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Factors Influencing Green Growth Practices and Avocado Yields: Insights from the Southern Agricultural Growth Corridor in Rungwe

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Abstract: Green growth practices in avocado farming involve balancing economic productivity, environmental sustainability, and social inclusiveness. These practices could boost resource efficiency, conserve biodiversity, and minimize environmental degradation. While global demand for avocados is increasing, there is little understanding of the factors influencing farmers' willingness to adopt green growth practices and the factors affecting avocado yields amid market pressures as well as insufficient information and inadequate resources. Therefore, this study investigated the current practices used by farmers and the factors influencing the adoption of green growth practices and avocado yields in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) region, specifically in Rungwe District. A cross-sectional research design and multistage sampling helped select targeted avocado farmers, from whom data was collected via questionnaires and surveys. Results of descriptive statistics showed that 82% of the interviewed farmers were male and 67% of them had primary education. Farmers identified mulching and the use of organic fertilizer as primary green growth practices. Regression analysis performed by SPSS version 27 was the main analytical method. Binary logistic regression indicated that larger avocado farm size, access to information, and perception of larger avocado demand significantly influenced the adoption of green growth practices; meanwhile, gender showed a marginally significant effect. Multiple linear regression further revealed that tree age significantly impacted avocado yields whereas chemical fertilizer decreased yields. The findings emphasized the importance of targeted interventions to improve knowledge dissemination and training of sustainable agricultural practices to enhance productivity in avocado farming.

Keywords: Factors; Green growth practices; Avocados; SAGCOT

1 Introduction

Green growth is increasingly endorsed by governments and development agencies worldwide as an all-encompassing strategy to combat critically environmental challenges, including climate change, biodiversity degradation, and over-exploitation of natural resources, while fostering equitable socio-economic environments [1, 2]. Green growth represents a development paradigm that seeks to harmonize economic advancement with inclusive social progress, while actively mitigating ecological degradation and pressure on the system of natural resources [3]. This integrated approach constitutes the agenda of global sustainable development, thus shaping policy directions and directing investments toward cleaner technologies and more sustainable production systems. Agriculture is central to these efforts, especially in developing countries where the majority of livelihoods depend directly on the natural resource base [4].

Green growth in agricultural systems seeks to enhance productivity, while preserving vital environmental functions such as maintaining soil fertility, conserving water, and protecting biodiversity [5, 6]. In this context, the cultivation of perennial crops like avocados could potentially fulfill both economic and environmental goals [7]. Avocado farming in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), particularly in Rungwe

District, is an emerging sustainable practice that strengthens soil structure, promotes the health of the ecosystem, and contributes to household income [8].

Amid rising constraints of natural resource and environmental degradation, Tanzania has adopted green growth as a key strategy to transform its agricultural sector toward sustainability [9]. This strategic shift aligns with the country's broader commitment to sustainable development and is especially important for regions that are heavily dependent on agriculture and are now vulnerable to climate change, land degradation, and biodiversity loss. The SAGCOT initiative, established under the Kilimo Kwanza (Agriculture First) policy, demonstrates this commitment by promoting agricultural productivity, boosting food security and rural incomes, and safeguarding natural ecosystems through climate-resilient and environmentally friendly farming practices [10].

One of the producing areas in the SAGCOT region is Rungwe District [10], where avocado has evolved into a high-value commercial crop, contributing significantly to household livelihoods and national export revenues [11]. According to the current data from the Tanzania Horticultural Association (TAHA), exports of avocados climbed from 15,432 tonnes to 26,826 tonnes, indicating a 74% rise between 2021 and 2023 [12]. Although there is advancement in avocado farming in the region, farmers still encounter significant sustainability challenges [13]. For instance, environmental issues such as soil erosion, declining soil fertility, and inadequate access to green technologies, along with economic uncertainties like market volatility, continue to limit the long-term productivity and resilience of the sector.

