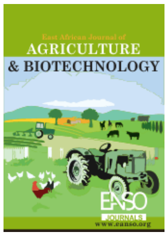

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Original Article

Determinants of Integrated Pest Management Adoption Among Large-Scale Farmers in Uasin Gishu County, Kenya

Nelly Cherotich[1] & Caleb Mireri[1]*

[1] Kenyatta University, P. O. Box 43844-00100 Nairobi, Kenya.
* Author for Correspondence Email: neliycherotich54@gmail.com

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Integrated Pest Management, Large-Scale Farmers, Adoption, Chemical Methods, Natural Methods, Determinants, Maize Production, Uasin Gishu, Kenya.

ABSTRACT

Agriculture plays a crucial factor in socio-economic growth and development in many developing countries as it is the main source of livelihood for many people across the world. However, several agricultural activities contribute to negative environmental impacts as they involve indiscriminate application of synthetic pesticides. Integrated Pest Management (IPM) is an environmentally safe and effective approach which helps in managing crop pests and diseases and protection of micro-organisms and beneficial insects. This paper examines the different determinants influencing the adoption of IPM practices. The study employed a research survey design where a total of 155 large-scale farmers were surveyed within the sub-county. The data was collected through household questionnaires and face-to-face interviews with the extension officers. Descriptive statistics was used to summarize data through tables and graphs. Qualitative data from face-to-face interviews with agricultural and extension officers from the Ministry of Agriculture was analyzed using qualitative content analysis. The findings showed that Education level, age, main occupation, household income, farmer field day participation, machinery ownership, farm size, and pest and weed resurgence were the main determinants for IPM adoption among the respondents.

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INTRODUCTION

Agriculture plays a crucial factor in socio-economic growth and development in many developing countries as it is the main source of livelihood for many people across the world. However, several agricultural activities contribute to negative environmental impacts as they involve indiscriminate application of synthetic pesticides such as fertilizers, herbicides, and insecticides. (Dubey *et al.*, 2021). Environmental pollution, the risk to human health, food contamination, and loss of biodiversity are associated with the overuse of pesticides (Biswas *et al*., 2014; Nicolopoulou-stamati, 2016). Organophosphate pesticides have been reported to cause several health effects and diseases in humans, including thrombosis, diabetes, cardiovascular disease, manic disorder, nephrosis, and cancer (Hashimi *et al.*, 2020). Organochlorine pesticides such as DDT, Dieldrin, endosulfan, heptachlor, dicofol, and methoxychlor cause hormonal disorders and affect early embryo growth in animals (Nicolopoulou-stamati, 2016). Studies show that carbamate pesticides such as carbofuran and ziram cause neurobehavioral perniciousness, mental illness, and non-Hodgkin's malignancy (Hashimi *et al.*, 2020).

Neonicotinoid pesticides have been reported to cause cerebrospinal nervous system illnesses such as paralysis agitans, hallucinosis, brain damage, depression, and reproduction in animals (Hashimi *et al.,* 2020). Unregistered and prohibited pesticides are extensively made available in the East African market. Concerns on food security together with the growing environmental perception, have initiated a necessity for promoting sustainable agriculture in crop production through reducing overdependence on agrochemical inputs (P. G. Kughur *et al*., 2020).To minimize these negative impacts caused by excessive pesticide application, registration of pesticides that are less harmful and advocating for natural methods of Integrated Pest Management (IPM) is vital for green cultivation and Sustainable Development Goals (SDGs).

Integrated Pest Management (IPM) is an environmentally safe and effective approach which helps in managing crop pests and diseases (Kabir & Rainis, 2015). It ensures well protection of micro-organisms and beneficial insects. It also provides for the prevention of harmful pests and their resurgence, as well as the spread of disease. IPM approach aims at protecting the environment through water, soil and air while meeting the objectives in production (Alam *et al*., 2016). The approach combines the use of various pest control methods such as cultural, physical and biological methods (Alam *et al*., 2016).

According to the literature review, many studies have shown the different determinants of IPM adoption among farmers. However, it's not clear whether farmers particularly large-scale farmers have adopted IPM practices and how they have been influenced by socio-economic and environmental factors in trying to adopt these IPM practices. IPM adoption requires resources such as capital and income, which many farmers may not access, making it difficult to implement the practice. Consequently, long droughts and floods lead to low adoption of IPM technology as it encourages pests and diseases resurgence which makes a farmer opt for synthetic pesticides (Dersseh *et al.*, 2016; Norton & Ouyang, 2019). Pesticide industries providing subsidies, and cheap and available pesticides in the market encourage farmers to rely on synthetic pesticides hence lowering farmers' attitudes towards IPM adoption (Prasanna *et al.*, 2022; Pretty & Bharucha, 2015). Therefore, there is a need to understand the different determinants influencing IPM adoption among large-scale farmers hence taking Uasin Gishu County as a case.

LITERATURE REVIEW

The decision of farmers to adopt an IPM technology depends on social, economic, and environmental factors. The adoption of IPM technology among farmers is based on the choices they make. Farmers often make decisions based on certain background conditions affecting crop production (Maguza-Tembo *et al*., 2017). The diffusion of innovation results from farmers' enthusiasm and readiness to adopt the new technology in relation to its importance and the cost of implementing it (Mwangi & Kariuki, 2015). A farmer's level of education greatly influences the adoption of IPM technology by increasing the capacity to acquire relevant information on how to implement the technology (Thomas Bilaliib Udimal & Owusu Samuel Mensah, 2017). Studies have shown that knowledge has a positive impact on adoption since farmers can understand and make decisions based on the importance of the technology (Ndimbwa, 2021).

