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Pesticides Handling and Risks Associated with Cassava Production in Apoje Farm Settlement: Farmers' Knowledge, Attitude and Perception

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Abstract

The study was carried out to evaluate the farmers' knowledge, attitudes and perception of the pesticides handling, application, and residue on the cassava roots produced and associated health and environmental risk exposures factors among the farmers in Apoje Farm Settlement Ogun State Southwestern Nigeria. A total of twenty-five (25) cassava root samples produced on the farm were collected and analyzed for the presence of any residues while fifty (50) farmers were randomly sampled with the administration of structured questionnaires/interviews. The results obtained showed the detections of polychlorinated biphenyl (PCB), Nitrate (NO3) and Hydrogen sulphide (H2S) with mean values of 0.01934mg/kg, 0.012564mg/kg and 0.00058mg/kg respectively that fall within the regulated limits. However, the knowledge of the farmers on pesticides handling and application are low, some cannot read the labels on the pesticides to understand the poison and hazards signs. Then, they exhibit poor attitudes and perceptions of health and environmental risks associated with the exposure to the pesticides. The majority of the farmers do not put on personal protective gadgets to prevent themselves from the exposures. The study concluded that there should be health talks organized for the farmers on the subject matter and there is an urgent need for resuscitations of farm extensions services where relevant government agencies support the local and semi-illiterates farmers given them adequate and necessary information on the handling and application of pesticides in order to reduce the risks to the farmers, the inhabitants, and the environment. Then, monitoring studies of human exposure, the soil and water bodies in the study area are required to evaluate the effects the pesticides.

Key words

Apoje Attitude, Cassava, Knowledge, Perception, Pesticides, Risks, Ogun State, Nigeria

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Introduction

Pesticides are designed to (in most cases) kill pests. However, from Business Dictionary (2016), pesticide is defined as Chemical or biological substance designed to kill or retard the growth of pests that damage or interfere with the growth of crops, shrubs, trees, timber and other vegetation desired by humans. Practically all chemical pesticides, however, are poisons and pose long-term danger to the environment and humans through their persistence in nature and body tissue. Most of the pesticides are non-specific, and may kill life forms that are harmless or useful (WebFinanceInc, 2016).

Though, according to many sources, there are positive effects and advantages of using pesticides, where human and the environment actually benefits from the direct or indirect results of pesticide application (My Garden Blog, 2016), modern agriculture has been considerably transformed due to the use of pesticides. Pests destroy about a half of potential food supply in the world and Pesticides play an important role in the control of these pests and Protection of the environment against weeds (Smith, 2012). Furthermore, one of the major advantages of pesticide use is that they kill pests faster than other pest control methods. This is because pesticides are specifically formulated chemicals

that target certain pests. Once administered in a crop that has been invaded by the pest, pesticides start working immediately by affecting the normal biological functions of the organs of the insect.

However, unfortunately, the pesticides applications for agricultural activities (crop production) have adverse human and environmental impacts. For instance, pesticides have negative impact of chemical pollution. An insecticide or herbicide may be designed to have a short-lived effect. However, studies have shown that residues are found in the atmosphere, waterways, and the ground (My Garden Blog, 2016). Over time, as people keep on using synthetic chemical substances, the environment accumulates the residues that later on become pollutants; that affect soil health, accumulation of the pesticides residual in the produced food. According to what are we the Project (2012), pesticides are detrimental for the environment and produce considerable damage to ecosystems. Insecticides and herbicides may be harmful for non-target species. Pesticides pollute air, water and soil. Carried by the wind, pesticide suspensions contaminate other areas. Pesticides affect considerably natural biological equilibrium. Pesticides diminish biodiversity, reduce nitrogen fixation, contribute to the disappearance of pollinators, threaten fish, and destroy bird and animal habitats. Pets may also become affected by strong pesticides (What are we the Project, 2012).

