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THE ROLE OF FARMER GROUPS IN THE ADOPTION OF SUSTAINABLE SUGARCANE FARMING PRACTICES IN KAKAMEGA NORTH SUB-COUNTY

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ABSTRACT

This study evaluated the role of farmer groups in the adoption of sustainable sugarcane farming practices among smallholder farmers in Kakamega North Sub-County. The research targeted all seven wards, covering a population of 65,323 sugarcane smallholder farmers, with a sample size of 394. Data were collected through structured questionnaires and interviews with key informants. Findings revealed that 95% of farmers were not members of farmer groups. Significant associations were observed between membership in farmer groups and the adoption of sustainable practices such as weeding ($p \leq 0.001$) and soil testing ($p \leq 0.001$). These results underscore the importance of farmer groups in facilitating access to knowledge, extension services, and collective action in promoting sustainable sugarcane farming. Strengthening and expanding farmer organizations could therefore play a critical role in scaling up sustainable practices among smallholder farmers in the region.

Key Words: *Farmer Groups, Adoption of Sustainable Sugarcane Farming Practices, Kakamega North Sub-County*

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INTRODUCTION

Sugarcane (*Saccharum officinarum* L) is a major industrial crop cultivated globally, contributing approximately 86% of the world's sugar supply (Daniels & Daniels, 1993; Voora et al., 2023). In addition to sugar, it supports industries producing ethanol, molasses, and bioenergy from bagasse (Formann et al., 2020). Despite global dominance by countries such as Brazil, India, and China, Africa's contribution remains at 5%, with Kenya accounting for about 7% of that total (Hess et al., 2016; Nanjala et al., 2022).

In Kenya, sugarcane is mainly grown in the Western, Nyanza, and Coastal regions. The sector supports over 250,000 farmers and contributes significantly to national GDP, rural employment, and food security (Khaemba et al., 2022). However, production has declined drastically due to poor farm-level practices, factory closures, and insufficient cane supply to sugar mills, threatening the sector's viability (Kombo et al., 2022).

Kakamega County, particularly Kakamega North Sub-County, remains a central hub for sugarcane farming. It hosts major mills such as West Kenya and Butali, which are currently experiencing operational disruptions due to inadequate cane supply. This shortfall is largely attributed to the failure of smallholder farmers to adopt sustainable sugarcane farming practices—such as mulching, soil testing, integrated weed management, and timely harvesting—which are essential for improving yields and maintaining factory supply chains (Francis et al., 2020).

Kakamega North Sub-County is home to over 65,000 sugarcane smallholder farmers (Nanjala et al., 2022), most of whom operate on landholdings averaging 1.5 acres (Ndung'u, 2023). Despite this significant farmer base, the adoption of sustainable practices remains low, raising concerns over productivity and sustainability.

Among the key drivers of sustainable practice adoption is the role played by farmer groups. Farmer organizations have been shown to facilitate access to training, credit, extension services, and collective marketing—all of which are critical enablers of modern agricultural practices. However, in Kakamega North, only a small fraction of farmers are affiliated with such groups, limiting their exposure to innovations and support systems (Kombo et al., 2022). The persistent low adoption of sustainable methods raises the need to evaluate how farmer groups influence uptake and whether strengthening these groups could enhance sugarcane production in the sub-county.

This study therefore seeks to evaluate the role of farmer groups in influencing the adoption of sustainable sugarcane farming practices in Kakamega North Sub-County. Understanding this relationship will inform targeted interventions to empower farmers, increase productivity, and stabilize the sugar industry in the region.

Statement of the Problem

Despite sugarcane being a key cash crop in Kakamega North Sub-County, smallholder farmers continue to face persistent challenges that limit their productivity and ability to sustainably cultivate the crop. Many of these farmers operate on small landholdings, which they must divide between sugarcane and essential food crops. While this mixed farming model supports food security, it places greater demand on the adoption of sustainable sugarcane farming practices to maximize yields and preserve soil health.

