KNOWLEDGE AND SKILLS OF AGROCHEMICAL USAGE AMONG CASSAVA FARMERS IN OVIA NORTH-EAST LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA

BY

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DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES

FACULTY OF AGRICULTURE

UNIVERSITY OF BENIN

BENIN CITY

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A PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS FOR THE AWARD OF BACHELOR'S DEGREE IN AGRICULTURE (OPTION: AGRICULTURAL ECONOMICS AND EXTENSION SERVICES)

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CERTIFICATION

This is to certify that the research work on the Knowledge and Skills of Agrochemical Usage among Cassava Farmers in Ovia North-East Local Government Area of Edo State was carried out by Oludare Esther Oreoluwa with the Mat. No AGR2004288 under the supervision of Dr. J. I Osabuohien of the Department of Agricultural Economics and Extension Services, Faculty of Agriculture, University of Benin, Edo State, Nigeria.

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Dr. J.I. Osabuohien
Project Supervisor

______________________ **Date____________________**

Dr. J.I. Osabuohien
Ag. Head of Department
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DEDICATION

I wholeheartedly dedicate this research work to God Almighty, by whose grace and mercy all things are possible. His steadfast love has been my source of strength and joy. May his name forever be praised.

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ABSTRACT

This study examined the knowledge and skills of agrochemical usage among cassava farmers in Ovia North-East Local Government Area of Edo State, Nigeria. The objectives were to describe the socio-economic characteristics of Cassava farmers, examine the level of perceived Knowledge the Cassava farmers have in agrochemical usage, determine the level of skill Cassava farmers have in applying agrochemicals effectively and safely and determine the constraints faced by farmers in acquiring the knowledge and skills in agrochemical usage.

A total of 90 cassava farmers were selected using a two-stage sampling technique, and data were collected through structured questionnaire and analyzed with descriptive statistics and logistic regression. Findings revealed that most farmers were within the productive age group ($\bar{x}$ = 42 years), 64.4% were male, and 72.2% had secondary education. All respondents (100%) used agrochemicals, and 57.8% had received some form of training on agrochemical usage.

The findings revealed that farmers had high knowledge level for information on agrochemical labels or cans ($\bar{x}$ = 2.98), the different types of agrochemicals for different pests or plant problems ($\bar{x}$ = 2.57), correct personal protective equipment to use by sprayer($\bar{x}$ = 2.55), weather can affect spraying chemicals ($\bar{x}$ = 2.96), how to calculate treatment area and calibrate spraying equipment properly ($\bar{x}$ = 2.60), how to safely mix different chemicals for use ($\bar{x}$ = 2.58) and low knowledge levels were recorded for others. Skill levels also varied, select the correct agrochemical for the target pest or crop issue ($\bar{x}$ =2.08), Measure and mixes agrochemicals accurately with the right tools ($\bar{x}$ = 2.44), Wear appropriate protective equipment (like gloves, masks) during handling and spraying ($\bar{x}$ = 2.08), Apply chemicals without polluting water, harming life or damaging land ($\bar{x}$ = 1.78), Act quickly and safely if you come in contact with dangerous chemicals (($\bar{x}$ = 1.93), Maintain accurate data of chemical use ($\bar{x}$ = 1.69). Significant constraints included low literacy levels ($\bar{x}$ = 2.63), labels not written in local languages ($\bar{x}$ = 2.51), inaccurate information from fellow farmers ($\bar{x}$ = 2.53), and lack of motivation to attend training (mean = 2.64). The Logistic Regression analysis showed that household size ($p = 0.012$), annual income ($p = 0.001$), and training ($p = 0.001$) significantly influenced knowledge. For skill level, sex ($p = 0.014$), household size ($p = 0.057$), farming experience ($p = 0.004$), income ($p = 0.002$), and training ($p = 0.004$) were significant. The study recommends more practical training, better extension support, clearer agrochemical labels in local languages, and improved access to protective equipment to ensure safer and more effective agrochemical use.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Study

Cassava (*Manihot esculenta,* Crantz) is a woody perennial shrub with an edible root, which grows in tropical and subtropical areas of the world, including Nigeria. It is rich in carbohydrates, calcium, vitamins B and C, and essential minerals. It is drought tolerant and thrives in poor soils. Cassava roots are typically processed before eating to remove natural toxins (mainly cyanogenic glucosides). The root is used to make products like tapioca, cassava flour and garri. Cassava is the world's fourth most important staple food following rice, wheat and maize and forms part of the diet of more than a billion people worldwide (Adebayo, 2023).

Agrochemicals are substances used in farming to improve crop yields and safeguard plants by killing insects and pests as well as weeds. They include fertilizers, pesticides (such as insecticides and herbicides), and other agents that promote plant growth and development. These agrochemicals play a vital role in protecting crops from pests, diseases, and weeds, as well as improving soil fertility and overall crop performance. However, the improper use of these chemicals can have severe consequences, not just for crops but also for the environment and human health. Using agrochemicals the wrong way can disrupt the balance of the environment, allowing pests, weeds and diseases suddenly break out of control resulting in their spread (Akinola *et al*., 2019)

According to Zagzebski (2017), knowledge is a form of perception and comprehension gained through experience, reasoning, direct understanding, and learning. Skill is the capacity to use knowledge and experience effectively to accomplish tasks and solve problems, typically developed through training and practice. This implies that skill is putting to practice or the practical aspect of the Knowledge acquired or gained.

The level of knowledge and skills that cassava farmers have regarding agrochemical use varies significantly, influenced by factors such as access to education, training programs, and agricultural extension services, as well as experience and familiarity with modern farming techniques. Knowledge encompasses understanding the types of agrochemicals, how much to use, when to apply them, and the necessary safety measures to be taken. On the other hand, skills are about the practical application of this knowledge, ensuring that chemicals are used in the right proportions and at the appropriate time for maximum effectiveness. According to Olowogbon *et al*. (2020), the research carried out in Kogi and Kwara States reported that a significant proportion of cassava farmers were exposed to agrochemical risks due to inadequate knowledge on their usage and failure to follow recommended safety practices. Akinola *et al*. (2019) reported that although many farmers were aware of agrochemicals, they often do not read product labels, increasing the risks of poisoning and environmental contamination. This reflects that many farmers in Nigeria, including those who cultivate cassava, lack the proper knowledge and skills to handle and apply agrochemicals safely.

In many developing countries, however, farmers may not have adequate training on how to safely handle and apply agrochemicals. The improper use of agrochemicals, especially herbicides and pesticides, has resulted in severe consequences for both agricultural lands and the broader environment. This highlights the urgent need for proper training and continuous education for farmers and aspiring youths in the field (Falade, *et al*. 2019).

For instance, improper storage of chemicals and handling can lead to accidents or poisonings (Moda *et al*., 2022), while applying pesticides incorrectly can leave harmful residues on crops, endangering food safety (Yami *et al*., 2025). Additionally, poor application methods can contaminate soil and water, affecting ecosystems and surrounding communities (Baoteng *et al*., 2023). Therefore, it is essential for farmers to have a strong understanding of how to use these chemicals safely and effectively, ensuring that they achieve the desired while minimizing negative effects.

Agricultural extension services play a critical role in improving farmers' knowledge and skills in agrochemical use. These services provide farmers with the latest information on safe and effective chemical applications, including guidance on proper techniques, protective equipment, and environmental safeguard (Obulamah *et al*., 2022). Government regulations and policies regarding agrochemical use are also crucial for ensuring safety and sustainability in farming. These policies often include safety standards, proper labeling, disposal methods, and regulations around the sale and distribution of chemicals

(FAO and WHO, 2019). By enforcing these regulations, governments can help mitigate the risks associated with agrochemical use.

Despite these efforts, several challenges still exist when it comes to ensuring that farmers have the proper knowledge and skills to use agrochemical safely. These challenges include limited access to education, a lack of effective extension services, the high cost of training programs, and the presence of unregistered or counterfeit chemicals on the market (Oludoye *et al*., 2021).

