Agrochemical Risks Perception and Farming Households' Safety Precaution Practices in Ekiti State Nigeria

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Abstract

This study assessed agrochemical risks perception and farming households' safety precaution practices in Ekiti State Nigeria. It measured the awareness, use and maintenance of personal protective equipment, the perception and factors influencing respondents' perception of recommended agrochemical safety precautions practices. A total of 120 farming households were selected for the study using a multi-stage sampling procedure. Data were collected using a pretested structured questionnaire. Descriptive statistics and regression analysis were used to analyze the obtained data. Likert rating scale was used to rate and categorize the respondents' knowledge of agrochemical risks level and the respondents' perception of recommended agrochemical safety precautions. The results obtained revealed a low level of use and maintenance of personal protective equipment even in cases where awareness is as high as 84%. The respondents largely agreed with the recommended agrochemical safety precautions practices but disagree with observation of waiting period, not leaving pesticides in equipment overnight, avoidance of re-using or selling of agrochemical containers. The result of the regression analysis shows that age of respondents ($p<0.05$), level of education ($p<0.01$), level of income ($p<0.10$), membership of farmers association ($p<0.05$), and access to extension services ($p<0.10$) significantly influence the perception of the farmers on recommended agrochemical safety precautions. This study recommends that campaign for attitudinal changes on the use of agrochemical should be mounted by extension agencies in collaboration with relevant stakeholders.

Key Words: *: Awareness, perception, agrochemicals, personal protective equipment, recommended agrochemical practices.*

INTRODUCTION

Agrochemicals has continued to be an important agricultural inputs in protecting crops from diseases, pests and weeds, its uses contribute not only to healthy growth of crops and animals but also to improve farm work efficiency and stable supply of tasty agricultural produce (Kughur, 2012). The reported widespread misuse of this vital input by farmers while protecting crops from incidences of pests, diseases and weeds is a serious ongoing threat to the health of farmers and will add burden to already poor and vulnerable farmers. Abdullahi, (2008), stated that, the high incidence of agrochemical misuse and unprecedented level of pesticides related accidents and their attendant consequences on the people's health is quite alarming. Specifically, a joint press release of the ILO/WHO on the number of work related accidents and illnesses indicated that use of pesticides causes some 70,000 poisoning deaths each year, and at least seven million cases of acute and long term non-fatal illness (ILO 2012, FAO, 2012). This obviously made Agriculture one of the three most dangerous sectors in which to work, along with construction and mining.

No doubt the introduction of innovations that emanates from science and technology embodied in Crop Protection Chemicals (CPCs) has led to noticeable improvement in crop production. However, the ability of the small-scale farmers, who dominate agricultural production in most developing countries, to adopt the recommended practices of these innovations becomes very crucial if the sector must continue to contribute significantly to national food security and foreign exchange earnings. The challenges of agrochemical misuse in most developing countries like Nigeria includes but not limited to, use of adulterated products, improper calibration of equipment, inappropriate application techniques, use of expired chemicals as well as inefficient use, improper storage habits, the reuse of old chemical containers for food and water storage non-compliance with personal health and environmental safety standards. This according to Olowogbon, Fakayode, Jolaiya, and Oke (2013) has led to agrochemical failure, environmental hazards thereby exposing farmers to some risks due to the hazardous effects of these chemicals. Also, Atu (1990) as quoted by Issa, Atala, Akpoko, and Sanni (2015) opined that the residual effect of the chemicals on crops, as a result of improper handling of the chemicals, constitutes source of concern because pesticides are toxic and can have

serious health hazards on human beings. Another source of great concern is the increasing continuous exposure of agricultural work practitioner to health risk as a result of ever increasing demand and a steady increase in the amount of pesticides marketed for agricultural use. According to Eurostat statistical books, (2007), in the European Union alone, more than 200,000 tonnes of pesticides (active ingredients) are used annually. Also (CropLife International, 2006 and 2010) stated that between 2005 and 2010, the total volume of global sales rose from US$ 31 billion to US$ 38 billion. The amount of pesticides used internationally has risen fifty-fold since 1950 (Ecobichon, 2001) with China using and producing the largest amounts of pesticides (Pesticide Action Network, 2010).