Sustainable practices such as mulching, soil testing, integrated weed management, and efficient harvesting techniques are known to significantly improve sugarcane productivity and land use efficiency. However, the adoption of these practices remains worryingly low among sugarcane smallholder farmers in the region. For instance, recent studies indicate that only 3% practice integrated weed management, and over 90% do not conduct soil testing, highlighting a gap in the uptake of sustainable methods.

Although multiple socio-economic factors contribute to this low adoption, the limited role and

influence of farmer groups stand out as a major barrier. Farmer groups have the potential to provide collective access to training, credit, extension services, and market linkages—all of which are critical enablers of sustainable farming. However, with 95% of farmers not belonging to any group, the benefits of collective action and knowledge dissemination remain untapped.

The continued closure and operational instability of local sugar mills, such as Mumias, West Kenya, and Butali, further underscore the consequences of inadequate sugarcane supply, much of which stems from poor on-farm practices. If sugarcane smallholder farmers are to sustain production while ensuring household food security, they must adopt sustainable farming methods at a higher rate. Understanding how farmer groups influence this adoption is therefore critical.

This study thus seeks to fill the knowledge gap by investigating the socio-economic factors influencing the adoption of sustainable sugarcane farming practices, with a particular focus on the role of farmer groups in Kakamega North Sub-County.

Objective of the study

- To evaluate the role of farmer groups/organizations in the adoption of sustainable sugarcane farming practices among sugarcane smallholder farmers in Kakamega North Sub-County. The study was guided by the following research hypothesis;
    - $H_{0;}$ There is no significant relationship between membership of sugarcane smallholder farmers in farmer groups/organizations and adoption of sustainable sugarcane farming practices in the Kakamega North sub-county.

Significance of the Study

This study is significant in several ways. First, it provides evidence-based insights into the socio-economic factors—especially the role of farmer groups—that influence the adoption of sustainable sugarcane farming practices among smallholder farmers in Kakamega North Sub-County. By identifying these factors, the study supports efforts to improve the productivity, profitability, and environmental sustainability of sugarcane farming in the region.

Second, the findings will inform policymakers, agricultural extension officers, and development partners in designing more targeted, inclusive, and farmer-driven strategies to promote sustainable farming. By understanding the role of farmer groups, interventions can be better structured to strengthen collective action, enhance access to training, inputs, and markets, and ultimately empower farmers to adopt best practices more effectively.

Third, the study contributes to improving the livelihoods of sugarcane smallholder farmers by advocating for sustainable and scalable farming models. Increased adoption of sustainable practices will help boost cane yields, stabilize incomes, and reduce production costs—thereby improving food and income security at the household level.

Lastly, enhanced local sugarcane production can reduce reliance on sugar imports, supporting national efforts to achieve agricultural self-sufficiency and food system resilience. The broader community and regional economy will benefit from job creation, value chain development, and improved rural livelihoods.

LITERATURE REVIEW

Empirical Literature On Farmer Groups/Organizations

Small-scale farmers face challenges in adopting sustainable agricultural practices in isolation. The absence of a collaborative environment potentially hinders the diffusion of innovations as farmers lack peer support and shared learning experiences in sugarcane cultivation. Farmer groups/organizations facilitate resource sharing, dissemination of new ideas, practices and innovation, knowledge exchange, and joint initiatives which improve their bargaining power, ultimately enhancing the farmers' capacity to successfully adopt and absorb effective sugarcane management practices. In a

study conducted by Abdul-Rahaman *et al.* (2020) findings revealed that members of groups and participants in collective marketing received higher prices for their produce and also faced lower input costs. Rokhani *et al*. (2021) found out 30.5% of sugarcane farmers were members of farmer groups and 69.4% were not members of the farmers group. Lack of formation of farmer groups/organizations is disadvantaging the farmers from maximizing the benefits of adopting sustainable sugarcane farming practices. The study sought to find out the association between farmer groups and the adoption of sustainable sugarcane farming practices within the study location.

Theoretical framework

Diffusion of Innovation theory guided the study. It was developed by Everett Rogers as a comprehensive framework that seeks to explain how innovations are disseminated and adopted by individuals or communities over time. The theory outlines crucial factors and stages that impact the adoption process. According to the theory, innovation involves a new idea, technology, or practice that is being introduced.