1.2 Statement of Problem

Agrochemical usage play a very vital role in the overall productivity of Cassava. However, the misuse of agrochemicals has a lot of disadvantages: environmental pollution and health hazards (Olowogbon *et al*., 2020). The methods and correctness of the application is greatly determined by the knowledge and skills that the Cassava farmers have (Akinola *et al*., 2020). Many farmers rely basically on information from their fellow farmers in the application of agrochemicals (Akinola *et al*., 2020). Farmers face a lot of challenges which includes illiteracy, insufficient training from extension workers (Akamobi, 2018). As much as agrochemicals usage is important, the knowledge and skills determine its effectiveness as it is not enough to have only the knowledge but also the skill. The Research on this will help give answers to the following questions:

1. What are the socio-economic characteristics of Cassava farmers?

2. What is the level of perceived knowledge among Cassava farmers in agrochemical usage?

3. What are skills cassava famers have in applying agrochemicals effectively and safely?

4. What are the constraints faced by farmers in acquiring the knowledge and skills on Agrochemical usage?

1.3 Objectives of the study

The broad objective of this study is to examine the level of Knowledge and Skills Cassava farmers in Agrochemical Usage in Edo State. The specific objectives are to:

1. describe the socio-economic characteristics of Cassava farmers

2. examine the level of perceived Knowledge the Cassava farmers have in agrochemical usage.

3. determine the level of skill Cassava farmers have in applying agrochemicals effectively and safely.

4. determine the constraints faced by farmers in acquiring the knowledge and skills in agrochemical usage.

1.4 Justification

Researches have majorly been carried out on the effects of agrochemical (singling out pesticide) usage. Rashid *et al*. (2022) carried out a study on the use, exposure and environmental impacts of pesticide in Pakistan focusing majorly on the effect of excessive use of pesticide on human and environment. Ogbomida *et al*. (2023) reported that smallholder farmers in Etsako West, Edo State, generally lacked adequate knowledge of pesticide safety and rarely read or followed usage instructions. This emphasizes the need to assess whether similar knowledge and skill gap that exist among cassava farmers in Ovia North East. The influence that the knowledge and skill acquired have on the usage of agrochemicals cannot be undermined. The effects of the misuse alone is not sufficient but should be traced to the base, which is the knowledge and skills farmers have.

Based on accessible previous studies in this area of study, no research has been carried out on the knowledge and skill of Cassava farmers on Agrochemical usage especially in Ovia North- East, Edo State, Nigeria, hence the necessity of this study. The study is to fill the gap between the Usage of Agrochemical in relation to their knowledge and skill among Cassava farmers. This study is to determine the factors that affect the farmers level of Knowledge and skill in Agrochemicals (comprising of pesticide, insecticide, herbicide) in Ovia North east which contribute greatly to their productivity.

This study will be valuable to farmers on how to improve their knowledge and skills in agrochemical usage and assist extension workers and government on the way forward in helping farmers on knowledge and skill improvement. The study is also to guide students on future researches.

1.5 Hypothesis

The hypothesis for this study is stated in null form.

$H0_1$: There is no significant relationship between the socio-economic characteristics of the Cassava farmers and knowledge and skill they have in agrochemical usage.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Cassava

Cassava, *Manihot esculenta*, also known as yucca, manidoca, manioca, tapioca is a shrubby perennial crop of the Euphorbiaceae family. The Food and Agriculture Organization of the United Nations has declared it "the crop of the 21st century", thanks to increased global average yields and versatility of cassava for multiple uses. The crop was introduced to Africa by Portugese traders in 1558 and brought to Asia by Europeans from South America between the late eighteenth century and early nineteenth century (Malik *et al*., 2020). Nigeria leads the world in cassava production, with around 4.5 million farmers growing the crop across 7.22 million hectares of land. Together, they produce more than 59 million tonnes each year (FAOSTAT, 2020). Cassava can be exploited for a broad range of potential economic and industrial applications such as animal feeds, fuel production, and as a raw material for manufacturing industries (Li *et al*., 2020). Although cassava plays a vital role in both nutrition and the economy in many countries, it is still underused in some places. This is often because cereal crops are in higher demand, cassava farming is not as easily accessible on a large scale, and many farmers are not familiar with how to grow improved cassava varieties that offer better yields or nutritional benefits (Mohidin, 2023).

2.2 Agrochemicals

Agrochemicals are chemical agents applied in agriculture to manage weed growth eliminate pests and enhance crop productivity (Ugbelu *et al*., 2022). The major classes include herbicides, pesticides (insecticides and fungicides), and fertilizers (FAO, 2019).

2.3 Herbicides

Herbicides are used for elimination of weeds that compete with cassava for nutrients, water, and light. Applying pre-emergence herbicides in cassava fields helps farmers spend less time and effort weeding, while also making weed control much more effective. (Ayeni and Akinbani, 2019).

According to the International Institute for Tropical Agriculture (IITA, 2020), there are two particularly sensitive times when weeds can seriously reduce cassava yields: the first few weeks after planting and again around the third month, when the tubers begin to form. This means that controlling weeds at these specific times is crucial to getting best possible harvest. Ekeleme *et al*. (2021) reported that there was a significant increase in cassava root yield when herbicides were used, compared to traditional farmer methods and manual weeding.

2.4 Pesticides

Pesticides are very essential in protecting cassava from biological infestation. Insecticides help manage insect pests such as cassava mealybugs and green mites which can seriously damage the leaves. Fungicides are used to control fungal diseases like cassava anthracnose and root rot. The impact of synthetic pesticide poisoning on people around the world is significant. Each year, an estimated 385 million farmers and agricultural workers suffer from unintentional acute pesticide poisoning. Tragically, about 11,000 of these cases result in death (Bodeker *et al*., 2020). Several acute psychological health problems caused by pesticides are commonly discovered in humans, including reproductive inhibition, hormonal disorder, immune system disorder, and death (Hassan and El Nemr, 2020). Everything involving the usage of pesticide should be properly handled so has to limit the side effects of its mishandling or misuse.

2.5 Fertilizers

Fertilizers play an important role in improving cassava yield by improving the soil nutrients.

Fertilizers have played a vital role in feeding the world, with nearly half the global population relying on food grown using synthetic fertilizers. They can also have some environmental advantage by increasing the crop yield on a farmland thereby limiting the need to clear more land for agriculture. However, there are adverse effects due to the overuse which runs into water bodies causing pollution, damage to ecosystem and water quality (Ritchie *et al*., 2022). Omondi and Yemiyahu (2021) reported that while fertilizers can significantly boost the yield of cassava storage root yield and starch content, these benefits may hold a little value for smallholder farmers unless there are reliable markets to sell their harvest.

2.6 Agrochemical Usage

Agrochemicals are essential inputs in agriculture that help safeguard crops against pests, diseases, and weeds. The term combines agriculture and chemicals and typically refers to product like fertilizers and pesticides, which include insecticides, herbicides, fungicides and nematicides (Akinola *et al*., 2019). The application of agrochemicals in agriculture has become essential in achieving high crop yields and sustaining world food demand (Bolori *et al*., 2020).

Even though there is growing concern about how agrochemicals harm both the environment and human health, their use continues to increase worldwide. This issue is especially pressing in developing countries, where weak regulations, limited public awareness, and poor infrastructure for safe handling and disposal make managing agrochemical pollution particularly difficult (Devi *et al*., 2022)

2.7 Knowledge in the use of agrochemicals

According to Oparah *et al*. (2019), Knowledge refers to the acquisition of information, abilities and comprehension obtained through education and practical experience. Knowledge is essential for properly understanding the use and management of agrochemicals, including identifying expired or adulterated products, utilizing personal protective equipment, and implementing safety measures to reduce the risk of unnecessary exposure.

Ugbelu *et al*. (2022) reported that farmers in Lejja do not have much knowledge about how to use agrochemicals properly, and this is putting both their health and the well-being of the wider community at risk. Farmers' knowledge on about agrochemicals including pesticides, herbicides, and fertilizers is crucial for ensuring they are used properly. Proper knowledge helps protect both human health and the environment. However, research from developing countries shows that farmers lack important information about these chemicals. This often leads to poor handling practices, misuse or overuse, and increased health and environmental risks.

According to Ugbelu *et al*. (2023), the understanding about agrochemicals and attitudes towards safety varied depending on the famers' level of education. Those with tertiary education were more likely to take safety seriously while farmers with only primary or secondary education tended to have more unsafe habits.

Cassava farmers were aware of both the advantages and risks of using agrochemicals, including air and water pollution, health problems, and skin irritation linked to agrochemical use. However, most farmers relied on information shared by fellow farmers rather than getting advice from trained professionals or organizations (Akinola *et al*. 2020).

