DECLARATION

I, VICTOR-SUNDAY SAMUEL, hereby declare that this project work is entirely my own work and has not been submitted to any other university or higher education institution, or for any other academic award in this university.

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Victor-Sunday, Samuel
(Matric No: AEE/2/0440)

04-12-2017

Date

CERTIFICATION

This research project written by VICTOR-SUNDAY, SAMUEL has been read, approved and adjudged to meet part of the requirements for the award of Bachelor of Agriculture (B. Agric.) Degree in Agricultural Economics and Extension of Federal University Oye-Ekiti, Ekiti state, Nigeria.

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Dr S.I. Ogunjimi (Supervisor)

4/12/2017

Date

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Prof. O.B. Adeniji. (H.O.D)

04-12-2017

Date

Dedication

This project is dedicated to the one and only true God, the master of the universe, the God of all flesh, the Father of all spirits and my mother, my precious jewel.

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ABSTRACT

The study assessed the compliance of Amaranth farmers with non-usage of banned agrochemicals in the selected Local Government Areas of Ekiti State, Nigeria. Multi-stage sampling procedure was used to select one hundred and twenty farmers from the selected Local Government Areas of Ekiti state. The average age of the farmers was 41years with majority (81.7%) as males. They had an average year of schooling as approximately 10years with an average annual income of 212,000 Naira. In addition, majority of the amaranth farmers (99.2%) were aware that some agrochemicals have been banned. Moreover, 85 percent of the Amaranth farmers obtained information on the use of agrochemicals from sales agents (agrochemicals retailers), 77.5 percent from fellow farmers and 32.5 percent from Extension workers. Consequently, all the respondents indicated that they were using agrochemicals for the production of Amaranth and they also indicated that they still used some of the banned chemicals as 87 percent still use Gammalin, (gamma-hexachlorocyclohexane) 17 percent still use DDT (dichloro-diphenyl-trichloroethane) and 16 percent still use Aldrex due to their effectiveness in the control of pest and diseases (98%), inexpensive (66%), availability in market (59%) and advice from sales agent (58%). The findings revealed that Amaranth farmers have low compliance to non-usage of banned agrochemicals and therefore recommended that there should be adequate registration of all approved agrochemicals as well as educating the amaranth farmers of the state.

Keywords: Amaranth, Banned agrochemicals, Gammalin, DDT, Aldrex.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Farmers are people that engage in agricultural activities in which they raise plants and animals for use as raw materials in industries and man's benefit. Nevertheless, one of the major farm inputs in agriculture is agrochemicals, which can be defined simply as any substance which is used to control pests and diseases at any stage in crop production, storage or transportation (Bateman, 2010). Amaranthus is a genus of the family *Amaranthaceae. Amaranthus species* (Amaranth) are the most commonly grown leafy vegetable of the lowland tropics in Asia and Africa (Schipper, 2000; Adeniji, 2015). Good productivity in *Amaranthus* however require optimum conditions which include judicious use of inputs such as fertilizers and pesticides (Adeniji, 2015).

Amaranth production in Nigeria has been on-going for decades providing employment and income for the increasing population especially during the long dry seasons of November-March. Leafy Amaranths are an important feature of Nigerian's diet that an average traditional man without it is assumed to be incomplete. Unfortunately, the consumption of Amaranth in Nigeria is lower than Food and Agricultural Organization (FAO) recommendation of 75kg per year (206g per day per capita) (Badmus and Yekinni, 2011.)

Interestingly, Amaranth farmers use a wide range of agrochemicals at different levels to reduce loss of farm produce to pest and diseases but the agrochemicals they use are mostly synthetic organic chemicals that can act by interfering with a vital metabolic process in the organism to which they are targeted (Mathur, et. al., 2005).

Despite the contribution of agrochemicals to agricultural production, evidences in the last few decades have shown that they could also be detrimental to human health and the ecosystem

(Tadesse and Asferachew, 2008). In addition, some of the agrochemicals have been banned for a variety of reasons such as "high acute toxicity", "possible carcinogen", "long residual effects", and "reproductive and fetotoxic effects". (Oluwafemi et al, 2009).

Government agencies such as National Environmental Standards and Regulations Enforcement Agency (NESREA), Federal Environmental Protection Agency (FEPA), National Agency for Foods and Drugs Control (NAFDAC), the Cocoa Research Institute of Nigeria (CRIN), the Nigeria Stored Products Research Institute (NSPRI), etc, are at the forefront of translating research findings to regulations and communicating these to the nation through various workshops. There are also private organizations such as the Pest Control Association of Nigeria (PECAN) and the West African Agricultural and Productivity Programme (WAAPP-Nigeria) working to ensure safe use of pesticides in Nigeria (Ojo, 2016).

Consequently, the National Agency for Food, Drug Administration and Control (NAFDAC) has banned the sale and supply of 30 different agrochemical products in Nigeria due to food poisoning in Cross-River State of Nigeria. (Inalegwu, 2008)

The laboratory analysis of the food substances in the situation explained that the food stuffs contained outrageously high levels of *lindane,* an organochlorinated pesticide commonly called *Gammalin* that affects the nervous system, producing a range of symptoms such as nausea, vomiting, headaches, dizziness to convulsion, to death. (Inalegwu, 2008)

As a result of this incident, NAFDAC banned 30 agrochemicals in Nigeria which includes: *Aldrex, binapacryl, captafol, lindane, chlordane, DDT* (dichloro-diphenyl-trichloroethane), *dieldrin, heptachlor, parathion, toxaphene, dinoseb, chlorobenzilate, endrin, ethylene oxide, phosphamidon, monocroptophos, ethylene dichloride, methamidophos, delta HCH,* etc.

Nevertheless, in view of the adverse environmental effects from the unsafe use of banned agrochemicals and ignorance to adverse health consequences of banned agrochemicals by some farmers, it therefore becomes imperative to identify farmers' pest management practices for Amaranth production by investigating farmers' awareness and perception towards the use of banned agrochemicals and its effect on man and the environment.

1.2 Statement of Research Problem:

According to Adeniji (2015) there are no practical reasons why Nigeria should not be self sufficient in vegetable production to meet her local food demand. However, the incidence of pests and diseases poses serious threat to vegetable production and these two problems have been the major impediments to the goal of our realization of self-sufficiency in vegetable production. Therefore, farmers are practicing chemical control methods employing the use of agrochemicals of which most of them might have been banned.

Due to the situation above, this research work will be providing answers to the following questions:

i. do the farmers use agrochemicals for their production and misuse them in terms of quantity applied or in dangerous combinations?
ii. are they aware of the banned agrochemicals?
iii. do they use banned agrochemicals unsafely in terms of lack of attention to safety precautions given by the label, use of faulty equipments and lack of appropriate clothing during handling of the agrochemicals?
iv. or are reluctance to the non-usage of banned agrochemicals?
v. are they aware of the health implications of the use of banned agrochemicals due to their reluctance to non-usage of banned agrochemicals?
vi. do they practice precautionary measures during the use of banned agrochemicals?

1.3 Basic assumptions

To establish the basis for the research questions and the objectives of this study, the following assumptions were made:

1. the farmers still use any available agrochemical for amaranth production.
2. the farmers have information that declares some agrochemicals banned/hazardous to use for amaranth production.
3. there are certain habits that farmers exhibit during the use of banned agrochemicals.
4. the socioeconomic characteristics of farmers usually affect the habit adopted by the farmers during the usage of agrochemicals.
5. there are always health hazards associated with the use of banned agrochemicals.

1.4 Objectives

The overall objective of this study is to assess the compliance of amaranth farmers with the non-usage of banned agrochemicals in Ekiti State, Nigeria while the specific objectives will be to:

- describe the socioeconomic characteristics of the farmers in the study area,
- determine the farmers' awareness of banned agrochemicals,
- evaluate farmers perception towards the use of banned agrochemicals,
- determine the probable effect of the use of banned agrochemical on the farmers' health,
- determine the farmers' opinion on precautionary measures.

