FARMERS KNOWLEDGE, ATTITUDES AND PERCEPTION ON THE USE OF BIO PESTICIDES IN CONTROLLING FIELD PESTS OF KALES (BRASSICA OLERACEAE) IN MUNDINDI PARISH BUSIME SUBCOUNTY IN BUSIA DISTRICT

BY

BWIRE DAVID

BU/UP/2020/0606

A RESEARCH REPORT SUBMITTED TO THE FACULTY OF SCIENCE AND EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF A DEGREE OF BACHELOR OF SCIENCE EDUCATION (AGRICULTURE) OF BUSITEMA UNIVERSITY.

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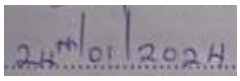
SUPERVISOR: MR. DRAMADRI GERALD AFAYO

FEBRUARY 2024

DECLARATION

I BWIRE DAVID declare that all the work in this report was carried out in accordance with the regulations of Busitema university, and that this work is original except where indicated in the text and no part of this research has been submitted to any other university for examination and degree award. Any views expressed in this research are those of the author and in no way represent those of Busitema University

Signature 

Date 

APPROVAL

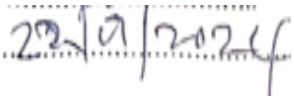
This is to certify that the research "**FARMERS KNOWLEDGE, ATTITUDES AND PERCEPTION ON THE USE OF BIO PESTICIDES IN CONTROLLING FIELD PESTS OF KALES (BRASSICA OLERACEAE) IN MUNDINDI PARISH BUSIME SUBCOUNTY IN BUSIA DISTRICT**" is submitted in partial fulfilment of the requirements for the award of degree of Bachelor of Science Education of Busitema University is Authentic record of bonafied research work carried out by BWIRE DAVID Registration No: BU/UP/2020/0606 under the guidance and supervision of MR. DRAMADRI GERALD AFAYO

No part of this research report has been submitted for any other degree or diploma award.

ACADEMIC SUPERVISOR BUSITEMA UNIVERSITY

Signature

Date



MR. DRAMADRI GERALD AFAYO

(SUPERVISOR)

DEDICATION

I thank God for the gift of life and for enabling me to complete my research project successfully. This report is dedicated to my beloved supervisor; Mr. Dramadri Gerald Afayo, my beloved father mze mangeni jared, mother Ms. Achiengi Joyce, sisters Nabwire Esiresi and Nafula Hellen, brothers Wafula Abel, Ojiambo Benard, Wandera moses, Okumu Samuel and Simon Peter shahuba ,all my course mates, and my dear lecturers for their maximum support that they offered to me both morally, technically and financially, materially and in all circumstances that I went through in carrying out this research report. You have been so fundamental in pursuit of my course. May the good and merciful lord reward you abundantly.

ACKNOWLEDGEMENTS

In the first place, I convey my sincere gratitude to the almighty God for the gift of life up to date , for I can not pay enough for this . I do express my sincere thanks to my supervisor and head of department Agriculture faculty of science and education Busitema university, Mr. Dramadri Gerald Afayo, my dear lecturers Mr. Ochan Martin Luther, and Prof. Ochwo Victor AKangah, prof James Egonyu and Mr. Oguzu Evans. Thank you so much for your technical and parental guidance and mentoring.

Special thanks go to my Beloved parents Mzee Mangeni Jared and Achiengi joyce who supported me morally financially, and technically throughout my academic endeavors. Special gratitude also goes to the University management for mentoring and providing me with technical knowledge and advice and for their efforts in ensuring that this research is completed. Further, I register my sincere appreciations to brother Ojiambo Benard, I cannot thank you enough to bring out the financial and moral support extended to me during my academic journey.

ABSTRACT

The purpose of this research was to find out farmers knowledge, attitudes and perception on the use of bio pesticides in controlling field pests of kales (brassica oleraceae) in Mundindi parish Busime sub county in Busia district.

The study employed a qualitative research design, and the methods of data collection were interview, questionnaires, observation and recording. The data analysis tool was Microsoft word Excel 2019 to generate statistical tables and figures. The study was carried out in Mundindi parish Busime sub county in Busia district in Uganda and a total of 50 respondents were selected from the rural areas in Mundindi parish

The results of the study indicated that kales farmers in Mundindi parishexperience a problem of field pests with varying status of harm to the kales crops and yet they have limited knowledge on the use of bio pesticide in the management of field pests of kales . it also indicated that most kales farmers in the area have negative attitudes on the use of bio pesticides as far as effictivenss is concerned. It also indicated that most farmers have misconceptions on formulations, use and effectiveness of bio pesticides.

The researcher ephasised more government intervention in improving awareness of bio pesticide use,changing farmers attitudes and perception for good

Key terms : bio pesticide, field pests, kales

LIST OF ABREVIATIONS/ACRONYMS

CDO -Community development officer

CIGs -Common interest groups

EKN-Embassy of the Kingdom of the Netherands

FAO -Food and agricultural

Fig –Figure

GDP- Gross Domestic product

ISSD-Integrated Seed Sector Development

NAADs- National agricultural advisory services

T.C- Trading centre

WCDI-Wageningen Centre for Development Innovation

BCA- biological control agents (

CHAPTER ONE

INTRODUCTION

1.1 Background.

According to Thrall P.H (2020), Agriculture was fundamental in the development of human society, enabling a gradual shift from a hunter-gatherer nomadic lifestyle to a more settled way of life, allowing primordial civilizations to flourish. Agriculture plays a big role in creating inclusive and providing great jobs for both the youth and adults. Growth in agriculture output increases farm productivity and profitability leading to improved wellbeing of the farmers and those living in the rural areas and hence enhancing rural development.

The primary purpose of agricultural and rural development in countries like Uganda is to achieve improvement in rural levels of living achieved primarily through increases in small farm income, output and productivity along with genuine food security as a critical way out of poverty toward great rural development. This therefore involves avoiding, prevention and control of all the possible causes of agricultural loses to such rural farmers who in most cases in Uganda are small scale farmers and operate on a small acreage of land.

Uganda is located at the equator with a favorable climate for producing all kind of fruits and vegetables. Uganda is the second largest producer of fresh fruits and vegetables in sub-Saharan Africa, after Nigeria, producing about 5.3 million tons per year according to recent FAO statistics.

However, production detailed data on Uganda’s fruits and vegetables are very limited. Vegetables and fruits are a major crop produced in all the districts of Uganda. Fruits and vegetables are produced by smallholders, scattered all over the country. The agricultural and fisheries sector as a whole represents 24.2% of Uganda’s GDP (Word Bank, 2019) and 70.7% of its employment n 2018 (ILOSTAT, 2019).

This has called for farmers' participation in the production of high value crops which is among the top leading economic activities that contribute to better living standards through employment which helps to curb poverty. As a result, the livelihoods of most rural households are also improved. This sector consist of Horticulture sub sector in the recent years has gained ready market due to increased demand of its products both locally and internationally.