2.8 Skill in Effective and Safe application of Agrochemicals

The ability of farmers to use agrochemicals safely depends a lot on the knowledge, attitude and the practical skills that they have which involves reading labels, measuring the right amounts, handling and storing the agrochemical products properly and understanding how these agrochemicals affect the environment. Applying pesticides requires a high level of skill and knowledge (Ozkan, 2020). Instringsih *et al*. (2020) carried out a research which confirmed and showed that having high level of knowledge does not mean that farmers will apply this knowledge in practices; including wearing of gloves and masks, disposing of empty containers appropriately. Pesticides should be stored in a safe place, well away from homes, schools, water sources, and other sensitive areas. It is important to make sure that children and anyone not authorized to handle them cannot get into the storage areas (Bilal *et al*., 2019).

Humphrey *et al*. (2024) made a research into how farmers approach pesticide use in vegetable farming and reported that while most farmers, about 82%, used some form of personal protective equipment misuse and inconsistent were common.

Proper application is key for agrochemicals to deliver desired results. This involves using the right method, applying the right quantity, timing the application correctly and wearing protective equipment during use.

To minimize the excessive use of agrochemicals, the Food and Agriculture Organization (FAO, 2019) advocates for Integrated Pest Management. This combines both chemical control and with biological and cultural practices helping farmers control pests effectively while reducing chemical exposure.

2.9 Constraints faced by farmers in acquisition of knowledge and skills

One of the most significant barriers to acquiring agrochemical knowledge is the low level of formal education among many rural farmers. Literacy is very important in reading chemical labels, safety guidelines, and dosage instructions. Akinwale *et al* (2022), noted that literacy greatly influences how well farmers can access and understand written information from sources like books, newspaper and agricultural journals. Farmers with little or no formal education often depend on verbal instructions or peer to peer advice which can sometimes be inaccurate or incomplete.

The effective use of agrochemicals is critical for enhancing agricultural productivity and ensuring food security. However, the sources of information that farmers rely on for the use of these chemicals present several challenges that can lead to improper usage, reduced effectiveness and adverse environmental and health impacts. Reliance on a wrong source can result in the dissemination of inaccurate or incomplete information, leading to improper use of agrochemicals. Studies have shown that informal networks are often preferred due to their accessibility and trustworthiness within communities, but they may lack scientific accuracy (Johnson and Wilson, 2022).

Another constraint faced by the farmers is inadequacy of extension workers in the dissemination of information required in the application of agrochemicals. Nwunji *et al*. (2024) reported that majority of the arable crop farmers did not have contact with extension agents and the work extension workers is to educate farmers about the safe handling of agrochemicals, provide training on the proper use of protective gear and equipment to minimize exposure, raises awareness about the risks associated with unsafe handling of agrochemicals including health and environmental hazards. Complexity of the label is also a challenge, many agrochemicals are written in technical jargon, foreign languages, or printed in fonts that are too small to read easily. In Meshginshahr Country, Iran, only about 26% of orchard farmers read pesticide labels mostly because they were too technical, unclear or printed in illegible fonts (Bagheri *et al*., 2021). Rosiji *et al*. (2018) observed that many cassava farmers in the southwestern Nigeria had trouble reading pesticide and recognizing label signs. This resulted in health and environmental risks as they often handled chemicals improperly.

2.10 Empirical Study

Uddin *et al*., (2015) used descriptive tools such as mean, standard deviation and percentages in analyzing their work. Cassava was the most cultivated crop where herbicide was used (90% of the respondents cultivated cassava) and this meaning Cassava farmers were dominant users of herbicide in the sample. It also showed that about 95.8% of the farmers knew that herbicide could harm both environment and consumers indicating that most of the respondents had some level of theoretical knowledge about the dangers of agrochemical (herbicide and pesticide misuse).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area and Scope

This study was carried out in Edo State. Edo State is one of the 36 States in Nigeria. Edo state is situated in Nigeria's South-South geopolitical zone and shares boundaries with Kogi State to the north, Delta State to the east and south, and Ondo State to the west. Geographically, it lies between latitudes 5^o.44' and 7^o.34' North, and longitudes 5^o.40' and 6^o.45' East. The State covers an area of 19,187 square kilometers (7,494.92 square miles) and is divided into eighteen local government areas. According to the Olotu *et al*. (2024), the 2006 National Population Census ranked Edo State as the 24^{th} most populous State in Nigeria, with an estimated population of 3, 233,366.

The eighteen local government areas include; Akoko-Edo, Egor, Esan Central, Esan North-East, Esan South-East, Esan West, Etsako Central, Etsako East, Etsako West, Igueben, Ikpoba-Okha, Oredo, Orhionmwon, Ovia North-East, Ovia South-West, Owan East, Owan West, Uhunmwonde. Ovia North-East is one of the Local government area in Edo State. Farmers in Edo State cultivate crops like yam, cassava, maize, cocoyam, banana, plantain and so on. The State also embraces various religion including Christianity, Islam and Traditional worshipping.

There was a decline in cassava production in Edo State due to inefficient use of fertilizer, while herbicide application also had adverse effects as a result of improper usage and application (Oyotomhe *et al*., 2025). Agrochemicals are meant to boost productivity except in cases where they are misused or inappropriately applied.

3.2 Population of the study

The population of the study area was composed of Cassava farmers that use agrochemicals in Ovia North-East Local government area of Benin City.

3.3 Sampling procedure and Sample Size

A two -stage sampling procedure was employed in the selection of respondents for the study. The first stage involved a purposive sampling of five communities (Oduna, Evblokpen, Ugbineh, Egbtan, Ikpao) from the major communities in Ovia North-East Local Government Area, based on their significant population of cassava farmers and used snowballing to form a list of those using agrochemicals in each of the five communities.

The second stage involved the use of simple random sampling technique to select eighteen (18) cassava farmers that use agrochemicals from each of the five communities, which will result to a total of 90 respondents in the study area.

3.4 Types and Sources of data

The data for this study was gotten from a primary source. The primary data collection involved questionnaire administration and the questionnaire was structured in terms of the study objectives.

3.5 Measurement of Variables

Independent Variables

a. The Socioeconomic characteristics of the respondents

Age: The age of the respondents was measured in years.

Sex: This was measured using the options of either male =1 or female=2.

Marital status: This was measured as Single=1, Married=2, Widowed=3, Divorced=4, Others=5.

Educational level: The level of education was measured as No formal education=1, Primary=2, Secondary=3, or Tertiary=4.

Farm Size: The farm size was measured in hectares (Ha).

Farming Experience: The farming experience of the respondents was measured in years.

Income: The income level of respondents was measured in Naira.

Household size: This was measured by the number of persons residing with them in their home and feeding from the same pot.

Training on Agrochemical usage: This was measured on whether they have been trained or not, Yes=1, No=2 and the source of the training.

Extension contacts: The respondents were requested to indicate if they have had any contact with an extension agent, No contact=1, Contact=2.

Frequency of contact: The respondents were asked to indicate how often they have contact with an extension agent (1=Daily, 2=Weekly, 3=Forth nightly, 4=Monthly, 5=Quarterly, 6=Annually).

b. Dependent Variables

Perceived Knowledge in Agrochemical usage.

Respondents were asked to indicate their knowledge of agrochemicals usage. Furthermore, the extent of the knowledge was also measured using a 4-point Likert scale of 1= Very little knowledge, 2 = Basic knowledge, 3= High knowledge, 4= Expert knowledge.

Skill in applying agrochemicals effectively and safely

The Respondents were asked to indicate their skill possessed for effective and safe usage of agrochemicals. Furthermore, the extent of their skill was also measured using a 3-point Likert scale of 1= Low skill, 2= Moderate skill, 3= High skill.

Constraints faced by respondents in acquiring knowledge and skills on Agrochemical usage

Respondents were asked to indicate the various factors that hinder them in acquiring knowledge and skills. Furthermore, the extent of their constraint was also measured using a 4-point Likert scale of 1= not serious, 2= maybe serious at times, 3= serious, 4= always a serious constraint.

3.6 Data Analysis

Objective one: to describe the socio-economic characteristics of the respondents.

Descriptive statistics such as means, percentages, standard deviation and frequency counts was employed to achieve this objective.

Objective two: examine the level of perceived Knowledge the Cassava farmers have in agrochemical usage.