Age is found to have influenced the adoption of new technology. Previous studies show that older farmers understand and make better decisions on the adoption of technology because of the greater experience acquired in their farming than young farmers (Mwangi & Kariuki, 2015). Additionally, other reports have described young farmers as having a greater potential for adopting the new technology compared to older farmers as they are more interested in valuable and longer investments (G. P. Kughur, 2020). Different farm sizes and machinery ownership also influence IPM adoption as farmers with machinery such as tractors and large farms have more potential to adopt the technology since many of them can allocate part of the farm for technology trial (Emerick *et al*., 2016; Udimal *et al*., 2017).

Household income greatly influences IPM adoption it provides farmers with adequate capital for the trial and implementation process. Farmer's occupation greatly determines IPM adoption as it is the source of income for crop production. The diverse sources of income are important among many farmers as they limit fluctuations and ensure sustainable livelihoods (Strzelecka & Zawadzka, 2021). The diversification of farmers' occupations reduces risk exposure caused by agricultural produce losses. Farmers with higher income are able to purchase farm inputs such as fertilizers, herbicides, and insecticides. This encourages dependence on pesticides compared to farmers with lower income as they may not afford to purchase all the farm inputs. They therefore integrate synthetic pesticides with natural IPM methods (Mwangi & Kariuki, 2015).

Climate change and variabilities such as long droughts and floods have led to reduced soil fertility, general degradation of the environment and landscapes, and pest resurgence which have made many farmers opt for synthetic pesticides because they find it easy to provide solutions and meet the demand for food from the growing population (Munyuli *et al*., 2017). Agriculture at large mainly faces new threats which are a result of changes in climate leading to outbreaks of pests and diseases hence altering crops and their normal abiotic environment (Karlsson Green *et al*., 2020). Pesticide use in large-scale farming does not require intense effort due to mechanization compared to cultural methods such as manual weeding, preparing compost manure, and timely planting which may not be effective as it is tiresome, time-consuming, and require a long time to plan (Akenga *et al*., 2017).

Theoretical Underpinning of the Study

The prospect theory was developed in 1979 by Daniel Kahneman and Amos Tversky where human attitudes affect decision-making depending on the consequences (Mitkov, 2022). IPM adoption rate may be slower or faster depending on the choice of method and its application time (Wyckhuys *et al.*, 2019). Because of the uncertainty of IPM practices,

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farmers compare between making losses and profits in crop production and therefore decide on the best option for them due to loss aversion (Alwang *et al.*, 2019). Over-confidence may lead to farmers making wrong decisions in crop production such as frequent monocropping, and over-dependence on synthetic pesticides (Pretty & Bharucha, 2015).

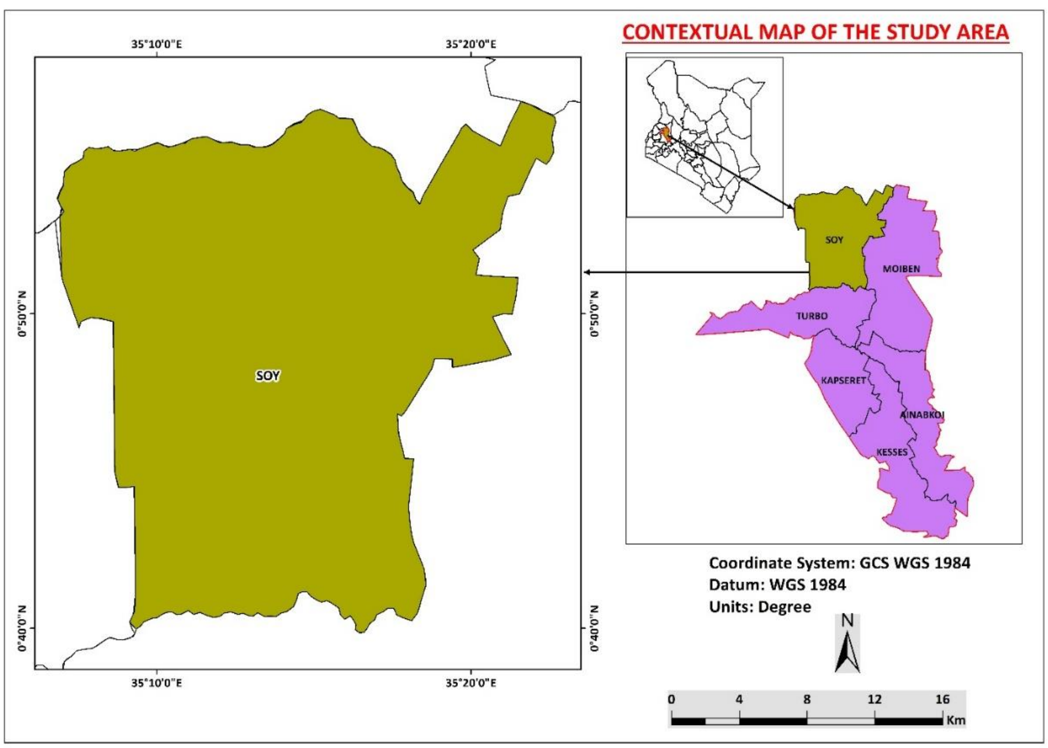
Farmers with limited attention are not fully informed of the consequences and therefore, end up making wrong decisions from the available options (Alwang *et al*., 2019; Tudi *et al*., 2021). Menu effects consisting of several crop production methods may sometimes overwhelm the farmer since he/she has to choose between many options, leading to a decision to take simple methods for crop production regardless of any consequences. Many farmers prefer pesticides because of their immediate solution and find other practices difficult to adopt while others find pesticides too expensive to purchase and prefer cultural, physical, and biological methods (Roobroeck & Lee, 2019).