The effects of acute poisoning due to exposure to dangerous levels of pesticides in food are reported to be more severe in developing countries than in industrialized countries (Issa, Atala, Akpoko, and Sanni, 2015). For example, Nigeria reported 112 cases of people poisoned by pesticide-contaminated food which led to the death of two children and specifically 120 cases of poisoning of students who had eaten beans contaminated with lindane (Organic Consumer Association, 2008; Integrated Regional Information Network, 2008).The increase incidence of occupational hazards in agricultural sector occasioned by unnecessary exposure to agrochemicals has made safety and health in the use of agrochemicals one of the primary concerns of international organizations and many governments, employers and workers and their organizations for over two decades (Nyatuame and Ampiaw 2015). These health complications could be as a result of measures being taken before; during and after the use of agro chemicals. Meanwhile, the use of personal protective equipment has been generally recognized as one of the best ways of freeing the human body from contacts with dangerous chemicals used on the farm for almost all farming activities. Therefore, there is the need for a systematic investigation of the farmer's level of awareness and compliance with recommended agrochemical safety precaution practices, including the extent of use of Personal Protective Equipment (PPE) among the users of agrochemicals so as to help convey the importance of the issues involved to bring out measures, to reduce exposure to hazards in chemical usage through modifications or practices.

Methodology

The study Area

The study was conducted in Ekiti State, Nigeria, the State is bounded by Kwara State on the North, Kogi State by the East, Osun State on the west and Ondo State by the south. Geographically, Ekiti State is located between the longitude 4o2' and 5o4' east and latitude 6o2' and 8o5' north of the equator. (wikipedia.org/wiki/ekiti_state). The state enjoys a typical tropical climate with a distinct rainy season, from March/April to October/November, and a dry season, from November to March. The temperature range is 21-28°C with high humidity. Ekiti State is generally an agrarian state with a tropical forest existing in the Southern part and Guinea Savannah in the North part of the State. The state is largely agrarian in which both food crops and cash crops are widely cultivated. The agricultural economy of the state is largely characterized by smallholder farms and fragmented land holdings on which farmers use simple farm implements and human labour.

Sampling technique

A three stage random sampling survey design was used. The respondents consisted of 120 randomly chosen farmers, actively involved in the use of agrochemicals in the last five years. In the first stage, a random selection of six Local Government Areas (LGAs) in the state was made. Secondly, two villages/communities were randomly selected from each of the selected LGAs for the study making a total of 12 villages/communities. Lastly, ten arable crop farmers were randomly selected from each of the selected farming villages/communities, giving a sample size of 120 arable crop farmers

Data were collected through the use of a pretested structured questionnaire. Personal observations were also carried out on selected days within the study periods to observe how farmers carried out agrochemicals application on their farm activities. Information collected was on socioeconomic characteristics, awareness, understanding and extent of compliance with Recommended Agrochemical Practices (RAP), Personal Protective Equipment (PPE) usage and the farmer's knowledge on the health implications of agrochemical use and aspects of the production activities.

Analytical technique

The analytical tools used were: Descriptive statistics, Likert rating scale and OLS. The descriptive statistics used were means, frequency counts, percentage, minimum and maximum values.

To evaluate the agrochemical risk knowledge of the respondents, eight items in a 3 point Likert type rating scale was adopted after an extensive review of agrochemical risk literatures (Appendix 1). For each statement 1 up to 3 points were given in scale. The maximum point (3) given for "yes", 2 points allocated to "don't know" and the minimum, 1 point weighted to "no". When a respondent scored one point for all items the minimum overall points would be 8 and 24 being the maximum point while the respondent scored three for all statements. The researcher, therefore, categorized the respondents as having: Poor, Fair, and Good agrochemical risk knowledge based on the individual overall score. Respondents who scored 0- 8 and 9-16 points out of twenty-four maximum points were categorized under poor and fair level of knowledge respectively. Respondents who scored 17-24 were considered as having good agrochemical risk knowledge. Also a five point Likert scale (1=Strongly Disagree (SDA), 2= Disagree (D), 3=Neutral (N), 4= Agree (A) and 5 =Strongly Agree (SA) was used to assign weight for the items on the questionnaire used to assess the respondents' perception of recommended agrochemical safety precautions

The mean response to each question was computed using the under listed formula:z

$$\overline{X} \text{ (Weighted mean score)} = \frac{\sum fx}{N}$$

Where: $\overline{X}$ = mean score

? = summation

f = Number of respondents to a given question

X= numerical value of scale point

N = total respondents to a question

Any weighted mean score (WMS) below3.0 was considered to indicate that the respondents disagreed with the statement while WMS above 3.0 indicated that the respondents agreed with the statement.