Descriptive statistics such as means, percentages, standard deviation, frequency count was used to achieve this objective. A 4-point Likert-type rating scale of 1= Very little knowledge, 2 = Little knowledge, 3= Moderate knowledge, 4= High knowledge was used.

This was added to get 10 and then divided by 4 to get a midpoint of 2.5. Variables with mean score of 2.5 and above was regarded as high (Score = 1) knowledge while less than 2.5 was regarded as low (Score= 0) knowledge.

Objective three: to know the skills Cassava farmers have in applying agrochemicals effectively and safely.

Descriptive statistics such as means, percentages, standard deviation, frequency count was employed to achieve this objective. A 3-point Likert-type rating scale of 1= Low skill, 2= Moderate skill, 3= High skill was used. This was added to get 6 and then divided by 3 to get a midpoint of 2.0. Variables with mean score of 2.0 and above was regarded as skilled (Score= 1) while below 2.0 was regarded as low skilled (Score= 0).

Objective four: to determine the constraints faced by farmers in acquiring the knowledge and skills in agrochemical usage. This objective was achieved using descriptive statistics such as means, percentages, standard deviation, frequency counts. A 4-point Likert rating scale of 1= not serious, 2= maybe serious at times, 3= serious, 4= always a serious constraint was used.

Test for hypothesis

Hypothesis one

H_{01}: There is no significant relationship between the socio-economic characteristics of the Cassava farmers and knowledge and (ii) skills they have in applying agrochemicals effectively and safely. This will be measured using the Logistic Regression Model.

(i)Knowledge they have in agrochemical usage

$$P(Y = 1) = \frac{1}{1+e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n)}} \frac{1}{1+e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n)}}$$

P = probability of the event

e = Euler's number (~2.718)

β_0 = intercept

$\beta_1 \ldots \beta n$ = coefficients for predictors $X_1 \ldots Xn$

Y = the dependent variable, Knowledge of agrochemical usage (Knowledge= 1, No Knowledge= 0)

X_1 to X_n = the independent variables (predictors)

(ii) skills they have in applying agrochemicals effectively and safely

$$P(Y = 1) = \frac{1}{1+e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n)}} \frac{1}{1+e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n)}}$$

P = probability of the event

e = Euler's number (~2.718)

β_0 = intercept

$\beta_1 \ldots \beta n$ = coefficients for predictors $X_1 \ldots Xn$

Y = the dependent variable, Skills on agrochemical usage (Skill= 1, No Skill= 0)

X_1 to X_n = the independent variables (predictors)

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Cassava farmers

The socio-economic characteristics of cassava farmers in the study area are presented in Table 4.1

4.1.1 Sex of the respondents

The result presented in Table 4.1 indicates that a greater proportion of cassava farmers in Ovia North-East were male, accounting for 64.4% of the respondents, while female farmers constituted 35.6% of the sample. This pattern reflects a gender distribution that is consistent with the structure of agricultural labour across many parts of southern Nigeria, where men tend to dominate activities that require substantial physical involvement, such as land preparation, pesticide application, and cassava harvesting. The finding is also in agreement with the report of Okojie and Egbodion (2023), who observed a similar distribution among cassava farmers in Edo State, with 63.2% being male and 36.8% being female, thereby reinforcing the argument that cassava production in this region remains a male-dominated enterprise.

This gender imbalance may be attributed to several factors. First, men traditionally engage more in field-based agricultural operations, while women tend to participate more in post-harvest processing, marketing, and household-level value addition, which are equally important components of the cassava value chain but occur outside the primary farming phase. Second, certain tasks within cassava cultivation, especially the application of agrochemicals, clearing of fields, and transportation of harvested tubers, are labour-intensive and may be perceived culturally as men's responsibilities. As a result, women may engage less frequently in direct cultivation activities due to social norms, labour constraints, or limited control over land and household decision-making.

Moreover, earlier studies have similarly documented male dominance in cassava farming across Nigeria. For instance, Eze *et al*. (2019) reported that cassava production in southeastern Nigeria was largely driven by male farmers, noting that men often have more secure access to farmland and production resources. In addition, Afolami *et al*. (2020) found that men's greater involvement in commercial farming activities is frequently linked to their better access to extension services, credit, and farm inputs, which further widens the gender gap in agricultural participation.

Therefore, the gender distribution observed in this study not only supports previous empirical findings but also highlights the broader structural and cultural dynamics that position men as the primary actors in cassava production in Ovia North-East. The result underscores the need for gender-sensitive agricultural interventions that consider the unique constraints faced by female farmers, particularly in accessing land, credit, and training opportunities essential for effective cassava production and agrochemical use.

4.1.2 Age distribution

Table 4.1shows that 6.7% of the farmers fell below 30 years of age, 30% of the farmers were within the age bracket of 30-39 years of age, largest population (47.8%) of the farmers were within the age bracket of 40-49 years of age and 15.6% of the famers fell above 50 years of age. The result also shows a mean age of 42 years and this indicates that majority of the farmers are still within their productive working years, physically capable of carrying out labor-intensive tasks such as land preparation, herbicide application, and harvesting. This is also consistent with the findings of Jimmy *et al*. (2024) in a study of Cassava farmers in Rivers State stating that the mean age of the farmers was 43. This pattern agrees with findings from similar studies where cassava production tends to be driven by adults who have enough experience and stability to manage farming activities. The dominance of middle-aged farmers also suggests that younger individuals may be less interested in agriculture due to alternative income opportunities or migration to urban areas.

4.1.3 Marital Status

The data in Table 4.1 shows that majority of the farmers (82.2%) were married, 13.3% were single and 4.4% were widowed. The result aligns with the observations of Ogunyinka *et al*. (2019) who reported that a large proportion (82.2%) of the cassava farmers were married, 10% were single, 4.4% were widowed while 3.3% were divorced. The high population of married people involved in cassava farming is a characteristic of the agrarian community.

4.1.4 Household Size

As presented in Table 4.1, the mean household size was 3 with majority (94.4%) of the households having 5 members or fewer. This household size does not provide the adequate labour force needed in cassava farming for demanding farm tasks such as clearing land or spraying agrochemicals. Smaller households often depend more on hired labor, which can affect production costs and reduce total farm output. Since family labor is especially important in cassava farming where tasks are often repetitive and time-sensitive, a smaller household may make it more difficult to manage larger cassava plots or adopt labor-intensive practices.

4.1.5 Educational Level of Farmers

A significant proportion (72.2%) of the farmers had their education level up to secondary school, 23.3% were educated up to tertiary level, 1.1% had primary education while 3.3%

had no formal education. The high level of literacy in the study area is significant because education strongly influences farmers' ability to understand agrochemical labels and follow safety instructions. Farmers with secondary or tertiary education are more likely to recognize the risks of improper chemical use, seek training, and adopt recommended protective measures.

The small number of farmers with low or no education also highlights why certain knowledge gaps still exist as technical instructions can be difficult to understand without adequate literacy.

4.1.6 Farming Experience

Table 4.1 revealed that a higher proportion (61.1%) of the farmers had Cassava farming experience of between 6 and 10 years with an average of 8 years. This suggests that the farmers have quite some experiences in cassava farming.

4.1.7 Farm Size

As shown in Table 4.1, majority (68.9%) of the farmers had a farm size of below 2 hectares while 31.1% had a farm size of above 2 hectares, with an average farm size of 0.9ha.

4.1.8 Annual Income

As presented in Table 4.1, 23.3% of the farmers received annual income of less than or equal to ₦500,000, 67.8% received an annual income of ₦500,001 – ₦1,000,000, 8.9% received an annual income of ₦1,000,001and above from all sources.

Income plays a major role in farmers' ability to purchase quality agrochemicals, protective equipment, and appropriate tools. Farmers with higher income are more likely to use safer and more effective products and follow recommended practices. Lower-income farmers may decide to settle for cheaper chemicals or avoid buying protective equipment, increasing the risks associated with chemical use.

4.1.9 Agrochemical Usage

All (100%) of the farmers used agrochemicals as shown in Table 4.1and this was as a result of the survey carried out before sampling.

4.1.10 Training

Table 4.1 shows that a significant proportion (52.2%) of the farmers received training on the usage of agrochemical.

4.1.11 Source of Training

As shown in Table 4.1, 42.2% of the farmers had their training from ADP, 23.3% of the farmers had their training from Agric Organizations, 13.3% of the farmers had their training from NGOs, 12.25% had their training from their fellow farmers and 8.9% had an online training.