National programs and policies promote green growth practices, including organic composting, agroforestry, water harvesting, and conservation tillage. Previous studies [7, 14, 15] addressed higher-order issues related to agricultural sustainability in avocados, while adoption among smallholder farmers remained relatively low. Although there is an accelerating global demand for avocados and sustainable farming of this crop could provide significant economic benefits, little is known about the specific factors influencing the willingness of farmers to adopt green growth practices and the factors affecting avocado yields. To address these research gaps, this study aims to enrich the understanding of these crucial factors by answering the following questions: i) What green growth practices are currently adopted by avocado farmers? ii) What factors influence the adoption of these practices by avocado farmers? and iii) What are the key factors impacting avocado yields?

2 Methodology

2.1 Study Area

The study was conducted in Rungwe District, part of Tanzania's Southern Agricultural Corridor (Figure 1). Rungwe is located in the Mbeya Region and covers 1,441 square kilometers. Situated in the Southern Highlands of Tanzania at $9°15'$S $33°40'$E, this area is known for its moderate climate, with temperatures ranging from 15°C to 30°C. Its tropical, sub-humid environment receives about 1,200 mm of rainfall annually, making the fertile soils ideal for growing avocados.

Avocado, an emerging horticultural trade commodity among the several crops produced in Rungwe, demands well-drained soil as well as full and uninterrupted sunlight. The hilly terrain in the district could provide a suitable condition to cultivate avocados.

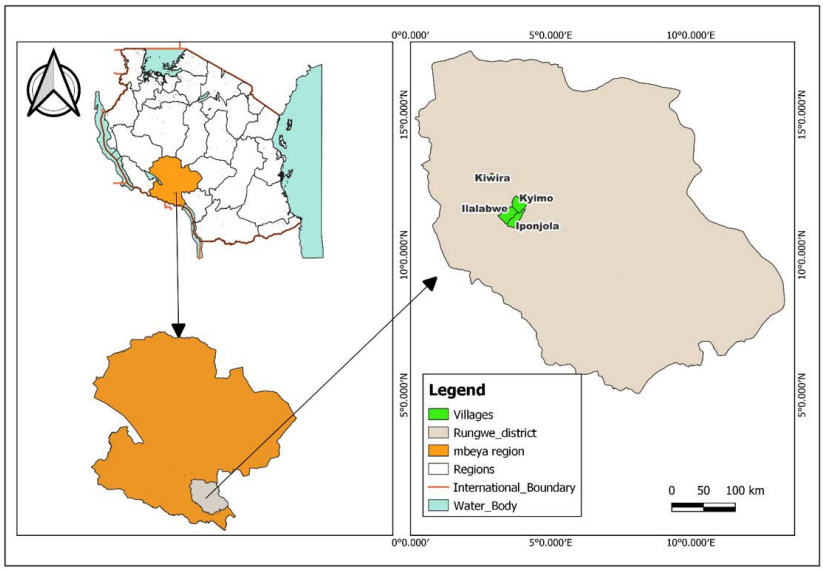

Figure 1. Map of the study area in Rungwe District

2.2 Sampling Design and Determination of Sample Size

A cross-sectional research design was employed to collect data at a single point in time in the field because it offers a snapshot of the current situation and is relatively efficient and cost-effective. The study population was selected by the multistage sampling technique. In both the first and second stages, purposive sampling was adopted; it helped select the study area, Rungwe District, which has a high concentration of avocado growers. Based on the concentration of these farmers and the accessibility of the locations, a total of four villages, namely Iponjora, Ilalabwe, Kyimo, and Kiwira, were chosen in the second stage. The final sample of active avocado farmers was randomly selected in the third stage to identify respondents, who constitute the sample size of 120 avocado farmers. Among them, 30 participants were interviewed in each of the four villages. According to Bailey [16], regardless of the population size, a sample of 30 respondents is the minimum requirement to be met for a study involving statistical analysis.

2.3 Methods of Data Collection

The study applied a mixed-method approach, combining both qualitative and quantitative methods to provide a thorough understanding of the current practices of avocado farmers, related sources of information, as well as factors influencing their willingness and avocado yields.

A structured questionnaire comprising open-ended and closed-ended questions was administered to the respondents. Quantitative data was retrieved by using pre-set questions on variables like demographic characteristics, current agricultural practices and factors affecting the adoption of green growth practices for direct statistical analysis. Meanwhile, open-ended questions allowed respondents to articulate their thoughts and experiences in their own words, yielding qualitative insights into the context and motivations behind their farming practices. This mixed-method approach allowed detailed investigation of factors affecting avocado farming, thus offering data about the statistical trends and individual opinions.