According to the theory stages of the diffusion process involve; knowledge, persuasion, decision, implementation, and then confirmation. Rodgers categorized individuals into different categories based on the timing of their adoption relative to others. These categories comprise innovators, early adopters, early majority, late majority, and laggards.

This theoretical framework, guided by the Theory of Diffusion of Innovation, provided a comprehensive lens to explore the intricate dynamics influencing the adoption of sustainable sugarcane farming practices among sugarcane smallholder farmers in Kakamega North Sub-County.

METHODOLOGY

The research encompassed all seven wards within Kakamega North sub-county, targeting a population of 65,323 sugarcane smallholder farmers, with a sample size of 394. A cross-sectional survey design was employed to explore the relationships between study variables. Proportionate sampling ensured adequate representation from each ward, while purposive sampling identified key informants who provided critical insights. Data were collected through a structured questionnaire administered to sampled farmers and an interview guide for key informants.

RESULTS AND DISCUSSION

Adoption status of sustainable sugarcane farming practices by sugarcane smallholder farmers.

Research findings on the adoption status of sustainable sugarcane farming practices such as soil testing, mulching, Integrated Weed Management Practices, and sugarcane harvesting methods among sugarcane smallholder farmers in the study area were obtained.

Adoption status of soil testing practice by sugarcane smallholder farmers.

The findings on the adoption status of soil testing practices by sugarcane smallholder farmers in the Kakamega North sub-county are presented in Figure 1.

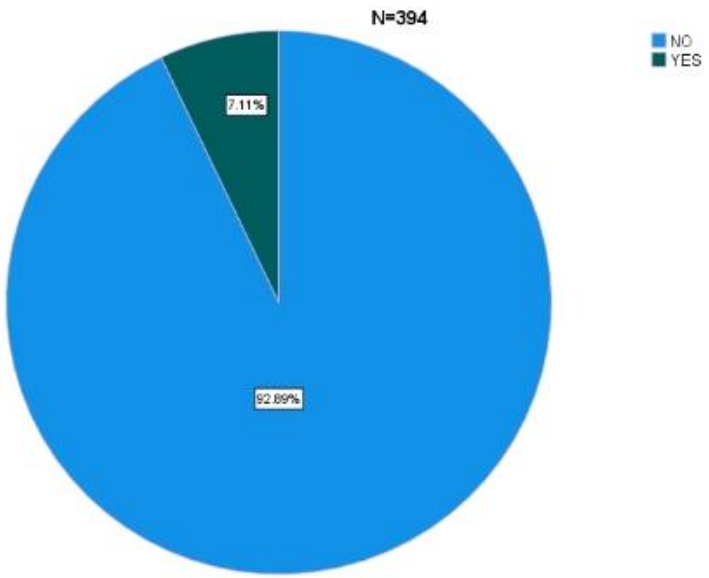

Figure 1: Distribution of sugarcane smallholder farmers based on adoption of soil testing practice in Kakamega North Sub-County, Kenya.

Source: Field data (2024)

Findings showed that 93% of sugarcane smallholder farmers didn't conduct soil testing while 7% conducted soil testing practices. This indicated that majority of sugarcane smallholder farmers did not conduct soil testing. The findings were in line with Sali *et al.* (2016) who found out the 76 % of respondents had a low level of soil testing adoption. The key informants also revealed that the small-scale sugarcane farmers within the study location partially adopted soil testing practices. They also reported that soil testing was conducted randomly annually by relevant sugarcane industries' stakeholders, especially among the registered farmers in the study area to help determine the type of fertilizer to supply for production purposes. Kumar *et al.* (2023) found that sugarcane yield increased by 16% for plant cane and 15% for ratoon crops when nutrients were applied to cane crops at the correct rate, time, place, and using the right nutrient source. Bhatt (2020) revealed that meeting crop nutrient demand and ensuring efficient nutrient utilization can be achieved by conducting regular soil testing practices on crop farms. Therefore, the low adoption of soil testing practices by the sugarcane farmers is a contributing factor to the low cane production observed in the study area. The reasons for the low adoption of soil testing practices by the smallholder farmers within the study location are indicated in Table 1.

