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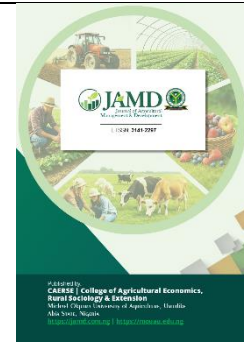
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Evaluation of Farmers' Proficiency in Utilizing Organic Products to Combat Cucumber Mosaic Virus Disease in Okra in Abia State, Nigeria

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ABSTRACT

Strengthening the extension services and providing timely and context-specific information through innovation platforms can contribute to building resilience in regenerative agriculture and nature-based agri-production systems. Thus, the study evaluated farmers' proficiency in utilizing organic products to combat cucumber mosaic virus disease in okra in Abia State, Nigeria. Specifically, the study ascertained farmers awareness and intensity of incidence of CMV, identified organic extracts and products used by farmers in the control of CMV, examined level and determinants of farmer's proficiency and constraints limiting farmers use of organic products on the control of CMV in okra. Multi-stage sampling procedure was employed in the selection of 150 respondents from two out of three Agricultural zones in Abia State Nigeria. Structured questionnaire was used to obtain relevant data for the study which was analyzed using simple descriptive statistics such as frequency counts, percentages, means as well as Z-test and OLS regression model. Results show that Majority (71%) of the farmers demonstrated basic understanding of organic products and their potential for disease control. Certain organic products (plants ($\bar{x} = 3.4$) and non-plant ($\bar{x} = 3.0$) extracts) were found to be more popular and widely used among farmers due to their effectiveness and availability. High level of proficiency in the use of *Azadirachta indica* (neem) ($\bar{x} = 3.60$) than *Zingiber officinale* (ginger) ($\bar{x} = 3.05$), *Allium sativum* (garlic), ($\bar{x} = 2.69$) and *Jathropha* leave extract ($\bar{x} = 2.55$) respectively were recorded. Coefficients for educational qualification (10%), extension contact (1%), participated in trainings (1%) are significant variables directly influencing the level of proficiency. The study therefore calls for empowering the farmers through access to informal education, trainings and contact with extension services to substantially increase access to information on organic farming practices, and/or pest and disease control as best control strategy ultimately leading to improved yields and livelihoods in the agricultural sector.

Introduction

In recent years, organic farming has gained substantial popularity owing to its multifaceted benefits in terms of economics, nutrition, and medicine. This approach carries minimal risk factors, places a strong emphasis on genetic and physical diversity, optimizes the use of local resources, and promotes environmental health. It has garnered recognition and support from a range of organizations, including international development agencies, governmental bodies, and non-governmental entities (IFOAM, 2020). Organic agricultural practices offer a solution to address issues related to poor soil quality and severely degraded soils. The traditional approach of harnessing our resources and technology to meet the ever-growing global demand for food production is commendable. However, it is vital to acknowledge the long-term adverse impacts of certain technologies on the environment and soil. For instance, the widespread use of chemical fertilizers, in addition to its high cost, tends to render the soil acidic and, when runoff contaminates water bodies, poses a threat to aquatic ecosystems and human health (Hurtado-Barroso et al., 2019; Khan et al., 2020).

Furthermore, the demand for food production that is free from diseases and chemical residues has been steadily increasing worldwide, even in the face of challenges associated with organic crop cultivation. Organic crops, in general, are considered more natural and involve fewer or no synthetic pesticides or fertilizers. The desire for healthier and environmentally-friendly food options has been a driving force behind the growing popularity of organic farming practices (Abdulraheem et al., 2022). Okra (*Abelmoschus esculentus* L. Moench) is a versatile crop with the potential to yield abundantly without the use of chemicals, is a notable example. It belongs to the Malvaceae family and is widely cultivated in tropical regions for its edible fruits. Okra is not only a source of dietary calories but also provides essential nutrients, including vitamins A, B, and C, as well as proteins, carbohydrates, fats, and various minerals.

