

Pesticide-handling practices among smallholder Vegetable farmers in Oyo state, Nigeria.

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Abstract- Pesticide use among smallholder farmers in Nigeria has been associated with significant health hazards. The study evaluates the pesticide handling practices among vegetable farmers in Oyo State Nigeria. Random samples of one hundred and fifty (150) vegetable farmers were interviewed using structured questionnaire in ten selected local government areas of Oyo state Nigeria. Data obtained were subjected to descriptive and inferential statistics. Majority of the farmers (74%) suffered from at least one health symptom associated with pesticide handling. However, most of them (65.4 %) claimed to have adopted the use of at least one or two safety protective equipment during pesticide application. A good number of the smallholder vegetable farmers (58.7%) do not have access to information on safety tips about pesticide handling or training on pesticide management. Cost of protective equipment and lack of training on pesticide handling seemed to be the most significant factors that influence proper pesticide handling practices among smallholder vegetable farmers in the state. It is therefore recommended that the regulatory agencies for pesticide use in Nigeria should implement the policy that will prohibit injudicious use of pesticide and provide effective training / workshop for the small holder farmers, retailers and all pesticide workers on the safety measures of pesticide application. The study also recommended integrated pest management (IPM) approaches for continued vegetable production to minimize risks associated with pesticide usage.

IndexTerms—Smallholder farmers, Pesticide management, Safety, Protective equipment, Vegetables.

I. INTRODUCTION

Vegetables are the most important and widely cultivated food and income generating crops in many parts of Africa. They are widely cultivated by both small-scale farmers and state enterprises. They can give high yield per unit area of land and hence generate high income for the farmers (Mohammed, 2002).Vegetables are the most affordable and accessible

sources of micronutrients and its production are increasingly recognized as a means for rural development and increasing generation of foreign exchange in Africa (AVRDC, 2004). Vegetables supply components of a balance diet at a comparatively low price (Iheke, 2009).They are eaten in a variety of ways, as part of meals, minerals and snacks. The nutritional content of vegetables varies. However, they generally contain little protein, fat and varying proportions of vitamins such as Vitamins A, K and B6, pro-vitamins, dietary minerals and carbohydrates (Woodruff, 1995; Whitaker, 2001).Vegetables contain a great variety of other phytochemicals, some of which have been claimed to have antioxidant, antibacterial, antifungal, antiviral and anti-carcinogenic properties(Steinme, 1996; Gruda, 2005).

Vegetable production in the tropics is severely constrained by pests and diseases. Traditionally, Nigerian farmers have been relying heavily on pesticides for the control of various weeds, insect pests and diseases, leading to the high importation of these products and their price have become so high that it is becoming impossible for local farmers to afford (Nwanze, 1991; Schwab *et al.*, 1995; Van den Berg and Nur, 1998; Okrikata and Anaso, 2008).Pesticides assist farmers to minimize potential crop yield loss due to pests and diseases but they also pose potential hazards to human health when inappropriately handled(Ajayi and Aknnifesi, 2007).Pesticides are toxic in nature and do not differentiate between target and non-target species of plants and animals, and hence should essentially be subject to safe and judicious use. Due to noncompliant and indiscriminate use of pesticides, many accidents have occurred in different parts of the world, and presence of pesticides in foods, fruits, vegetables, and environment and even in mother's milk is a matter of great concern (FAO, 2005).

Empirical studies on pesticide spraying practices and the effects of pesticides on farmers' health in developing countries have been documented in Asia (Mancini *et al.*, 2005; Kishiet *al.*, 1995; Antle and Pingali, 1994), Africa (Ngowi *et al.*, 2007; Ajayi and Waibel, 2003; Drafor, 2003; Maumbe and Swinton, 2003; Ngowi and Partanen, 2002) and in Nigeria (Dahiru *et al.*, 2014; Asogwa and Dongo, 2009; Tijani, 2006). The implication of pesticide use and handling practices on farmers' health is particularly important in vegetable –based production systems because it is one of the major agricultural systems on which smallholder farmers' use substantial proportion of pesticides. Reports of ill health due to pesticides exposures have been documented. FAO (1998) and WHO (1986), estimate that about a million people are being poisoned by pesticides annually with 20, 000 cases resulting in death. Most of these toxicities and fatal consequences are through pesticides used by small-scale farmers without adequate knowledge acquired through formal training and failure to wear appropriate clothing (FAO, 1993; WHO, 1996).