MATERIALS AND METHODS

The Study Area

The study mainly focused on Uasin Gishu County which borders Kericho to the south, Nandi to the southwest, Elgeyo Marakwet to the east, Baringo to the southeast, Trans Nzoia to the north and Kakamega to the northwest (Akenga *et al.*, 2017). The favourable climatic conditions within the county such as a reliable amount of rainfall of between 900 to 1,200 mm with an altitude of 1800 m above sea level greatly promote crop production (Akenga *et al.*, 2017). The red loam and clay soils within the county also boost the production of maize and other food crops. The county is made up of six sub-counties namely; Soy, Moiben, Turbo, Kapseret, Ainabkoi, and Kesses as shown in Figure 1. Due to the research limitations, the study focused on Soy Sub-county which lies between longitudes 35°10'East and 35°20'East and latitudes 0°40' North and 0°50' North where the predominance of maize production is practiced on large-scale farms.

Figure 1: Contextual Map of the Study Area



Source*:* *ArcGIS*

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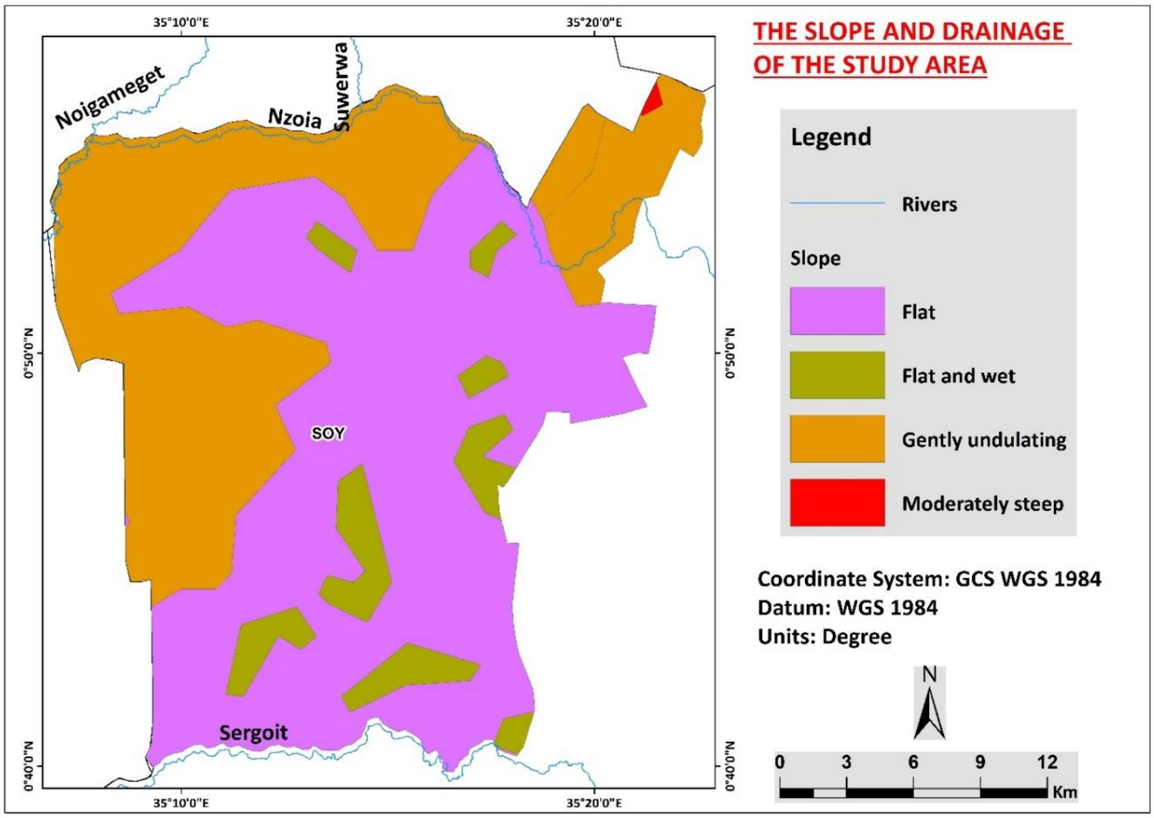
The Slope and Drainage of the Study Area

The county receives a high and reliable amount of rainfall of between 900 to 1,200 mm annually with a height of 1800 m above sea level (Akenga *et al.,* 2017). The county experiences temperatures ranging between 70 ºC and 290 ºC (RoK, 2022). The county has red loam and clay soils which are good for maize and other crop production. The area mainly consists of a flat and gently undulating landscape which is good for crop production as it reduces soil erosion and provides efficient development of good infrastructure. The area also comprises several wetlands which help conserve water for agricultural production. The main river flowing through the sub-county is River Nzoia which drains excess water from the area during heavy rains hence reducing flood risks (Figure 3).