The agricultural subsector of vegetable farming plays a vital role in enhancing quality food and reducing the number of those suffering from malnutrition hence achieving the Sustainable Development Goals. This is greatly achieved by encouragement of the private sector. The

production of horticultural products is gaining importance. The horticulture sector has been supported by the Integrated Seed Sector Development (ISSD Plus Project) (2017-2020). The ISSD and the ISSD Plus Project have been coordinated by the Wageningen Centre for Development Innovation (WCDI) funded by the Embassy of the Kingdom of the Netherands (EKN). In Uganda such horticultural crops can be categorized into four categories namely;

a).Vegetable and species e.g. i).Okra, Garlic, Irish potatoes Pepper green peppers, watermelon sukuma wiki, tomatoes, nakati, cabbage among others

b).Fruit crops e.g. i).Pineapples, Mangoes, Gooseberry, Passionfruits, among others

c).Medicinal crops e.g. Moringa, Neem tree, Aloevera, Artemisia spp.

d).Cottage crops e.g. Mushrooms, Flowers (Roses), Upland rice.

In most developing countries, the use of modern synthetic pesticides is limited and sometimes non-existent (Scalabba, 2000). This is so not only because they are expensive but also because of the small fields cultivated by subsistence farmers making the use of such pesticides uneconomic. Yet, most of these countries lie in tropical and subtropical areas where pests and diseases are abundant throughout the year. This implies that, pests and diseases pose a major problem in agricultural production in these areas.

According to Oerke and Dehne (2004), pests contribute 30-40% of crop loss worldwide while the loss in the tropics is reported to be even higher than 40% (FAO,)

Vegetables are edible plants or plants that are consumed by humans or other animals as food containing vitamin and minerals. Examples of vegetables grown in Busime sub county include;

Leafy green-sukuma wiki, lettuce, spinach and silver beet, cruciferous – cabbage and cauliflower

Root - potato, sweet potato and yam.

Edible plant stem – celery and asparagus, allium – onion, garlic and shallot.

However, sukuma wiki is the most grown vegetable in the area

BIO PESTICIDES

Crop losses caused by various pathogens, i.e., bacteria, fungi, insects, weeds, etc., reduce agricultural productivity and cause economic loss to the country. Usage of chemical fertilizers, pesticides, and other aids had a significant role as a protagonist during the green revolution. It favored the scenarios of agricultural production, and all seemed to rely on these aids in a very smooth manner. The negative side of these chemically synthesized fertilizers and pesticides got the limelight when the chemical residues started to accumulate in the soil, water, and products. Their impact on the environment became visible when these started to contaminate and deteriorate the quality of soil, water, and other vegetation. Thus, chemicals used in these pesticides have direct as well as indirect implications on human health and environment. Global demand is for safe, non-toxic, nutritious food products. These products can be obtained only by good agricultural practices, followed by safe post-harvest processing techniques. Sustainable agriculturalcultural practices cannot be achieved only by scientific expertise. Farmers' field knowledge for combating problems related to pests should also be given proper importance. More requirement of organic and pesticide independent food ingredients is the prime driving force for innovative ideas formulating safer pesticides for agriculture practices. The stakeholders are now concentrating on alternatives to these chemically synthesized pesticides in the form of bio-pesticides, which is a marvelous innovation in the field of agriculture science. Bio-pesticides formulated with microbes or plant extracts promote the growth of beneficial micro-organisms and control the targeted harmful pests. Pyrethrin, neem extracts, essential oils, and alkaloids extracted from various plants show significant effects on pests which include repellency, feeding deterrence, negative impact on oviposition, growth inhibition, disruption during mating, chemosterilization, etc. Application of bio-pesticides and natural biodegradable nanopesticides is the key to success in chemical-free agricultural practices in future. Keyword

A bio-pesticide is a biological substance or organism that damages, kills, or repels organisms seen as pests. Biological pest management intervention involves predatory, parasitic, or chemical relationships. They are obtained from organisms including plants, bacteria and other microbes, fungi, nematodes, and other animal extracts.

According to Gasic, S. and Tanovic, B. (2013), Biopesticides are products and by-products of naturally occurring substances such as insects, nematodes, microorganisms, plants as well as semiochemicals

1.2 PROBLEM STATEMENT.

Vegetable farmers in Busime sub county are facing a problem of field pests that doesn't only destroy their vegetable crops but also causes and spread plants and human diseases. Such pests among others include;

Field crickets(Gryllus ssp), which feed and cuts off sprouts and young plants in vegetable crops such as sukuma wiki, tomatoes, eggplants , green peppers, watermelon among others.

Variegated grasshoppers (Zonoceru variegatus), which feed on leaves and stems of both young and mature plants of eggplants, spinach,sukuma wiki among others.

Aphids (aphis ssp,myzusssp), which feeds on leaves and stems of vegetables such as onions, eggplants, spinach, sukuma wiki, green peppers among others.

In the absence of effective alternative management options to tackle pests, smallholder farmers rely extensively on indiscriminate application of synthetic pesticides. These synthetic pesticides are harmful to human health, detrimental to the environment and biodiversity, and lead to rapid build-up of resistance in the target pests while decimating natural enemies of pests, resulting in secondary pest outbreaks.

In addition, presence of pesticide residues on export crops that are above the permissible maximum residue levels of importing nations results in informal trade barriers (Bailey et al., 2020) crops that are above the permissible maximum residue levels of importing nations results in informal trade barriers (Bailey et al., 2020). For example continuous use of synthetic chemical pesticides has affected the quality of water sheds near the farms such as Narioba swamp (found on the border with namayingo district) whose water is no longer safe for domestic use due to such residues

In addition, synthetic pesticides are also expensive which makes it difficult for some small scale farmers in Busime subcounty.

1.3Justification of the study.

There is pre harvest loses of sukuma wiki in Mundindi parish Busime subcounty in Busia district due to pests and diseases, this is because many farmers can't afford to buy synthetic

chemical pesticides to control pests, and also there's development of pesticide resistance by pests in that some pesticide are no longer effective in the pest control. This calls for investigation into and also device the means to overcome this problem, and therefore the need to device an alternative for the situation. This is because vegetable growing is the major source of income to the people of Mundindi after many restrictions put on fishing on lake Victoria which was previously the major economic activity in the area. However the alternative should also be environmental friendly as;

Continuous use of synthetic chemical pesticides in Busime subcounty will lead to loss of biodiversity, increased costs of production which may reduce the profit margin of vegetable farming hence pushing many small scale farmers in Busime out of vegetable growing. It may also lead to air pollution in Mundindi parish Busime subcounty and it's related effects on human health such as airborne diseases, water pollution in nearby water streams of Lake Victoria, Mundindi swamp, and Narioba swamp. And yet bio-pesticides can replace synthetic pesticides without significantly affecting productivity and yield of vegetables, if their potentials are fully maximized

1.4Significance of the study.