In Africa, particularly in Nigeria, Ghana, and Burkina Faso, there is a significant diversity of okra production. It ranks as the second most important vegetable crop in West Africa, following tomatoes (Zandjanakou-Tachin et al., 2021). In 2019, global okra production covered vast acreage and yielded millions of tons, with Nigeria being one of the largest producers (FAOSTAT, 2020). The production and consumption of okra in Nigeria have seen remarkable growth in recent years, surpassing the growth rates of other key crops like cassava and maize. However, the success of okra cultivation relies heavily on factors such as soil fertility and cultural practices, as well as the ability to manage abiotic and biotic factors affecting production.

One notable biotic challenge in okra production is the prevalence of plant viruses, with cucumber Mosaic Virus (CMV) being a major concern. This virus, which spreads through insect vectors, causes severe damage to okra crops and results in significant economic losses. These losses, ranging from 10% to 100%, have a direct impact on food security (Fudzagbo and Abdulraheem, 2020). Cucumber mosaic virus of okra (CMV) is a member of the Tymovirus group, and its symptoms include a characteristic yellow mosaic pattern on leaves, ultimately affecting yield. Farmers have employed various measures to address the CMV issue, including planting resistant cultivars, weed management, integrated pest management, and the use of organic products to prevent and control viral diseases. The effectiveness of these measures depends on farmers' proficiency in implementing organic methods for disease prevention and control. Understanding the level of knowledge and proficiency among farmers in this regard is essential for designing effective strategies to manage CMV and enhance okra production sustainably.

Farmer's proficiency in utilizing organic products plays a crucial role in sustainable agriculture and effective disease management. Proficiency refers to the level of skill, knowledge, and capability a farmer possesses in using organic products, techniques, and practices to enhance crop growth, productivity, disease resistance and climate resilience (UNDP 2022). In the context of organic farming, proficiency extends to understanding the principles of organic agriculture, utilizing organic inputs effectively, and implementing environmentally friendly practices. Proficiency starts with a solid understanding of organic farming principles, including the use of natural fertilizers, pest control, soil health management, and sustainable agricultural practices. Farmers need to be aware of the benefits of organic products and how they can positively impact crop health, soil fertility, and the ecosystem as a whole. It also involves hands-on skills in applying organic products, such as compost, organic fertilizers, biopesticides, and beneficial microorganisms. Farmers should know when and how to use these products effectively to improve crop yield, reduce pests, and enhance overall plant health.

Proficient farmers are adaptable and open to adopting new organic farming techniques and products as they evolve. They demonstrate an ability to innovate and incorporate sustainable farming practices into their existing agricultural methods, ensuring continual improvement in their proficiency levels (europa.eu, 2022).

The farmers are skilled in managing diseases using organic approaches (Ekwe and Umeh, 2019). They understand the specific organic products that are effective in preventing, controlling, or mitigating various plant diseases. This knowledge helps them address disease challenges sustainably and reduce reliance on synthetic chemicals.

The study assessed farmers' proficiency in utilizing organic products to combat cucumber mosaic virus disease in okra in Abia State. Specifically, the study ascertained farmers' experience of intensity of incidence of CMV in okra in the study area, identified organic extracts and products used by farmers in the control of the diseases, ascertained level of farmers' proficiency in the use of selected organic products on the control of CMV and identified constraints militating against Okra farmers in the use of organic products in the control of cucumber mosaic virus.

Methodology

This study was conducted in Abia State of Nigeria. Abia State with Umuahia as its capital has seventeen (17) Local Government Areas, three senatorial zones namely, Abia South, Abia Central and Abia North and many communities. It is one of the five states in the South East geo-political Zone of Nigeria. The total land area of Abia state is 4,900 Km² (Wikipedia, 2021). The State has a population density of 580 persons per square kilometer and a population of 3,727,300 persons. Historically, Abia was carved out of the former Imo State in 1991. It lies between latitude 4°45' and 06°07' N and longitude 07°00' and 08°10' East of the equator (NBS, 2020). The climate is tropical and humid with minimal rainfall ranges of 2000mm to 2500mm.