Table 1: Distribution of sugarcane smallholder farmers' reasons for not conducting soil testing

Reasons for not conducting soil testing	Frequency	Percent (%)
Cost prohibitive	25	7
Lack of access to soil testing services	212	58
Lack of awareness concerning soil testing practices	129	35
Total	**366**	**100**

Source: Field data (2024)

Table 1 outlines the reasons given by smallholder sugarcane farmers for not adopting soil testing practices. The most commonly cited reason was lack of access to soil testing services, accounting for 58% of responses, followed by lack of awareness concerning soil testing practices at 35%, and cost

being prohibitive at 7%. The results aligned with the findings of Mugo *et al*. (2020), who assessed soil fertility and nutrient status in potato crops across the Central and Eastern highlands of Kenya. They reported that smallholder farmers are faced majorly with high costs and lack of access to soil testing services during crop production.

Table 2: Statistical significant differences between adopters and non-adopters of soil testing practices among smallholder farmers in Kakamega North Sun-county, Kenya.

	Soil Testing
Chi-Square	289.959[a]
df	1
p-value	.001

The chi-square value (χ^2_1 = 289.959, p ≤ 0.001) indicated a statistically significant difference between adopters and non-adopters of soil testing practices among sugarcane smallholder farmers in the study area. With 95% confidence level, this implies the observed difference did not occur by random chance but rather there may be factors influencing the adoption of soil testing practices by the sugarcane farmers in the study location. Given the substantial difference revealed by the chi-square test, greater emphasis should be placed on promoting soil testing among sugarcane smallholder farmers.

Adoption status of weeding practices by sugarcane smallholder farmers.

The results of the adoption status of weeding practices by sugarcane smallholder farmers are presented in Figure 2.

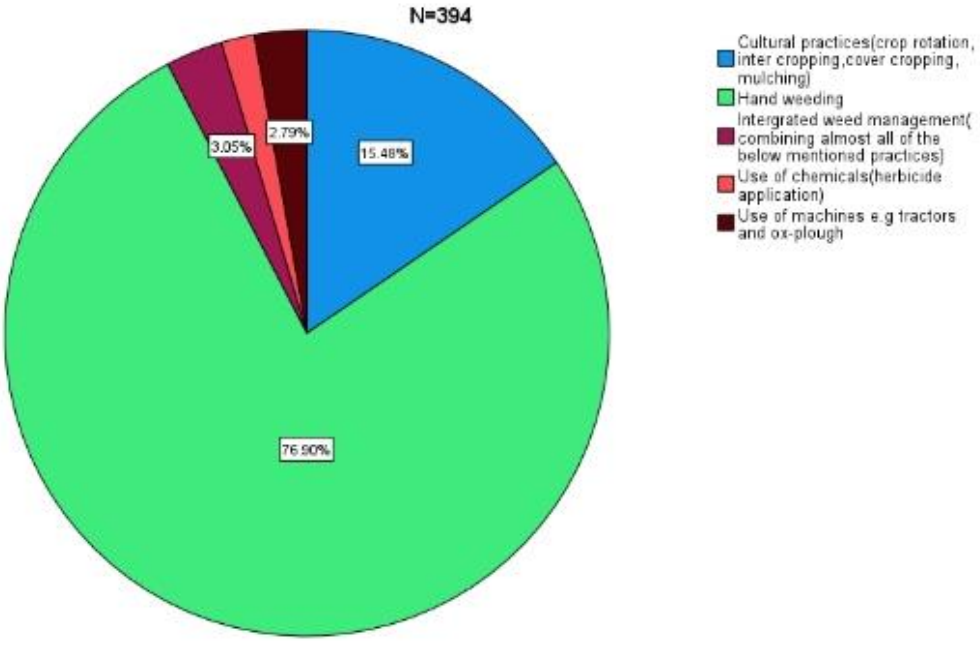

Figure 2: Distribution of sugarcane smallholder farmers based on the adoption of weeding practices in Kakamega North Sub-County, Kenya.
Source: Field data (2024)