4.1.12 Extension Agent Contact

As presented in Table 4.1, 64.4% of the cassava farmers had contact with extension agent while 35.6% of the farmers did not have contact with extension agent.

4.1.13 Contact Frequency

As shown in Table 4.1, 42.2% of the farmers had quarterly contacts, 18.9% had annual contacts, 2.2% had monthly, 1.1% had weekly contact while 35.6% has never had contact with extension agent.

Table 4.1: Socio-economic characteristics

Sex	**Freq.**	**%**	**Mean**	**Std. Dev.**
Male	58	64.4		
Female	32	35.6		
Age in years				
< 30.00	6	6.7		
30.00 - 39.00	27	30	41.68	7.59
40.00 - 49.00	43	47.8		
50.00+	14	15.6		
Marital Status				
Single	12	13.3		
Married	74	82.2		
Widowed	4	4.4		

Household Size				
<= 5.00	85	94.4		
6.00+	5	5.6	3.37	1.34
Educational Level				
No formal education	3	3.3		
Primary education	1	1.1		
Secondary education	65	72.2		
Tertiary Education	21	23.3		
Farming experience				
<= 5.00	24	26.7		
6.00 - 10.00	55	61.1	8.29	3.13
11.00+	11	12.2		
Farm Size in hectares				
< 2.00	62	68.9		
>2.00	28	31.1	0.88	0.36
Annual Income (in Naira)				
<= 500000.00	21	23.3		
500001.00 - 1000000.00	61	67.8	826,222.22	526,178.89
1000001.00+	8	8.9		
Agrochemical usage	90	100		
Training on Agrochemical usage	52	57.8		
If yes, source of training				
ADP	38	42.2		
Agr. ORG (Min of Agric)	21	23.3		
Fellow farmers	11	12.2		
NGO	12	13.3		
Online	8	8.9		
Contact with extension agent				
Yes	58	64.4		
No	32	35.6		
If contact, what is your frequency of contact?				
Daily				
Weekly	1	1.1		

Forth-nightly		
Monthly	2	2.2
Quarterly	38	42.2
Annually	17	18.9
NA	32	35.6

Source: Field Survey, 2025.

4.2 Level of perceived Knowledge the Cassava farmers have in agrochemical usage

As presented in Table 4.2, all (100%) the farmers had knowledge on information on agrochemical labels or cans, 100% of the farmers had knowledge on the different types of agrochemicals for different pests or plant problems, 98.9 % had knowledge on appropriate timing and how often to use chemicals and 72.2% of the farmers were knowledgeable on correct personal protective equipment to use by sprayer. A large proportion (95.6%) of the cassava farmers had knowledge on concept of agrochemical pest resistance and how to prevent it, Weather can affect spraying chemicals (98.9%), How to calculate treatment area and calibrate spraying equipment properly (95.6%), How to safely mix different chemicals for use (100%). How to reduce health risks when using agrochemicals (100%), How to protect nearby farms, animals and people when spraying chemicals (98.9%), How to clean sprayers and containers after spraying (98.9), Consequences of misusing agrochemicals (98.9%), Proper disposal of used agrochemical cans (98.9), Storage of agrochemicals away from children and food (100%), Identifying expired agrochemical products (98.9%) and almost all (98.9%) had knowledge on Identifying adulterated agrochemical products. This implies that a very large majority of the cassava farmers had knowledge on all listed.

The Table 4.2 also shows the extent of the knowledge the farmers had in agrochemical usage. The findings indicate high knowledge level for information on agrochemical labels or cans ($\bar{x} =$ 2.98), the different types of agrochemicals for different pests or plant problems ($\bar{x} = 2.57$), correct personal protective equipment to use by sprayer ($\bar{x} = 2.55$), weather can affect spraying chemicals ($\bar{x} = .96$), how to calculate treatment area and calibrate spraying equipment properly ($\bar{x} = 2.60$), how to safely mix different chemicals for use ($\bar{x} = 2.58$).

Low knowledge levels were observed for the following, appropriate timing and how often to use chemicals ($\bar{x} = 2.38$), concept of agrochemical pest resistance and how to prevent it ($\bar{x} = 2.37$), how to reduce health risks when using agrochemicals ($\bar{x} = 2.42$), how to protect nearby farms, animals and people when spraying chemicals ($\bar{x} = 2.00$), How to clean sprayers and containers after spraying ($\bar{x} = 1.94$), consequences of misusing agrochemicals ($\bar{x} = 2.10$), proper disposal of used agrochemical cans ($\bar{x} = 1.93$), Storage of agrochemicals away from children and food ($\bar{x} = 2.14$), identifying expired agrochemical products ($\bar{x} = 2.02$), Identifying adulterated agrochemical products ($\bar{x} = 1.61$).

Table 4.2. Level of perceived Knowledge the Cassava farmers have in agrochemical usage

Perceived Knowledge in agrochemical use	Knowledge Freq.	%	Knowledge Level Mean	Std. Dev
Information on agrochemical labels or cans	90.0	100.0	2.98	0.58
The different types of agrochemicals for different pests or plant problems	90.0	100.0	2.57	0.75
Appropriate timing and how often to use chemicals	89.0	98.9	2.38	0.68
Correct personal protective equipment to use by sprayer	65.0	72.2	2.55	0.79
Concept of agrochemical pest resistance and how to prevent it	86.0	95.6	2.37	0.77
Weather can affect spraying chemicals (e.g. spraying against wind and in the rain)	89.0	98.9	2.96	0.95
How to calculate treatment area and calibrate spraying equipment properly	86.0	95.6	2.60	0.69
How to safely mix different chemicals for use	90.0	100.0	2.58	0.73
How to reduce health risks when using agrochemicals (like washing hands, changing clothes and soon)	90.0	100.0	2.42	0.75
How to protect nearby farms, animals and people when spraying chemicals	89.0	98.9	2.00	0.94
How to clean sprayers and containers after spraying	89.0	98.9	1.94	0.92
Consequences of misusing agrochemicals	89.0	98.9	2.10	1.01
Proper disposal of used agrochemical cans	89.0	98.9	1.93	1.00
Storage of agrochemicals away from children and food	90.0	100.0	2.14	1.07
Identifying expired agrochemical products	89.0	98.9	2.02	0.75
Identifying adulterated agrochemical products	89.0	98.9	1.61	0.73

Source: Field Survey, 2025. Mean≥2.5 = High knowledge.

4.3 Level of skills Cassava farmers have in applying agrochemicals effectively and safely

Table 4.1 shows that almost all the farmers had all the enlisted skills. However, the level of the skill they have vary, Select the correct agrochemical for the target pest or crop issue ($\bar{x} = 2.08$), Measure and mixes agrochemicals accurately with the right tools ($\bar{x} = 2.44$), Wear appropriate protective equipment (like gloves, masks) during handling and spraying ($\bar{x} = 2.08$), Apply chemicals without polluting water, harming life or damaging land ($\bar{x} = 1.78$), Act quickly and safely if you come in contact with dangerous chemicals ($\bar{x} = 1.93$), Maintain accurate data of chemical use ($\bar{x} = 1.69$), Use the right equipment appropriately in the spraying of chemicals ($\bar{x} = 1.94$), Apply agrochemicals only when needed and in the right amount ($\bar{x} = 2.09$), Make sure agrochemicals do not drift to unwanted place during application ($\bar{x} = 2.27$), Avoid eating, drinking, or smoking while working with agrochemicals ($\bar{x} = 2.22$), Stop working immediately and take action if you feel dizzy, itchy or sick during application ($\bar{x} = 1.84$), Avoid spraying against the wind($\bar{x} = 1.87$)

Table 4.3. Level of skills Cassava farmers have in applying agrochemicals effectively and safely

Skills in Agrochemical Application	Skills Possess Freq	%	Skill Level Mean	Std. Dev.
Select the correct agrochemical for the target pest or crop issue	90	100	2.08	0.75
Measure and mixes agrochemicals accurately with the right tools	89	98.9	2.44	0.71
Wear appropriate protective equipment (like gloves, masks) during handling and spraying	90	100	2.08	0.97
Apply chemicals without polluting water, harming life or damaging land	89	98.9	1.78	0.89
Act quickly and safely if you come in contact with dangerous chemicals	90	100	1.93	0.96
Maintain accurate data of chemical use (what, how much, when and where)	89	98.9	1.69	0.76
Use the right equipment appropriately in the spraying of chemicals	90	100	1.94	1.00
Apply agrochemicals only when needed and in the right amount	90	100	2.09	0.63
Make sure agrochemicals do not drift to unwanted place during application	90	100	2.27	0.93
Avoid eating, drinking, or smoking while working with agrochemicals	90	100	2.22	0.78
Stop working immediately and take action if you feel dizzy, itchy or sick during application	90	100	1.84	0.94
Avoid spraying against the wind	90	100	1.87	1.02