2.4 Data Analysis

The collected data was analysed using Statistical Product and Service Solutions (SPSS) version 27 to assess the current green growth practices of avocado farmers. Binary logistic regression was used to determine factors influencing the willingness of farmers to adopt green growth practices whereas a multiple linear regression model was adopted to determine factors influencing the avocado yields.

For question 1: What are the green growth practices currently implemented by avocado farmers?

Descriptive analysis, including frequencies and percentages, was conducted to identify the specific green growth practices of avocado farmers. The variables included organic fertilizer, mulching, pruning, and agroforestry integration.

For question 2: What are the key factors influencing the adoption of green growth practices by avocado farmers?

A binary logistic regression model was employed to identify factors influencing the willingness of farmers to adopt green growth practices. The dependent variable for this study was whether the farmers were willing to adopt green growth practices, with a value of 1 assigned to indicate when a farmer was willing to adopt green growth practices and 0 assigned to indicate if the farmer was not willing to adopt green growth practices. The equation of the logistic regression model is given as follows:

$$\log(P) = \ln\left(\frac{p}{1-P}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots \beta_k x_k$$

where,

P is the probability of the farmer willing to adopt green growth practices;

B_0 is the intercept;

$\beta_1, \beta_2, \beta_3 \ldots\ldots, \beta_{\mathrm{k}}$ are coefficients of independent variables;

$X_1, X_2, X_3 \ldots\ldots, X_k$ are independent variables.

Independent variables were gender, education, farmers' perception of the demand for avocados, avocado farm size, occupation, part of any farmer associations/societies, and access to training (This includes organized and practical capacity-building seminars, workshops, and demonstrations for farmers to directly interact with trainers or experts. The training enables farmers to obtain practical skills and techniques pertinent to sustainable cultivation of avocados).

For question 3: What are the factors influencing the avocado yields?

A multiple linear regression model was employed to determine factors influencing the avocado yields. The continuous dependent variable in this study was the avocado yields and multiple independent variables were factors that affected yields. The regression equation applied was:

$$Y_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots \beta_{10} x_{10} + \varepsilon$$

where,

Y_l is the dependent variable, which is the avocado yield;

α is the intercept;

$\beta_1, \beta_2, \ldots, \beta_{\mathrm{k}}$ are the coefficients for each independent variable;

$X_1, X_2, X_3 \ldots, X_{10}$ are the independent variables, which are the factors influencing yields;

$\mathcal{E}$ is the error term for the difference between observed and predicted values.

Independent variables were demographic factors, farm size, number of trees planted, age of trees, soil management techniques, use of fertilizer, participation in any farmer associations/groups, and access to information (This represents farmers' access to agricultural knowledge and guidance acquired through avenues, such as extension services, radio broadcasts, television, conversations of farmer groups, mobile phones, and non-governmental organizations).

3 Results

3.1 Demographic Characteristics of Respondents

The results of the 120 avocado farmers interviewed showed that 82% (n = 99) of them were men and 17% (n = 21) were women, as reflected in Table 1. This demonstrated that men made up a majority of farmers engaged in the agricultural sector, particularly in the production of avocados. Meanwhile, most of the interviewed avocado farmers were over 18, with 47% (n = 57) falling into the age range of 41–55, and 23% falling into the age range of 56–65.

Table 1. Information on the number of avocado farmers interviewed in each village

Villages	No. of Farmers	
	Male	Female
Kiwira	24	6
Kyimo	26	4
Ilalabwe	25	5
Iponjora	24	6
Total	99	21

Table 2. Demographic characteristics of avocado farmers

Variables		Frequency ($n = 120$)	Percentage (%)
Gender	Male	99	82.5
	Female	21	17.5
Education level	Non formal	12	10
	Primary	81	67.5
	Secondary	19	15.8
	Tertiary	8	6.7
Marital status	Never married	6	5
	Monogamous	81	67.5
	Polygamous	14	11.7
	Cohabited	6	5
	Separated	3	2.5
	Divorced	3	2.5
	Widower	7	5.8
Occupation	Government employment	16	13.3
	Self-employment (farming)	100	83.3
	Retirement income	4	3.3
Age (Years)	18-25	2	1.7
	26-40	24	20
	41-55	57	47.5
	56-65	28	23.3
	Above 65	9	7.5