1.5 Hypotheses of the study

Hypothesis I

There is no significant relationship between the farmers' socio-economic characteristics and compliance with non-usage of the banned agrochemicals in the study area.

Hypothesis II

There is no significant relationship between farmers' perception towards the use of banned agrochemicals and compliance with non-usage of the banned agrochemicals in the study area.

Hypothesis III

There is no significant relationship between effects of the use of banned agrochemical on the farmers' health and their compliance with non-usage of the banned agrochemicals by the farmers in the study area.

CHAPTER TWO

BRIEF LITERATURE REVIEW

This chapter will reveal the contributions of other scholars to the use and effects of agrochemicals as well as the implications and consequences of the actions of farmers with respect to usage of agrochemicals. The brief literature review for this study focuses on:

1. Amaranth production in Nigeria
2. Pests and diseases of Amaranths in Nigeria
3. Use of agrochemicals
4. Hazard level of agrochemicals

2.1 Amaranth production Nigeria

In Nigeria, vegetable production is as old as agriculture since most of the vegetables are native to Nigeria. (Ibeawuchi, et. al., 2015) which includes: onions, tomatoes, okra, pepper, Amaranth, carrot, melon, *Corchorus olitorus* (ewedu), *Hibiscus sabdariffa* (sobo), *Adansonia digtata (*baobab leaves*)*.

Amaranth is believed to have originated from central and south America (Gimplinger, et. al., 2007) where it has been cultivated for more than 6,000 years (Yarger, 2008). It has now become cosmopolitan, spreading to and becoming established in Africa, Asia, parts of Europe and South America (Yarger, 2008)

In Africa, Nigeria is the largest producer and consumer of Amaranth followed by Ghana, Benin Republic, and Senegal in West Africa. (Smith, et. al., 2007)

Amaranth popularly known as spinach is a leafy vegetable grown in sub-Saharan African countries (Alam, et. al., 2015). It is unique among all other vegetables in terms of short

duration of maturity, profitability and can be easily cultivated on small areas. (Olujide and Oladele, 2007)

For example, Amaranth is widely grown for subsistence purpose and it offers a significant opportunity for poor household to generate income which in-turn engages relatively higher youth labour in farming operations (Emokoro, et. al., 2007)

The vegetable can be produced all year round depending on the availability of water. In Nigeria, it is being produced near a low lying area (FADAMA) where there are some available sources of water for irrigation (Alam, et. al., 2015)

Despite the effort being made by the government to boost food production and security in the country, the reverse is the case: as the vegetable rapidly increase, the demand for vegetables has also continued to rise over. In addition, increase in vegetable production is necessary because it has a great potential to play a crucial role in contributing to food and nutritional security, income generation, poverty alleviation and socio-economic growth of Nigerians (Habwe, et. al., 2008)

2.2 Pests and Diseases of Amaranth

One of the greatest limiting factors in increasing the productivity of Amaranth is the range of insect pest with which they are associated and the level of losses suffered in unimproved and improved agriculture (Banjo, 2007)

Aderolu, et. al., (2013) indicated insects of various order namely: Coleoptera, Hemiptera, Lepidoptera and Orthoptera. Lepidopterous insect pests of Amaranth includes: *Psara bipunctalis, Sylepta derogate* (Okunlola, et. al., 2008) as well as *Hymenia recurvalis, Helicoverpa aemigera* and *Spodoptera litura* (Ebert, et. al., 2011)

Furthermore, the publication by Tamil Nada Agricultural University, Coimbatore, India, on 'Insect Pests of Amaranth' recorded that leaf caterpillar, *Hymenia recurvalis* and *Psara basalis* are the most important pest of Amaranth.

The Beetworm Moth, *Hymenia recurvalis* Fab. (Lepidoptera: Pyralidae) causes several loss to Amaranth. The caterpillar rolls the leaves into distinctive leaf shelter and voraciously feed on the green matter. Severe attack results in complete skeletonisation and drying-up of the leaves within a short time (James, et. al., 2010)

Wet rot or Stem rot caused by the fungus *Choanephora cucurbitarum* is the main disease of Amaranth. It is favoured by wet condition, poor soil fertility, and high nitrogen doses (Grubben, 2004)

Damping-off caused by *Pythium aphanidermatum* and *Rhizoctonia* is often serious in seed beds. White rust caused by *Albugo candida is also reported.* Alternaria leaf spot have been reported from Tanzania. No virus diseases have been reported (Grubben, 2004)

2.3 Use of Agrochemicals

The management of pests and diseases of Amaranth in Nigeria has been by the use of agrochemicals. (Alam, et, al., 2015).

Some of the problems associated with approved agrochemicals are scarcity and high cost thereby making them beyond the reach of local farmers (Adefila, 2013)

The inappropriate use of agrochemicals have been observed more in rural areas of developing countries (Williamson, 2003; PAN AP, 2010)

Banned chemicals are common in local markets, utilized in various locations and are considered as potential threat to the environment and health of the people (PAN AP, 2010)

Dales, 1996 noted that the use of agrochemical pose health risks and result in environment pollution. Also, Schmutterer, 2002 reported that the world Health Organization (WHO) had reported the poisoning of at least 3 million agricultural workers from which 20,000 deaths are recorded annually due to agrochemicals usage.

The efforts towards addressing agrochemical poisoning in developing countries have led to the adoption of the International Code of Conduct on the distribution and use of agrochemicals (FAO, 2002).

As stated in this code among others, it was 'designed for use within the context of national legislation as a basis whereby government authorities, agrochemical manufacturers, those engaged in trades and any citizen concerned may judge whether their proposed actions and the actions of others constitute acceptable practice'. Adoption of the code made the Food and Agricultural Organization of the United Nations (FAO) renew its commitment by banning highly hazardous pesticides (FAO/COAG, 2007)

Major factors affecting control of agrochemicals in circulation are weak regulations on importation and use of dangerous chemicals and the inactivity or absence of control agencies at the international body (Tijani, 2006)

The National Agency for Food, Drug Administration and Control (NAFDAC) has banned the use of 30 agrochemicals in Nigeria. (NLIP, 2008)

2.4 Hazard Level of Agrochemicals

Most of the agrochemicals used by farmers are toxic and they have been classified by World Health Organization (1992) as 'Highly Hazardous and Moderately Hazardous'

Table 1: Classification of some agrochemicals according to their hazardous level by World Health Organization (WHO)

Agrochemical Group	Trade name/ Common name	Active ingredient	Chemical group of active ingredient	W.H.O. classification of toxicity	Hazard to man
Insecticide	Aldrex	Aldrine	Organochlorine	Highly hazardous	Harmful
	DDT (also a rodenticide)	DDT	Organochlorine	Moderately hazardous	Harmful
	Gamma-BCH (Gammalin) (also a rodenticide)	Lindane	Organochlorine	Moderately hazardous	Extremely harmful
	Nogos (also an acaricide)	Dichlorous	Organophosphate	Highly hazardous	Extremely harmful
Herbicides	Atranex	Atrazine	Triazine derivative	Slightly hazardous	Harmful
Fungicides	Fernasan	Thriam	Dithiocarbamate	Slightly hazardous	Extremely harmful

Source: World Health Organization (1992)

CHAPTER THREE

METHODOLOGY

3.1 Study Area: The study was conducted in Ekiti State, southwestern Nigeria, which is largely an agriculture-based state in the country.

The state is located at latitude 7° 40'N and longitude 5° 15'E and is mainly an upland zone (250 metres above sea level) It lies south of Kwara and Kogi States, east of Osun State and bounded by Ondo State in the east and south (EKSG, 1997).

The area is underlain by metamorphic rocks and has a generally undulating land surface. The state enjoys a tropical climate with two distinct seasons: rainy season (April to October) and dry season (November to March).