Source: Field Survey, 2025. Mean≥2.5 = High Skills

4.4 Constraints faced by farmers in acquiring the knowledge and skills in agrochemical usage

Results from Table 4.4 shows that four out of the thirteen listed constraints were significant. Respondents from the study area considered the following as significant constraints: low literacy levels ($\bar{x} = 2.63$), agrochemical labels are not in local languages ($\bar{x} = 2.51$), inaccuracy of information from fellow farmers ($\bar{x} = 2.53$), lack of motivation to attend training ($\bar{x} = 2.64$) while the following as insignificant constraints: lack of access to agricultural extension services ($\bar{x} = 2.35$), time constraint in attending training programs ($\bar{x} = 2.15$), Cultural barrier ($\bar{x} = 2.02$), high cost of training programs ($\bar{x} = 2.24$), language barrier in training session ($\bar{x} = 2.29$), lack of trust in extension agents ($\bar{x} = 2.39$), insufficient information on safe agrochemical usage ($\bar{x} = 2.05$), lack of access to internet or digital training materials ($\bar{x} = 2.00$), with-holding of vital information by fellow farmers ($\bar{x} = 2.40$).

Table 4.4: Constraints faced by farmers in acquiring the knowledge and skills in agrochemical usage

	Constraints		Level of seriousness	
Constraints	**Freq**	**%**	**Mean**	**Std. Dev.**
Lack of access to agricultural extension services	89	98.9	2.35	0.68
Low literacy levels	81	90	2.63	1.15
Agrochemical labels are not in local languages	89	98.9	2.51	1.15
Time constraint in attending training programs	89	98.9	2.15	0.72
Cultural barrier	66	73.3	2.02	0.85
High cost of training programs	89	98.9	2.24	0.85
Language barrier in training session	89	98.9	2.29	0.77
Lack of trust in extension agents	88	97.8	2.39	0.85
Insufficient information on safe agrochemical usage	86	95.6	2.05	0.70
Inaccuracy of information from fellow farmers	83	92.2	2.53	0.86
Lack of access to internet or digital training materials	88	97.8	2.00	0.68
Lack of motivation to attend training	84	93.3	2.64	1.15
Withholding of vital information by fellow farmers	85	94.4	2.40	0.98

Source: Field Survey, 2025.
Significant Constraint: Mean (≥2.5)

4.5 Hypothesis Testing

4.5.1 Determinants of level of knowledge

There is no significant relationship between the socio-economic characteristics of the Cassava farmers and knowledge and skill they have in agrochemical usage

The logistic regression model examined the extent to which socio-economic characteristics that influence cassava farmers' knowledge of agrochemical usage in the study area. Although the null hypothesis stated that socio-economic factors have no significant relationship with farmers' knowledge, the results demonstrate that three variables, household size, annual income, and training, significantly predict knowledge levels, thereby partially rejecting the null hypothesis. The overall model fit, indicated by a Nagelkerke R^2 value of 0.48 and a classification accuracy of 57.8%, shows that the included socio-economic characteristics collectively explain a substantial proportion of the variation in farmers' knowledge of agrochemical usage.

Household size emerged as a significant predictor of knowledge, with a positive coefficient ($B = 0.522$; $p = 0.012$) and an odds ratio of 1.686. This result implies that farmers with larger households are more likely to possess higher levels of knowledge regarding agrochemical usage. The relationship suggests that households with more members tend to share labour responsibilities, which increases the possibility of joint involvement in farming operations such as mixing, spraying, and storing agrochemicals. Through this shared participation, knowledge is transferred within the household, creating a small but effective internal learning environment. This observation aligns with findings by Olowogbon *et al*. (2020), who reported that larger families in Kogi and Kwara States had higher awareness of agrochemical-related risks due to internal communication patterns that enhanced the spread of safety information. A similar trend was noted by Akinwale *et al*. (2022), who explained that household size acts as an informal information network that facilitates agricultural learning, especially where extension services are limited.

Annual income also showed a strong and significant influence on knowledge, with a coefficient of 0.962 ($p = 0.001$) and an odds ratio of 1.628. This indicates that farmers with higher income levels are about 62.8% more likely to have adequate agrochemical knowledge compared to those in lower income categories. Higher income enhances farmers' ability to access quality agricultural inputs, extension services, and training opportunities, all of which contribute directly to knowledge acquisition. Financial capacity often determines whether farmers can afford recommended agrochemicals, safety equipment, and advisory services, thereby shaping their understanding of proper usage and health precautions. Ugbelu *et al*. (2023) reported a similar association in southeastern Nigeria, where income level significantly influenced farmers' understanding of agrochemical hazards and correct application methods. In Edo State, Ogbomida *et al*. (2023) found that wealthier smallholders demonstrated higher awareness of the environmental and health impacts of pesticides, further supporting the present study's findings. These patterns are consistent with global observations, as documented by Rashid *et al*. (2022), which demonstrate that farmers with greater economic resources tend to have better access to technical information, safer products, and professional guidance.

Training on agrochemical usage was the most influential predictor of knowledge, displaying a highly significant coefficient of 2.113 ($p = 0.001$) and an odds ratio of 8.273. This means that farmers who have received training are more than eight times as likely to have a high level of knowledge compared to those who have not received any formal instruction. This result underscores the centrality of training as a mechanism for transmitting both technical and safety-related information. Agrochemical training programmes—whether delivered by ADP officers, NGOs, input suppliers, or agricultural organisations—typically cover essential topics such as label interpretation, calibration techniques, correct mixing ratios, protective equipment, environmental precautions, and emergency response procedures. These programmes bridge significant knowledge gaps, particularly in rural communities where literacy levels are low and label instructions are often printed in unfamiliar technical language. Bagheri *et al*. (2021) demonstrated that training substantially improved farmers' ability to understand pesticide labels in Iran, especially among farmers who initially reported difficulty interpreting instructions. The importance of training is also emphasised globally; according to the FAO and WHO (2019) International Code of Conduct on Pesticide Management, structured training is one of the most reliable strategies for improving farmers' knowledge of safe pesticide use and reducing the incidence of accidental exposure. In the Nigerian context, Falade *et al*. (2019) and Akinola *et al*. (2020) similarly reported that farmers who had contact with extension services or participated in training sessions exhibited significantly higher knowledge scores than those relying solely on peer advice or personal experience.

Therefore, these findings suggest that cassava farmers' knowledge of agrochemical usage is shaped by the combined effect of social, economic, and institutional factors. Household size contributes through internal knowledge diffusion within family units; income influences the ability to access safe products, information, and services; and training provides structured, accurate, and practical guidance. The strength of the training variable, in particular, indicates that agrochemical knowledge is highly responsive to targeted interventions rather than being naturally acquired through demographic characteristics alone. This implies that strategic investment in farmer education, especially through inclusive training and strengthened extension services, can significantly enhance the safe and effective use of agrochemicals in the study area. The findings therefore demonstrate that while the null hypothesis cannot be entirely rejected for all socio-economic variables, it is clearly rejected for household size, income, and training, which exhibit strong significant relationships with knowledge levels.

Table 4.5.1: Relationship between socio-economic characteristics and knowledge level in agrochemical usage

Variables	B	S.E.	Wald	Sig.	Exp(B)
Sex	-0.011	0.623	0.274	0.986	0.989
Age	-0.054	0.054	1.009	0.315	0.947
Marital status	-0.434	0.879	0.244	0.621	0.648
Household size	0.522	0.291	3.228*	0.012	1.686
Educational Level	0.727	0.565	1.654	0.198	2.068
Farming Experience	0.154	0.117	1.727	0.189	1.167
Farm size	-1.849	1.321	1.959	0.162	0.157
Annual Income	0.962	0.018	6.876**	0.001	1.628
Training	2.113	0.643	10.81**	0.001	8.273
Constant	-7.935	3.024	6.883	0.009	0.771

Source: Field Survey, 2025.
-2 Log likelihood = 75.453; Nagelkerke R Square = 0.48.
Overall percentage prediction = 57.8
**Sign. at 0.01 level and *Sign. at 0.05 level.