The immediate beneficiaries of the project are going to the be the smallholder farmers of vegetables who will participate in the field demonstrations as they will benefit from the resources made available by the project process.

Ultimately the small scale vegetable farmers of Mundindi parish are the major target to benefit as they adopt the technology in relation to understanding the formulation and application of bio pesticides .This will be through analyzing the strategies that other farmers are using in reducing such loses.

The findings of the study will also be of great significance to the policy makers in understanding which policies can be formulated to help out farmers reduce the over reliance on synthetic chemical pesticides.

1.5Objectives.

General objective

To contribute to management of field pests of kales using bio pesticides in Uganda

Specific objectives

- To find out field pests affecting growth and yield of kales in Mundindi parish Busime sub county Busia district.
- To find out if kales farmers in Busime use bio pesticides control field pests in Mundindi parish
- To identify the bio pesticides used to control some of the field pests of kalesi n Mundindi parish Busime Sub county in Busia district
- To evaluate the farmers' perception on efficiency and effectiveness of the bio pesticides used in the control of field pests pests in kales in Busime Sub county
- To identify farmers' perception on the use and the measures to increase adoption, efficiency and effectiveness of bio pesticides in control of field pests in kales in Busime sub county.

1.7 Research questions.

What were some of the field pests affecting growth and yield of kales in Busime sub county Busia district

Do sukuma wiki farmers in Mundindi parish Busime sub county use bio pesticides in the control of field pests?

What were some of the bio pesticides used in Mundindi parish Busime sub county to control field pests in kales

What was the farmers' perception on the efficient and effective is/are the bio pesticides use to control field pests in kales.

What are the suggested measures that can be employed to increase adoption, efficiency and effectiveness of the bio pesticides in control of field pests of kales in Busime sub county in Busia district

1.8 Scope of the study

Content scope.

The study is to consider the extent of growing vegetables, pre-harvest loses of vegetables due to pests and diseases, strategies to be use by smallholder vegetable farmers in Busime subcounty in Busia district . Smallholder farmers in this study , particularly those categories of farmers who can cultivate more than one type of vegetable crops on less than one hectare of land and own a few domestic animals for family consumption (subsistence farming) with little if any surplus for the market.

The study is focusing on assessing the causes of pre harvest losses of vegetables due to pests and diseases among small scale farmers with the aim of assessing factors contributing to pre harvest losses, the extent of pre harvest losses and suggest the possible strategies to reduce pre harvest losses of vegetables in Busime in Busia District. The data is to be collected within Mundindi parish, Busime sub county in Busia district .

Geographical scope.

The study will be conducted in 3 villages of Mundindi parish, Busime subcounty in Busia district, which will cover an average area of 3 square kilometers.

Time scope.

I will conduct my study from 2nd of August 2023 upto 1st of January 2024 in the time frame I believe without major hindrance, I will be done and submitting my research report .

Conceptual framework.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Overview of vegetable production

Agriculture is the backbone of Uganda's economy, employing 70% of the population in 2018, and contributing half of Uganda's export earnings and a quarter of the country's gross domestic product (GDP). The current production structure of agriculture in Uganda is dominated by small-scale farmers comprising an estimated 2.5 million households (90% of the farming community), the majority of which own less than 2 acres of land each (FAOSTAT, 2018). Despite good agro-climatic conditions, with two rainy seasons in most parts of the country, smallholder yields remain low. Constraints include limited access to quality inputs, low adoption of modern technology, and a lack of storage and market infrastructure. Small-scale farmers are the majority, constituting about 85% of the farming community; 12% are medium scale farmers; while 3% are large-scale farmers.

2.2 COMMON PESTS AFFECTING KALES GROWING

Francisco Jorge Cividanes etal (2020), reported that" vegetables of the family Brassicaceae, *Brassica oleracea* L., are considered a food eaten routinely and in quantities that constitute an important portion of people's diets in many parts of the world. The leafy kale, *Brassica oleracea* L. var. *acephala* DC., stands out for its economic importance and high nutritional value" . it also reported that" Pest damage is widely reported as one of the major problems that concerns kale growers". Such pests include

Aphids . Aphids are one of the most economically important hemipteran pests, with about 100 aphid species being reported to cause significant agricultural losses worldwide Aphids are silent feeders that cause less tissue damage than chewing insects and, during feeding, release effector proteins in their saliva that suppress host plant defence responses. Damage caused by aphids reduces plant fitness due to their feeding on phloem sap, which makes the plant nutritionally weaker compared to un infested ones They also serve as important vectors for the transmission of plant viruses and produce honeydew

Others include; diamondback moth (DBM- *Plutella xylostella*), common cutworm (CCW-S*podoptera litura*), flea beetle (FBT-*Phyllotreta sinuata*), aphids (APH-*Aphis gossypii* Glover), cabbage looper (CBL-*Trichoplusia ni*) and cabbage webworm (CWW- *H. undalis*).

2.3 CONTROL OF FIELD PESTS IN KALES

Jamin Ali etal. (jamin 2023) reported that new pest management and control strategies are being developed in order to meet current and future challenges

These pest management practices fall under the following categories "chemical, biological, and cultural". However, the use of chemical pesticides is one that is common due to their availability, efficacy, and ease of use .Therefore, the majority of current management practices for are based on chemical pesticides.

Jamin Ali etal. (jamin 2023) also repoted synthetic pesticides containing active ingredients, such as pyrethroids, carbamate, organophosphates, and neonicotinoids, have a strong negative effect on a number of herbivores. Even though pests shows a certain level of resistance to most of these chemical compounds, some of them still have a high potential to be used as synergists with other control measures against pests.

However, growing concerns about their adverse effect on the environment and non-target organisms are leading to restrictions on their use .

Besides chemical methods, there are several other management approaches that show high potential in managing this pest, such as the use of natural defence elicitors and biocontrol agents, the application of entomopathogens, and cultural methods. An accumulating body of evidence shows that the use of bio control agents, i.e., parasitoids and predators, can be an excellent managing tool to protect crop plants from direct damage caused by this pest . Similarly, the use of entomopathogens against pests have revealed a hidden potential for their management Cultural methods, such as intercropping companion plants ,the application of neem leaf extract, and winter pruning, have also been found to be effective against the peach–potato aphid . Altering plant defence mechanisms using natural compounds is another preventive measure, which presents some potential as a future pest management tool Several crops, when treated with these natural compounds, e.g., benzothiadiazole (BTH), *cis*-Jasmone (CJ), and methyl jasmonate (MeJA), have shown high levels of induced resistance against *M. persicae* .Despite

being safe and eco-friendly in nature, these control strategies are not being used considerably and do not receive the attention they need