The population of the study comprises of all the Okra crop producing farmers in Abia State, Nigeria. A simple random sample procedure was used to select 150 okra producers for the study. This involved selection of one block from each zone, two circles from each block and 25 okra farmers from each circle. Questionnaire administration was employed in collecting data from the farmers while descriptive statistics (namely frequency counts, percentages, mean) and Ordinary Least Square regression analysis were used to analyze the data obtained.

farmers experience of intensity of incidence of CMV in okra farm was captured using a six-point rating scale using Very High (VL) = 6, High (H) = 5, Moderate (M) = 4, Low (L) = 3, Very Low (VL) = 2, and None (N) = 1, a midpoint of 3.50 was obtained implying that mean scores equal to or higher than 3.50 indicates high intensity of incidence of CMV while mean score of less than 3.50 indicates low intensity of incidences of CMV. Organic extracts and products used by farmers in the control of the disease were captured descriptively with frequency and percentage. Level of farmers' proficiency in the use of selected organic products was captured using a four-point Likert-type scale of High proficiency HP = 4, Moderate Proficiency MP = 3, Low proficiency LP = 2 and No proficiency NP = 1 with a midpoint of 2.50. The decision rule is that mean scores of 2.50 and above imply that they are positive and in affirmative to having proficiency needed for utilization and application of the organic product while factors with mean score of less than 2.5 are negative and rarely have the needed proficiency for the organic product being measured. Constraints militating against Okra farmers in the use of organic products in the control of CMV were captured using a five-point Likert scale of SA = Strongly Agree (5), A = Agree (4), U = Undecided (3), D = Disagree (2), SD = Strongly Disagree (1). Based on the weights assigned, a midpoint of 3.00 was obtained. The decision rule is that a mean score of 3.00 and above indicates agreement with the statement while a mean score of less than 3.00 posits disagreement with the statement.

The model specification for the Least Square regression analysis is implicitly stated as follows:

Linear Function

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + \dots + b_nX_n + e_i$$

Semi – log function

$$Y = L_nb_0 + b_1L_nX_1 + b_2L_nX_2 + b_3L_nX_3 + b_4L_nX_4 + b_5L_nX_5 + b_6L_nX_6 + b_7L_nX_7 + b_8L_nX_8 + b_9L_nX_9 + b_{10}L_nX_{10} + b_{11}L_nX_{11} + \dots + b_nL_nX_n + e_i$$

Exponential function

$$LnY = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + \dots + b_nX_n + e_i$$

Cobb Douglas Function

$$LnY = L_nb_0 + b_1L_nX_1 + b_2L_nX_2 + b_3L_nX_3 + b_4L_nX_4 + b_5L_nX_5 + b_6L_nX_6 + b_7L_nX_7 + b_8L_nX_8 + b_9L_nX_9 + b_{10}L_nX_{10} + b_{11}L_nX_{11} + \dots + b_nL_nX_n + e_i$$

Y	= farmers' level of proficiency (provided by the mean score of 4 point weighing scale).
X ₁	= Age (years)
X ₂	= Education (years)
X ₃	= Farming experience (years)
X ₄	= Farm size (hectare)
X ₅	= Sex (Male =1, Female – 0)
X ₆	= Access to land (hectares)
X ₇	= Cooperative membership (yes =1, No = 0)
X ₈	= Extension visit (Number of times)
X ₉	= participated in trainings on organic agriculture standards (yes=1, no=0)
X ₁₀	= easy access to organic planting resources (yes=1, no=0)
X ₁₁	= Access to improved seed varieties (Yes=1, No =0)
ei	= error term

Results and Discussion

Intensity of incidence of CMV in the study area

The incidence of CMV in the study area, as depicted in Table 1, revealed notable intensity. Farmers reported high incidences of yellow, white, or green stripe/spores on leaves (5.35), CMW (5.64), and OYVMV (5.68), all surpassing the acceptable mean of 3.50. This indicates the considerable prevalence of these viruses among the local farming community. This aligns with prior findings by Salaudeen et al. (2018), which observed severe CMV infection in okra plants in a similar region of Nigeria. Consistent with Asare-Bediako et al. (2018) and Amiteye et al. (2021), the study also noted high incidences of OYVMV and Okra mosaic virus. In contrast, leaf curl (3.20), damping off (3.16), and powdery mildew (3.21) were less frequently experienced, scoring below the acceptable mean of 3.50.