Then, from the point of environmental health and public health, the pesticide applications can be issues because soil, air and water bodies can easily be contaminated with these pesticides when they accumulated (PAN-UK, 2016) and from the perspective of environmental health, food is another medium like water, air, soil that diseases, substances and materials can be transmitted or exchanged within human (Crentsil- Kofi, Archibold, Dzifa, Asomaning, & Osei Tutu, 2011).

Consequently, food safety is a major public concern worldwide. During the last decades, the increasing demand of food safety has stimulated research regarding the risk associated with consumption of fruit and vegetables as they constitute major part of human diet contributing nutrients and vitamins. Therefore, residues of pesticides could affect the ultimate consumers especially when these commodities are freshly consumed. The total dietary intake of pesticides residues that remain on agricultural commodities are known as carcinogens/or toxins and therefore it is desirable to reduce these residues (Zawiyah et al., 2007) cited in (Abdulhamid, Bolanle, Agbaji, Gimba, & Agbaji, 2015).

More so, farmers using pesticides can face a lot of risks from consumption of the crop and exposure to the pesticides even the populace that consumed such crops produced with application of pesticides. The exposure is possible due to lack of adequate personal protective equipments/gadgets and the lack of awareness of potential risks associated with poor pesticides handling among the farmers, which can create more problems for the farmers and the negative impacts can also be felt on the environment. There is need to evaluate the farmers activities on pesticides application and potential risks facing them. Then create awareness among the farmers and the study can serve as a tool for monitoring the level of risks exposure to the crops, residents and environment in the study area Apoje Farm Settlement Southwestern Ogun State. Based on the aforementioned, the study focused on the pesticides management used for cultivation of cassava and the Farmers knowledge, attitudes and perception on health and environmental risks constituted by the pesticides residual and exposure as results of cassava cultivations in the study area the Apoje Farm Settlement.

Broad Objective: The study evaluated the pesticides handling, application and residue on the cassava (roots) crops produced and associated health and environmental risk exposures factors among the farmers in Apoje Farm Settlement Ogun State Southwestern Nigeria.

Specific Objectives: The following specific objectives were addressed during the study:

- To determine the presence of the pesticides residue in the cassava roots produced at the Apoje Farm Settlement.
- To determine the knowledge, attitude and perception of the farmers on risk associated with the usage of pesticides during the production of the cassava roots.

MATERIALS AND METHODS

The study employed both analytical methodologies and descriptive study. The materials and methods for the study determined the presences of pesticide residues in the cassava root samples produced in the study area and then the knowledge, attitudes and perception of the farmers on the subject matters- the risks associated with the pesticides exposures, handling of the pesticides contents and disposal of the empty containers and application practices among others were determined through survey.

The Study Site

The study site Apoje Farm Settlement is located within Ijebu North Local Government of Ogun State sharing a boundary with Ondo State. Apoje, one of the eight farm settlements established during the Obafemi Awolowo premiership in the defunct Western Region, The oil palm settlement, occupying 8,500 hectares, is situated in the Ijebu North Local Government Area about 13km from Ijebu-Igbo the headquarter of the local government area (6°57′N

4°00'E.). Apart from vast land consist of palm plantation, citrus, the residents still engage in cultivation of other food crops and engage in fishing activities.

The Study Design

The study adopted two research methods- (1) cross sectional descriptive study design where the study were carried out among cassava farmers during preparation for the cultivation of the crops around April 2015 for observation purpose during application of pesticide and harvesting of the crops in the month of March 2016 .(Adopted from Oesterlund , *et al*., 2014). Then, the farmers were interviewed to gather information on their knowledge, attitudes and perception on risk exposure to pesticides (2) Laboratory analysis of cassava samples collected and prepared for analysis, in order to determine any presence of pesticide residues, the laboratory work involved, clean, extraction, determination and confirmation of the pesticides residues in the collected cassava tube samples.

Two research instruments were employed for the study:

(1) Interview/Questionnaire used for gathering information on the knowledge, perception and attitudes of farmers on pesticides usage and risks exposure. The survey involved interviewing of the illiterates farmers and administration of questionnaires to the literate farmers.