The temperature ranges from 21°C to 28°C, with high humidity. South-westerly and north-easterly winds blow in the rainy and dry seasons, respectively. Tropical forest exists in the southern part of the state, while guinea savannah occupies the northern peripheries.

Agriculture is the predominant occupation of the people in Ekiti state. Their major produce includes: yam, cassava, cocoyam, cocoa, Amaranth, kola nut, orange (and other citrus), oil palm, maize, rice, sweet potato, etc. People also engage in trading and manufacturing of goods such as textiles, pottery, bricks, mats and footwear.

3.2 Sampling and Sampling Procedure

Amaranth farmers were interviewed for the study. Multi-stage sampling procedure was used to select the respondents in the study area and the sample size was 120 respondents.

The first stage involved a purposeful sampling of three main Amaranth producing Local Government Areas from the sixteen (16) Local Government Areas of Ekiti state, which were

Ikole, Ijero and Ekiti-West Local Government Areas, base on crop production data from the Agricultural Development Programme (ADP).

At the second stage, four communities were randomly selected from the Local Government Areas respectively, giving a total of 12 communities.

The Third and final stage involved snow-ball sampling of 10 respondents from each of the communities to give a total sample size of 120 respondents in all.

3.3 Data collection

Data were collected from two sources, that is, primary and secondary sources. Secondary data were extracted from related documented information, while primary data were collected directly from Amaranth farmers through personal interview, between April and June, 2017 with the aid of a structured questionnaire designed to obtain information on socio-economic characteristics of the farmers, the farmers' awareness of banned agro-chemicals, usage of banned agrochemicals, farmers' reasons for continuous usage of the banned agrochemicals, farmers' knowledge of hazardous level of banned agrochemicals, farmers' perception towards the use of banned agrochemicals, farmers' opinion on precautionary measures, and probable effects of use of banned agrochemicals on the farmers' health.

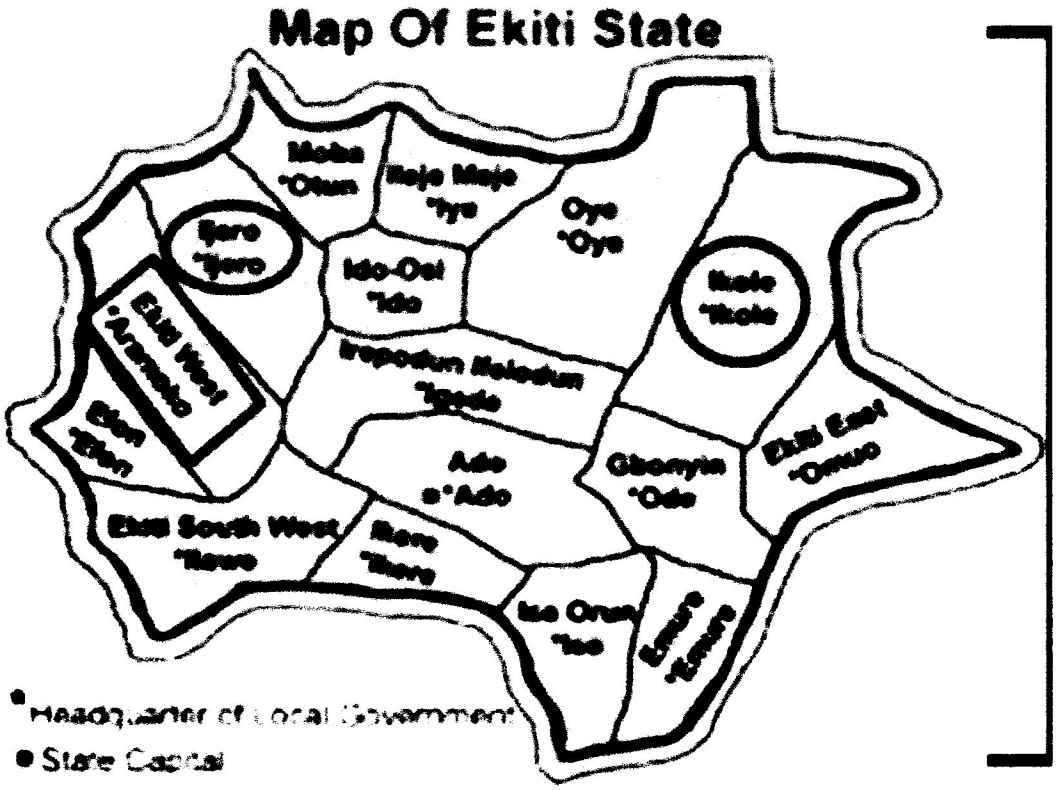

Fig 1: Map of Ekiti state showing Local Government Areas.

3.4 Measurement of variables

Dependent Variables

The dependent variable of the study was the compliance of the Amaranth farmers with non-usage of banned agrochemicals. The responses of the farmers were scored: Very Often, Often, Rarely and Never as 1, 2, 3 and 4 respectively. The possible maximum score was 12 and the minimum score was 4. The compliance level was calculated as High or Low using the Grand Mean.

Independent Variables

They are the variables that involved direct measurements such as age of the farmers, sex, family size, level of education, farm size, annual income, farmers' external orientation, participation in social organizations, source of information and training, usage of agrochemicals, awareness of banned agrochemicals, knowledge of hazardous level of banned agrochemicals, perception of Amaranth farmers towards the usage of banned agrochemicals, reasons for continuous usage, precautionary measures adopted during use and probable health hazards experienced after usage of banned agrochemicals.

Age: farmers were asked to state their ages in years. For the purpose of analysis, respondents' ages were grouped as follows: less than 30, 31-60 and 61 and above.

Family Size: this is the total number of husband/wives, children, relatives and dependants feeding in the same pot at the period of study. Family size was categorized into three as: 1-5, 6-10 and 11 and above.

Years of schooling: farmers were asked to indicate their years of schooling. The years were further categorized into: Never went to school as 0, Primary education as between 1-6years, Secondary education as between 7-12years and Tertiary education as 13years and above.

Farm Size: this refers to the total area of the cultivated land in hectarage. Majority of the farmers were not able to give the precise hectarage of their farm land but were able to state the area in plots: one plot is 100m X 30m which is equal to an acre of land. Therefore 2.5acres were taken as one hectare. The farm size was then categorized: Small Farm size as 0.5 hectares, Medium Farm size as between 0.6 and 1 hectare and Large Farm Size as 1.1 hectares and above.

Occupation: this was divided into primary occupation and secondary occupation. The primary occupation was Amaranth farming and respondents were asked to indicate their secondary occupation such as commercial bike, teaching, artisan and trading.

Annual Income: this refers to the total amount of money realized from the sales of the amaranth in the market in one year. The annual income was calculated by multiplying the number of bunches/bags per harvest with the amount per bunch/bag and number of harvest per month. The absolute values were recorded and categorized into: less than #100,000, #101,000-#200,000, #201,000-#300,000, #301,000-#400,000, #401,000 and above.

Farmers' External Orientation: this is the degree to which the Amaranth farmers were exposed to their social system. To measure this, the farmers were asked to indicate whether they travelled to other areas outside their village in the past one year and the frequency of their travelling. The frequencies of their travelling were scored: Daily, Weekly, Fortnight, Monthly, Seasonally and Never as 5, 4, 3, 2, 1 and 0 respectively.

Participation in Organizations: this refers to the farmers' participation in any social group activities. The Amaranth farmers were asked to indicate the social group(s) they belong to as were stated: farmers' cooperatives, social clubs, church associations, Islam associations and any other.

Sources of Information and Training: this refers to the farmers' sources of information and training on the use of agrochemicals. Amaranth farmers were asked to indicate their source(s)

of information as from: Extension Agents, Other farmers, Friends and family. The farmers were also asked to also indicate whether they attended training and the absolute values of the number of times they attended were recorded.