Identification of organic extracts and products used by farmers in the control of the diseases

The study's findings on the organic extracts and products used for CMV control, as presented in Table 2, indicate a notable preference for *Azadirachta indica* (neem) among the majority of respondents (81.30%). *Zingiber officinale* (ginger) follows at 56.00%, with *Jathropha* Leaf (41.30%), *Allium sativum* (garlic) (40.00%), and *Alliumcepa* L (onion) (21.30%) also noted. Neem extracts are widely recognized for their efficacy in controlling various insect pests and viral diseases, including CMV, making them a popular choice in vegetable farming, particularly in developing regions like sub-Saharan Africa (Akama et al., 2023). Additionally, the use of plant extracts from locally available materials, such as neem, ginger, and *jatropha* leaf, is considered an environmentally friendly and cost-effective approach for pest and viral disease control in crops (Adhikari et al., 2020).

Furthermore, regarding non-plant extracts, the study identified a high usage of ash (92.00%), surpassing organic boosters/fertilizers (58.70%) and urea (17.30%). This preference for ash as a non-plant extract may be attributed to its accessibility and effectiveness in the context of organic farming practices. The study revealed that most farmers (98.70% and 92.00%) utilized regular weeding and rouging as planting/management controls for CMV, followed by improved seed use (86.70%), planting timing (69.30%), proper spacing (68.00%), and mixed cropping (49.30%). Abdulraheem et al. (2022) also emphasized the significance of weeding in preventing viral diseases in okra, underscoring the importance of proper cultural practices. They noted that weed infestation and erroneous practices like contaminated tools and seeds exacerbate crop vulnerability to pests, heightening the risk of CMV infection.

Level of farmer's proficiency in the use of selected organic products on the control of okra mosaic virus (CMV)

Table 3 outlines the proficiency levels of farmers in employing selected organic products for controlling CMV. Notably, farmers displayed high proficiency in the use of *Azadirachta indica* (neem), *Zingiber officinale* (ginger), *Allium sativum* (garlic), and *Jathropha* leaf extract with mean scores of 3.60, 3.05, 2.69, and 2.55, respectively. This aligns with a growing trend towards using organic substances, where farmers demonstrate significant proficiency in application methods for pest and virus control. Adhikari et al. (2020) also highlighted farmers' expertise in utilizing these organic substances. Farmers' high proficiency is attributed to their experience with various viral diseases affecting okra during its growth and development, with CMV and OYVMV being the most significant and prevalent. As Carvalho et al. (2022) noted, farmers are seeking alternatives to toxic substances in agriculture, leading to a focus on the effectiveness of plant extracts.

However, there remains low proficiency among respondents in using *Alliumcepa* L (onion) (1.79), possibly due to limited awareness and knowledge regarding its application for controlling CMV. Bilqees et al. (2020) reported the successful use of various plant extracts, including garlic and neem, to manage CMV and its

vector. Ali *et al.* (2018) demonstrated that *Allium sativum* extracts, while known to farmers, were less effective compared to salicylic acid and *Azadirachta indica* against the vector. These findings emphasize the need to expand knowledge and proficiency in the utilization of a wider range of organic products. This paucity of knowledge in the effectiveness and method of applications of other varieties of organic products has limited the farmers to constant use of the indicated few thereby causing scarcity, higher cost of input as well as compromise of organic standards among organic practitioners.

Furthermore, the findings also indicated high proficiency in using non-plant extracts, particularly ash (3.56) and organic booster/fertilizer (2.95), while proficiency in using urea was notably low (1.73). Adeyemo *et al.* (2022) supported the study's observations, noting farmers' extensive knowledge of wood ash's role in enhancing soil quality and combating viral diseases in okra and other crops in South Western Nigeria's degraded alfisols.