Procedures Sampling Procedure for Interview/Questionnaire Administration and Data Collection

The sampling procedure techniques used for the study was simple random sampling techniques. It involved meeting farmers at the farm sites and their homes and administered with copies of structured questionnaires or the interviews were carried out among those who were illiterate respondents. The sample sizes for the study was 50 consisting of respondents both male and female farmers due to low population of the residents in the farm settlement.

The following questions were raised to extract information from the respondents on the subject matter-(a) which chemicals are being used to control the cassava pests?, (b) How much pesticide do you use for your farm?, (c) do you observe spraying practices by wearing gloves, mouth and nose guard?, (d) do you observe the proper storage of pesticides and disposal of empty containers?(, e) do you recognize signs and symptoms of poison and hazards on the pesticides containers?, and (f) when you buy the pesticides were you taught how to measure and apply them ? (g) Will you agree that wrong application of the pesticides can affect human health? Then six statements were raised so that the farmers can reveal their level of agreement or disagreement.

(2) Gas Chromatography spectrometry used for the analysis of pesticides residues in the cassava samples

The procedures that adopted for the analysis of the cassava samples involved

- Homogenization of samples,
- Extraction of the samples into a suitable organic solvent,
- Clean-up of the solvent extract using chromatographic techniques, and
- Analysis of the cleaned up extract with detectors and GC-mass spectrometry.

[DAFR Department of Agriculture, Food and Rural Development (2001)]

Procedure for Data Analysis

Data obtained collected during were organized and analyzed using descriptive statistics. Chart were used to display the values of presence of pesticides residues in the cassava samples and the responses of the farmers analyzed to determine the health risks exposure.

RESULTS AND DISCUSSION

This section contains the results obtained from the field work and laboratory analysis and their interpretation

Results of Laboratory Detection of the Residues

The laboratory analysis showed presences of different level of residues polychlorinated biphenyl (PCB) residues in different twenty five samples of cassava tubers ranging between 0.01931 mg/kg -0.01937 mg/kg. Other residues indentified were Nitrate **(**NO_3) with the values between 0.01252(mg/Kg) - 0.01260 (mg/Kg) and Hydrogen Sulphide (H_2S) having the values between 0.00052 (mg/Kg)-0.00061(mg/Kg).

Results of Field Survey Analysis

Demographics Characteristics of the Respondents (farmers)

Sex Distribution of the Respondents

Table 1: Sex Distribution of the Respondents

	No of Respondents	Percentages %
Male	45	90
Female	5	10
Total	50	100

The sex distribution of the surveyed farmers was forty five (45) male and five (5) female respondents.

Age Distribution of the Respondents

Table 2: Age Distribution of the Respondents

Age Group	No of Respondents	Percentages %
1-30	2	4
31-60	40	80
61-above	8	16
Total	50	100

The age of majority of the respondents, forty (40) lies between 31-60 years, followed by the farmers (eight) with age above sixty one (61) and those farmers within age range of 1-30 years was two (2).

Educational/Qualification Distribution of the Respondents

Table 3: Educational/Qualification distribution of the respondents

	No of Respondents	Percentages %
Primary	15	30
Secondary	27	54
Tertiary	8	16
Total	50	100

The results showed in the table 3 above, indicated that respondents with tertiary qualifications were least 8 (16%), followed by 15 (30%) respondents with primary leaving certificates and the rest of the respondents 27 (54%) had secondary school certificates. With the results, relatively the level of education is low among the farmers.

Respondents Years of Farming Experiences

Table 4: Years of Farming of the respondents

No of Years	No of Respondents	Percentages %
1-3	6	12
4-6	24	24
7-above	32	64
Total	50	100

However, responses on the numbers year of farming experiences showed that 32 (64%) respondents have spent 7 years and above, 12 (24%) of the respondents have spent between 4-6 years in farming while 6 (12%) have between 1-3 years experiences.