OLS was then used to evaluate factors influencing the perception of respondents on recommended agrochemical safety precaution. Recommended Agrochemical Safety Precaution Index (RASPI) was generated for each of the respondents by using a five point likert scale to assign weights to the 15 items in the safety index statements. For each statement 1 up to 5 points were given in the scale. The maximum point (5) given for strongly agree, 4 points was awarded for agree, 3 points for undecided, 2 points for disagree while the minimum, 1 point weighted to strongly disagree. When a respondent scored one point for all items in the safety index statements the minimum point would be 15 and 75 being the maximum point when the respondent scored five for all statements. Individual respondent point were calculated accordingly using various points scored per safety index statements

The regression model is implicitly specified as follows:

$Y = f(X_1, X_2, X_3 \ldots\ldots\ldots\ldots\ldots\ldots Xn, ?)$

Y = Dependent variable (RASPI)

X_i = Independent variables

X_1 = Age of farmers (years)

X_2 = Gender (Dummy Male = 1; Female = 0)

X_3 = Level of education (years spend in acquiring formal education)

X_4 = Marital Status (Dummy Male = 1; Female = 0)

X_5 =Household size (Number of individuals living and feeding under the same roof)

X_6 =Farm size (ha)

X_7= Level of income (₦)

X_8= Farming experience (years)

X_9 = Membership farmers Association. (Dummy Yes =1; No = 0)

X_{10} = Access to Extension services.(Dummy Yes =1; No = 0)

ε_i = error term

Results and Discussion

This section presents and discuss the results of categorization and description of socioeconomic characteristics of the respondents.

Socio economics characteristics of the respondents

Table 1 shows the result of socio economic categorization and distribution of the respondents. From the table, the average age of the respondents was 46.57 years with a dispersion of 13.41; however, those within the age bracket of 31 to 50 years constituted the highest percentage (49.10%). This shows that majority of respondents were in their active productive age group, and a vast majority (65%) were male. The educational background of respondents showed that 9 respondents passed through adult education class, while 52 out of 120respondents went through primary school; another 33 respondents completed secondary school with just five of them making it to post-secondary school. This was an indication that at least a good number of them could read and write. The average Farming experience of respondents was 22.05 years with a dispersion of 12.81 however, 40.83% of the respondents have up to 10 years farm work experience while 26.68% of them had between 11 – 20 years farm work experience. However, 15.83% of the respondents were 21 – 30 years experienced with 7% of the respondents having over 40 years working experience. The average household size of the respondents is about five with a dispersion of 2.18; however respondents with household size ranging from 4 – 7 has the highest percentage (54.17%).The average farm size recorded is 1.12 ha with a dispersion of 0.52. a sizable proportion of the respondents (25%) is cultivating not more 0.5 ha, while 27.50% and 33.34% are cultivating between 0.6 – 1.0 and 1.1 – 1.5 respectively. This clearly shows that the respondents are small scale farmers. Equally, the average gross margin recorded by the respondents is ₦4642.15 with a dispersion of ₦1020.11, and only 39.17% of the respondents have access to extension services while the remaining 60.85% of the respondents did not have any contact with any extension officer. This shows that there need to increase extension coverage in the study area

Table1: Socioeconomic characteristics of respondents N = 120

Variable	Frequency	Percentages	Mean	Standard deviation
Age (yrs)				
< 30	19	15.8	46.57	13.41
30 – 39	22	18.3		
40 – 49	37	30.8		
50 – 59	27	22.5		
≥60	15	12.5		
Gender				
Male	78	65		
Female	42	35		
Education Status				
Never been to School	21	17.5		
Adult Education	9	7.5		
Primary School	52	43.3		
Secondary School	33	27.5		
Faming Experience				
≤10	49	40.83	22.05	12.81
11 – 20	32	26.68		
21 – 30	19	15.83		
31 – 40	13	10.83		
>40	7	5.83		

Table1 Continued : Socioeconomic characteristics of respondents N = 120

Variable	Frequency	Percentages	Mean	Standard deviation
Household size				
≤3	33	27.50	5.33	2.18
4 – 7	65	54.17		
8-11	16	13.33		
>11	06	5.00		
Farm size				

Source: Field Survey, 2016.