Figure 2: The Slope and Drainage of the Study Area



Source*:* *ArcGIS*

Sampling Procedure and Sample Size

The target population was the large-scale farmers in Soy sub-county. According to the report from the extension officers on maize production, the sub-county had a total of 181 large-scale farmers. This study sought to investigate all the large–scale farmers in the sub-county. The study covered the accessible population of (85.6%), 155 large-scale farmers which were spread within the sub-county.

Data Analysis

Descriptive statistics was used to summarize data through tables and graphs. Qualitative data from face-to-face interviews with agricultural and extension officers from the Ministry of Agriculture was analyzed using qualitative content analysis. The qualitative content analysis was achieved by organizing the collected data into several categories based on the different information obtained then followed by writing them down systematically.

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(O.Nyumba *et al*., 2018). The data was then combined with the data obtained from household questionnaires.

RESULTS AND DISCUSSION

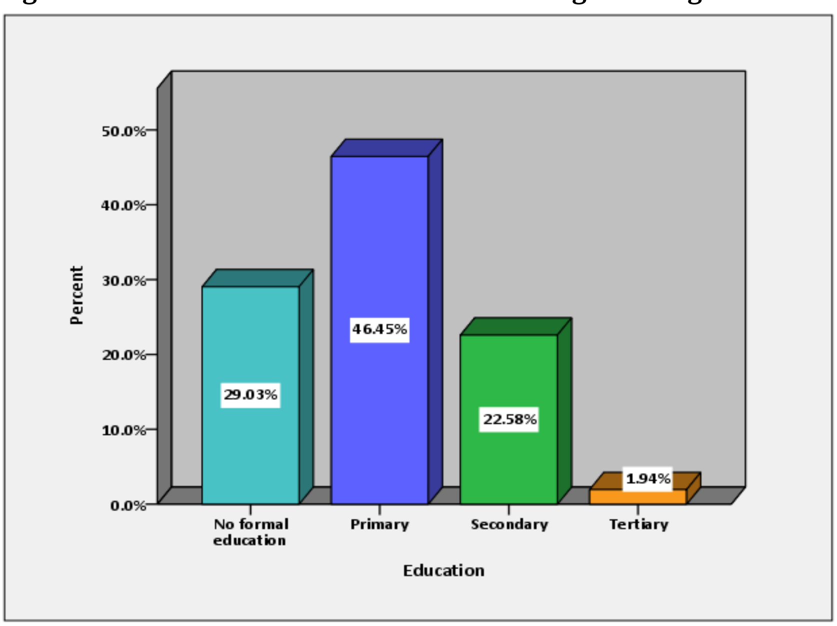
Determinants of Integrated Pest Management Adoption

From the data collected, Integrated pest management adoption has been influenced by education level, knowledge of IPM practices, main occupation, household income, machinery ownership, age, farm size, farmer field days participation, and pest and weed resurgence.

Education Level with Knowledge of IPM Practices

From the data collected, the highest number of respondents reached primary education level with 46.45%, 29.03% had no formal education, 22.58% reached secondary education level while the least number of respondents (1.94%) attained tertiary level of education (Figure 3). From Table 1 below, the majority of the respondents with the primary level of education had adopted cultural (47.52%), physical (53.01%), biological (50.00%), and chemical methods (40.65%). Farmers with no formal education had adopted cultural (31.68%), physical (28.92%), biological (29.63%), and chemical methods (27.10%). The respondents with the secondary level of education had also adopted cultural (18.81%), physical (15.66%), biological (20.37%), and chemical methods (19.35). The respondents who have attained the tertiary level of education have adopted cultural (1.98%), physical (2.41%), and chemical methods (1.94%) (Table 1). The adoption of these IPM practices coincides with research done by Ndimbwa, (2021) that the adoption level depends on the knowledge which a farmer has on IPM practices regardless of education level as they can make better decisions based on the importance of IPM technology. The majority of the respondents with a primary level of education have invested in learning and adopting all the IPM practices as they are economical compared to chemical methods. The farmers who have adopted chemical methods are not interested in long-term practices of IPM (natural methods). Instead, they mainly focus on easier and quicker methods of controlling crop pests and diseases to meet market demand for the produce through the use of synthetic pesticides.