Responses on the Knowledge of Pesticides Applications and Handling

Table 5: Showing the respondents Knowledge of Pesticides Applications and Handling

Questions		**Yes**	**No**
1	Do you know the various pesticides available for cassava pests' control?	32	18
2	Do you know how much of pesticides you use for your farm?	23	27
3	Do you wear Personal Protective Equipments like gloves, mouth and nose guard	10	40
4	Can you recognize signs and symptoms of poisoning on the pesticides containers?	4	46
5	Do you receive any instruction on how to handle, measure and the pesticides at the points of sale or by extension workers?	0	50
6	Do you properly dispose of the empty pesticides containers after use?	4	46

The table 5 contains the responses on the risk factors and pesticides occupational exposure among the farmers. From the farmers' responses, thirty two (32) were aware of the pesticides used to control cassava pests while eighteen (18) not aware of the pesticides, while twenty three (23) out fifty (50) farmers had knowledge of how much pesticides

needed or required for particular acres/hectares of farms used for cassava production. Unfortunately, ten (10) of the farmers do sometimes wear personal protective equipments (PPE) for respiratory protection, head wear, eye wear, gloves to prevent exposure to the pesticides during preparation and application of the pesticides while the rest forty (40) farmers responded not to wear PPE when preparing and spraying the pesticides.

The results on the exposure risk factors indicated that four (4) of the farmers can recognize signs of poison and caution on the pesticides containers and the rest forty six (46) do not aware or care to about the poison and cautions sign on the pesticides containers. Then, the potential exposures of the farmers will be high because none of the farmers surveyed do receive an instruction on how to handle the pesticides from the buyers or the extension workers, the farmers rely on other colleagues knowledge.

Furthermore, the improper disposal of empty pesticides containers after use is common among the farmers, where only four (4) farmers believed they properly disposed off the empty pesticides containers after use while forty six (46) do not care about the proper disposal of the used pesticide containers.

The Knowledge, Perception and Attitude of the Farmers on risk associated with usage of Pesticides

The table 6 below showed responses of the farmers' knowledge, perception and attitudes toward usage of pesticides and their understanding how to reduce health and environmental risks associated with exposure to pesticides. In the first case, the majority of the farmers do not believed that application of pesticides through poor spraying behaviours can results to health and environmental risks, thirty six (36) and eight (8) disagreed and strongly disagreed respectively that poor spraying behaviours can result to health and environmental risks. It was only two (2) respondents that agreed that the spraying of pesticides can result to health and environmental risk and hazards.

Table 6: The Farmers Knowledge, Perception and Attitude on risks associated with the pesticides usage

	Statements	SA	A	D	SD
A	The spraying practices among the farmers can result to health and environmental risks	-	6	36	8
B	The storage methods of the pesticides and improper disposal of empty containers can result to health and environmental risks	-	3	39	8
C	Recognition of signs and symptoms of poisoning on the labels of pesticides can reduce the health and environmental risks	-	3	41	6
D	The high volume and frequency of pesticides use can results to health and environmental risks	-	10	35	5
E	The training and extension services on pesticides handling for the farmers can reduce health and environmental risks	8	-	32	8

Furthermore, There was no respondent that strongly agreed that proper storage of the pesticides and disposal of empty containers are risky and hazardous, three (3) agreed that storage of pesticides and improper empty containers can result to health and environmental while thirty nine (39) disagree and nine (9) strongly disagreed that improper storage and disposal of empty pesticides container can constitute health and environmental risks.

On the issue of understanding of pesticides labels that indicate that the pesticides are poisonous/hazardous and required proper and careful handling as a means to reduce exposure risks indicated that it was only three (3) that agreed that by understanding the labels on the pesticides containers can reduce the risk and hazard while forty one (41) disagreed and six (6) strongly disagreed respectively understand otherwise or do not understand the need for recognition of hazardous labels on the pesticides containers

The responses on effects of high volume and frequency of pesticides application on the human health and environment indicated that Ten (10) of the respondents agreed that too much and frequent uses of the pesticides can negatively affect human health and environment while majority thirty five (35) and five (5) disagreed and strongly disagreed that too much and frequent application of pesticides can results to health and environmental risks.

