochemical. The finding is in line Ajayi and Ogunola (2005) who reported that membership of cooperative societies has advantages of accessibility to micro-credit and essay access to input at a reduced cost. Availability of credit (0.438) was positive significant at 5% level of probability. Having readily available credit decreases the probability of a farmer being in the low and moderate level of compliance by 2.192% and 17.073% but increases the probability of being in the high level of compliance by 19.265% respectively. Access to credit increases liquidity position of farmers hence they can afford to secure large quantities of agrochemical and consequently adhere to safety practices. The result is in agreement with the findings of Adnan *et al.* (2020) who opined that typically, rich farmers are more apprehensive about agrochemical hazards than poorer farmers.

Availability of labour (0.001) was positive and significant at 1% level of probability which is line with *a priori* expectation. The result shows that having readily available labour decreases the probability of a farmer being in the low and moderate level of compliance by 0.007% and 0.005% while increases the probability of being in the high level of

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compliance by and 0.063% respectively. Availability of labour has been identified as one of the major problems confronting small-scale farmers, consequently increase in labour availability might lead to increase in cultivation of more lands, use of agrochemical and hence compliance to agrochemical safety practices. The result is in line with the findings of Catherin (2019) who reported that source of labour had a positive effect on the chance of a higher level of agrochemical usage and hence safety habits Another possible explanation could be that farmers with more labour (especially family labour) might be more cautious while using agrochemical in order to reduce harmful effects since more family members are exposed to hazardous products.

IV. Conclusion and Recommendations

Results of the study reported that maize farmers where majorly male, married and with a mean age of the farmers was 40 years; these were attributed to the tedious cultural practices involved in maize production. More so extension agents and radio were the most effective means of receiving agrochemical safety and health information. Finally, it was discovered that Marital status, Education, Farm size, Membership of association, Credit and Labour where some of the factors influencing compliance to agrochemical safety and health practices among maize farmers in Kogi State Nigeria. It is advised, according to the findings, to:

i. Women should be encouraged to take part in maize farming in order to increase their sources of income
ii. Extension agents should organize campaigns and mass trainings on the use, handling and application of agrochemicals.
iii. Furthermore, farmers should be encouraged to join or form cooperatives societies as better relationships with other villagers helps to reduce agrochemical misuse.

References

[1] Aderonke, O. O., Oluwatoyin T. F., Latifat M. A., Damilola E. F., & Muyideen, O. M., Human 2017). Health Risk of Organochlorine Pesticides In Foods Grown In Nigeria. Journal Of Health and Pollution, 7(15), 63-70.

[2] Adesuyi, A. A., Njoku, K. L., Akinola M. O., Nnodu & Valerie, C. (2018) Pesticides related knowledge, attitude and safety practices among small-scale vegetable farmers in lagoon wetlands, Lagos, Nigeria. *Journal of Agriculture and Environment for International Development - JAEID 112 (1), 81-99.*

[3] Adnan, A, Abdul-Hamid, B. M. & Gazali I. (2020). Fertilizer subsidy policy and smallholder farmers' crop productivity: The case of maize production in North-Eastern Ghana. *Journal of Agricultural Extension and Rural Development 12(2),18-25.*

[4] Ajayi, O.C. & Ogunola, A. O. (2005). User cost, biological, capital and productivity of pesticides in Sub-sahara Africa. *International Journal of Agriculture, sustainability*. (3)3, 154 – 166.

[5] Catherine, W. K. (2019). Determinants of pesticide use and uptake of alternative pest control methods among small scale tomato farmers in Nakuru Country, Kenya. A Thesis Submitted to the Graduate School in Partial Fulfilment for the Requirements of the Master of Science Degree in Agricultural and Applied Economics of Egerton University, Kenya. Pp93-121.

[6] Danso-Abbeam, G., & Baiyegunhi, L. J. S. (2017). Adoption of Agrochemical Management Practices among Smallholder Cocoa Farmers in Ghana. *African Journal of Science, Technology, Innovation and Development,* 9(6),7171-728.

[7] Department for External Relations: Directorate General for Policies of the Union (2021). The use of pesticides in developing countries sand their impact on health and the right to food. policy. PE 653.622.

[8] Food and Agricultural Organizations (FAO) (2007).The State of Food Insecurity in the World.

[9] Food and Agricultural Organization (FAO)(2017). The future of food and agriculture: Trends and challenges. Rome:Pp 205.

[10] Franklin, M. N, Kwadwo, T., & Gideon, D. (2017). Awareness of health implications of agrochemical use: effects on maize production in Ejura-Sekyedumase Municipality, Ghana. *Journal of Advances in Agricultur*e. 3(9), 136-140.