2. 4. BIO PESTICIDES

Crop losses caused by various pathogens, i.e., bacteria, fungi, insects, weeds, etc., reduce agricultural productivity and cause economic loss to the country. Usage of chemical fertilizers, pesticides, and other aids had a significant role as a protagonist during the green revolution. It favored the scenarios of agricultural production, and all seemed to rely on these aids in a very smooth manner. The negative side of these chemically synthesized fertilizers and pesticides got the limelight when the chemical residues started to accumulate in the soil, water, and products. Their impact on the environment became visible when these started to contaminate and deteriorate the quality of soil, water, and other vegetation. Thus, chemicals used in these pesticides have direct as well as indirect implications on human health and environment. Global demand is for safe, non-toxic, nutritious food products. These products can be obtained only by good agricultural practices, followed by safe post-harvest processing techniques. Sustainable agriculturalcultural practices cannot be achieved only by scientific expertise. Farmers' field knowledge for combating problems related to pests should also be given proper importance. More requirement of organic and pesticide independent food ingredients is the prime driving force for innovative ideas formulating safer pesticides for agriculture practices. The stakeholders are now concentrating on alternatives to these chemically synthesized pesticides in the form of bio-pesticides, which is a marvelous innovation in the field of agriculture science. Bio-pesticides formulated with microbes or plant extracts promote the growth of beneficial micro-organisms and control the targeted harmful pests. Pyrethrin, neem extracts, essential oils, and alkaloids extracted from various plants show significant effects on pests which include repellency, feeding deterrence, negative impact on oviposition, growth inhibition, disruption during mating, chemosterilization, etc. Application of bio-pesticides and natural biodegradable nanopesticides is the key to success in chemical-free agricultural practices in future. Keyword

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2.3. CLASSIFICATION OF BIO PESTICIDES

They can be classified accordiding to

1. Based on the nature and origin of the active ingredients, biopesticides fall into several categories such as botanicals, antagonists, compost teas, growth promoters, predators and pheromones(Semeniuc, C.A etal. (2017))
2. Plants and microorganisms are the major sources of biopesticides due to the high components of bioactive compounds and antimicrobial agents(Nefzi, A., etal (2016))
3. The active compounds in plants include phenols, quinones, alkaloids, steroids, terpenes, alcohols and saponins (Mizubuti, etal (2017))
4. Mode of action. Biopesticides exhibit different modes of action against pathogens such as hyperparasitism, competition, lysis and predation

2.4. EFFECTS OF USING BIO PESTICIDES

According to Miha Curk and Stanislav Trdan(2023), Biological control, a well-established plant protection method, has garnered substantial a ention in recent decades. They also reported that various approaches, including biological control agents (BCA), catch crops, bio fumigation, sticky traps, and pheromones, have been extensively explored. While the effectiveness of these methods varies depending on specific circumstances, their collective significance has grown amid mounting pressures to curtail or eliminate conventional synthetic plant protection products. Previous review articles have highlighted the synergistic benefits of using two or more BCAs simultaneously, yet limited information exists regarding the concurrent use of diverse biological control methods. This comprehensive review incorporates a thorough literature search to assess the synergistic potential of concurrently employing two or more of these methods, followed by a discussion on perspectives of holistic management and mimicking of complex natural systems, shedding light on the vast potential and need for further research in this domain

2.5 FORMULATION AND USE OF BIO PESTICIDES

Rishi kesh meena and preeti mishra(2020) published the following formulation and use of bio pesticides

Paddy and vegetables

(all pests)

Decomposed solution of cow dung, cow urine, chilli (*Capsicum annum*) and garlic at the ratio of 0.5:10:0.25:0.25 for three weeks

Chilli, (Wilt)

Mixed cropping of chilli (*Capsicum frutescens*), coriander (*Coriandrum sativum*) and garlic

Coffee (Coffee rust)

Garlic and papaya (*Carica papaya*) are

used as fungicides

Coconut (Root wilt and nut fall)

Apply crushed small onion (l Kg) and salt

(2 Kg) in the basin of coconut trees

Vegetables (Aphids)

A mixture of extracts of garlic and neem cake

Vegetables (Fruit borers)

Spraying of garlic extract and kerosene

solution (2 Kg of garlic + 200 L of water + l400 ml of kerosene)

Vegetables (All pests)

Application of neem cake 16.66%, dusting the ash 23.33%, spraying garlic and asafoetida (*Ferula asafoetida)* solution 10%, spraying of soap water 2.50%

Vegetables (All pest) One Kg gulvel pieces (*Tinospora cordifolia*), 100 g onion pieces, 50 g chilli powder and 250-500 g turmeric (*Curcuma longa*) mixed with 1 L water. The mixture is thoroughly stirred, boiled and filtered. 2 L of the filtered extract is mixed in 100 L water and 100 g washing powder solution and used after 3 days for spraying[12]

2.6 EFFICIENCY OF BIO PESTICIDES

Miha Curk and Stanislav Trdan (2023) in their publication "Unlocking Synergistic Potentials" reported that the reviewed studies strongly support the idea that combining various nature based solutions in biological control is more effective than single-method approaches. The discussion explores the challenges of single-factor research and emphasizes the need for a broader perspective in sustainable agriculture. The scarcity of studies on synergistic effects using specific keywords underscores a common issue in scientific literature—ambiguous terminology. The gap between theoretical benefits and real-world effectiveness highlights the importance of holistic approaches that consider ecosystem dynamics. Barriers to adopting sustainable pest management practices persist, including rigid adherence to predefined rules without the consideration of a wider context, therefore it would be highly beneficial for future studies to focus more on the ecosystem services-based comparisons and holistic environmental-socio-economic approaches like the recently developed "agroecological plant protection" concept. They also reported that it is crucial to move the debate from solely "which is the best organism to use" to "what type of environment can support multiple organisms simultaneously", calling scientists to consider researching a wider context

Rishi Kesh Meena and Preeti Mishra(2020) reported that "Alkaloids from various plants cause poisoning in pests. They camouflage the mode of action of organophosphates and carbamate

insecticides. Alkaloids like “nicotine” were used primarily but soon discovered to be nerve toxin to human as well. Pyrethrin is another widely used phytochemical showing the excellent biocidal property. Pyrethrin I and II esters cause hyperactivity and convulsions in most flying insects. Pyrethrin blocks sodium/ potassium channels of nerve axons. The function is similar to dichloro diphenyl trichloroethane (DDT), the popular chemical pesticide. This activity of pyrethrin causes problems related to half-lives in ultraviolet radiation. Synthetic pyrethroids solved the problem with similar efficacy and negligible side effects on the environment. Pyrethroids with piperonyl butoxide work synergistically and paralyze insects for a shorter period. Neem and its derivative allele-chemicals show a range of ramifications on pests which include repellency, feeding, negative impact on oviposition, growth inhibition, disruption during mating, chemo-sterilization,. Its high level of efficiency and different mode of action largely reduce the risk of pest resistance. Few specific metabolites like azadirachtin (tri-terpenoid) demonstrate the anti-feeding activity to insects. This approach is non-toxic and gained popularity due to environment reported hormonal balance disruption in insects due to azadirachtin”.