Among the assessed management controls, farmers displayed the highest proficiency in regular weeding (3.79), followed by rouging out infected plants (3.69), use of improved seeds (3.00), proper spacing (2.61), and timing of planting (2.59). This suggests that farmers possessed sufficient proficiency to understand that regular weeding and proper farm sanitation can reduce CMV incidence. In line with these findings, Abdulraheem *et al.* (2021) reported that regularly weeded farms had the lowest viral infection incidence and severity. Planet Natural Research Center (2023) emphasized that infected soil, seeds, containers, and plant cuttings contribute to virus spread, further endorsing the importance of improved seeds, proper spacing, and planting time in reducing CMV incidence.

Constraints militating against Okra farmers in the use of organic products in the control of okra mosaic virus (CMV)

The study presented the results on constraints militating against okra farmers in the use of organic products in the control of cucumber mosaic virus (MV) in the Table 4. The results showed that high cost of labour (4.88), high cost of organic materials (4.72), unavailability of farm input (4.61), procedure difficult to understand (4.51), fear (4.15), and lack of access to credit facilities (4.02), and non-availability of technologies (3.79) had mean scores above the acceptable mean of 3.0, and therefore were major constraints militating against okra farmers in the use of organic products to control CMV.

Tikon *et al.* (2023) in line with the findings noted that organic farmers faced high cost of organic farming, scarcity of organic inputs, low technical know-how on applications of organic inputs and standards, poor premium market outlet, poor storage facilities and inadequate consumer information, which constrains the for effective participation and control of pest and diseases such as CMV.

Relationship between selected socio-economic characteristics of the farmers and their level proficiency in the use of organic products to control CMV

The study depicted the results of OLS regression estimates of influence of selected socio-economic characteristics on the level of proficiency of organic control of CMV in Table 5. The study showed that among the four functional forms estimated, the exponential was chosen as the lead equation based on a high R^2 value, number of significant factors and agreement with a priori expectations. The F-value was highly significant at 1% level indicating a regression of best fit. The R^2 value of 0.5501 indicated that 55.01% of the variability in level of proficiency was explained by the independent variables, meaning that the combined effects of all independent variables (namely, age, sex, marital status, educational status, monthly income, working experience, household size, extension contact, participation in training and access to organic planting resources) in the model were responsible for 55.01 percent of the variations in the use of digital tools. Four factors (namely, educational status (2.08), extension contact (4.39), participation in training on organic standard (5.45) and access to organic planting resources (2.32) were statistically significant in effecting farmers' proficiency in utilizing organic products to combat cucumber mosaic virus disease in okra. This implies that okra farmers who are more educated, have regular contact with extension agents, participate in trainings on organic standards and have access to organic planting are more likely to have higher proficiency in utilizing organic products to combat cucumber mosaic virus disease.

These findings are similar with earlier research conducted by Ucha *et al.* (2018), highlighting the importance of improving farmers' educational attainment through formal and informal educational programs to enhance okra production and CMV control. Uche *et al.* (2018) in agreement also reported that extension services guide farmers on how to enhance capacity in organic farming operations and their quality of life by effectively using natural resources, which overlaps with the principles of organic farming.

Conclusion and Recommendations

Enhancing farmers' proficiency is the key in maximizing the benefits of utilization of organic products to control CMV in the context of okra farming. These findings emphasized the need to recognize and address key socio-economic variables affecting the use of organic products to control CMV among farmers as this could positively impact effective utilization. Promoting collaboration between researchers, extension agents, and farmers can facilitate the adoption of regenerative agriculture and nature-based agri-production practices, ultimately leading to improved yields and livelihoods in the agricultural sector. Recommendations are: Strengthening the extension services, organic Training and enhancing access to farm resources and organic inputs.