Figure 3: Different Levels of Education Among the Large-scale Farmers



Source: *Field survey, 2024*

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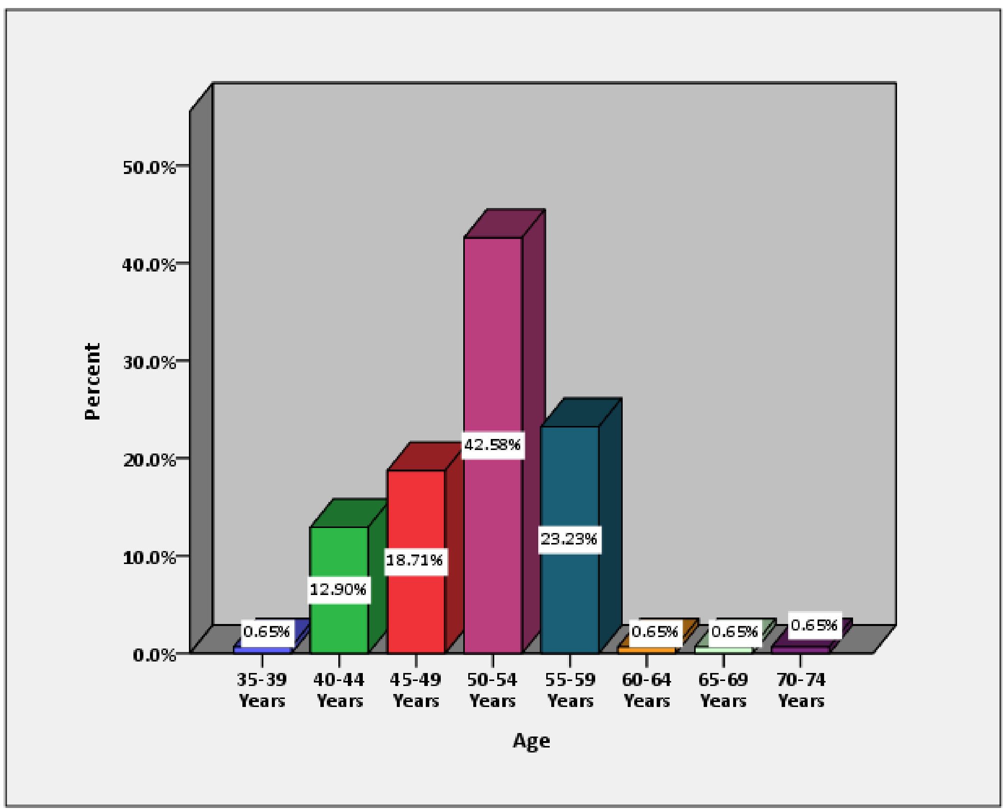
Table 1: Adoption of Different IPM Practices Among Large-scale Farmers Based on Education Level

Education	Cultural practices		Physical practices		Biological practices		Chemical methods	
	N	%	N	%	N	%	N	%
No formal education	32	31.68	24	28.92	16	29.63	42	27.10
Primary	48	47.52	44	53.01	27	50.00	63	40.65
Secondary	19	18.81	13	15.66	11	20.37	30	19.35
Tertiary	2	1.98	2	2.41	0	0.00	3	1.94
Total	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Age

The majority of the large-scale farmers under the survey were middle-aged between 40 to 59 years while the youngest were between 35-39 years and the oldest were between 60-74 years (Figure 4). Table 2 shows that farmers aged 50-54 years have the highest number of IPM adopters with cultural (44.55%), physical (44.58%), biological (38.89%), and chemical methods (41.30%). This is because they have more interest in learning new IPM technology compared to older farmers who have more experience in commercial farming and mainly depend on chemical methods through the use of various synthetic pesticides to boost production. This makes it difficult for them to learn and adopt the natural IPM methods. This is similar to the research conducted by Kughur, (2020) on how young farmers are more likely to adopt IPM technology as they have more interest in learning new farming techniques compared to older farmers.

Figure 4: The Different Age Brackets Among the Large-scale Farmers



Source: *Field survey, 2024*

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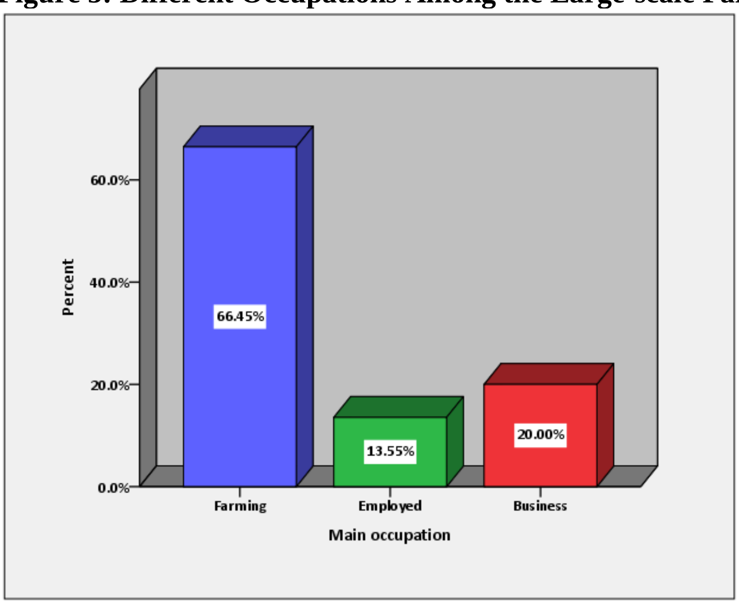
Table 2: Adoption of Different IPM Practices Based on the Age of the Large-scale Farmers

Age	Cultural practices		Physical practices		Biological practices		Chemical practices	
	N	%	N	%	N	%	N	%
35-39 Years	1	0.99	1	1.20	1	1.85	1	0.72
40-44 Years	11	10.89	8	9.64	7	12.96	19	13.77
45-49 Years	19	18.81	17	20.48	11	20.37	24	17.39
50-54 Years	45	44.55	37	44.58	21	38.89	57	41.30
55-59 Years	23	22.77	18	21.69	13	24.07	34	24.64
60-64 Years	1	0.99	1	1.20	0	0.0	1	0.72
65-69 Years	1	0.99	1	1.20	1	1.85	1	0.72
70-74 Years	0	0.00	0	0.0	0	0.0	1	0.72
Total	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Main Occupation

Figure 5 below shows the respondents' main occupations where the majority of the respondents were farmers (66.45%), 13.55% were employed, and 20.00% were business traders (Figure 5). The respondents who mainly practice farming as their main occupation had the highest adoption of both natural and chemical IPM practices with cultural practices (60.40%), physical practices (63.86%), biological practices (62.96%), and chemical control methods (67.39%) (Table 3). This is because these farmers have a willing capacity to learn any new technology to boost the quality and quantity of crop yields. The farmers who do business have fairly adopted cultural practices (23.76%), physical practices (21.69%), biological practices (24.07%), and chemical methods (18.12%). The few employed respondents have little time to interact with other farmers in learning the natural IPM techniques and therefore mainly rely on pesticides to save time. 15.84% of these farmers have adopted cultural practices, physical practices (14.46%), biological practices (12.96%), and chemical methods (14.49%) (Table 3). This is contrary to research done by Strzelecka & Zawadzka,(2021) as diversification of farmer's occupations has little impact on IPM adoption. The respondents who mainly concentrate on farming as their main occupation have more interest in IPM practices.