Research findings indicated that 77% practiced hand weeding, 15% used cultural practices (crop rotation, intercropping, cover cropping, and mulching), 3% practiced Integrated Weed

Management, 2% applied chemicals(herbicides) and 3% used implements such as ox plough for weeding. Findings revealed majority of the sugarcane smallholder farmers practiced hand weeding. Key informants reported hand weeding was majorly practiced by sugarcane smallholder farmers because tools (hoes) were simple to use, available, and affordable. Findings by Coleman *et al*. (2024) indicated significant knowledge gaps related to Integrated Weed Management practices existed among sugarcane growers thus leading to low adoption of the practice. Shukla *et al.* (2021) conducted a study on identifying suitable agricultural technologies to minimize yield gaps in various sugarcane-growing states of India. The study found that using Integrated Weed Management in cane production increased sugarcane yields by 13% to 19% compared to the state average yield of 59 tons per hectare. Singh *et al*. (2024) conducted a study on sugarcane growers' knowledge of Integrated Weed Management practices in Meerut, UP, India. The findings revealed Integrated Weed Management had a significant positive impact on cane yield thus improving cane production. IWM improves soil health, reduces weed competition, and minimizes herbicide resistance, thereby enhancing crop growth and increasing cane yield, which boosts overall cane production (Scavo *et al.,* 2020). Low adoption of Integrated Weed Management by sugarcane smallholder farmers in the study area contributed to the low sugarcane production within the study location.

Table 3: Statistical significant difference between adopters and non-adopters of various weed control methods among sugarcane smallholder farmers in Kakamega North Sub-County, Kenya.

	Weeding practices
Chi-Square	822.294[a]
df	4
p-value	0.001

Chi-square value ($\chi^2_4 = 822.294$, $p \leq 0.001$) indicated statistically significant differences between adopters and non-adopters of various weeding control methods among sugarcane smallholder farmers in Kakamega North sub-county. This showed adoption of various weed control methods varied significantly among sugarcane smallholder farmers within the study location. Increased effort is needed to encourage smallholder sugarcane farmers to shift their weed control methods and focus on adopting Integrated Weed Management practices.

Adoption status of mulching as a practice by sugarcane smallholder farmers.

The study sought to determine the adoption status of the sugarcane smallholder farmers. Findings are presented in Figure 3.

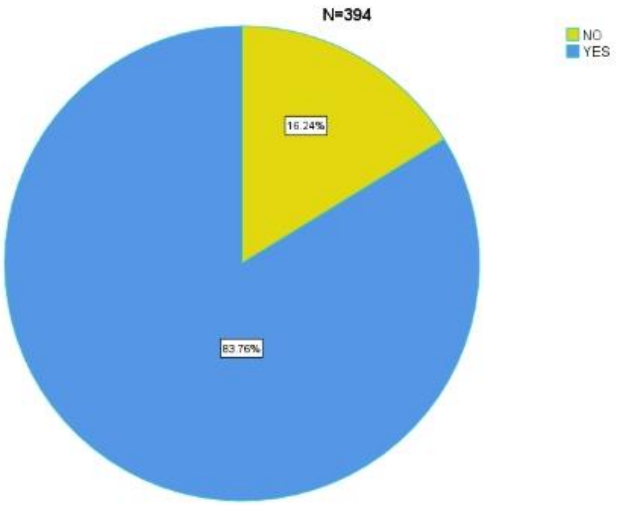

Figure 3: Distribution of sugarcane smallholder farmers based on adoption of mulching practice in Kakamega North Sub-County, Kenya.
Source: Field data (2024)