[11] Gitahi, M. W. (2014). Risk of agrochemicals on the environment and human health- in Mukaro location, Nyeri County, Kenya. **(**Bsc. Agric).

[12] Harlold, M. (2015) Cereal crops: Rice, Maize, Millet, Sorgum, Wheat Abduo Doiuf International Conference Center, Dakar, Senegal.

[13] Jibrin, S., Tanko, L., Ibrahim, F. D., Jirgi, A. J., & Umar, I. S. (2016). Effects of socio-economic characteristics of farmers on maize production in Chanchaga Local Government Area of Niger State. *International Journal of Agriculture and Development Studies, (1)2, 72-78.*

[14] Jibrin, S., Ajayi, O. J., Salihu, I. T., Bello, L. Y. and Loko, A. I. (2021). Factors Affecting Awareness Of Maize Farmer On Health Risk Of Agrochemical Usage In Niger State, Nigeria. *Journal of Agripreneurship and Sustainable Development (JASD)* 4 (2), 154 – 167.

[15] Kaisa, S. P., Anna,O. K., Carlos, G., Daniel, P. J., Nathalie, M. S., Ingela, M. M., Anne, K. E., Pia, C. S., Emilia, N. & Nesli, S. (2022) Grains – a major source of sustainable protein for health *Nutrition Reviews*, 80 (6) 1648–1663, https://doi.org/10.1093/nutrit/nuab084

[16] Kogi State Ministry of Agriculture (2020). Medium term Sector Strategy (MTSS).

[17] Kogi State Ministry of Commerce and Industry: Official Web portal, 2009.

[18] Mani, J. RIssah, F. O., Abdussalam, Z, & Damisa, M.A. (2022). Factors influencing farmer participation in maize production in Kaduna State, Nigeria. Journal of Agriculture and Environment 18(1); 1 – 11.

[19] Mohammed, U., Umar, I. S., Olaleye, R. S., Pelemo, J. J., Ahmed, B. S. Mohammed, U. & Umar, A. L. (2021). Effects of banditry on income and Livelihood of Yam marketers in Shiroro Local Government Area of Niger State Nigeria. *Journal of Agriculture and Food Science. 19(1),163-178*.

[20] Muhammed, A. A. & Biola, T. O. (2019). Resource use efficiency of rain-feed maize farming in Nigeria. *Nobel international Journal of Agriculture and Food Technology*. (2),3 20-30.

[21] National Bureau of Statistics (NBS), (2015). Consumption Pattern in Nigeria 2015/10. Preliminary Consumption Report in March 2014 p8. Retrieved on December 2015 from *www.nigeriastat.gov.ng/pages/download/44*.

[22] Ndaghu, G. M, Bunu, B. & Dire, I. (2017). Perception of health hazards associated with agro-chemicals use among arable crop farmers in Mubi Agricultural zone, Adamawa State, Nigeria. *International Journal of Agricultural Extension and Rural Development Studies. 4(2), 17-24.*

[23] Nnamonu, L. A. & Onekutu, A. (2015). Green Pesticides in Nigeria: An Overview. *Journal of Biology, Agriculture and Healthcare*, 5(9), 48-62.

[24] Offiah, E. O. (2015). Sustainability of Maize-based Production system in Anambra State Nigeria. M.sc Thesis submitted to the Department of Agricultural Economics, University of Nigeria, Nsukka, in partial fulfilment of the requirement for the award of a degree of Master of Science in Agricultural Economics. Pp 69-85

[25] Omari, S. (2014). "Assessing farmers' knowledge of effects of agrochemical use on human health and the environment: a case study of Akuapem South Municipality, Ghana," *International Journal of Applied Sciences and Engineering Research*. 3(2), 87-92.

[26] Stella A. E. (2022). A review of application of chemicals for enhanced agricultural productivity. problems and perspectives. Nigerian research Journal of Chemical Sciences 10 (1) 110-119.

[27] Tijjani, H., Tijjani, B. A., & Audu, A. (2018). Socio-economic determinants of vegetable farmers' awareness of safety measures in pesticide use in Jere local government area, Borno State, Nigeria .*Agrosearch, 18 (1), 66 – 76.*

[28] United Nations Population Division (UNPD) (2007). Annual Report 2007.

[29] United Nations (UN) (2015). Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No.

ESA/P/WP.241. United Nations New York, 2015.
[30] Xiaomei, Y. (2016) pesticides use and off-site risk assessment a case study of glyphosate fate in Chinese Loess soil. Science of the total Environment 4(9), 172-179.
[31] Yamane, T (1967), Statistic: An introductory analysis, 2nd edition, New York: Harper and Row.

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