Figure 5: Different Occupations Among the Large-scale Farmers



Source: *Field survey, 2024*

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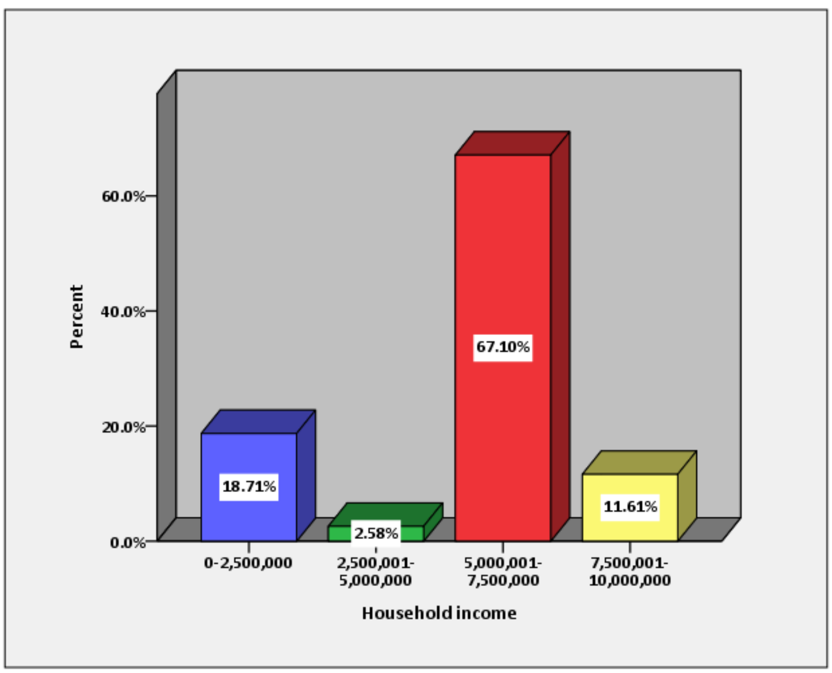
Table 3: IPM Practice Adoption Based on the Farmers' Occupation

Main Occupation	Cultural practices		Physical practices		Biological practices		Chemical methods	
	N	%	N	%	N	%	N	%
Farming	61	60.40	53	63.86	34	62.96	93	67.39
Employed	16	15.84	12	14.46	7	12.96	20	14.49
Business	24	23.76	18	21.69	13	24.07	25	18.12
Total	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Household Income

From the survey conducted, the majority of the respondents (67.1%) earn Ksh 5000,0001-7,500,000 annually. 18.71% of the respondents earn up to Ksh 2,500,000 ,2.58 % earn between Ksh 2,500,001-5,000,000 while 11.61% earn Ksh 7,500,001-10,000,000 annualy (Figure 6). The respondents earning Ksh 5000,0001-7,500,000 annually have contributed to higher adoption of cultural practices (67.33%), physical practices (69.88%), biological practices (74.07%), and chemical methods (65.22%) (Table 4). Despite the few numbers of farmers earning 0-2,500,000 (18.7%) and 2,500,001-5000,000 (2.6%), the majority of them have managed to adopt both natural methods as well as integrating with chemical methods. The respondents with the highest household income have the least number of cultural practices (4.95%), physical practices (1.20%), and biological practices (7.41%). They have mainly adopted chemical control methods (10.87%) (Table 4). This is because farmers with higher income can easily purchase pesticides mainly to boost production while farmers with lower income are unable to purchase all the pesticides and therefore choose to combine chemical methods with natural methods to save on expenses. This coincides with the studies showing how diffusion of innovation depends on farmer's willingness and readiness in relation to the cost of IPM implementation (Mwangi & Kariuki, 2015).

Figure 6: Different Household Income Among the Large-scale Farmers



Source: *Field survey, 2024*

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Table 4: Adoption of Different IPM Practices Among the Large-scale Farmers Based on Household Income

Household income	Cultural practices		Physical practices		Biological practices		Chemical methods	
	N	%	N	%	N	%	N	%
0-2,500,000	25	24.75	21	25.30	9	16.67	29	21.01
2,500,001-5000,000	3	2.97	3	3.61	1	1.85	4	2.90
5000,0001-7,500,000	68	67.33	58	69.88	40	74.07	90	65.22
7,500,0001-10,000,000	5	4.95	1	1.20	4	7.41	15	10.87
Total	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Farmer Field Day Participation

According to the respondents, farmer field days are usually conducted annually at the Chebororwa Agricultural Training Centre in Uasin Gishu County. 34.90 % of the respondents participate in farmer field days (Table 5). They have adopted cultural practices (32.1%), physical practices (34.7%), biological practices (34.9%), and chemical control methods (38.06). These respondents reported that they are mainly taught about pesticide handling and application, new seed varieties in the market, pesticide products, and their actions against weeds and insect pests. On the other hand, 56.10% of the respondents who do not participate in farmer field days have also adopted cultural practices (67.90%), physical practices (65.30%), biological practices (65.1%), and chemical methods (50.97%) where they mainly obtain information and learn IPM practices from their fellow farmers. This is contrary to studies (Dorothy *et al*., 2019; G. P. Kughur, 2020; Pretty & Bharucha, 2015) as the majority of the respondents in Soy sub-county do not participate in these farmer field days yet IPM adoption among them is evident (Table 6).