Findings showed that 84% of the farmers adopted mulching while 16% did not adopt the practice. Key informants reported organic mulching was majorly done due to the availability of mulching materials (sugarcane residue) and ease of application to farmers. This aligns with research findings from Fadeyi *et al*. (2022) who conducted a systematic review in Africa on factors influencing adoption among smallholder farmers, and findings revealed farmers would adopt a technology due to factors like the comparative cost of technology, perceived simplicity of use, and perceived benefits of adopting the technology. Application of mulch conserve soil moisture, enhance the nutrient status of soil, control erosion losses, suppress the weeds in crop plants, and remove the residual effects of pesticides, fertilizers, and heavy metals (Iqbal *et al*. 2020). An experimental study by Iqbal *et al*. (2020) revealed plot treated with 6 t ha^{-1} of mulch improved cane yield and quality. Although the majority of sugarcane farmers in the study area use organic mulch in cane production, other factors such as inadequate soil nutrients, weed competition, disease attacks, and pest infestations may still contribute to low cane production (Tabriz *et al.,* 2021).

Table 4: Statistical significant difference between adopters and non-adopters of mulching practices among sugarcane smallholder farmers in Kakamega North Sub-County, Kenya

	Mulching
Chi-Square	179.584[a]
df	1
p-value	0.001

The chi-square value ($\chi^2_{1,}$ =179.584, p ≤ 0.001) indicated there was significant difference between adopters and non-adopters of mulching practices among sugarcane smallholder farmers in the study area. This highlights the need to understand the factors that may have influenced the current state of mulching practice adoption within the study location

Adoption status of sugarcane harvesting methods by sugarcane smallholder farmers.

The study sought to determine the adoption status of sugarcane harvesting methods of the sugarcane smallholder farmers as presented in Figure 4.

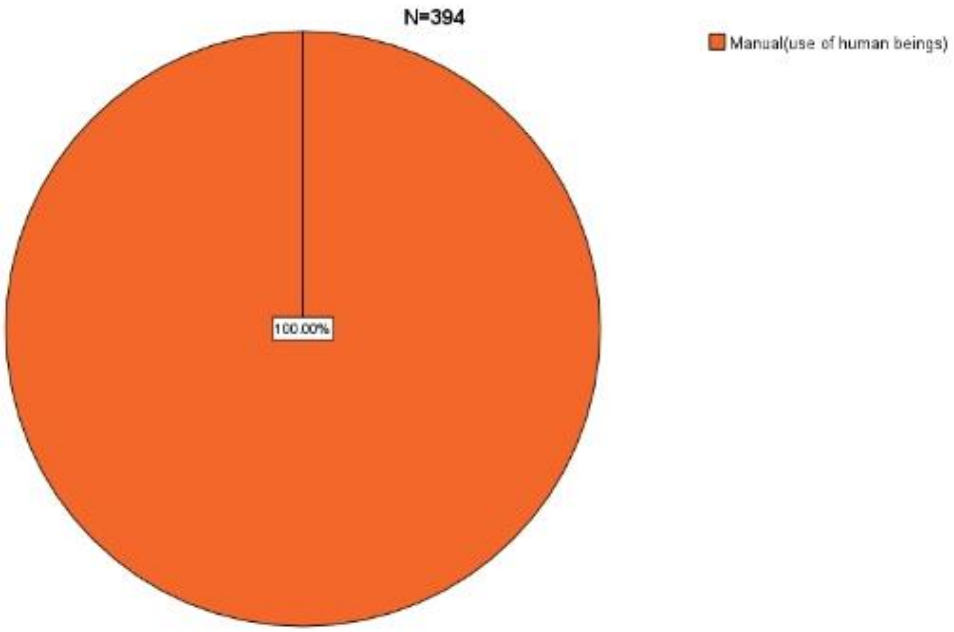

Figure 4: Distribution of sugarcane smallholder farmers based on adoption of sugarcane harvesting methods in Kakamega North Sub-County, Kenya.