According to the findings, the majority of farmers (n = 81) had completed primary school, thus suggesting that farmers typically possessed basic education. In contrast, 10% of the farmers (n = 12) had completed non-formal education, 15% (n = 19) had completed secondary school, and 7% (n = 8) had attained tertiary education. A smaller

percentage, as evidenced by 6% of the farmers who had advanced education, had completed secondary and tertiary levels. In terms of revenue, the majority of farmers (n = 100) were self-employed, accounting for 83% of the total, while 13% (n = 16) worked for the government and 3.3% (n = 4) solely engaged in farming as a side job. In addition, 3% were both engaged in agriculture and relied on retirement income. As seen in Table 2, the majority of farmers, about 79% (n = 95), were married, hence forming a family-oriented farming system.

Research question 1. What are the green growth practices currently implemented by avocado farmers?

Avocado farmers were employing standard green growth practices regarding the cultivation of avocado trees, including the use of organic fertilizer and mulching as reflected in Figure 2. Most farmers, 40.8% (n = 49), reported using organic fertilizer, while 25% (n = 30) indicated utilizing mulching. 18.3% (n = 22) mentioned integrating agroforestry techniques, whereas only 15.8% (n = 19) cited using pruning on trees.

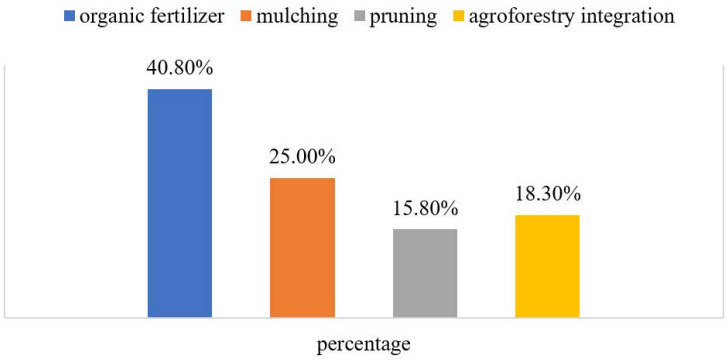

Figure 2. Green growth practices used by avocado farmers

In Table 3, avocado farmers reported using soil management techniques to achieve green growth practices. 36.7% of the respondents (n = 44) reported using organic fertilizers, 31.7% mentioned maintaining the right amount of moisture in their soil, 11.7% reported practising mixed cropping, another 11.7% practised soil testing, and only 8.3% practised weeding.

Table 3. Soil management techniques used by avocado farmers

Soil Management Techniques	Frequency	Percentage (%)
Adding organic matter	44	36.7
Mulching	38	31.7
Mixed cropping	14	11.7
Soil testing	14	11.7
Weeding	10	8.3

3.2 Factors Influencing the Willingness of Avocado Farmers to Adopt Green Growth Practices

A binary logistic regression model was performed to determine factors influencing the willingness of avocado farmers to adopt green growth practices. The model contained seven independent variables, i.e., gender, education, farmers' perception of the demand for avocados, farm size, access to training, membership in any farmer associations, and occupation. The dependent variable was the number of farmers adopting green growth practices.

The full model containing all predictors was statistically significant $X^2(7, n = 120) = 39.899, p < .000$. The findings indicated that gender had a marginally significant effect ($p = .096$) on willingness to adopt green growth practices, while the negative coefficient indicated that being male decreased the likelihood of adopting green growth practices by 87% (1-0.133). Although the coefficient for avocado farm size was positive ($B = 1.775$), suggesting a potentially positive influence on the above adoption, the effect was not statistically significant ($p = .407$). Therefore, farm size could not be considered a reliable predictor of adopting the practices in this model. Compared to access to information and knowledge, the results showed that receiving information and knowledge about green growth practices significantly increased the likelihood of such adoption ($p = .001$). Farmers who received information and training were 25 times more likely to adopt green growth practices than those who did not. Meanwhile, being a member of a cooperative society did not significantly influence the adoption of green growth practices ($p = .307$). However, membership tended to raise the likelihood of adoption ($OR = 4.413$). The results of regression analysis showed that the variable, access to training, was slightly statistically significant at $p = .089$ and positively related to the dependent variable ($B = 2.932$), in terms of the demand for avocados significantly influencing ($p = .023$) the