This study was carried out to access the knowledge of pesticide use safety procedures, handling practices and health hazards among smallholder vegetable farmers in the Oyo state, Nigeria.

II. METHODOLOGY

Study Area: The study area was Oyo State Nigeria, which belongs to the Yoruba ethnic group with a total population of about 5,591,589 inhabitants (NPC, 2006). Oyo state is in latitude 8° 00' N and longitude 4° 00' E in southwestern Nigeria, West Africa. The mean annual rainfall ranges from 100mm to 1500mm (Adeola *et al.*, 2010).

Sampling procedures: A multi stage sampling technique was used to obtain the respondents for the purpose of this study. The first stage was the selection of ten local government areas namely: Afijio, Atiba, Kajola, Oluyole, Ido, Akinyele, Ibadan North West, Egbeda, Lagelu and Ona-ara. The second stage was the selection of three villages known for production of vegetable in each selected local governments. The third stage was the random selection of 5 respondents in each selected village per selected local government. A total of one hundred and fifty (150) structured questionnaires were administered.

Source of data and analytical techniques: Primary data were used for this study. These were obtained by using a well-structured questionnaire. The respondents were vegetable farmers. The data collected were on socio-economic status of the farmers, pesticide use safety, handling practices and pesticide hazards. The various data collected were subjected to

descriptive statistics such as frequency distribution, percentage and the associations between pesticide-handling practices and factors potentially influencing them were explored by inferential statistics using the SPSS version 20.

III. RESULTS

The socio-economic characteristics of the respondents:

The results of the socio economic characteristic of the respondents are shown in Table 1. Majorities (84.6%) of the respondents were within the age of 31-40 years and most of them (76.7%) were married. It also showed that (81.3%) of the respondents are male while 18.7% are female, indicating that vegetable farming in Oyo state was dominated by males. This finding corroborates earlier report by Adelani *et al.*, (2011), that Fadama farming in Oyo state were dominated by males. Fadama farming system in South West Nigeria basically involves the production of vegetables in wet lands during dry season.

The results of the educational background of the respondents showed that majority (40.7%) have no formal education, 8% have primary school education, 23.3% attended secondary school, while 28% have tertiary education. This implies that illiterates and perhaps unacquainted persons represent majority of people in vegetable cultivation in the state. These will definitely reduce the possibility of compliance with dosages and ethical practices with regards to pesticide usages. Ashburner and Friedrich, (2001) and Hayes, (1982) have earlier reported that education has a great influence on the overall behavior and the dispositions of individuals towards adoptions of agricultural related innovation. Also, 57.3% of the respondents were found to be Christians, 40.7% Muslims, while 2.0% were traditional religion practitioners. Majority (81.3%) of the farmers were small scale farmers with an average farm size of between 0.1 – 5 hectares of land, while very few (16.0%) have large farm size of 5-8 hectares and an insignificant number (2.7%) possess very large farm size of 8-10 hectares of land.

The vegetable farmers in the study area are growers of eight different vegetables namely; *Corchorus olitorius* (ewedu), *Amaranthus hybridus* (tete), *Celosia argentea* (soko), *Abelmoschus esculentus* (okra), *Telferia occidentalis* (Ugu), *Lycopersicon esculentum* (tomato) *Solanum gilo* (garden egg) and *Capsicum annum* (pepper). However, the most common vegetable grown in these areas are the leafy vegetables (*Corchorus olitorius*, *Amaranthus hybridus* and *Celosia argentea*).

Table 1: Socio-economic characteristics of respondent

Variable	Frequency	Percentage
Age		
20-30	2	1.3
31-40	127	84.6
41 and above	21	14.0
Marital status		
Married	115	76.7
Single	2	1.3
Widow	13	8.7
Divorced	11	7.3
Widower	9	6.0

Gender		
Male	122	81.3
Female	28	18.7
Education		
Primary school	12	8.0
Secondary school	35	23.3
ND/NCE	22	14.7
HND/BSc	18	12.0
No formal education	61	40.7
Religion		
Christianity	86	57.3
Islam	61	40.7
Traditional	3	2.0
Farm size		
0-5	122	81.3
5-8	24	16.0
8-10	4	2.7

Field survey, 2014

Pesticide use and method of application among 150 vegetable farmers in Oyo state Nigeria: Methods of application of pesticides adopted by vegetable farmers in the study area is shown in Table 2. The analyses show that majority (98%) of the respondents use pesticides on their farms. The method of application adopted by almost all the respondent (98%) is spraying method by dusting and fogging

method was rarely used by the vegetable farmers in all the study areas. Moreover, majority (84%) of the farmers use knapsack sprayer in applying the pesticide. However, about fifteen percent (14.7%) of the respondents use watering can to apply pesticide while only 1.3% use bucket for pesticide application.