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Appendix**Table 1: Level of Intensity of incidence of OKMV in the study area**

Viruses of okra	VH	H	M	L	VL	N	T	M
Yellow, white or green stripes/spores on leaves	68(408)	66(330)	16(64)	0(0)	0(0)	0(0)	802	5.35
CMV Okra mosaic virus	100(600)	48(240)	0(0)	2(6)	0(0)	0(0)	846	5.64
OYVMV	116(696)	26(130)	4(16)	2(6)	2(4)	0(0)	852	5.68
Leaf curl	0(0)	4(20)	52(208)	66(198)	26(52)	2(2)	480	3.20
Damping off	0(0)	6(30)	42(168)	74(222)	26(52)	2(2)	474	3.16
Powdery Mildew	2(12)	2(10)	60(240)	56(168)	22(44)	8(8)	482	3.21
Grand mean								4.37

Source: Field survey, 2023. Values in parenthesis are the lickert frequency values. Very High (VL) = 6, High (H) =5, Moderate (M) =4, Low (L) =3, Very Low (VL) = 2, None (N) =1. Acceptance mean = 3.5 and above

Table 2: Organic extracts and products used by farmers in the control of OKMV

Control	Used	Not Used
Plant extracts		
Azadirachta indica (neem)	122(81.30)	28(18.70)
Allium sativum (garlic)	60(40.00)	90(60.00)
Zingiber officinale (ginger)	84(56.00)	66(44.00)
Alliumcepa L (onion)	32(21.30)	118(78.70)
Jathropha Leaf	62(41.30)	88(58.70)
Non-plant extract		
Ash	138(92.00)	12(8.00)
Urea	26(17.30)	124(82.70)
Organic booster/fertilizer	88(58.70)	62(41.30)
Planting/management control		
Wedding regularly	148(98.70)	2(1.30)
Improved seeds	130(86.70)	20(12.30)
Proper Spacing	102(68.00)	48(32.00)
Time of planting	104(69.30)	46(30.70)
Mixed cropping	74(49.30)	76(50.70)
Rogue out	138(92.00)	12(8.00)

Source: Field survey, 2023. Values in parenthesis are the percentage values

Table 3: Level of farmer's proficiency in the use of selected organic products on the control of okra mosaic virus (OkMV)

Products	HP	MP	LP	NP	Total	Mean
Plant extracts						
Azadirachta indica (neem),	120(480)	1442	2(4)	14(14)	540	3.60
Allium sativum (garlic),	68(272)	24(72)	2(4)	56(56)	404	2.69
Zingiber officinale (ginger)	56(224)	46(138)	48(96)	0(0)	458	3.05
Alliumcepa L (onion)	24(96)	22(66)	2(4)	102(102)	268	1.79
Jathropha leave extract	18(72)	46(138)	86(172)	0(0)	382	2.55
Non-plant extract						
Ash	96(384)	42(126)	12(24)	0(0)	534	3.56
Urea	20(80)	24(72)	2(4)	104(104)	260	1.73
Organic booster/fertilizer	36(144)	70(210)	44(88)	0(0)	442	2.95
Management control						
Wedding regularly	122(488)	24(72)	4(8)	0(0)	568	3.79
Use of Improved seeds	56(224)	66(198)	0(0)	28(28)	450	3.00
Proper Spacing	30(120)	76(228)	0(0)	44(44)	392	2.61
Time of planting	28(112)	76(228)	2(4)	44(44)	388	2.59
Inter cropping	32(128)	36(108)	12(24)	70(70)	330	2.20
Rogue out the infected	118(472)	18(54)	14(28)	0(0)	554	3.69

Source: Field survey, 2023. Values in parenthesis are the weighted frequency values. High proficiency HP =4, Moderate Proficiency MP =3, Low proficiency LP =2 and None proficiency NP =1 Acceptable mean =2.50

Table 4: Constraints militating against Okra farmers in the use of Organic Products in the control of okra mosaic virus (OkMV) in the study area