Awareness of Banned Agrochemicals: this refers to the farmers' awareness that the agrochemicals they are using were banned. The respondents that were AWARE were scored 1 and the respondents that were NOT AWARE were scored 0.

Use of banned agrochemicals: this explains that the banned agrochemicals they were still using despite their awareness, have been banned. The farmers were asked to indicate from an array of banned agrochemicals, the ones they were using in multiple responses.

Reasons for continuous usage of banned agrochemicals: this refers to some of the reasons why the respondents still use the banned agrochemicals for Amaranth production. The farmers were asked to indicate whether the reasons were as a result of any of these: low cost, effectiveness, availability in market, advice from sales agents, and inadequate information about banned agrochemicals.

Knowledge of hazardous level of banned agrochemicals: this refers to the respondents' knowledge of the hazard level of the banned agrochemicals. The respondents were asked to indicate the hazard level of the banned agrochemicals. Their responses were scored: Not hazardous as 0, Low hazardous as 1, Moderately hazardous as 2 and Highly hazardous as 3. The possible maximum score was 9 and the possible minimum score was 0.

Perception of amaranth farmers towards the use of banned agrochemicals: the respondents were asked to indicate their perception based on the questions that were asked. Their responses were scored: Strongly Disagreed, Disagreed, Indifferent, Agreed and Strongly agreed as 1, 2, 3, 4 and 5 respectively. The possible maximum score was 35 and the possible minimum score was 7. The respondents' level of perception was calculated as High or Low using the grand mean.

Statement of opinion on Precautionary Measures: this refers to the respondents' opinion on precautionary measures during the usage of the banned agrochemicals to prevent health hazards. The respondents were asked to indicate how often (Very often, Often, Not often and Never) they employed some precautionary measures mentioned in the study and their responses were scored 3, 2, 1 and 0 respectively.

Probable Health Hazard: this refers to the possible bad health symptoms that the respondents might be experiencing after the use of banned agrochemicals. The farmers were asked to indicate the negative health symptoms they usually experience after the use of the banned agrochemicals.

3.5 Data Analysis

Descriptive statistics such as frequencies, percentages, means, grand means and standard deviations were used to analyse the data. The results were compared to determine the farmers' compliance to non-usage of banned agrochemicals, farmers' knowledge of hazardous level of banned agrochemicals, perception towards the use of banned agrochemicals, farmers' adopted precautionary measures, and probable effects of use of banned agrochemicals on the Amaranth farmers' health in Ekiti state.

Nevertheless, to test the hypothesis, Correlation Coefficients (r) were used to measure the associations between the dependent variable and the independent variables. The values that the 'r' may assume ranges from -1 to +1. The signs (-ve and +ve) indicated the direction of the relationship. This implies that when r-values were negative it means negative relationship and when r-values were positive it means positive relationship. More so, r= -1 means perfect negative relationship whereas r= +1 means perfect positive relationship.

Chi-square goodness of fit was also used to determine the significance of the nominal variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter contains the results of the field survey as well as explains the implication of the results. The results will be discussed under the following subsections:

1. Respondents' socioeconomic characteristics
2. The farmers' awareness of banned agrochemicals
3. The farmers' usage of agrochemicals
4. The farmers' perception towards usage of banned agrochemicals
5. The probable health effects of the use of banned agrochemicals
6. Statement of opinion on precautionary measures
7. Hypothesis testing

4.1 Respondents' Socio-economic Characteristics

The results of the analysis in Table 2 shows that the average age of the Amaranth farmers in Ekiti state was 41years and the age distribution was 76.7% percent between 31-60years, 20.8% less than 30years and 2.5% above 61years old. In addition, majority of the farmers (81.7%) were male while 18.3% were female. This was as expected and corroborated with previous findings by Ogunjimi (2012) that women are usually involved in other activities like cultivation of other arable crops, processing and trading and may also be attributed to the tenure system of land ownership where females are denied right to own land.

Interestingly, the average year of schooling of the respondents was 10.47years where 35% had secondary education, 34.2% had tertiary education, 20.8% had primary education and 10% had no formal education. This implies that majority (69.2%) of the farmers were literates and could read and write.

Moreover, from the results in Table 3, 64.2% had family size of between 1-5, 34.1% had family size of 6-10 and 1.7% had more than 11 as their family size. This implies that families of small size (64.2%) were more involved in Amaranth production.

Nevertheless, with Amaranth Production as their primary occupation, majority (53.3%) were Artisans, 31.7% were Traders, 7.5% were Teachers and 7.5% were Commercial bike riders as their secondary occupation.

Table 2: Distribution of respondents according to age, sex, religion, marital status, family size, year of schooling and secondary occupation.

Farmers' Socioeconomic Characteristics	N = 120	
Age	**f**	**%**
30 years)	25	20.8
31-60 years	92	76.7
≥61 years	3	2.5
Mean Age = 41 years		
Standard deviation = 11.30		
Sex		
Male	98	81.7
Female	22	18.3
Religion		
Christianity	90	75
Islam	28	23.3
Traditional	2	1.7
Marital status		
Single	13	10.8
Married	104	86.7
Divorced	1	0.8
Separated	2	1.7
Family size		
1-5	77	64.2
6-10	41	34.1
≥ 11	2	1.7
Mean family size = 5		
Standard deviation = 2.73		
Years of schooling		
Never went to school	12	10
Primary education (1-6 years)	25	20.8
Secondary education (7-12 years)	42	35
Tertiary education (≥ 13 years)	41	34.2
Mean = 10.47		
Standard deviation = 4.78		
Occupation		
Amaranth production	100	100
Secondary occupation		
Commercial motorbike	9	7.5
Teaching	9	7.5
Artisan	64	53.3
Trading	38	31.7

Source: Field Survey, 2017.

The results in Table 3 show that majority (79.2%) of the farmers had less than 0.5 hectares as farm size, 18.3% had between 0.6 and 1 hectare as farm size and 2.5% had more than 1.1 hectares as farm size. The Amaranth farmers had an average annual income of 212,002 Naira where 40.8% had 101,000-200,000 Naira, 25% had 201,000-300,000 Naira, 17.3% had less than 100,000 Naira, 10% had 301,000-400,000 Naira and 6.7% had greater than 401,000 Naira. The findings revealed that Amaranth farmers have huge annual income which might be as a result of increased price of Amaranth during dry seasons and this corroborates with the findings of Ogunjimi (2012) that farmers' huge income might be due to increase in market price.

The Amaranth farmers show a high level of involvement in farmers' cooperative (89.2%) where 5.8% belonged to no association/coorperative, 3.3% belonged to Church association and 1.7% belonged to Islam association.

It can be inferred that majority (89.2%) belong to Farmers' Cooperative Associations which ought to have influence on their compliance to non-usage of banned agrochemicals.

This result corroborated previous findings of (Tijani, 1999) who asserted that cooperative associations influence the farmers on receiving information concerning the usage of agrochemicals in Ondo and Osun states.

This implies that Amaranth farmers in Ekiti state are likely to be influenced on their compliance to non-usage of banned agrochemicals by their cooperative societies.

More so, the farmers were actively social and travelled outside their locality (90.1%). Furthermore, 90% travelled within their Local Government Area, 71.7% travelled to other Local Government Area and 25.8% travelled to other states. In addition, 41.7% of the farmers travelled daily, 20% travelled weekly, 14.2% travelled fortnight, 9% travelled monthly and 5% travelled seasonally. Consequently, the farmers' high external orientation (90.1%) ought to have influence on the farmers' compliance with non-usage of banned agrochemicals.

Table 3: Distribution of respondents according to Farm size, Annual income, participation in organizations and external orientation.