2.7 ADVANTAGES OF USING BIO PESTIDES IN CONTROLLING FIELD PESTS IN KALES

Rishi Kesh Meena and Preeti Mishra(2020) reported that Neem and its derivative allele-chemicals show a range of ramifications on pests which include repellency, feeding, negative impact on oviposition, growth inhibition, disruption during mating, chemo-sterilization, etc. Its high level of efficiency and different mode of action largely reduce the risk of pest resistance. Few specific metabolites like azadirachtin (tri-terpenoid) demonstrate the anti-feeding activity to insects. This approach is non-toxic and gained popularity due to environment-friendly.reported hormonal balance disruption in insects due to azadirachtin. Essential oils extracted from neem, Eucalyptus, etc. inhibit acetylcholinesterase enzyme in insects (Keane and Ryan 1999). Bioactivity and bio-efficacy of essential oils depend upon type and nature of individual constituents, the process of extraction of oil.

2.8 DISADVANTAGES OF USING BIO PESTICIDES IN CONTROLLING FIELD PESTS IN KALES.

Rishi Kesh Meena and Preeti Mishra(2020) reported that Microbial pesticides mainly pose three types of challenges to pests:

(a) competition for food, habitat, and survival,

(b) creation of physical barriers.

(c) suppression by metabolites and chemicals.

These ecological, physical, and biochemical mode of actions play a crucial role in the choice of manufacturing methods and the final cost of production. B.Subtilis is an endospore-forming Grampositive bacterium. These spores are heat, chemical, radiation resistant and provide long shelf life to pesticidal products made up by them. This gives B. subtilis commercial upper hand to other pesticides in the industry. The property of the bacterium poses ecological pressure on many bacterial and fungal pests' population for food and habitat. Secreted toxic metabolites are antimicrobial and inhibit the growth of other microbial population present in soil and nutrient-limited niche.

Alkaloids from various pesticicidal plants cause poisoning in pests. They camouflage the mode of action of organophosphates and carbamate insecticides . Alkaloids like "nicotine" were used primarily but soon discovered to be nerve toxin to human as well. Pyrethrin is another widely used phytochemical showing the excellent biocidal property. Pyrethrin I and II esters cause hyperactivity and convulsions in most flying insects. Pyrethrin blocks sodium/ potassium channels of nerve axons. The function is similar to dichloro diphenyl trichloroethane (DDT), the popular chemical pesticide. This activity of pyrethrin causes problems related to half-lives in ultraviolet radiation. Synthetic pyrethroids solved the problem with similar efficacy and negligible side effects on the environment. Pyrethroids with piperonyl butoxide work synergistically and paralyze insects for a shorter period.

2.9 FUTURE PROSPECT FOR USING BIO PESTICIDES IN CONTROLLING FIELD PESTS IN KALES.

Indian agriculture is facing many challenges like diseases, climate change, soil quality degradation, loss of biodiversity, etc. To increase the yield in a limited area of the field, farmers are trying all sorts of strategies. One of the strategies greatly benefitted rural area farmers was

the use of chemical pesticides for crop against pests like an insect, nematodes, mites, fungi, bacteria, viruses, etc. Proper programs for the training of farmers for specific usage, quantity measurement, and time of usage of pesticides were not provided, resulted in an unorganized agriculture sector. Intensified and targeted research is required in the field to combat crop diseases, without negatively impacting yield and enhanced nutrition. Customers' awareness in the nutritional content, as well as pesticide pesticide-free propagation of food products, has compelled farmers and researchers to redesign agricultural practices. The increasing growth rate of nutraceuticals' market per annum and rising demand for organic food products is an alert to adopt agronomically compatible practices in agriculture. Application of bio-pesticides and natural biodegradable nano-pesticides is the key to success in chemical-free agricultural practices. We have to discover and formulate new active principles of bio-control having longer shelf life, easy to handle, and higher efficacy products which are environmentally safe. Commercialization of non-hazardous bio-pesticides is another concern of the manufacturing companies. Most of the companies are new and trying to sustain in the market. The government should give subsidy and aid to the companies for market survival. Increasing resistance in pests due to the application of chemical pesticides has driven awareness towards natural practices. Botanical extracts are being exploited because they tend to depend on various closely related active constituents rather than a single active ingredient. There are many key drivers to increase the growing market of bio-pesticides in near future that are growing organic food market demand for residue-free crop produce, and smooth registration than chemical pesticides

CHAPTER THREE

3. Materials and methods

3.1. Study Area

Location

The study will be conducted at Mundindi parish Busime subcounty in Busia district. It's located along Busia-jinja highway. Mundindi is located in the region of Eastern Region. Eastern Region's capital Jinja (Jinja) is approximately 81 km / 50 mi away from Mundindi .The distance from Mundindi to Uganda's capital Kampala (Kampala) is approximately 149 km / 92

Population

A population is the entire set of people who l will focus on, in the study from which a sample is to be taken. Busime subcounty has a total population of 30,685 as per 2014 census (UBOS, 2017).

Target population

The target population in this study is kales farmers, businessmen involved in kales production, local leaders and the agricultural officers. This choice will help me as the researcher to get the required and relevant information because they will be the key people to involve in vegetable production.

3.2 Research Design

The study is to employ the cross-sectional survey research design to collect data for the field. The design is use on the basis that it shall allow collection of data from different groups of respondents at one point in time. In addition to that, cross-sectional survey research design is use as it is less costly to perform and shall not require a lot of time and captures a specific point in time for future reference (Kothari, 2004). Surveys used questionnaire guides as data collection instruments (Amin, 2005).

3.3, Sampling procedure

The researcher will use simple random sampling and purposive sampling procedures. Simple random sampling is use to select farmers dealing in sukuma wikiproduction since they form a bigger proportion of the study population size. According to Kathuri & pall (1993), Simple random sampling is not biased selection because each member of the population may have an equal chance to be included in the sample. On the other hand, Purposive sampling is to be use in getting respondents that l will interview such as the Agriculture Officers, and Local leaders.

Sample size determination

This refers to the number of respondents to be selected from the population to constitute a sample (Kothari, 2004). The sample size is to be determined using Yamane formula for determining sample size (Yamane, 1997). This formula is as below.

Due to financial constraints, the researcher will use a sample of 50 kales farmers in order to covera range of variables such as level of pest problem, level of bio pesticide applications ,soil conditions among others

Farmers using at least different types of bio pesticides are to be selected among all kales farmers in Busime sub county in Busia district.

n= N/ (1+N (e) 2)

Where,

n= sample size

N= population that can easily accessible

e= level of precision

3.4 Data collection instruments.

3..4.1. unstructured Interviews .

I used unstructured interview for a specific group of respondents particularly the CDO, sub county chief. Thwas method helped me to collect raw data and interact with farmers and other

respondents physically. The method was beneficial and helped me to obtain hidden information and also build good relationship with respondents. The method was beneficial and helpful to respondents who could not read and write, including those with physical dwasabilities.