Constraints	SA	A	U	SD	D	T	M
Lack of awareness/information	10(50)	8(60)	20(60)	74(148)	38(38)	328	2.17
High cost of organic materials	120(600)	24(96)	2(6)	2(4)	2(2)	708	4.72*
Long time in preparation	16(80)	30(120)	2(6)	46(92)	56(56)	354	2.36
Long time to effect on the plant	0(0)	16(64)	4(12)	58(116)	72(72)	264	1.76
Long time to effect on the plant	0(0)	12(48)	4(12)	66(132)	68(68)	260	1.73
Lack of Financial Support	8(40)	40(160)	14(42)	56(112)	32(32)	386	2.57
Unavailability of farm input	104(520)	40(160)	2(6)	2(4)	2(2)	692	4.61*
Cultural beliefs	12(60)	118(472)	4(12)	8(16)	8(8)	568	3.79*
Environmental factors	4(20)	14(56)	84(252)	24(48)	24(24)	400	2.67
Non-availability of technologies	12(60)	98(392)	24(72)	6(12)	10(10)	546	3.64*
Fear	60(300)	70(280)	4(12)	14(28)	2(2)	622	4.15*
Poor knowledge of Subject Matter	2(10)	36(144)	36(108)	42(84)	34(34)	380	2.53
Lack of access to credit facilities	22(110)	118(472)	6(18)	0(0)	4(4)	604	4.02*
High cost of labour	132(660)	18(72)	0(0)	0(0)	0(0)	732	4.88*
Procedures difficult to understand	118(590)	14(56)	0(0)	12(24)	6(6)	676	4.51*
Difficulty in applying technology	10(50)	6(24)	0(0)	76(152)	58(58)	284	1.89
Lack of technical support	16(80)	8(32)	2(4)	70(140)	54(54)	312	2.08

Source: Field Survey, 2023. Figures in Parentheses are the weighted frequencies. SA = Strongly Agree, A = Agree, U = Undecided, D = Disagree, SD = Strongly Disagree. *S = Significant, NS = Non-significant. Acceptable mean = 3.00

Table 5: OLS Regression Estimates of influence of selected socio-economic characteristics on the level of proficiency of organic control of CMV

Variables	P	Linear	Exponential +	Double Log	Semi-Log
Constant	B0	4.0218 (1.46)	1.6348 (7.06)***	1.5759 (4.51)***	2.6191 (0.63)
Age	X1	-0.0323 (-1.07)	-0.0017 (-0.68)	-0.3391 (-0.54)	-0.3634 (1.99)*
Education status	X2	0.5029 (1.58)	0.0559 (2.08)*	0.0650 (2.41)*	-0.2431 (-0.44)
Farming experience	X3	-0.0009 (-0.01)	-0.0039 (-0.51)	-0.0409 (-0.88)	-0.2431 (-0.44)
Farm size	X4	0.0703 (0.43)	0.0087 (0.63)	0.009 (0.55)	0.0653 (0.35)
Sex	X5	0.0120 (0.02)	0.0042 (0.07)	0.0271 (0.46)	0.2666 (0.39)
Access to land	X6	0.5223 (0.74)	0.0424 (0.71)	0.0585 (0.96)	0.6871 (0.95)
Membership of cooperation	X7	-0.4279 (-0.36)	-0.0287 (-0.29)	0.0400 (0.39)	0.4222 (0.35)
Extension contact	X8	0.3086 (3.94)***	0.0289 (4.39)***	0.2289 (3.74)***	2.4006 (3.31)**
Participated in trainings on organic agric. standards	X9	4.1600 (5.00)***	0.3817 (5.45)***	0.3844 (5.38)***	4.2003 (4.96)***
Access to organic planting resources	X ₁₀	2.1965 (1.94)*	0.1788 (2.48)*	-0.1976 (-1.61)	-2.4560 (-1.69)*
Access to improved seed varieties	X ₁₁	3.8869 (2.54)*	0.2983 (2.320)*	0.2638 (1.97)*	3.6864 (2.32)*
F-cal		8.63	10.19	9.14	7.71
R-squared		0.5093	0.5501	0.5233	0.4822
Adj R-squared		0.4618	0.5059	0.4770	0.4326

Source: field survey, 2023. Figures in parenthesis are t-values. *, ** and *** are significant at 10%, 5% and 1% level of probability respectively. + = lead equation