Farmers' Socioeconomic Characteristics	N = 120	
	f	%
Farm size		
Small size (≤0.5 hectares)	95	79.2
Medium size (0.6 - 1 hectare)	22	18.3
Large size (≥1.1 hactares)	3	2.5
Mean = 0.40		
Standard deviation = 0.32		
Annual income		
≤ 100,000	21	17.3
101,000 - 200,000	49	40.8
201,000 - 300,000	30	25.2
301,000 - 400,000	12	10
≥ 401,000	8	6.7
Mean = 212,002		
Standard deviation = 159,841		
Participation in Social Organizations*		
Farmers' cooperative	107	89.2
Church association	4	3.3
Islamic association	2	1.7
No participation	7	5.8
External Orientation*		
Within their Local Government	108	90
To other Local Governments	86	71.7
To other States of the Federation	31	25.8
Frequency of Travelling		
Daily	50	41.7
Weekly	24	20
Fortnight	17	14.2
Monthly	11	9.2
Seasonally	6	5
Travel = 90.1%		
No travelling = 9.9%		

*Multiple responses

Source: Field Survey, 2017.

4.2 The Farmers' awareness of banned agrochemicals

The results in Table 4 shows that 99.2% of the respondents were aware that some agrochemicals have been banned and the result further shows that 88.3% of the farmers were aware that Gamma- BCH (Gammalin) had been banned, Dichloro-diphenyl-trichloroethane (DDT) (77.5%) and Aldrex (47.5%)

The implication of this result is that majority of the farmers that used banned agrochemicals were aware that the agrochemicals had been banned which corroborates with findings of Mokwunye (2012) that those farmers are aware that some agrochemicals have been banned.

Majority of the farmers (76.7%) sort information on banned agrochemicals. The result in Table 4 further shows that 85% obtained information from sales agents, 77.5% from fellow farmers and 32.5% from Extension agents.

This implies that majority (85% and 77.5%) farmers obtained information from sales agents and fellow farmers respectively which might have influence on their awareness of banned agrochemicals. This might also be due to visit of the Extension agents.

Table 4: Distribution of Respondents According to their Awareness of Banned Agrochemicals and Sources of Information.

Farmers' Awareness	N = 120	
	f	%
Awareness*		
Dichloro-diphenyl-trichloroethane (DDT)	93	77.5
Gamma- BCH (Gammalin)	106	88.3
Aldrex	57	47.5
Source of information*		
Get information	92	76.7
From extension Workers	39	32.5
From other farmers	93	77.5
From Sales agents	102	85

*Multiple responses

Source: Field Survey, 2017.

4.3 Farmers' usage of banned agrochemicals

The results in Table 5 shows that all the respondents indicated that they use agrochemicals for production of Amaranth. The result further shows that 83.3% were using Gamma- BCH (Gammalin), 10% were using Aldrex and 3.3% were using DDT (dichloro-diphenyl-trichloroethane).

The result also shows that the amaranth farmers were using these agrochemicals because of their effectiveness (81.7%), low cost (55%), availability in the market (49.2%) and advice from sales agents (48.3%)

This result corroborates with findings by Adeniji (2015) that farmers still use banned pesticides because they are inexpensive and available in the market.

Table 5: Distribution of Respondents According to Usage of Banned Agrochemicals and Reasons for continuous usage.

Farmers' Usage of Banned Agrochemicals	N = 120	
	f	%
Use agrochemicals*	100	100
Dichloro-diphenyl-trichloroethane (DDT)	4	3.3
Gamma- BCH (Gammalin)	100	83.3
Aldrex	12	10
Reasons for continuous usage*		
Low cost	66	55
Effectiveness	98	81.7
Availability in market	59	49.2
Advice from sales agents	58	48.3

*Multiple responses

Source: Field Survey, 2017.

4.4 The Farmers' perception towards usage of banned agrochemicals

The result shows in Table 6 shows that the farmers had high perception that the use of banned agrochemicals increased amaranth production (mean= 3.46) which implies that the farmers believed that the use of banned agrochemicals increases the production probably because of its effectiveness. The farmers also had high perception that the use of banned agrochemicals increased health bills (mean= 3.22) which implies that they were aware of the of the negative health effects of the use of banned agrochemicals. They also had high perception to whether it was necessary to use banned agrochemicals (mean= 2.98) which implies that the farmers still have interest in the use of banned agrochemicals. In addition, the farmers had high perception that banned agrochemicals were cheaper than other agrochemicals (mean= 2.80) which corroborated with the findings of Mokwunye (2012) that they were still using some of the chemicals due to their perceived effectiveness in the control of pest and diseases, and cheapness. Furthermore, the farmer had low perception that advice from Extension agents initiated the use of banned agrochemicals (mean= 2.44) which implies that information obtained from Extension agents did not influence the usage of banned agrochemicals. The farmers had low perception that the use of banned agrochemicals is not harmful (mean= 2.28) which implies that they were aware of the negative health effects of the use of banned agrochemicals. Finally, the amaranth farmers had low perception that there is no risk/hazard associated to the use of banned agrochemicals (mean= 2.27) which implies that they perceived that the banned agrochemicals were hazardous to use.

In conjunction to this, results from this study in Table 7 also revealed that majority of the amaranth farmers were not knowledgeable of the actual hazardous level of the banned agrochemicals as postulated by World Health Organization (1992). 80% of the farmers indicated that Aldrex is lowly hazardous, 65% indicated that DDT is not hazardous and 51.7% indicated that Gammalin is lowly hazardous which contradicts the classification based

on hazardous level World Health Organization (1992) where Gammalin was classified as moderately hazardous and extremely harmful, DDT as moderately hazardous and harmful, and Aldrex as highly hazardous and harmful. This result might influence their perception towards the use of banned agrochemicals.

Table 6: Distribution of respondents according to their perception towards the usage of banned agrochemicals.

Farmers' Perception	N = 120	
	Mean	Perception
The use of agrochemicals increases levels of production	3.46	High perception
It usage led to increase in cost of medical bills because of its effect on human heath	3.22	High perception
It is necessary to use the agrochemicals	2.98	High perception
They are cheaper than unbanned agrochemicals so it reduce the cost of production	2.80	High perception
Advice from extension agents initiates use of agrochemicals	2.44	Low perception
The use of agrochemicals is not harmful	2.28	Low perception
There is no risk and hazard attached to the use of agrochemicals	2.27	Low perception

Source: Field Survey, 2017.

Table 7: Distribution of respondents according to their knowledge of hazardous level of banned agrochemicals.

Farmers' Knowledge of hazardous level	Highly hazardous		Moderately hazardous		Lowly hazardous		Not hazardous	
	f	%	f	%	f	%	f	%
DDT	0	0	24	20	18	15	78	65
Gammalin	7	5.8	51	42.5	62	51.7	0	0
Aldrex	0	0	24	20	96	80	0	0

Source: Field Survey, 2017.

4.5 The probable health effects of the use of banned agrochemicals

The health effect of agrochemicals especially organochlorins, organophosphates and carbamates are rapid. According to Larry (1997), there are symptoms that are notable and they begin shortly after exposure and in acute poisoning during exposure.

The result in Table 8 shows that majority (78.3%) of the farmers indicated that the use of banned agrochemicals had negative effects on their health where 84.2% experienced excessive sweating and salivation, 83.3% experienced sneezing, 83.3% experienced loss of appetite with nausea, 81.7% experienced fatigue, 70.8% experienced headache, 60% experienced diarrhea, 57.5% experienced stomach cramp and 40.8% experienced joint pain.

It can be inferred the use of banned agrochemicals by Amaranth farmers in Ekiti state have negative effects on their health. Ojo (2016) said that agrochemicals are essentially poisons meant to kill or ward off unwanted living organisms; it is not surprising that they could produce adverse health impacts in people. Most affected are the people who directly apply the pesticides (such as farmers and applicators), followed by members of their immediate family, and ultimately, the general public who consume food products with high residues of pesticides.

Table 8: Distribution of respondents according to occurrence of health symptoms.