Source: Field data (2024)

Harvesting of sugarcane in the study area was primarily done manually. It was indicated by findings in Figure 4 whereby 100% of the population harvested cane manually. Key informants reported no harvesting machines were used by farmers due to their unavailability in the study location. Nanjala *et al*. (2022) conducted research titled "The Economic Challenges Facing Small-Scale Sugarcane Farmers in Malava Sub-County, Kakamega, Kenya." The findings revealed that 100% of sugarcane smallholder farmers in the study area use manual sugarcane harvesting methods. Manual harvesting of cane takes more time compared to mechanized methods (da Silva *et al*., 2021). Even though it is time consuming it requires less capital investment since it doesn't involve expensive machinery. Mechanical harvesting of cane improves efficiency by ensuring cane production is done at high speed. If transportation facilities are readily available, the harvested cane can promptly be delivered to processing plants to ensure freshness and maintain optimal quality (Ma et al., 2014). Studies revealed countries such as India, Brazil, and Sudan utilize both manual and mechanical methods in cane harvesting (Ashraf et al. 2023). Combination of the two methods in harvesting ensures continuous productivity across diverse field conditions. In the study area, farmers are paid based on cane weight, so when manual harvesting takes more time, there is a risk of weight loss due to factors such as moisture loss, leading to financial losses for the farmers. Less income level affects the adoption of sustainable agricultural practices by smallholder farmers (Oyetunde-Usman *et al*., 2021).

Role of Farmer groups in the adoption of sustainable sugarcane farming practices among sugarcane smallholder farmers.

The study sought to identify the influence of farmer groups in the adoption of sustainable sugarcane farming practices. Binary and multinomial logistic regression were used to determine the influence of smallholder farmers' membership in farmer group(s)/organization(s) on the adoption of various sustainable sugarcane farming practices.

Table 5: Influence of sugarcane smallholder farmers' membership in farmer group(s) on adoption of soil testing practices in Kakamega North sub-county, Kenya.

	B	S.E.	Wald	df	Sig.	Exp(B)
Farmer group(s)	**.730**	**.653**	**1.252**	**1**	**.263**	**2.076**

Binary logistic regression analysis was conducted to assess the influence of farmer groups on the adoption of soil testing practices. The results indicated that membership in a farmer group has a positive association with the likelihood of adoption, as evidenced by a B coefficient of 0.730 However, this effect is not statistically significant, with a Wald value of 1.252, a p-value of 0.263, and an Exp(B) value of 2.076. The p-value being greater than 0.05 suggests that membership in farmer groups does not statistically significantly influence the adoption of soil testing practices among sugarcane smallholder farmers within the study area.

Table 6: Influence of farmer group(s) on the adoption of Integrated Weed Management practices in Kakamega North sub-county, Kenya.

Weeding practice	B	S.E	Wald	df	p-value	Exp (B) Lower Bound	Exp(B) Upper Bound
Integrated Weed Management	-2.197	1.145	3.682	1	.05	.012	1.048

95% confidence level

Table 6 provided is a multinomial logistic regression output for influence of farmer group(s) on adoption of **Integrated Weed Management**, the parameter estimates for sugarcane smallholder farmers not belonging to a farmer group (B = -2.197) indicated that these farmers are less likely to use Integrated Weed Management compared to other weeding practices. This suggests that being a member of a farmer group positively ($p \leq 0.05$) influences the adoption of integrated weed management, as non-members have significantly lower odds of choosing this method over other weeding practices ($p \leq 0.05$). Similarly, Moss (2019) revealed that farmer groups serve as an effective solution in reducing reluctance towards the adoption of Integrated Weed Management practices. He found farmer groups had a positive significant influence on adoption of Integrated weed management among small-scale farmers.

Table 7: Influence of farmer group(s) on the adoption of mulching practices by smallholder farmers in Kakamega North sub-county, Kenya.

Variable	B	S.E.	Wald	df	p-value	Exp(B)
Farmer group(s)	.405	.525	.594	1	.441	1.499

Binary logistic regression analysis was conducted to assess the influence of farmer group(s) on the adoption of mulching practices. The results indicated that membership in farmer group(s) has a positive association with the likelihood of adoption, as evidenced by a B coefficient of 0.405. However, this effect is not statistically significant, with a Wald value of 0.594, a p-value of 0.441, and an Exp(B) value of 1.499. The p-value being greater than 0.05 suggests that membership in farmer groups or

organizations does not significantly influence the adoption of mulching practices among sugarcane smallholder farmers. The Exp(B) value of 1.499 indicates that holding other variables constant, the odds of adopting mulching practices increase by approximately 49.9% for those who are members of a farmer group or organization, although this effect is not statistically significant.