Finally, on the knowledge, attitude and perception of the farmers on pesticides usage, the results showed that eight (8) strongly agreed that the training and extension services on pesticides handling for the farmers can reduce health and environmental risks. Unfortunately, thirty two (32) disagreed that the training and extension services on pesticides handling for the farmers can reduce health and environmental risks and the rest eight (8) strongly disagreed too.

DISCUSSION OF THE RESULTS

The study showed that the detected levels of polychlorinated biphenyl (PCB), Nitrate (NO_3) and Hydrogen sulphide (H_2S) with mean values of 0.01934mg/kg, 0.012564mg/kg and 0.00058mg/kg respectively. Presently, the residues levels detected do not exceeded the standards requirements according to FAO/WHO guidelines for Organochlorine Pesticides.

However, there is need to monitor the level of the residues and make efforts to reduce the levels and not allow the residue to increase not only in the produced cassava but other crops. This is because, apart from presence of high concentration of pesticides residues in crops, the health of the farmers can be threatened due to exposure, then the residues can be toxic to aquatic organisms like fish, in water bodies around the farm settlement and the environment (Bordajandi, L R, Goä Mez,G, Abad, E,. Rivera, J, Fernaä Ndez-Bastoä , M.N, Blasco, J, & Gonzaä Lez, M J, 2004). As the level increases, that would warrant concerns for direct, lethal effects on aquatic organisms, because of the introduction of the residues into the food chain and ecosystem (FAO, 1985), (Virginia Polytechnic Institute and State University, 2009). Furthermore, pesticides residues can also after environment and human; despite the efficiency pesticides in agriculture and public health, their use is usually accompanied with deleterious environmental and public health effects, because pesticides are usually capable of harming all forms of life other than the targeted pest species (Tano, 2011).

However, the knowledge of the farmers on pesticides handling and application are low, some cannot read the labels on the pesticides to understand the poison and hazards signs. Then, they exhibit poor attitudes and perceptions on health and environmental risks associated with the exposure to the pesticides. Majority of the farmers do not put on personal protective gargets to prevent them from the exposure. The situations and results of the study supported by the work of the Oesterlund , *et al*.,(2014). Furthermore, they do not properly dispose the empty pesticide containers after use; couple with none wearing of personal protective equipment/gadgets will expose the farmers to various health hazards and diseases as supported by previous studies like (Al-Zain & Jihad, 2014) and (Damalas & Koutroubas, 2016). For instance, most illiterate farmers didn't use protection tools during using pesticides and vegetable harvesting. Moreover, they overuse, misuse, and neither aware of safe handling nor proper disposal of empty containers and unfortunately, pesticide-related health symptoms (Dizziness, Breathlessness, headache, Cough and Nausea) were observed among the Palestine farmers (Al-Zain & Jihad, 2014) and other hands, .farmers' exposure to pesticides can be reduced through less use of pesticides and through the correct use of the appropriate type of personal protective equipment in all stages of pesticide handling (Damalas & Koutroubas, 2016) unfortunately the situation was otherwise in the study area.

CONCLUSION AND RECOMMENDATIONS

The study concluded that pesticides that used for cassava production leave behind traces of the residues in the cassava crop that will be consumed by the people, and when the level of the residues not monitor, the levels might increase over time. However, not only that the increased level affecting the consumers both the human and animals, but nearby water bodies, soil, and air other bodies can easily be contaminated with the pesticides residues and during rainy season the run-off and infiltration can be encouraged and the residues end up in the surface water bodies and the groundwater systems. Based on the results of the study here are the recommendations:

- When applying pesticides, the use of protective gadgets during application should be enforced to reduce the risk of exposures and creation of awareness of potential risks and hazards among the farmers which will consequently reduce any short and long term problems for the farmers and the impact of the residues on the environment.
- There is should be resuscitations of farm extensions services where the relevant government agency actively support the local and semi-illiterates farmers given them adequate and necessary information on the application of pesticides and how to reduce the potential risk and hazards on the heath of the farmers and the inhabitants and the environment.

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