Farmers' Probable Health Symptoms	N = 120	
Probable Health Symptoms*	**f**	**%**
Joint pain	49	40.8
Fatigue	98	81.7
Excessive sweating and salivation	101	84.2
Loss of appetite with nausea	100	83.3
Diarrhea	72	60
Sneezing	100	83.3
Stomach cramp	69	57.5
Headache	85	70.8

Source: Field Survey, 2017.

4.6 Statement of farmers' opinion on precautionary measures

The Table 9 shows the distribution of adopted precautionary measures during the usage of banned agrochemicals. It shows that majority (68.3%) of the farmers never used their bare hands to mix the agrochemicals before spraying, but 16.7% mix the agrochemicals with their hands very often. It further shows that 55.8% never wore protective clothing while only 14.3% wear protective clothing during spraying. This result implies that the body of majority of the farmers is usually exposed to the banned agrochemicals during application.

Further more, 98.3% never ate when spraying the agrochemicals, 95% never drank when spraying, 11.7% bathe immediately after spraying while 46.7% never bathe immediately after spraying. In addition, 26% often wash their contaminated clothes while 46.7% never did so. This implies that the farmers might be exposed to direct contact with the banned agrochemical and that they practice unhealthy hygiene.

More so, 28.3% of the farmers enter the farm very often within 24 hours after spraying, 50.8% never burn/bury the containers of the banned agrochemicals. This implies that the farmers might be predisposed to the danger of poisoning due to contact/eating of freshly sprayed crops and re-usage of chemical containers. Furthermore, exposure to the use of these chemicals without necessary precautionary measures might aggravate health related problems.

Table 9: Distribution of respondents bases on their opinion on precautionary measures.

Farmers' Precautionary Measures	N = 120							
Precautionary Measures	Very Often		Often		Rarely		Never	
	f	%	F	%	f	%	f	%
Use hand to mix chemicals before spraying	20	16.7	7	5.8	11	9.2	82	68.3
Wear protective clothing when spraying	17	14.2	19	15.8	17	14.2	67	55.8
Eat when spraying chemical	0	0	0	0	2	1.7	118	98.3
Drink when spraying chemical	3	2.5	0	0	3	2.5	114	95
Bath immediately after spraying chemical	14	11.7	22	18.3	28	23.3	56	46.7
Wash your contaminated clothes immediately after spraying	18	15	32	26.7	14	11.7	56	46.7
Blow the spraying gun with mouth	3	2.5	4	3.3	2	1.7	111	92.5
Spray against air direction	22	18.3	4	3.3	4	3.3	90	75
Wash hands immediately after spraying	3	2.5	25	20.8	38	31.7	54	45
Wash and clean spraying equipments immediately after spraying	3	2.5	34	28.3	30	25	53	44.2
Enter the farm within 24hours after spraying chemical	34	28.3	9	7.5	14	11.7	63	52.5
Burning and burring chemical containers after spraying	10	8.3	40	33.3	9	7.5	61	50.8

Source: Field Survey, 2017.

4.7 Hypothesis Testing

4.7.1 Hypothesis I

The first hypothesis of this study states that there is no significant relationship between the farmers' socio-economic characteristics and their compliance with non-usage of the banned agrochemicals in the study area.

The relationship between the farmers' socio-economic characteristics and the dependent variable were examined using Chi-square goodness of fit test and linear correlation at 0.05 level of significance. The characteristics includes: the amaranth famers' age, sex, marital status, family size, year of schooling, farm size, annual income, farmers' external orientation, participation in external organization and source of information.

The results in Table 10 shows that the amaranth farmers' sex ($X^2(1) = 48.13$, $P \leq 0.5$), marital status ($X^2(3) = 246.33$, $P \leq 0.5$) and participation in organization ($X^2(3) = 263.93$, $P \leq 0.5$) had significant relationships using Chi-square goodness of fit test.

Table 10: Chi-square test of significance of socio-economic Characteristics of amaranth Farmers.

Test Statistics

	Sex	Marital status	Religion	Participation in organization
Chi-Square	48.133[a]	246.333[b]	102.200[c]	263.933[b]
df	1	3	2	3
Asymp. Sig.	.000	.000	.000	.000

Linear correlation analysis revealed in Table 11 that there is no significant relationship between the farmers' family size (r=0.029) years of schooling (r =0.044), farm size (r=0.029), farmers' external orientation (r=0.049) and their compliance to non-usage of banned agrochemicals. It further shows a negative and significant relationship between the farmers' source of information (r=0.102), annual income (r=0.126) and compliance to non-usage of banned agrochemicals.

This implies that as the farmers' income increases, they continue to use the banned agrochemicals and the more the information obtained concerning the usage of the banned agrochemicals, the more they use it hence, not complying with non-usage of banned agrochemicals.

This result reveals that there is no significant relationship between the farmers' socio-economic characteristics and compliance with non-usage of banned agrochemicals save for their annual income and source of information on usage of the banned agrochemicals. It therefore implies that the socio-economic characteristics of the farmers had no influence on their compliance with non-usage of banned agrochemicals.

4.7.2 Hypothesis II

This hypothesis states that there is no significant relationship between farmers' perception towards the use of banned agrochemicals and compliance with non-usage of the banned Amaranth agrochemicals by the farmers in the study area.

The farmers' perception towards usage of banned agrochemicals as represented in Table 11 was found to be negatively and significantly related to their compliance to non-usage of banned agrochemicals.

This implies that the higher their perception towards the use of banned agrochemicals, the lower their compliance to non-usage of banned agrochemicals.

4.7.3 Hypothesis III

There is no significant relationship between effects of the banned agrochemical usage on the farmers' health and compliance with non-usage of the banned Amaranth agrochemicals by the farmers in the study area.

The relationship between the health effects of usage of banned agrochemicals with the farmers' compliance to non-usage of banned agrochemicals was found to be positive and significantly related as presented in Table 11.

This implies that the health symptoms the farmers experienced had influence on their compliance to non-usage of banned agrochemicals, that is, as the health symptoms increased, their compliance to non-usage of banned agrochemicals increases.

Table 11: Summary of Linear Correlation of Farmers' Compliance with non-usage of banned agrochemicals and socio-economic characteristics, Perception and Probable Health Effects.

Variables	Correlation (r)	Decision
Age	0.096	Not Significant
Family size	0.029	Not Significant
Year of schooling	0.044	Not Significant
Farm size	0.039	Not Significant
Annual Income	-0.126	Significant
Farmers External Orientation	-0.049	Significant
Source of Information	-0.102	Significant
Perception towards usage of banned agrochemicals	-0.174	Significant
Probable Health Effects of use of banned agrochemicals on farmers' health	0.117	Significant

Number of Independent Variables = 9

Number of Respondents = 120

Level of Significance = 0.05

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The incidence of insects and diseases pests poses serious threat to vegetable production and these two problems have been the major impediments to the goal of our realization of self-sufficiency in vegetable production (Adeniji, 2015) Therefore, farmers are practicing chemical control methods employing the use of agrochemicals of which most of them are banned for controlling pests and diseases.

This study is aimed at assessing the compliance of Amaranth farmers with non-usage of banned agrochemicals in Ekiti State, Nigeria with the following specific objectives:

- to describe the socioeconomic characteristics of the farmers in the study area,
- to determine the farmers' awareness of banned agrochemicals,
- to evaluate farmers perception towards the use of banned agrochemicals,
- to determine the probable effect of the use of banned agrochemical on the farmers' health,
- to determine the farmers' opinion on precautionary measures.

For the purpose of this study, three hypotheses were formulated:

Hypothesis I

There is no significant relationship between the farmers' socio-economic characteristics and compliance with non-usage of banned agrochemicals by amaranth farmers in the study area.

Hypothesis II

There is no significant relationship between farmers' perception towards the use of banned agrochemicals and compliance with non-usage of the banned agrochemicals by the farmers in the study area.