4.5.2 Determinants of level of skills

The logistic regression model assessing the determinants of cassava farmers' skill level in agrochemical application produced a Nagelkerke R^2 value of 0.455 and an overall prediction accuracy of 78.9%, indicating that the socio-economic variables included in the analysis jointly explain approximately 45.5% of the variability in skill levels. This shows a reasonably strong model fit and confirms that socio-economic factors play a meaningful role in shaping farmers' practical competence in agrochemical handling. Although the null hypothesis proposed that socio-economic characteristics have no significant association with skill level, the results demonstrate that five variables, sex, household size, farming experience, income, and training, were statistically significant predictors, thereby partially rejecting the hypothesis.

Sex emerged as a significant determinant of skill, with a positive coefficient of 1.539 ($p = 0.014$) and an odds ratio of 4.661. This indicates that male farmers were substantially more likely than female farmers to possess higher levels of skill in agrochemical handling. The gender disparity may be attributed to the physical demands associated with agrochemical application, which often requires strength to operate sprayers, carry chemical containers, or walk long rows during field application. In many rural agrarian contexts in Nigeria, agrochemical handling is considered a task more appropriate for men, while women often focus on planting, weeding, and processing. As a result, men may gain more hands-on exposure and experiential learning, which increases their skill proficiency. Similar trends were documented by Rosiji *et al*. (2018), who found that men in southwestern Nigeria were more engaged in pesticide application and, consequently, exhibited higher skill levels in equipment handling and mixing procedures. Humphrey *et al*. (2024) further observed that male vegetable farmers were more consistent in carrying out tasks requiring precision in pesticide calibration and sprayer use, suggesting a gendered division of labor that translates into differential skill acquisition.

Household size also showed a significant positive relationship with skill level, with a coefficient of 0.505 ($p = 0.057$) and an odds ratio of 1.648. Although the significance level is marginal, it still indicates that farmers with larger households were more likely to demonstrate stronger practical skills in agrochemical use. Larger households often provide more labour support, and this increases the likelihood that multiple members participate in the process of mixing, spraying, or cleaning equipment. Through repeated involvement, household members reinforce one another's skills, leading to improved proficiency. Studies by Olowogbon *et al*. (2020) and Akinwale *et al*. (2022) similarly noted that households with more members tend to have better internal knowledge transfer and greater operational support, enabling farmers to develop and refine skills through practice and observation.

Farming experience had a significant negative relationship with skill level, with a coefficient of 0.159 ($p = 0.004$) and an odds ratio of 0.853. Interestingly, this suggests that farmers with longer years of experience were less likely to have high skill levels compared to those with fewer years of experience. This counterintuitive finding may reflect the influence of technology shift: newer entrants into cassava production may have been exposed to more modern, safer, and more efficient agrochemical practices promoted by extension agencies, NGOs, and agrochemical companies, while older farmers may rely on outdated or inherited practices. A similar pattern was observed by Instringsih *et al*. (2020), who reported that senior farmers in Indonesia did not consistently apply best practices despite years of experience because much of their technique was based on habit rather than updated knowledge from training or extension services. In Nigeria, Akinola *et al*. (2020) also found that long years of farming experience did not translate to safer pesticide handling, as many experienced farmers continued to apply chemicals based on traditional methods that neglected essential safety procedures such as PPE use, calibration, or correct dilution ratios.

Annual income was another strong and highly significant predictor of skill level, with a coefficient of 5.172 ($p = 0.002$) and an odds ratio of 2.176. Farmers with higher incomes were considerably more likely to have advanced skills in agrochemical application. This relationship likely stems from the ability of higher-income farmers to purchase appropriate equipment, such as functioning knapsack sprayers, protective clothing, measuring containers, and anti-drift nozzles. Income also enables farmers to access certified agrochemical dealers, where they receive product guidance, demonstrations, or technical advice that directly enhances their operational skills. Ugbelu *et al*. (2023)

reported that higher-income farmers in southeastern Nigeria were significantly more likely to handle agrochemicals correctly because they could afford modern sprayers, PPE, and improved formulations. Similarly, Ogbomida *et al*. (2023) observed that income disparities in Edo State influenced not only what chemicals farmers purchased but how skillfully and safely they applied them. These patterns affirm that skill acquisition is not merely a function of exposure but also of economic capacity to adopt safer and more efficient application methods.

Training again appeared as the most influential predictor, with a coefficient of 1.887 ($p = 0.004$) and an odds ratio of 6.597, showing that trained farmers were more than six times as likely to possess higher skill levels than their untrained counterparts. This finding is consistent with the results from the knowledge model and highlights the powerful effect of targeted instruction on farmers' practical competence. Training programmes typically include demonstrations on measuring accurate chemical doses, calibrating sprayers, using protective equipment, preventing spray drift, and identifying safe weather conditions for application. These practical components of training directly strengthen farmers' technical proficiency. Falade *et al*. (2019) found that trained farmers were significantly more competent in pesticide handling than those without formal training, largely because training emphasizes hands-on learning. The FAO and WHO (2019) Code of Conduct on Pesticide Management also stresses that practical, field-based training is essential for improving farmers' operational skills and minimizing occupational exposure. In the

Nigerian context, Akinola *et al*. (2019) confirmed that training and extension exposure substantially increased cassava farmers' ability not only to understand agrochemical safety but to apply chemicals correctly and efficiently.

The study therefore shows that the significant predictors in this model—sex, household size, farming experience, income, and training—demonstrate that skill acquisition in agrochemical usage is shaped by a complex interplay of gender roles, family labour dynamics, economic capacity, orientation toward new practices, and structured learning opportunities. These factors reinforce one another in determining how effectively and safely cassava farmers handle, mix, and apply agrochemicals. The strong influence of training and income suggests that skill levels can be significantly improved through targeted extension efforts and economic support, while the roles of sex and household size highlight the importance of social and household contexts in shaping farmers' practical competence

Table 4.5.2: Relationship between socio-economic characteristics and level of skills

Variables	B	S.E.	Wald	Sig.	Exp(B)
Sex	1.539	0.626	6.038**	0.014	4.661
Age	0.063	0.053	1.387	0.239	1.065
Mstatus	-0.703	0.898	0.611	0.434	0.495
Hhsize	0.505	0.263	3.614*	0.057	1.648
Edu	0.458	0.513	0.797	0.372	1.581
Exp	-0.159	0.108	2.182*	0.004	0.853
Farmsize	1.245	1.077	1.336	0.248	3.472
Income	5.172	2.761	6.846**	0.002	2.176
Training	1.887	0.655	8.304**	0.004	6.597
Constant	-11.04	3.373	10.71**	0.001	0.612

Source: Field Survey, 2025.
-2 Log likelihood = 82.713; Nagelkerke R Square = 0.455.
Overall percentage prediction = 78.9
**Sign. at 0.01 level and *Sign. at 0.05 level.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The primary aim of this study was to examine the knowledge and skills levels of agrochemical usage among cassava farmers in Ovia North-East Local Government Area of Edo State, Nigeria

A survey of 90 cassava farmers using agrochemicals, obtained through a two-stage sampling procedure involving purposive and simple random sampling techniques was carried out in the study area. The analysis was conducted using various statistical tool, including mean, percentages and standard deviation to draw references from the data collected.

Results showed that 63.2% of the farmers were male while 36.8 were female. The study also found that the 82.2% of the farmers were married with the mean age of 42 years, indicating that more middle-aged individuals were involved in cassava farming. 94.4% had household size of less than and equal to 5. 72.2% had secondary education, 23.3% had tertiary education, 1.1% had primary education while 3.3% had no formal education. The farmers had a mean farming experience of 8 years and a mean annual income of N826, 222. 64.4% of the farmers had contact with extension agent and they all used agrochemicals.