Table 5: IPM Practice Adoption Based on Farmer Field Day Participation

Farmer field days participation	N	%	Cultural practices		Physical practices		Biological practices		Chemical methods	
			N	%	N	%	N	%	N	%
Yes	68	34.90	36	35.64	28	33.73	25	46.30	59	38.06
No	87	56.10	65	64.36	55	66.27	29	53.70	79	50.97
Total	**155**	**100**	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Machinery Ownership

From the survey conducted, a total of 130 farmers own farm machinery (Table 6). The ownership of the farm machinery has enabled many farmers to adopt different IPM practices. According to Table 6, the IPM practices adopted were cultural (89.11%), physical (92.77%), biological (87.04%), and chemical methods (86.23%). Farmers who do not own farm machinery have least adopted cultural practices (10.89%), physical practices (7.23%), biological practices (12.96%), and chemical methods (13.77%). These farm machinery such as plough and harrow provide a cultural technique of integrated pest management as it exposes larvae to UV light hence reducing pest population and this is similar to the past studies on machinery ownership contributing to IPM adoption (Emerick *et al*., 2016; Udimal *et al*., 2017).

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Table 6: Machinery Ownership and Its Influence on IPM Adoption Among Large-scale Farmers

Machinery ownership	N	%	Cultural practices		Physical practices		Biological practices		Chemical control	
			N	%	N	%	N	%	N	%
Yes	130	83.90	90	89.11	77	92.77	47	87.04	119	86.23
No	25	16.10	11	10.89	6	7.23	7	12.96	19	13.77
Total	**155**	**100**	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Pest and Weed Resurgence

53.5% of the respondents reported that they have encountered annual pests and weeds resurgence while 46.5% of the large-scale farmers do not face the challenge of pests and weed resurgence (Table 7). According to Table 8, the respondents who encounter pests and weed resurgence have adopted cultural practices (46.53%), physical practices (45.78%), biological practices (61.11%), and chemical methods (49.28%). Farmers who have not encountered any pests and weed resurgence have also adopted IPM practices to prevent such re-occurrence of harmful pests and weeds in their crop production. They have adopted cultural practices (53.47%), physical practices (54.22%), biological practices (38.89%), and chemical methods (50.72%). The push-pull method of cultural practices by intercropping maize with either napier grass or desmodium has been proven to be effective as it protects maize against niger weeds and stem borer hence minimizing overdependence on synthetic pesticides. The method also works to eliminate pests and weeds that have developed resistance to synthetic pesticide application. This is similar to the studies by (Dara, 2019).

Table 7: Farmer's Encounter with Pests and Weed Resurgence

Pest and weed resurgence	N.	Percentage
Encounter	83	53.50
Non-encounter	72	46.50
Total	**155**	**100**

Table 8: Influence of Pest and Weed Resurgence on IPM Adoption Among Large-scale Farmers

Pest resurgence And weed resurgence	Cultural practices		Physical practices		Biological practices		Chemical methods	
	N	%	N	%	N	%	N	%
Encounter	47	46.53	38	45.78	33	61.11	68	49.28
Non-encounter	54	53.47	45	54.22	21	38.89	70	50.72
Total	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

Farm Size

Based on the respondents interviewed majority own large farms mainly under crop production where 65.16% own 50-99 Ha, 8.3% own 100-149 Ha,14.84% own 150-199 Ha, 6.45% own 200-249 Ha, and 5.16% own 250-299 Ha (Figure 7). The majority of them have adopted a combination of natural IPM methods and chemical control methods. The large-scale farmers owning 50-99 Ha have the highest number of IPM adopters where cultural practices (73.27%), physical practices (77.11%), biological practices (75.93%), and chemical methods (67.39%) adoption were evident among them (Table 9). Farmers owning 100-299 Ha have the least adopters of natural methods as their farms are highly mechanized and mainly rely on synthetic pesticides. This is contrary to research conducted by Emerick *et al*., (2016); Udimal *et al*.,(2017) on how farmers with large farms are more likely to adopt IPM technology as they can allocate parts of their