Table 2: Pesticide use and method of application among 150 vegetable farmer in Oyo state Nigeria

Variable	Frequency	Percentage
Pesticide	147	98.0
Yes	3	2.0
No		
Method of application		
Spraying	147	98.0
Dusting	2	1.3
Fogging	1	0.7
Types of instrument		
Knapsack sprayer	126	84.0
Bucket	2	1.3
Watering can	22	14.7

Field survey, 2014

The use Personal Protective Equipment (PPE) use during pesticide handling among vegetable farmers in Oyo State: Majority (95.3%) of the respondents claimed that they use personal protective equipment during pesticide application. The personal protective equipment reportedly used by the farmers were rubber gloves (95.3%), nose guard (85.3%), overall (83.3%), cap (62.7%) and face mask (60%), while the use of other personal protective equipment (PPE) like rubber boot and long sleeves rated below 45% (Table 3). However, during the two observations in the course of the study no farmer used respiratory protection (respirator and face/dust mask), ocular protection (safety goggles), or rubber gloves. Moreover, most farmers wore rubber boots on the outside with the pants tucked into them rather than on the inside of their pants, which would effectively prevent pesticide runoffs from settling inside their boots. Short sleeved instead of long sleeved

shirts were also worn by the majority of farmers, with the chest area sometimes left open, and thereby leaving large areas of the skin (hands, arms and chest) exposed to pesticides.

Also in the course of the observation, no use of coverall was recorded which, contradicted what they claimed to adopt during pesticide handling. Some farmers said that coveralls are not necessary during application of herbicides because these are applied close to the ground. Some farmers, who were observed not to use protective gloves, said that gloves obstruct the activation of the trigger on the spray equipment (knapsack sprayer). Finally, several practices were observed to be adopted by farmers to mitigate the risk of pesticide intoxication, among which are; drinking milk before and after pesticide application and consuming/ using mud to wash hands after pesticide handling. Mud is believed to act as a sorbent for pesticide residues on the skin. The farmers also reported that they consume soil as an antidote to a suspected pesticide poisoning.

Table 3: Reported personal protective equipment use during pesticide handling among 150 vegetable farmers in Oyo State Nigeria

Protective equipment	Frequency	Percentage
Rubber gloves		
Yes	143	95.3
No	7	4.7
Nose guard		
Yes	128	85.3
No	22	14.7
Overall		
Yes	125	83.3
No	25	16.7
Long sleeves		
Yes	66	44
No	84	56
Face mask		
Yes	90	60
No	60	40
Cap		
Yes	56	37.3
No	94	63.7
Rubber boot		
Yes	61	40.7
No	89	59.3

Field survey, 2014

Health issues related to pesticide-handling: The result of the health hazards associated with pesticide handling among the vegetable farmers in the study area is shown in Table 4. One hundred and one (101) farmers corresponding to 74% of the sample reported having experienced at least one of the symptoms on occasion of pesticide handling. The most

frequently reported symptom was skin irritation, followed by dizziness. The skin irritation was due to the chemicals coming into contact with the farmer's bare skin during mixing or application. Headaches, difficult breathing and tightness in the chest, blurred vision, diarrhea and cramps were also reported by more than a half of the interviewed farmers.