Farmers' knowledge of agrochemicals risks

This section deal with the presentation and discussion of respondents' knowledge of harmful/risk effects of agrochemicals. Items in appendix 1 was used to measure the respondents' knowledge of agrochemical risks. Table 2 shows the result of categorization of respondents' knowledge of agrochemical risks. The table shows that, 65.83% of the respondents were categorized as having good knowledge of agrochemical risks having scored between 16 -24 point on the risk knowledge rating scale, also 20.83% were categorized as having fair knowledge of agrochemical risks having scored between 9 – 16 on the rating scale while the remaining 13.34% scored between 0 -8 on the rating scale and were consequently classified as having poor knowledge of agrochemical risks. The findings of this study confirms that of Amera and Abate (2008) that generally, farmers have varying knowledge on the harmful effects of pesticide to human health, animal health, wild life, as well as water bodies.

Table 2: Farmers' knowledge of agrochemicals risks

Level of category	Frequency	Percentage
Good knowledge(17-24)	79	65.83
Fair knowledge(9-15)	25	20.83
Poor knowledge(0-8)	16	13.34
Total	**120**	**100**

Source: Field survey, 2016

Awareness, Use and Maintenance of Personal Protective Equipment to Protect the Body

This section deals with the presentation and discussion of analysis of respondents' awareness, use and maintenance of Personal Protective Equipment (PPE) used in agrochemical application. This includes the frequency counts and percentages of respondents who are aware, use and maintain PPE as recommended. The use and adequate maintenance of prescribed PPE had become very important step to take into consideration in agrochemical use because it is a vital precaution towards freeing the human body from contacts with dangerous chemicals used for almost all farming activities against hazard during the farm operation. Table 3 shows the result of farmers' awareness, use and maintenance of PPE. From the Table, out of 60% of respondents that claimed awareness of necessity to wear prescribed protective clothing 34.17% were actually wearing protective clothing, 43.33% was aware of need to wear goggle while 23.33% were actually wearing goggles, 35.83% was aware of need to wear nose mask 15% were actually wearing nose mask

Table 3: Respondents Awareness, Use and Maintenance of Personal Protective Equipment.

	Aware	Practice
Use of Personal Protective Equipment		
Wearing prescribed protective clothing	72 (60.00)	41(34.17)
Wear goggle	52 (43.33)	28 (23.33)
Wear nose mask	43 (35.83)	18 (15.00)
Wear boots	53 (44.17)	32 (26.67)
Wear gloves	45 (37.50)	20 (16.67)
Maintenance of Personal Protective Equipment		
Wash cloth with soap immediately after use	84 (70.00)	48 (40.00)
Wash goggle	48 (40.00)	12 (10.00)
Wash boots	33 (27.50)	21 (17.50)
Wash gloves	28 (23.33)	17 (14.17)
Wash the clothing separately	21 (17.50)	15 (12.50)
Regularly replacement of worn-out PPE	29 (24.17)	18 (15.00)

Figures in bracket are percentages.
Source: Field Survey, 2016

Respondents' perception of recommended agrochemical safety precautions

This section deals with the respondents' perception of recommended agrochemical safety precautions. Table 4 shows the results of Likert rating used in evaluating the respondents' perception of recommended agrochemical safety precautions. From the Table it is evident that the respondents had a good knowledge of recommended agrochemical safety precautions as shown in their perception weighed mean scores. Out of the fifteen recommended agrochemical safety precaution practices listed in the questionnaire, the respondents agreed with twelve items and disagreed with three items. The use of right dosage was rated first with a WMS of 4.39, follow by adherence to the labeling instructions with a WMS of 4.36 while Checking that the seal and original labels have not been broken was rated third with a WMS 4.30 among others, however, observing waiting periods after chemical application was rated lowest with a WMS of 2.96, others are avoid leaving pesticides in equipment overnight with WMS of 2.98 and avoid re-using or selling of agrochemical containers also with a WMS of 2.98.