The study examined the level of knowledge and skills that cassava farmers have in using agrochemicals. Their level of perceived knowledge varied, from high knowledge level to low with the one they had the highest level of knowledge on being information on agrochemical labels or cans ($\bar{x} = 2.98$) and the lowest level of knowledge on, Identifying adulterated agrochemical products ($\bar{x} = 1.61$). Their level of skills also varied, select the correct agrochemical for the target pest or crop issue ($\bar{x} = 2.08$), measure and mixes agrochemicals accurately with the right tools ($\bar{x} = 2.44$), Wear appropriate protective equipment (like gloves, masks) during handling and spraying ($\bar{x} = 2.08$), apply chemicals without polluting water, harming life or damaging land ($\bar{x} = 1.78$), act quickly and safely if you come in contact with dangerous chemicals ($\bar{x} = 1.93$). Low literacy levels ($\bar{x} = 2.63$), agrochemical labels are not in local languages ($\bar{x} = 2.51$), inaccuracy of information from fellow farmers ($\bar{x} = 2.53$), lack of motivation to attend training ($\bar{x} = 2.64$) were the major constraints faced by the farmers in the study area.

The logistic regression analysis revealed that certain socio-economic factors significantly influenced both knowledge and skill levels. Household size ($p = 0.012$), income ($p = 0.001$), and training (0.001) were strong predictors of knowledge. For skills, significant determinants included sex (with men more skilled), household size, farming experience (negatively), income, and training. Training on agrochemical usage was the most influential factor in both models.

5.2 Conclusion

The findings from this study indicate that household size, annual income, and training explain a substantial proportion of the variation in farmers' knowledge of agrochemical usage. The respondents have a generally high level of knowledge on key aspects of agrochemical usage, particularly those related to chemical types, label interpretation, and safety considerations. these findings suggest that cassava farmers' knowledge of agrochemical usage is shaped by the combined effect of social, economic, and institutional factors.

Similarly, while farmers demonstrate moderate to high skill in selecting and mixing chemicals correctly, they show weaknesses in consistently applying safety practices such as the use of protective equipment, maintaining accurate data of chemical use, acting quickly and safely if they come in contact with dangerous chemicals. The inconsistency between knowledge level and skill level suggests that knowing what to do does not always translate to doing it correctly. The analysis also reveals a significant relationship between sex, household size, farming experience, income, training and skills in applying agrochemicals effectively and safely.

Improving the safe and effective use of agrochemicals among cassava farmers requires strengthening extension services, increasing access to training, and ensuring that agrochemical information is accessible, accurate, and easy to understand. Addressing these issues will contribute to safer production practices, improved crop yields, and reduced environmental and health risks.

5.3 Recommendations

Based on the findings of this study, the following recommendations were made:

1. Government and agricultural organizations should increase the number of extension agents in the area and ensure more frequent visits to help increase the knowledge and skills the farmers have.

2. Training sessions should be practical and held regularly. Farmers should be trained and be motivated to join training on safe disposal of containers, prevention of agrochemical drift, accurate record keeping, use of protective equipment, and emergency response techniques during exposure to agrochemicals.

3. Agrochemical companies should provide labels and instructions in commonly spoken local languages to address literacy and language barriers. Visual symbols should also be made clearer for farmers with limited literacy.

4. Income has a significant influence on farmers' skills, government or NGOs should introduce subsidies for protective equipment such as gloves, masks, and boots to promote safer application practices.

5. Women-specific training should be introduced to close the gender gap and ensure women can independently handle agrochemicals safely, as male farmers exhibited higher skill levels.

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RESEARCH QUESTIONNAIRE

FACULTY OF AGRICULTURE

UNIVERSITY OF BENIN, BENIN CITY, EDO STATE NIGERIA

Dear respondent, I am an undergraduate student of the above named institution carrying out research to gather useful information on the topic: "**Knowledge and Skill of Cassava Farmers in Agrochemical Usage in Ovia North-East Local Government Area, Edo State, Nigeria**". I hereby solicit your assistance by responding to the questions below accurately, all information given will be kept absolutely confidential and only used for the purpose of this study.

Thanks for your cooperation.

Esther Oreoluwa OLUDARE

INSTRUCTION: Please tick (✔) where applicable

SECTION A: Socio-Economic Characteristics

1. Sex: (a) Male ☐ (b) Female ☐

2. Age: ---------- (years)

3. Marital Status: (a) Single ☐ (b) Married ☐ (c) Widowed ☐ (d) Divorced ☐ (e) others specify: ______

4. Household Size: ______ (Number of persons in your household)

5. Educational Level: (a) No formal education ☐ (b) Primary education ☐

(c) Secondary education ☐ (d) Tertiary Education ☐

6. How many years have you been farming cassava? ______

7. Farm Size (in hectares): _______________

8. Annual Income (in Naira): ______________ (from all sources)

9. Agrochemical usage? (a)Yes☐ (b)No☐

10. a. Training on Agrochemical usage? (a)Yes☐ (b)No☐

10. b. If yes, source of training: _____________

11. Contact with extension agent? (a)No contact☐ (b) Contact☐

12. If contact, what is your frequency of contact? (a) Daily☐ (b) Weekly☐ (c) Forth nightly ☐ (d) Monthly☐ (e) Quarterly☐ (f) Annually☐

Section B: Perceived Knowledge in Agrochemical Use

13. Do you have knowledge in agrochemical usage? Tick (✔) if Yes

14. How well do you know about agrochemical usage and rank the extent of your knowledge of agrochemical usage in the underlisted areas?

Key: 1= Very little knowledge, 2 = Little knowledge, 3= Moderate knowledge, 4= High knowledge

		(A)	**Rank(B) Tick**			
S/N	**Perceived Knowledge in agrochemical use**	**Tick(✔)**	**1**	**2**	**3**	**4**
1	Information on agrochemical labels or cans					
2	The different types of agrochemicals for different pests or plant problems					
3	Appropriate timing and how often to use chemicals					
4	Correct personal protective equipment to use by sprayer					
5	Concept of agrochemical pest resistance and how to prevent it					
6	Weather can affect spraying chemicals (e.g. spraying against wind and in the rain)					
7	How to calculate treatment area and calibrate spraying equipment properly					
8	How to safely mix different chemicals for use					
9	How to reduce health risks when using agrochemicals (like washing hands, changing clothes and so on)					
10	How to protect nearby farms, animals and people when spraying chemicals					
11	How to clean sprayers and containers after spraying					
12	Consequences of misusing agrochemicals					
13	Proper disposal of used agrochemical cans					
14	Storage of agrochemicals away from children and food					
15	Identifying expired agrochemical products					
16	Identifying adulterated agrochemical products					
17	Others (please specify): (i)					
18	(ii)					

Section C: Skills in applying agrochemicals effectively and safely

14. Which of the following skills do have in applying agrochemicals effectively and safely? Tick accordingly and rate the extent of your skill in agrochemical usage.

Key: 1= Low skill, 2= Moderate skill, 3= High skill

		A	B		
S/N	**Skills in Agrochemical Application**	**Tick (✔)**	**1**	**2**	**3**
1	Select the correct agrochemical for the target pest or crop issue				
2	Measure and mixes agrochemicals accurately with the right tools				
3	Wear appropriate protective equipment (like gloves, masks) during handling and spraying				
4	Apply chemicals without polluting water, harming life or damaging land				
5	Act quickly and safely if you come in contact with dangerous chemicals				
6	Maintain accurate data of chemical use (what, how much, when and where)				
7	Use the right equipment appropriately in the spraying of chemicals				
8	Apply agrochemicals only when needed and in the right amount				
9	Make sure agrochemicals do not drift to unwanted place during application				
10	Avoid eating, drinking, or smoking while working with agrochemicals				
11	Stop working immediately and take action if you feel dizzy, itchy or sick during application				
12	Avoid spraying against the wind				
13	Others (please specify): ______________				

Section D: Constraints faced by respondents in acquiring knowledge and skills in agrochemical usage

16. Which of the following hinders you from acquiring knowledge and skills in agrochemical usage and indicate the level of seriousness on a 4-point rating scale **of 1- not serious, 2- maybe serious at times, 3- serious, 4- always a serious constraint.**

S/N	Constraints	Yes	No	1	2	3	4
1	Lack of access to agricultural extension services						
2	Low literacy levels						
3	Agrochemical labels are not in local languages						
4	Time constraint in attending training programs						
5	Cultural barrier						
6	High cost of training programs						
7	Language barrier in training session						
8	Lack of trust in extension agents						
9	Insufficient information on safe agrochemical usage						
10	Inaccuracy of information from fellow farmers						
11	Lack of access to internet or digital training materials						
12	Lack of motivation to attend training						
13	Withholding of vital information by fellow farmers						
14	Others(specify): ______________						