Table 4: Reported Health effect associated with pesticides handling of 150 vegetable farmers in Oyo State Nigeria

Symptoms	Frequency	Percentage
Skin irritation	101	67.3
Dizziness	94	62.3
Breathing difficulty	41	27.3
Tightness in the chest	62	41.3
Cramps	20	13.5
Blurred vision	9	6
Diarrhea	61	40.7
Loss of consciousness	14	9.3
Vomiting	7	4.2
Others	14	9.3

Field survey 2014

Pesticide handling among vegetable farmers in Oyo state

The pesticide handling practices among vegetable farmers in Oyo state is shown in Table 5. The majority (94.7%) of the respondent engage in self application of pesticide to their farms. However, none of the farmers have certification for pest control and only very few (5.3%) contract pesticide application out for experts. Also respondents claimed that men are mostly involved in pesticide application. The analysis showed that (94.7%) of men are involved in pesticide application while

only 5.3% admitted that very few women were involved too. A good number of farmers claimed that they apply chemical more than once to their vegetable before harvesting; 31.3 % apply twice, 2.7 % thrice and 2.7% more than three times before harvesting of their vegetable, however, 62.7% apply only once before harvesting. This implies that vegetable farmers exposed themselves frequently to pesticide because the life span of most vegetables they produce are within 2 to 4 months

Table 5: Pesticide handling among vegetable farmers in Oyo state South west Nigeria

Variable	Frequency	Percentage
Self application		
Yes	142	94.7
No	8	5.3
People involved in application		
Men	142	94.7
Women	8	5.3
Application periods before harvesting		
Once	94	62.7
Twice	47	31.3
Thrice	4	2.7
More than three times	4	2.7

Field survey, 2014

Factors influencing pesticide-handling practices:

Farmers showed a satisfactory level of knowledge of pesticide misuse implications and the recommended safety measures. There was no coherent association between the demographic characteristics of the respondents and the use of pesticide. Age, religion and education level did not show any significant relationship with the use of pesticide, however, there was positive significant association between use of pesticide and sex ($P > 0.01$) as well as marital status($P > 0.05$) (Table 6). Similarly, there was no consistent association between the duration of exposure to chemical (duration of application of chemical) and the reported health hazards due to pesticide handling. Dizziness and difficulty in breathing

showed negative significant ($P > 0.01$) association with duration of pesticide application. Also head ache showed a negative significant ($P > 0.05$) correlation with the duration of pesticide application while other reported health hazards like; skin irritation, tightness in the chest, vomiting diarrhea and loss of consciousness showed no significant association with the duration of pesticide application (Table 7).

Education level was not associated with access to information on pesticide management and the use of some Personal Protective Equipment (PPE). However, there was a positive significant correlation ($P > 0.05$) between education level and the use of face mask among other PPE (Table 8)

Table 6: Pearson correlation between the use of pesticide and demographic factors

		Age	Marital Status	Sex	Education	Religion
Use of pesticide	Corr. variables	.089	.187*	.607**	.054	.062
	Sig.(2-tailed)	.276	.022	.000	.512	.450

*Correlation is significant at the 0.05 level (2- tailed)

**Correlation is significant at the 0.01 level (2- tailed)

Table 7: Pearson correlation between the length of exposure to pesticide and the reported health hazards

		Skin irritation	Dizziness	Diff. in Breathing	Head ache	Tightness in the chest	Cram ps	Blurred vision	Diarrhea	Loss of consciousness	Vomiting	Other symptoms
Duration of application	Corr. variables	-.112	-.268**	-.218**	-.163*	.008	-.074	-.039	-.076	.028	-.004	.061
	Sig.(2-tailed)	.171	.001	.007	.046	.926	.370	.634	.357	.734	.964	.456

*Correlation is significant at the 0.05 level (2- tailed)

**Correlation is significant at the 0.01 level (2- tailed)

Table:8. Pearson Correlation between Education level of the respondents, access to information to pesticide management and use of Personal Protective Equipment.

		Access to info.	Rubber gloves	Nose guard	Overall	Long sleeves	Facemask	Cap	Rubber boot
Education level	Corr. Variables	.124	.065	.014	-.093	-.060	-.179*	.011	-.158
	Sig.(2 tailed)	.130	.429	.862	.256	.468	.028	.892	.053

*Correlation is significant at the 0.05 level (2- tailed)

IV. DISCUSSION

The study provides insights into pesticide-handling practices and related health issues among smallholding vegetable farmers in Oyo state Nigeria. This study confirmed that there were health problems associated with pesticide-handling practices among vegetable farmers in South west Nigeria. The majority of vegetable farmers (about 74%) in the studied region suffered one or more forms of pesticide-related health symptoms. This result supports the findings by Dahiru *et al*, 2014 who reported that majority of grain merchants in Mubi grain markets of Adamawa state, Nigeria had experienced some sort of reactions due to exposures to pesticides. Tijani (2006) also reported that about 80% of both cocoa farmers and farm workers indicated that they experience discomforts such as such as headaches, tiredness vomiting, nausea, and skin problems (itching and skin burn) after spraying. Moreover, reports of ill health due to pesticides exposures have been documented which, estimates that about a million people are being poisoned by pesticides annually with 20, 000 cases resulting in death (FAO, 1998).