Table 4: Respondents' perception of recommended agrochemical safety precautions

Recommended agrochemical safety precautions	SA	A	U	DA	SD	WMS	Remark
A. Genuine Product							
Agrochemicals should be purchased from only authorized dealers	27	31	40	18	04	3.49	Agree
Avoid using expired/banned chemicals	32	77	10	01	00	4.17	Agree
Using the appropriate agrochemicals	39	69	10	01	01	4.20	Agree
Checking that the seal and original labels have not been broken	42	72	06	00	00	4.30	Agree
B. Health and Safety							
Follows labeling instructions	54	56	09	01	00	4.36	Agree
Using the right dosage	55	58	06	01	00	4.39	Agree
Observe waiting period	14	21	42	28	15	2.96	Disagree
Avoid leaving pesticides in equipment overnight	21	25	27	24	23	2.98	Disagree
Avoid exposure of food items to agrochemicals	31	24	23	23	19	3.21	Agree
Avoid facing wind direction when applying agrochemicals	22	33	42	12	11	3.36	Agree
Avoid eating, drinking, smoking when applying agrochemicals	38	42	26	14	00	3.87	Agree
Avoid blowing into sprayer with mouth	18	36	31	20	15	3.18	Agree
Never store agrochemicals inside room or near food stuff	26	31	32	22	09	3.36	Agree
Avoid re-using or selling of agrochemical containers	16	23	42	21	18	2.98	Disagree
Keep agrochemicals away from source of drinking water, wells, and streams	31	47	14	28	00	3.68	Agree

Source: Field Survey, 2016

Factors influencing respondents' perception of recommended agrochemical safety precautions

The result of the regression analysis used to evaluate factors influencing respondents' perception of recommended agrochemical safety precautions is as presented in Table 5. Based on statistical, econometric and economic criteria as well as a priori theoretical expectation on the sign and magnitude of the parameter estimates, the linear regression function was chosen as the lead equation out of the three estimated functions fitted to estimate factors influencing respondents' perception of recommended agrochemical safety precautions. From the Table, age of respondents ($p < 0.05$), level of education ($p < 0.01$), level of income ($p < 0.10$), membership of farmers association ($p < 0.05$), and access to extension services ($p < 0.10$) significantly influence the perception of the farmers on recommended agrochemical safety precautions. It is only the age of respondents that have negative effect on the perception scores, showing that for every unit increase in age the perception score of the respondent will reduce by 0.007 units. This might be due to the fact that increase in age often leads to difficultly in learning; therefore the farmers might find it difficult to imbibe some new instructions. As expected level of education have positive effect on the perception scores of the respondents, this implies that a year increase spent in acquiring formal education will increase perception scores 0.230 units, also a Naira increase in the income of the respondents will increase the perception score by 0.034. Membership of farmers association and access to extension services will increase the respondents perception score by 0.319 unit and 1.835 units respectively. This result further emphasized the importance of extension agents in agricultural information dissemination as access to extension service has the highest effect on the perception scores.

Table 5: Factors influencing respondents' perception of recommended agrochemical safety precautions

Variable	Coefficients	Std Error	p-value
Constant	2.173	0.1508	
Age	- 0.007**	0.0460	0.013
Gender	1.835	0.0571	0.186
Marital status	0.567	0.0324	0.144
Level of education	0.230***	0.1018	0.003
Household size	0.403	0.2607	0.241
Farm size	0.003	0.0024	0.552
Level of income	0.034*	0.5166	0.075
Farming experience	1.145	0.0791	0.352
Membership of farmers Association	0.319**	0.0378	0.028
Access to Extension Services	1.835*	0.2113	0.067
R^2	0.814		
Adj R^2	0.725		
F- value	5.373***		0.000

Source: Data Analysis, 2016

Conclusion

The research revealed that a great number of farmers in the study area had satisfactorily adopted and practiced precautionary method of agrochemical usage. Nevertheless, there are few farmers who have not been practicing safe agrochemical usage and since there must be zero tolerance for agrochemical fatalities there is the need to adopt further practical and effective interventions to eliminate agrochemical usage hazard. Government should enlighten users through extension services on the dangers associated with such agrochemical use. Government and non-governmental organization should educate users of agrochemicals on the need to strictly adhere to various recommended precautionary measures when handling agrochemicals and possible first aid treatments in case of any accident. It is therefore recommended that farmers field days should be regularly organize in collaboration with representative of manufacturers and distributors of agrochemicals to practically demonstrate the needed safety precaution practices.

Appendix 1

Potential harmful effects of Agrochemicals
Agrochemicals can cause damage to human health
Agrochemicals can cause other damages than indicated
Agrochemicals can cause damage to water bodies
Agrochemicals can cause damage to animal health
Agrochemicals can cause damage to wild life
Agrochemicals can cause environmental pollution
Agrochemicals can destabilize ecosystem
Excessive use of agrochemicals can lead to underground water contamination

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