3.4.2 Questionnaires .

I used open and closed- ended structured questionnaires to collect restricted information from the respondents. Questionnaires were filled only by respondents who were able to read and write.

3.4.3 Recording

I used recording to obtain information during interview and observation of useful data. I used use materials like a ball pen, paper, pencil, ruler, and an umbrella under strong sunshine.

Data collection procedure

The researcher will get an introductory letter from the Dean faculty of Science and Education as seeking permission to conduct the study the supervision will start afterward. This letter is to be presented to the local authority in the study area for permission to conduct the Study. Once the permission is granted, then l shall start to visit kales farmers with questionnaires to the respondents. For the case of those farmers who may be unable to write, then I will help them to fill by reading and translating for them and their responses shall be fill on the questionnaire accordingly. A list of farmers should be from the relevant authorities of the villages of Mundindi parish Busime subcounty from which the respondents is to be chosen.

Data analysis.

Data is to be analyze using Statistical Package for Social Sciences (SPSS) computer program where percentages, tables and frequencies is always generated. Quantitative data is group and statistical description in tables showing frequencies and percentages is use for better interpretation.

Ethical consideration]

Ethical issues which is consider here include: confidentiality; voluntary participation; anonymity; and informed consent. By this, the l shall respect human dignity by not revealing the identity of the respondents in the Study. In addition, l will first seek for their consent and reach a consensus before the information is to be collected. The information to be provided by the respondent is treated confidential and will serve only for the intended study purposes. I will also inform about the respondents that their participation is to be voluntarily whereby they are free to join and free to leave during the process of data collection.

CHAPTER FOUR

4.0. DATA PRESENTATION,ANALYSIS AND DISCUSSION

This chapter includes data presentation, analysis and discussion of the research findings using tables ,statistical figures and diagrams

4.1.DEMOGRAPHIC/SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

TABLE 1: SOCIO-ECONOMIC/DEMOGRAPHIC DATA OF RESPONDENTS

Table 4.1.1. residents of respondents by village

Village	**Number of respondents(frequency)**	**Percentage**
Mundindi "B"	**7**	**14**
Mundindi "A"	**7**	**14**
Sihubira	**6**	**12**
Sibodohi	**6**	**12**
Nanjese	**6**	**12**
Lwala "A"	**6**	**12**
Nambngere	**6**	**12**
Lwala "B"	**6**	**12**

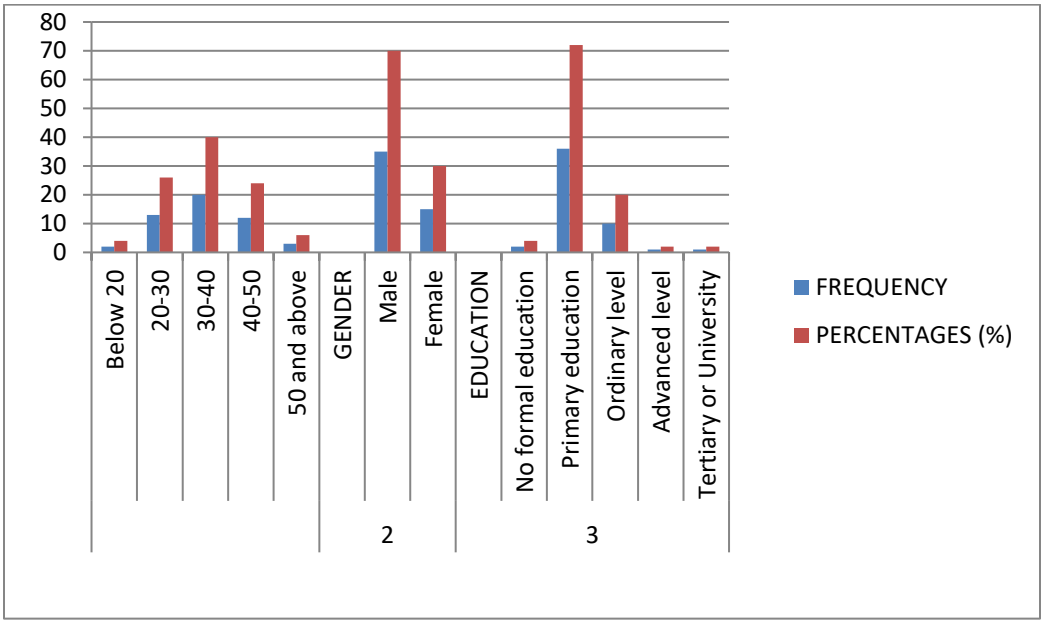
Source; primary data (n=50)

4.1.2 . demography of respondents by age,gender and education background

1	AGE (YEARS)	FREQUENCY	PERCENTAGES (%)
	Below 20	2	4
	20-30	13	26
	30-40	20	40
	40-50	12	24
	50 and above	3	6
2	GENDER		
	Male	35	70
	Female	15	30
3	EDUCATION		
	No formal education	2	4
	Primary education	36	72
	Ordinary level	10	20
	Advanced level	1	2
	Tertiary or University	1	2

Source: primary data

FIGURE4.1.1. DEMOGRAPHY OF RESPONDENS BY AGE ,GENDER AND ACADEMIC LEVEL



From results in table 4.1.2 ,fig 4.1.1 above, regarding the age, the majority of respondents 20 (40%) were ranging between 30-40 years and 13repondents (26%) between 20- 30 years.The minority were 2(4%) below the age of 20. According to the personal interactions with one respondent in the interview, most of the people below 20 years are school going children who have limited time to involve in kales growing which requires a lot of time during management, this contributes to their lower participation in kales growing.drop outs increase in the range 20-30 which gradually increases participation. Similarly the range 30-40 constitute of energetic people with very few school going people. The number drops in the range 40-50(according to one respondent)due to reduced energy with age

According to one respondent, based on gender, most of the respondents were male(35) constituting 70% of the total population sampled due land ownership in Mundindi parish where 97% of land is owned by men. leHowever according to another respondent, it is because

women(females) are mostly involved in growing food crops such as maize and cassava for home consumption and hence more men than women in cash crop (kales)production