The hazards experienced by vegetable farmers as shown in this study indicated that most vegetable farmers in Oyo state do not engage labor in their farming activities implying that they are mostly subsistence farmers. This reflected on their response to the questionnaire where the majority (81.3%) owned a farm size of between 0.1 – 5 hectares). This implies that subsistence farmers (small holder farmers) are more prone to pesticide hazards due to self involvement with the pesticides and lack of training on the pesticide usage. This assumption support the earlier report by WHO (1996), which, reported that the largest part of pesticide toxicities and fatal consequences are through pesticides used by small-scale farmers without adequate knowledge acquired through formal training and failure to wear appropriate clothing.

The use of personal protective equipment (PPE) as claimed by the vegetable farmers in the study area did not commensurate with the health hazards they reported. Personal protective equipment reduces the applicator’s exposure to pesticides. To give effective protection, PPE should be chosen based on the information given on the pesticide label. This equipment should be able to handle the rigors of work and length of pesticide exposure. The results of this study suggest that the farmers do not use the PPE during pesticide application probably due to its cost or they do not have good knowledge of how to use the PPE they claimed to be using during pesticide application or they abuse it by not using complete kit or by not taking good precautionary measures during application. There are safety precautions that should be taken during pesticide application like avoid eating, drinking or smoking when handling pesticides among others. Moreover, the lack of safety

practices, such as wearing contaminated clothes and caps in the house hold could be a major source of exposure for other people in the household (Quandt *et al.*,2006). Similarly, Henry and Feola (2013) reported that farmers were reported to use pieces of PPE incorrectly, thus reducing their protective potentials.

In addition, farmers pay little attention to labels on pesticide containers. Also the usual habit of farmers storing pesticide not in its original container makes it impossible for them to read the related safety labels. Farmers were also observed adopting traditional intoxication mitigating measures, such as drinking milk, palm oil or coconut water. However, increasing evidence abound that drinking milk does not prevent poisoning, but may even be counterproductive in case of pesticide intoxication, as it may accelerate the take up of the chemical (NSA, 2011). According to Palis *et al.*, (2006) such traditional practices and beliefs are not uncommon in developing countries. Similarly, Asogwa and Dongo(2009) reported that most of the cocoa farmers are ignorant of the hazardous effects of pesticides and are very unlikely to buy protective clothing, especially in cases where they are scarce. In Nigeria generally, farmers do not wear any protective materials at all, no matter what pesticide is being applied (Meijden, 1998). Other precautionary measures are scarcely observed by these farmers as they are found eating, smoking or drinking in-between spraying activities(Asogwa and Dongo, 2009).Furthermore, the sales of chemical pesticide are strongly abused in Nigeria, they are seen everywhere at the nooks and cranny of both urban and rural places being hawked by non-registered dealers like consumables. These create a lot of potential danger to the environment and humans. Apart from making it readily available to uneducated farmers who do not know how to use it, they also adulterate it to make more profit. This constitute a lots of health hazards to the users and non users in the environments.

V. CONCLUSION

It can be concluded that vegetable farmers in Oyo state Nigeria, were not taking good measures in their pesticide handling practices. Therefore, efforts to increase farmers’ knowledge on pesticide use through improved training are important and should be encouraged by Nigeria Government. This alone does not offer a solution to ensure proper protection of farmers from health hazards because poor pesticides practices that exposed farmers to potential health risks cannot be attributed to lack of information alone, but on other factors such as accessibility and cost of procuring protective equipment.

In addition to strengthening farmer’s capacity on safety issues, there should be strict enforcement on the regulations on the sales of pesticides. It is also recommended that appropriate

approaches such as Integrated Pest Management (IPM), which has the potential to reduce the quantity of pesticide use and exposure to chemicals, should be adopted for vegetable production.

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