Table 8: Major benefits obtained through membership into farmer group(s) or organization in the adoption of sustainable sugarcane farming practices by smallholder farmers in Kakamega North sub-county, Kenya.

Benefits obtained	Total	Percent (%)
Shared knowledge and skills i.e. learning from each other on improved farming methods	3	15
Collective bargaining power i.e. negotiated with group members when buying fertilizers, seeds, or selling produce	5	25
Access to resources i.e. Money (capital), machinery e.g. tractors, ox-ploughs, tools, and equipment set.	6	30
Social support and networking i.e. encouraged by other farmers to adopt a practice.	6	30
Total	**20**	**100.0**

Source: Field data (2024)

Sugarcane smallholder farmers reported various benefits of group membership, with the most common being access to resources (e.g., capital, machinery), cited by 30% of respondents. Similarly, 30% of respondents mentioned receiving social support and networking opportunities, which encouraged them to adopt new practices. Collective bargaining power, which helped them negotiate better deals when buying inputs or selling produce, was noted by 25% of the participants. Meanwhile, 15% of the farmers highlighted the value of shared knowledge and skills, particularly in learning improved farming methods from peers. Sumane *et al*. 2018 reported farmer groups promote knowledge sharing among farmers. Courtois *et al.* (2019) revealed farmers who are part of identified groups can more easily sell their products compared to those who are not in groups, as increased networking helps them access a wider market for their products. According to Bizikova *et al.* (2020) group membership increases farmers' access to farming resources, likely due to enhanced collaboration, shared knowledge, and collective bargaining power, which improve their ability to obtain inputs, financial support, and technical assistance. Cofré-Bravo *et al.* (2019) revealed farmer groups/organizations offer opportunities for social networking, which can facilitate the exchange of knowledge and experiences, thereby enhancing the adoption of sustainable farming practices.

CONCLUSIONS AND RECOMMENDATIONS

Findings indicated membership into farmer groups did not influence adoption of mulching ($p \leq 0.441$) and soil testing practices ($p \leq 0.263$) but influenced adoption of Integrated weed Management practices ($p \leq 0.05$). Therefore, the null hypothesis that there is no significant relationship between membership of sugarcane small-scale farmers in farmer groups/organizations and the adoption of sustainable sugarcane farming practices in the Kakamega North sub-county was rejected.

The study Recommended the following;

- Strengthen and Support Farmer Groups: Government agencies, NGOs, and sugarcane companies should invest in the mobilization, capacity building, and formal registration of farmer groups. These groups serve as effective platforms for knowledge dissemination, peer learning, collective input acquisition, and advocacy for better terms with sugar mills.

- Map and Digitize Farmer Group Membership in Sugarcane Zones: Sugar companies should integrate updated data on farmer group membership into their farm mapping systems. This will enhance transparency, reduce permit processing delays, and improve coordination of cane harvesting and marketing.
- Subsidize Inputs and Extension Services Through Farmer Groups: The government and private sector should channel subsidized agricultural inputs (e.g., certified seed cane, fertilizers, and soil testing services) through organized farmer groups to ensure equitable access and better utilization, thereby enhancing adoption of sustainable practices.
- Promote Group-Based Training and Demonstration Plots: Agricultural extension services should prioritize farmer groups for training on sustainable sugarcane farming practices such as mulching, integrated weed management, and soil conservation. Group-managed demonstration plots should be established to encourage peer-to-peer learning and real-time adoption.
- Incentivize Farmer Group Participation in Sustainability Programs: Stakeholders should create incentive schemes—such as preferential access to markets, microcredit, or certification programs—for farmer groups that consistently apply sustainable farming methods. This will motivate wider adoption and long-term behavioral change.

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