Hypothesis III

There is no significant relationship between effects of the use of banned agrochemical on the farmers' health and compliance with non-usage of the banned agrochemicals by the farmers in the study area.

Interestingly, the study was conducted in Ekiti state, Nigeria. Three Local Government Areas were purposively selected being major producers of amaranth then four communities were randomly selected from each Local Government Area and finally, snow-ball method was used to obtain ten respondents each from the selected communities, giving a sum of 120 respondents. Data was collected primarily by interview schedule and use of well-structured questionnaire while the secondary data was obtained from literatures.

Descriptive statistics such as frequencies, percentages, means, grand means and standard deviations were used to analyze the data.

5.1.1 Summary of Results

Farmers' socio-economic characteristics

The average age of the Amaranth farmers in Ekiti state was 41years and the age distribution was 76.7% percent between 31-60years, 20.8% less than 30years and 2.5% above 61years old. In addition, majority of the farmers (81.7%) were male while 18.3% were female.

The average year of schooling of the respondents was 10.47years where 35% had secondary education, 34.2% had tertiary education, 20.8% had primary education and 10% had no formal education. 64.2% had family size of 1-5, 34.1% had family size of 6-10 and 1.7% had more than 11 as their family size. Majority (53.3%) was Artisans, 31.7% were Traders, 7.5% were Teachers and 7.5% were Commercial bike riders as their secondary occupation. Majority (79.2%) of the farmers had less than 0.5 hectares as farm size, 18.3% had between 0.6 and 1 hectare as farm size and 2.5% had more than 1.1 hectares as farm size. The

Amaranth farmers had an average annual income of 212,002 Naira where 40.8% had 101,000-200,000 Naira, 25% had 201,000-300,000 Naira, 17.3% had less than 100,000 Naira, 10% had 301,000-400,000 Naira and 6.7% had greater than 401,000 Naira. They were highly involvement in farmers' cooperative (89.2%) where 5.8% belonged to no association/coorperative, 3.3% belonged to Church association and 1.7% belonged to Islam association. The farmers were actively social and travelled outside their locality (90%). Furthermore, 90% travelled within their Local Government Area, 71.7% travelled to other Local Government Area and 25.8% travelled to other states. In addition, 41.7% of the farmers travelled daily, 20% travelled weekly, 14.2% travelled fortnight, 9% travelled monthly and 5% travelled seasonally.

Awareness of Banned Agrochemicals

99.2% of the respondents were aware that some agrochemicals have been banned and 88.3% of the farmers were aware that Gammalin had been banned, DDT (77.5%) and Aldrex (47.5%)

Majority of the farmers (76.7%) sort information on banned agrochemicals and 85% obtained information from sales agents, 77.5% from fellow farmers and 32.5% from Extension agents.

Usage of banned agrochemicals

All the respondents indicated that they use agrochemicals for production of Amaranth and 83.3% were using Gammalin, 10% were using Aldrex and 3.3% were using DDT. The amaranth farmers were using these agrochemicals because of their effectiveness (81.7%), low cost (55%), availability in the market (49.2%) and advice from sales agents (48.3%)

The Farmers' Perception towards Usage of Banned Agrochemicals

The farmers had high perception that the use of banned agrochemicals increased amaranth production (mean= 3.46), high perception that the use of banned agrochemicals increased health bills (mean= 3.22), high perception to whether it was necessary to use banned agrochemicals (mean= 2.98), high perception that banned agrochemicals were cheaper than other agrochemicals (mean= 2.80), low perception that advice from Extension agents initiated the use of banned agrochemicals (mean= 2.44), low perception that the use of banned agrochemicals is not harmful (mean= 2.28) and low perception that there is no risk/hazard associated to the use of banned agrochemicals (mean= 2.27)

Majority of the amaranth farmers were not knowledgeable of the actual hazardous level of the banned agrochemicals as postulated by World Health Organization (1992). 80% of the farmers indicated that Aldrex is lowly hazardous, 65% indicated that DDT is not hazardous and 51.7% indicated that Gammalin is lowly hazardous.

The Probable Health Effects of the use of Banned Agrochemicals

Majority (78.3%) of the farmers indicated that the use of banned agrochemicals had negative effects on their health where 84.2% experienced excessive sweating and salivation, 83.3% experienced sneezing, 83.3% experienced loss of appetite with nausea, 81.7% experienced fatigue, 70.8% experienced headache, 60% experienced diarrhea, 57.5% experienced stomach cramp and 40.8% experienced joint pain.

Statement of Opinion on Precautionary Measures

Majority (68.3%) of the farmers never used their bare hands to mix the agrochemicals before spraying, but 16.7% mix the agrochemicals with their hands very often. 55.8% never wore protective clothing while only 14.3% wear protective clothing during spraying. Furthermore, 98.3% never ate when spraying the agrochemicals, 95% never drank when spraying, 11.7%

bathe immediately after spraying while 46.7% never bathe immediately after spraying. In addition, 26% often wash their contaminated clothes while 46.7% never did so. More so, 28.3% of the farmers enter the farm very often within 24 hours after spraying, 50.8% never burn/bury the containers of the banned agrochemicals.

Hypothesis Testing

Hypothesis I: The amaranth farmers' sex ($X^2(1)= 48.13$, $P\leq 0.5$), marital status ($X^2(3)= 246.33$, $P\leq 0.5$) and participation in organization ($X^2(3)= 263.93$, $P\leq 0.5$) had significant relationships using Chi-square goodness of fit test. Linear correlation analysis revealed that there is no significant relationship between the farmers' family size (r=0.029) years of schooling (r =0.044), farm size (r=0.029), farmers' external orientation (r=0.049) and their compliance to non-usage of banned agrochemicals. Furthermore, there is a negative and significant relationship between the farmers' source of information (r=0.102), annual income (r=0.126) and compliance to non-usage of banned agrochemicals.

Hypothesis II: The farmers' perception towards usage of banned agrochemicals was found to be negatively and significantly related to their compliance to non-usage of banned agrochemicals.

Hypothesis III: The relationship between the health effects of usage of banned agrochemicals with the farmers' compliance to non-usage of banned agrochemicals was found to be positive and significantly related.

5.2 Conclusion

Based on the results on the assessments, the conclusions will be that the amaranth farmers in Ekiti state do not comply with non-usage of banned agrochemicals. The major sources of information on banned agrochemicals to the farmers are sales agents and fellow farmers. Some of the banned agrochemicals still in use by some of the farmers include Gammalin, DDT and Aldrex. Although farmers agree with the health implications of the use of banned

agrochemicals yet they were still using some of the chemicals due to their perceived effectiveness in the control of pest and diseases, and cheapness. A pertinent issue with agrochemical in the country is inadequate, proper information and conviction of the famers on the dangers of the usage of the banned agrochemicals as well as the availability and potency of better alternatives such as the approved agrochemicals and Integrated Pest Management schemes.

5.3 Recommendations

Base on the findings of this study, following recommendations are made:

1. There should be revitalization of the activities and actions of Agricultural Development Programme (ADP) and Extension agents as well as agencies concerned on the issue of banned agrochemicals.
2. There should be educative enlightenment by extension agents on the approved chemicals to the farmers in each of the Local Governments of the state through the use of advertisement, programmes and jingles on radio and television.
3. There should be collaborations among amaranth farmers, Agricultural Development Programme (ADP) and National Agency for Foods and Drugs Administration and Control (NAFDAC in awareness creation on implications of use of banned agrochemicals and prevention of their circulation and/or use by farmers.
4. There should be method demonstration of the use of approved agrochemicals to influence the perception of the farmers towards banned agrochemicals.
5. With respect to health and environmental concern, alternatives to the use of agrochemicals should be provided to support the farmers and the use of Integrated Pest Management strategies should be encouraged.