adoption of green growth practices. Farmers perceived that a low demand for avocados were significantly less likely for them to adopt green growth practices ($p = .012, OR = .123$). Furthermore, other variables indicated in Table 4 were positively associated with the dependent variable but with lower significance.

Table 4. Factors influencing the willingness to adopt green growth practices

Variables (Assigned Value)	S. E.	Wald	Sig.	Exp (B)
Gender (1)	1.212	2.774	.096	.133
Occupation		2.940	.230	
Occupation (1)	1.300	2.877	.090	.110
Occupation (2)	2.208	1.699	.192	.056
Education		1.616	.656	
Education (1)	1.017	.019	.891	.870
Education (2)	1.362	.096	.757	.656
Education (3)	2.168	1.362	.243	.080
Avocado farm size		2.160	.340	
Avocado farm size (1)	.819	.687	.407	1.972
Avocado farm size (2)	1.208	2.159	.142	5.899
Did you get any information and knowledge about green growth (1)	.881	13.435	.000	25.243
Have you received training concerning sustainable avocado farming (1)	1.713	2.928	.087	18.764
Are you part of any farmer cooperatives or association societies (1)	1.454	1.042	.307	4.413
Demand of avocados		7.569	.023	
Demand of avocados (1)	1.053	.297	.586	.564
Demand of avocados (2)	.838	6.250	.012	.123
Constant	1.937	.787	.375	.179

3.3 Factors Affecting Avocado Yields

Multiple linear regression was used to identify factors affecting the avocado yields. The result demonstrated that some variables had a significant influence on the avocado yields, while others had a marginal or no impact.

Table 5. Factors affecting the avocado yields

	B	Std. Error	t	Sig.	95.0% Confidence Interval for B	
					Lower Bound	Upper Bound
(Constant)	37.924	12.264	3.092	.003	13.601	62.247
Age	-.527	1.308	-.403	.688	-3.121	2.066
Occupation	-1.862	2.084	-.894	.374	-5.995	2.270
Education	-.640	1.546	-.414	.680	-3.706	2.427
Marital status	.523	.700	.747	.457	-.865	1.911
Avocado farm size	3.065	2.826	1.085	.281	-2.539	8.668
Trees planted	.014	.020	.687	.493	-.026	.053
Age of trees	26.258	1.648	15.938	.000	22.991	29.526
Soil management techniques	-.654	.734	-.892	.375	-2.110	.801
Chemical fertilizer	-4.340	2.123	-2.045	.043	-8.551	-.130
Herbicides	-2.264	2.511	-.902	.369	-7.245	2.716
Pesticides	-3.593	2.248	-1.598	.113	-8.051	.865
Fungicides	-3.208	2.367	-1.355	.178	-7.902	1.487
Irrigation system	-2.115	1.376	-1.537	.127	-4.843	.614
Did you get any information and knowledge about green growth	-5.480	3.111	-1.762	.081	-11.650	.689
Are you part of any farmer cooperatives or association societies	1.222	2.637	.463	.644	-4.008	6.452

The findings in Table 5 revealed that the age of trees was a highly significant predictor of avocado yields, with a coefficient of $B = 26.258$ ($p < .001$); the age of the avocado trees greatly increased production. Meanwhile, the application of chemical fertilizers decreased yields with $B = -4.340$, at $p = .043$, reflecting overreliance on or improper use of chemical fertilizers which would reduce avocado yields. Emphasizing the effects of applying chemical fertilizers, one of the avocado farmers said, "*There was a time when I relied on chemical fertilizers, expecting*

higher yields, but the results were disappointing. After attending training sessions on improving yields through the use of organic fertilizers, I applied the knowledge I gained, and my yield performance improved significantly".