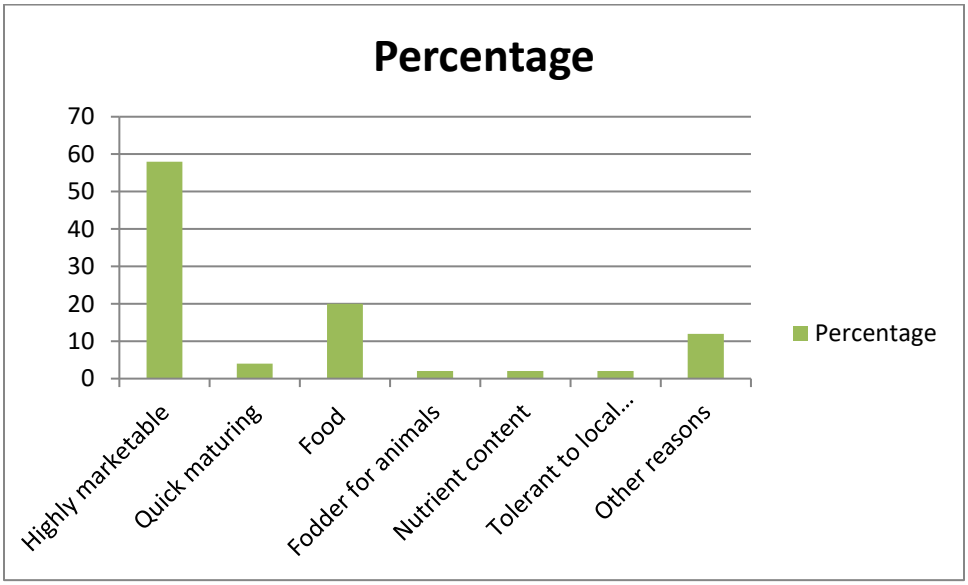
Based on the level of education, 2 respondents 4% had no formal education while only one respondent attained tertiary level of education. Most of the respondents 36 (72) were of primary level. According to many respondents, their community constitute of mostly primary leavers because many families can not to pay for post primary education hence more of this academic level in the kales production

4.2 REASONS WHY FARMERS IN MUNDINDI PARISH BUSIME SUB COUNTY GROW KALES

Table 4.2.1. reasons for growing kales by sampled population

Reasons	Frequency	Percentage
Highly marketable	29	58
Quick maturing	2	4
Food	10	20
Fodder for animals	1	2
Nutrient content	1	2
Tolerant to local conditions	1	2
Other reasons	6	12

Fig 4.1.2. bar graph showing reasons for growing kales by sampled population



According to the research conducted as represented in table 4.1.3.,fig 4.1.2 above, most of the respondents grow vegetables for cash and therefore kales production the best choice as it has ready local market in the trading centers of harambeTC, bwanikhaTC, Mundindi TC and mwembeteyari TC in addition to market in Kenya . This supports Thrall, P.H. etal (2020) that said Agriculture was fundamental in the development of human society, enabling a gradual shift from a hunter-gatherer nomadic lifestyle to a more settled way of life, allowing primordial civilizations to flourish

In interview with another respondent, he also informed me that the people of this locality use cassava bread and source as their common food. However fish their most preffered source is expensive and becoming rare due fishing restriction on lake Victoria which is just south of Mundindi parish .this leaves kales one of the cheapest source hence grown for food. According to respondents, other reasons include peer pressure,abundant land

4.3FIELD PESTS THAT AFFECT KALES GROWING IN MUNDINDI PARISH

According to many respondents, field pests affected kales crop plants in the field which has led losses to the farmers by reducing the quantity and the quality of kales

Table 4.3.1 pests that affect kales andfield pest status of kales in Mundindi parish

Field pest	Status	Frequency
Aphids	Severe	50
Beet army worm	High	35
Cabbage looper	Very low	2
Diamond check month	High	15
Flea beetles	High	30
White fly	High	30
Root knot	Low	5

Source: primary data

According to research I conducted as represented in table 4.1.4, the field pests affecting kales production include but not limited to aphids, whiteflies ,diamond back moth flea beetles, beet army worm among others. e

Aphids were one of the most common pest in this area, with all respondents repoting aphid species affecting their kales in the field. This is in agreement with Francisco Jorge Cividanes etal (2020), which reported that Aphids are one of the most economically important hemipteran pests, with about 100 aphid species being reported to cause significant agricultural losses worldwide

4.4.CONTROL OF FIELD PEST IN KALES FIELD BY KALES FARMERS IN MUNDIDNDI PARISH

Table 4.4.1. control of field pest in kales field by kales farmers in mundidndi parish

Field pest	Control	Frequency
Aphids	bio pesticide	2
	Chemical	4
	Biological	2
	Physical	2
	IPM	40
Beet army worm	Physical	1
	bio pesticide	1
	Chemical	2
	Biological	1
	IPM	30
Cabbage looper	Physical	0
	bio pesticide	0

	Chemical	0
	IPM	2
Diamond check month ((*Plutellaxylostella)*	Biological	0
	Physical	0
	bio pesticide	0
	Chemical IPM	5 10
Flea beetles	Chemical	2
	Physical	2
	bio pesticide	2
	IPM	24
Root knot	Chemical	1
	Biological	0
	Physical	0
	bio pesticide	1
	Chemical	1
	IPM	3
White fly	Physical	0
	bio pesticide	5
	Chemical	5

	IPM	20

Source: primary data

The emergence of insect pests in crops represents a serious problem, since they decrease the yield of production leading to considerable losses of time and money invested(Weinberg etal (2019))Synthetic insecticides are commonly chosen to tackle that problem, since they offer a solution that is often quick and effective, acting almost instantly and not requiring much labour-intensive work to be applied.

IPM is the most widely used method of pest control according to table 4.4.1, In interview with many respondent ,it's because it is more effective than the rest of available methods. This is not in agreement with Jamin Ali etal. (jamin 2023) that reported that the majority of current management practices for are based on chemical pesticides.

4.5.TYPES OF BIO PESTICIDES COMMONLY USED KALES FARMERS IN MUNDINDI PARISH.

Table 4.5.1. Types of bio pesticides commonly used kales farmers in Mundindi parish

Type of bio pesticide	pest(s) controlled	Mode of application
Neem tree extract	All field insect pests	Aqueous solution
Tobacco extract	Diamond back moth,	Aqueous solution
Wood ash	Aphids	Powdered form
Animal urine	Whitefly, flea beetles	Liquid form
Pyrethrum extracts	Aphids, root knot, cabbage looper	Aqueous solution

4.6 ADVANTAGE OF USING BIO PESTICIDES IN CONTROLLING FIELD PESTS ACCORDING TO KALES FARMERS OF MUNDINDI PARISH

According to one respondent, Bio pesticides are also effective in management of crop pests. This is in agreement with Birech, R. etal. (2006) which stated bio pesticides are as effective as synthetic pesticides in management of crop pests.

According to many respondents , bio pesticides leave less harmful residues to their immediate environment. This is in agreement with Leng, P.,etal (2011) publication which stated bio pesticides are also eco-friendly since they are easily biodegradable and therefore do not pollute the environment

Consumer tastes and preferences fluctuate over time and following the demand for organically produced food, this makes biopesticides suitable alternatives to synthetic pesticides. This agrees with the(Okunlola, A.I. and Akinrinnola, O. (2014)) which ephasised substitution of harmful chemicals with bio pesticides

Bio pesticides have very short pre-harvest intervals and are therefore safe to use on fresh fruits and vegetables .

They are also target specific and hence do not affect the beneficial organisms such as the natural enemies.