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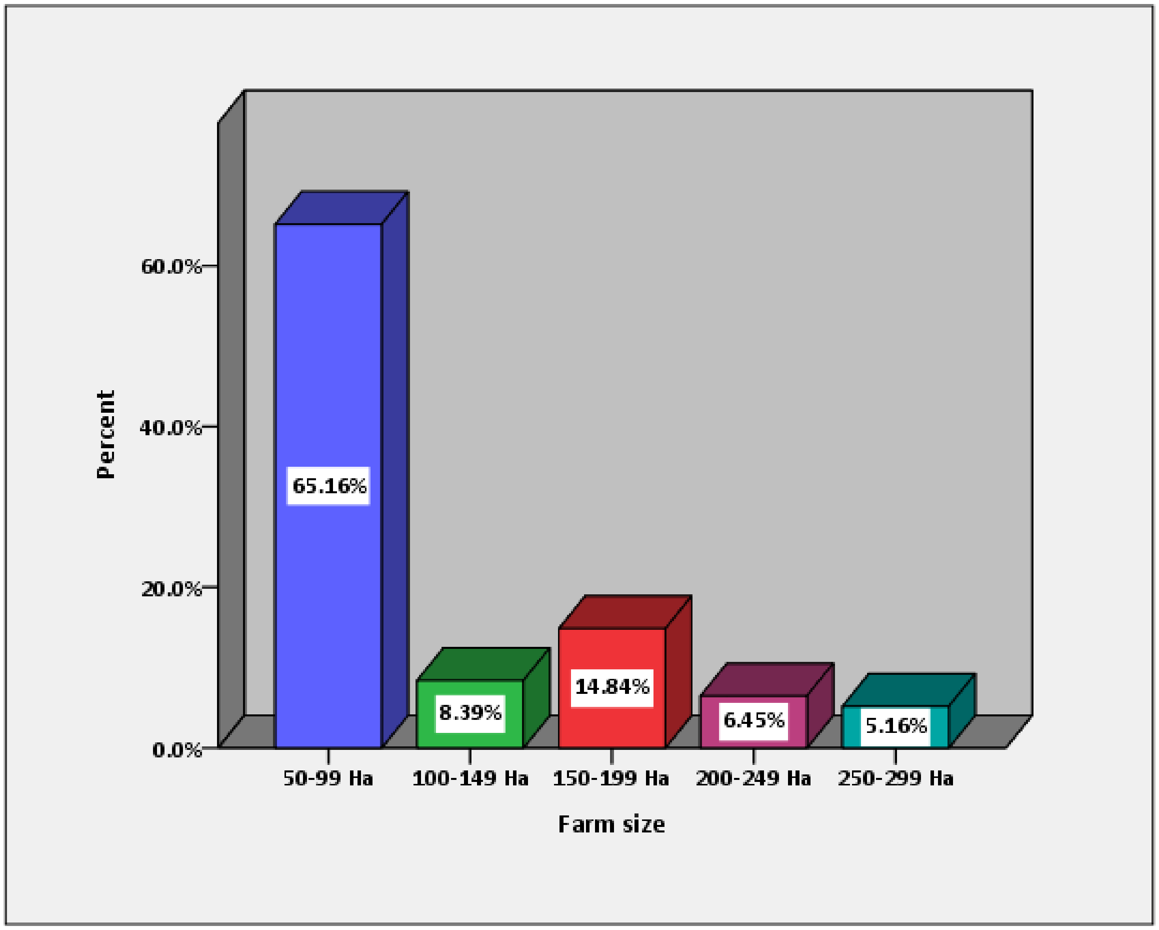
farms in IPM trials and implementation. These respondents reported that physical practices such as manual weeding and uprooting are expensive and time-consuming compared to the application of pesticides using boom sprayers. They also stated that manual weeding requires supervision to ensure weeds are properly removed in the maize farm hence time-consuming and therefore they do not allocate any farm for natural IPM trials.

Figure 7: Different Farm Sizes Owned by Large-scale Farmers in Soy Sub-county



Source: *Field survey, 2024*

Table 9: IPM Adoption Influenced by Different Farm Sizes

Farm size	Cultural practices		Physical practices		Biological practices		Chemical methods	
	N	%	N	%	N	%	N	%
50-99 Ha	74	73.27	64	77.11	41	75.93	93	67.39
100-149 Ha	7	6.93	6	7.23	7	12.96	13	9.42
150-199 Ha	7	6.93	3	3.61	2	3.70	17	12.32
200-249 Ha	5	4.95	2	2.41	1	1.85	7	5.07
250-299 Ha	8	7.92	8	9.64	3	5.56	8	5.80
Total	**101**	**100**	**83**	**100**	**54**	**100**	**138**	**100**

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CONCLUSION

The findings showed that farmers with a primary level of education were mainly IPM adopters of the traditional methods hence natural IPM adoption. Farmers with secondary and tertiary levels of education have advanced their knowledge through learning and adopting various agrochemicals. Farm machinery was mainly owned by large-scale farmers hence the adoption of both natural and chemical methods of IPM practices. Middle-aged farmers have more experience in crop farming and are interested in trying IPM compared to older and younger farmers. The large-scale farmers who concentrate on farming as their main occupation were found to have more IPM adopters compared to employed or business-oriented farmers.

Farmers with smaller farms had a high percentage of natural IPM adoption while farmers with larger farms were found to have a high percentage of chemical adoption. Farmers who have encountered pests and weed resurgence have mainly adopted natural IPM practices to reduce pests and weed resistance. The prospect theory has been used to explain how farmers adopt IPM practices through the decisions they make while considering between making losses and profits in their maize production. The decisions made are attributed to certain socio-economic and environmental factors. While the study provided an in-depth understanding of the research problem, it was greatly limited to the farmers' illiteracy as they could not explain themselves fluently. In addition, the nature of the data collected could not be analyzed using inferential statistics as it was limited to the required assumptions.

Recommendations

The majority of the farmers were willing to adopt the use of plant extracts and compost manure despite their inadequacy. Therefore, setting aside different large farms for growing plant extracts such as neem, pepper, and tobacco as well as organic manure preparation will ensure their availability hence promoting the adoption of these biological practices.

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