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APPENDIX I

A QUESTIONNAIRE ON THE ASSESSMENT OF FARMERS' COMPLIANCE TO NON-USAGE OF BANNED AGROCHEMICALS: CASE STUDY OF VEGETABLE FARMERS IN EKITI STATE, NIGERIA.

*Questionnaire Number*_____
*Name of Local Government Area*_____

Dear respondent,
This questionnaire is an attempt to gather important information about the compliance of vegetable farmers with non-usage of banned agrochemicals in Ekiti state, Nigeria. As the main intention behind the survey is not to identify any individual's name, but your responses: you should not write your name anywhere on the questionnaire. As seen on this first page, at the top left-hand section, a code number is provided for each individual; this is to conceal any individual's identity. Your participation in this study is very important as it would help to understand the awareness of approved and banned agrochemicals, perceptions towards the use of banned agrochemicals, probable health effects of the banned agrochemicals and opinion on precautionary measures during the use of banned agrochemicals. There is no right or wrong answers to the questions asked or the statements made; instead, what is desired of you is your truthful and honest response. Please note that the completion of this questionnaire is entirely voluntary. All information gathered as a result of your participating in this study will be treated with utmost confidentiality. Your willingness to complete the questionnaire implies you have given consent to participate. Thank you for cooperating.

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1.1 Age in years? _____
1.2 Sex: Male☐ Female☐
1.3 Family size _____
1.4 Marital status: Single☐ Married☐ Divorced☐ Separated☐
1.5 Religion: Christianity☐ Muslim☐ Traditional☐
1.6 Year of schooling :_____
1.7 Size of farm cultivated with vegetables in hectares _____
1.8 Other source(s) of income apart from vegetable production:
   a. Commercial motorbike rider☐ b. Teacher☐ c. Electrician☐ d. Barber☐ e. Taxi driver☐ Others(please specify)_____
1.9 How many bunches of vegetable do you get per harvest? _____
1.10 How much do you sell per bunch? _____
1.11 How many times do you harvest per month? _____
1.12 To what organization do you belong?
   a. Farmers' cooperative☐ b. thrift society☐ c. Descendant union☐ d. Social club☐
   e. Church association☐ f. Muslim association☐ g. Others specify_____
1.13 Do you like travelling out of the village to other places? YES☐ NO ☐
1.14 If yes, indicate where you visited during the past one year
   a. other villages in this Local Government Area☐ b. other Local Government Areas☐

c. other states☐ d. others specify_____

1.15 How often do you travel out of the village?

a. Daily☐ b. Weekly☐ c. Fortnight☐ d. Monthly☐ e. Seasonally☐ f. others specify___

1.16 Have you attended any training/workshop about the use of agrochemicals? YES☐ NO☐

1.17 If yes, how many times / annum have you attended? _____

1.18 Do you seek advice on the type of agrochemical to use? YES☐ NO☐

1.19 If yes, from whom?

a. Extension agents☐ b. Other farmers☐ c. NGOs☐ d. Friends and family☐

e. Others specify_____

1.20 How many Agricultural Extension agents in this area do discus about the type of agrochemical to use for vegetable production in the past two years? _____

1.21 How many times have you met him? _____

SECTION B: AWARENESS OF APPROVED AND BANNED AGROCHEMICALS

2.1 Do you use agrochemicals for your vegetable production? Yes☐ No☐

2.2 Which of these agrochemicals are you using?

a. DDT ☐ **b.** Aldrex☐ **c.** Gammalin 20☐ **d.** Ultracide☐

e. Alamon☐ **f.** Nogas 50 EC☐ **g.** Atranex☐ **h.** Touch down☐

i. Clear weed☐ **j.** Round up☐ **k.** Basudin 10 G☐ **l.** Furadam 3 G ☐

Others (specify)_____

2.3 Are you aware that some agrochemicals used in vegetable production have been banned? YES☐ NO☐

If yes, identify the agrochemicals you are aware of

a. DDT☐ **b.** Aldrex☐ **c.** Gammalin 20☐ **d.** Ultracide☐

e. Alamon☐ **f.** Nogas 50 EC☐

Others (specify)_____

2.4 How often do you use the following agrochemicals?

Instruction: tick ✓ to indicate **Very Often, Often, Rarely** or **Not Used**

Banned Agrochemicals	Very often	Often	Rarely	Not used
DDT				
Aldrex				
Gammalin 20				
Ultracide				
Alamon				
A tranex				
Nogas 50 EC				

SECTION C: KNOWLEDGE LEVEL

1.20 How many years have you been using agrochemicals? _____

1.21 Do you know the doses of every agrochemical you use? YES☐ NO☐

3.9 Do you know that banned agrochemicals are not good for healthy vegetable production? Know☐ don't know☐

3.10 How hazardous are the following agrochemical?

Banned Agrochemicals	Highly Hazardous	Moderately Hazardous	Low Hazardous	Not Hazardous
DDT				
Aldrex				
Gammalin 20				
Ultracide				
Alamon				
A tranex				
Nogas 50 EC				

3.11 Your reason(s) for continue usage of the banned agrochemicals:

a. Low cost☐ b. Effective than unbanned agrochemicals☐ c. Availability in the market☐ d. Instruction from sale agents☐ e. Inadequate information on banned agrochemicals☐ f. Others(please specify)_____

SECTION D: PERCEPTION TOWARDS USAGE OF BANNED AGROCHEMICALS

SA= strongly agree **A=** Agree **I=** Indifferent **D=** Disagree **SD=** Strongly disagree

	Routine activities	SA	A	I	D	SD
a.	It is necessary to use the agrochemicals					
b.	Advice from extension agents initiates use of agrochemicals					
c.	The use of agrochemicals is not harmful					
d.	The use of agrochemicals increases levels of production					
e.	There is no risk and hazard attached to the use of agrochemicals					
f.	They are cheaper than unbanned agrochemicals so it reduce the cost of production					
g.	It usage led to increase in cost of medical bills because of its effect on human heath					

SECTION D: PROBABLE HEALTH EFFECTS

4.1 In the past month, which diseases did you suffer from ?

a. Malaria☐ **b.** Dizziness☐ **c.** Headache☐ **d.** Vomiting☐ **e.** Abdominal pain☐
f. Diarrhea☐ **g.** Skin irritation☐ **h.** Muscular Weakness☐ **i.** Joint pain☐
j. Respiratory difficulties☐ **k.** Others specify_____

4.2 Usage of Agrochemicals can have any bad/ negative effect on your health? YES☐ NO☐

4.3 If yes what symptoms did you observed after usage of the banned agrochemicals?

a. Extreme weakness☐ **b.** Dizziness☐ **c.** Headache☐ **d.** Vomiting☐ **f.** Diarrhea☐
g. Skin irritation☐ **h.** Muscular Weakness☐ **i.** Joint pain☐ **j.** Respiratory difficulties☐
k. Blurred vision☐ **l.** Trembling hands☐ **m.** Excessive sweating☐ **n.** Tearing eyes☐
o. cough and sneezing☐ **p.** Yellow Skin☐ **q.** Dripping mouth☐
others(specify)_____

SECTION E: PRECAUTIONARY MEASURES

VO= Very often **O**= Often **NO**= Not often **N**= Never

	Precautionary Measures	**VO**	**O**	**NO**	**N**
1.	Use hand to mix chemicals before spraying				
2.	Wear protective clothing when spraying				
3.	Eat when spraying chemical				
4.	Drink when spraying chemical				
5.	Bath immediately after spraying chemical				
6.	Wash your contaminated clothes immediately after spraying				
7.	Blow the spraying gun with mouth				
8.	Spray against air direction				
9.	[redacted]h hands immediately after spraying				
10.	[redacted]lean spraying equipments immediately after spraying				
11.	Enter th[redacted] within 24hours after spraying chemical				
12.	Burning and [redacted]ng chemical containers after spraying				