They are effective in small quantities and their use promotes sustainable pest management and contribute towards sustainable agriculture

Natural pesticides do not cause resistance build up among pests

Availability of their source materials makes them inexpensive to attain since they are found within the natural environment and some of them are used for other purposes like food and feed

Bio pesticides are safe products both for the applicant and the consumer since they have no toxicity

Therefore, bio pesticides can suitably be incorporated in integrated pest management (IPM) which helps reduce the amounts of chemical pesticides used in management of crop pests.

Natural products decompose quickly which makes them safer for use in the environment

Pesticides from natural sources have very short re-entry intervals which guarantee safety for the applicant Bio pesticides are also used in decontamination of agricultural soils through introduction of important microbial species

4.7 .DISADVANTAGES OF USING BIO PESTICIDES IN CONTROLLING FIELD PESTS ACCORDING TO KALES FARMERS OF MUNDINDI PARISH

According to one respondent, continous application of bio pesticides limit the number of small organisms in the soil. This is in agreement with the statement Microbial pesticides mainly pose three types of challenges to pests: (a) competition for food, habitat, and survival, (b) creation of physical barriers, and (c) suppression by metabolites and chemicals. These ecological, physical, and biochemical mode of actions play a crucial role in the choice of manufacturing methods and the final cost of production (Hubbard et al. 2014).

According to respondents , bio pesticides are so bulky to transport use

According to respondents ,They also contain unknown amount of useful substances,

According to respondents , very few respondents (3) have knowlodge of formulation of various pesticides

According to respondents, bio pesticides have very slow(if at all) effect on field pests

According to respondents , there are also limited plants for bio pesticide extraction

4.8 SOLUTIONS TO THE PROBLEMS ASSOCIATED WITH BIO PESTICIDES USE

Respondents suggested the following recommendations

Increased awareness creation through employing more extension workers to teach all kales farmers

Extension of sample bio pesticides to selected farmers

Planting of more pericidal plants

CHAPTERFIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter constitutes of the summary of the findings of my research, conclusion, and recommendations.

5.2 SUMMARY OF THE FINDING

The main purpose for my rsearch was to investigate the farmers' ,attitudes and perception on the use of bio pesticides in controlling field pests of kales in Mundindi parish Busime sub county- Busia district.

The research aimed at finding out; field pests affecting growth and yield of kales, if farmers in Mundindi parish, Busime sub county- Busia district have knowledge of and use bio pesticides and if so to identify the bio pesticides used and the farmers perception on using them to control field pests of kales. Also to find out theadvantages, constraints of using bio pesticide and possible remedies to address the problems associated with pesticide use.

Aphids , diamond back month, white flies ,root knot, flea beetles, beet army worm among others were found to be the major field pests affecting kales in Mundindi parish. It was also found out that some farmers use neem extract,tobacco extract, wood ash, onion and garlic extract, chill powder, pyrethrum extract and animal urine

The research also found out that some of the advantages of using bio pesticide was that it was less expensive, easy to prepare and apply, less toxic to non-target, handling and application does not require high level of expertise and also their application requires simple equipments and techniques.

The researcher also found out that inadequate knowledge on formulation and use, delayed effect, bulkiness, bad odour and unavailability of plant and animal material in some areas are the reasons for low adoption of the bio pesticide use in Mundindi parish Busime sub county-Busia district.

5.3 CONCLUSION

The findings of the research study reported major field pests of kales in Mundindi parish,low knowledge on bio pesticides ,negative attitudes towards bio pesticide use especially the females with the highest academic level of primary. It was also noted that more has to be done especially by the government ,and agriculture extension workers to change the attitudes and perception of kales growers in Mundindi parish.

5.4. RECOMMENDATIONS

The government shouid encourage Field use of bio pesticide products can be enhanced using nanotechnology and micro-encapsulation to improve their stability, residual effects, and effectiveness (Damalas & Koutrobas, 2018; Vurro et al., 2019).

APPENDICES

APPENDIX 1: WORK PLAN OF THE RESEARCH STUDY

Month	Activity	Responsible person
July	Designing research proposal Submission of research proposal for review by the supervisor	Bwire David
August	Adjusting the proposal	Bwire David
September October	Preparation of questionnaires for data collection	Bwire David
October	Carrying pilot study in the study area	Bwire David
November	Preparation of materials for data collection Collection of data in the field	Bwire David
December	Analysis of the data collected Compilation of research report Submission of research report	Bwire David

APPENDIX 2: QUESTIONNAIRS

QUESTIONNAIRE

A SURVEY ON THE FARMERS KNOWLEDGE, ATTITUDES AND PERCEPTION ON THE USE OF BIO PESTICIDES IN CONTROLLING FIELD PESTS OF KALES (BRASSICA OLERACEAE) IN MUNDINDI PARISH BUSIME SUBCOUNTY IN BUSIA DISTRICT

INTRODUCTION

Introduction My name is Bwire David, a student of Busitema University Faculty of science and education. I am conducting a study on the "**FARMERS KNOWLEDGE, ATTITUDES AND PERCEPTION ON THE USE OF BIO PESTICIDES IN CONTROLLING FIELD PESTS OF KALES (BRASSICA OLERACEAE) IN MUNDINDI PARISH BUSIME SUBCOUNTY IN BUSIA DISTRICT" in Uganda**

Dear respondent, you have been identified and selected with great honour to take part in this study. I kindly request you to spare part of your time to participate in the study by answering a few questions below. The information you provide will be purely for academic purpose and all the information provided shall be treated with maximum confidentiality. Thank you for accepting to be part of the study.

DEMOGRAPHIC DATA

Tick where necessary

Age

Below20 ☐

20-30 ☐

30-40 ☐

40 -50 ☐

Above 50 ☐

Gender

Male ☐

Female ☐

Other ☐

Education background

No formal education ☐

Primary ☐

Secondary (ordinary) ☐

Secondary ☐

Tertiary ☐

How long have you been involved in kales growing?

Lessthan5years ☐

5-10years ☐

10-15years ☐

Morethan15years ☐

What is the main reason for growing kales?

Cash income ☐

Food security ☐

Contract with factory ☐

Other (specify) ☐

Do you encounter field pests of kales during the growing season?

Yes ☐

No ☐

(If yes) what are the field pests you encounter

……..

……

……

……

…….

……

What is the field pests status of kales during the growing season of kales?

Severe ☐

High ☐

Moderate ☐

Low ☐

Very low ☐

How do you control field pests of kales in your field?

Field pest	Control method (s)

Name the different types of bio pesticides that you use in the control of the mentioned field pests

……..

……..

…….

……..

…….

…….

Do your mix two or more extracts to come up with one bio pesticide?

Yes ☐

No ☐

(If yes) how do you formulate to obtain the bio pesticide?

……..

……

……..

……..

……

Which of the following statement is correct about the use of bio pesticides.

Very effective ☐

Effective ☐

Mildly effective ☐

Ineffective ☐

From your experience of using bio pesticides, what is/are the advantages of using bio pesticides

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What are the complains associated with the use of bio pesticides

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What do you suggest as the possible solutions to the above mentioned complains

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