4 Discussion

4.1 Demographic Characteristics of Avocado Farmers

Avocado production is mainly male undertaking, comprising 82% (n = 99) of the respondents, as shown in Table 1. Traditional gender roles significantly influence avocado farming as the vast majority of farmers are male. Malekela [17] noted that the type of crops produced affected gender involvement. A related observation by Rop et al. [18] highlighted that most farmers were male, given that avocado farming was labour-intensive and some farm tasks were designated for men and young men only. The low participation of female farmers in avocado cultivation might hinder the adoption of green growth practices due to their limited access to resources and involvement in decision-making, which restricted their influence in this area. These findings suggested that greater gender equality could enhance productivity and promote sustainable farming practices [19]. Similarly, the SAGCOT aims to foster sustainable agriculture and create quality job opportunities for youth and women within its framework [20].

The education level of the avocado farmers shown in Table 2 indicate that the majority, 67%, of the respondents have attained primary education as basic educational attainment is prevalent among the farmers. A smaller percentage, 22%, had completed secondary and tertiary education, thus indicating potential areas for academic development and training. Fasha and Minde [21] stated that primary education was compulsory for every individual in Tanzania, as literacy enabled them to read and write. The results revealed a high percentage of those with merely primary education, implying that most farmers might lack the advanced agricultural knowledge and skills necessary for sustainable farming practices. This finding aligned with the argument of George et al. [22], who advocated that farmers with higher education tend to adopt new farming methods more efficiently than their less-educated counterparts because they are better equipped to notice, understand, and respond to new information and advancement in agriculture.

The age distribution shows that most avocado farmers (47.5%) are between the age of 41 and 55, followed by those aged between 56 and 65 (23.3%). As indicated in Table 2, avocado farming is pursued by middle-aged individuals; it is anticipated that a high level of farming experience is an asset for adopting sustainable practices. Usually, older farmers have a better understanding of local agricultural conditions, pest management, and crop rotation techniques for sustainable green growth practices. On the other hand, traditional practices may prevent the adoption of innovative green technologies, which younger farmers might indicate more interest to invest. Limited youth involvement (1.7% of the respondents) indicates a demand for incentives like funding, training, and market linkages to attract young people to partake in agriculture.

4.2 Green Growth Practices Currently Implemented by Avocado Farmers

The different growth practices of avocado farmers in the study showed their preferences and related implications for sustainable agriculture. The results indicated that most of the farmers, 40%, were using organic fertilizers, thus indicating the latest trends in farming towards sustainability and healthy soil, rather than dependence on synthetic chemicals. Tzatzani et al. [23] provided substantial input to improve sustainable avocado farming practices in subtropical regions by highlighting promising opportunities for using organic fertilizers, which can positively influence avocado tree growth and fruit quality under specific conditions. Mulching was applied by 25% of the farmers whereas in soil management, 3% focused on moisture management by mulching as shown in Figure 3a to conserve water and regulate soil temperature to retain soil moisture and control weeds. Farmers in Rungwe explained that to retain water and moisture, they placed leaves and other tree debris around the base of the tree. The qualitative data in this study reported farmers participating in community coping strategies against such constraints; as mentioned by one farmer, "*Soil health here is good. We normally make a plate-like weep around the avocado tree to retain moisture*". As such, farmers could adapt to seasonal moisture stress through low-cost and environmentally friendly methods. It demonstrates sensitivity to local environmental conditions and grassroots innovation, thus indicating that green growth does not have to depend solely on foreign technology. This finding aligned with Iqbal et al. [24], who stated that mulching could improve the microclimate of avocado trees by creating favorable conditions for growth. However, lower adoption rates of mulching compared to organic fertilizers suggested that farmers may need more education and support for this practice.

To diversify income at the farm level, 18% of the farmers reported implementing agroforestry practices as these practices could increase biodiversity and ecosystem services. Avocado farmers in Rungwe believed that agroforestry enhanced soil fertility, which could benefit avocado trees even with good shade conditions. Mixed cropping was practiced by 11% of the farmers for soil management, especially growing crops like coffee and beans as shown in Figure 3b. Another study in Ethiopia explained how avocados could be integrated with coffee to help meet shade and other soil requirements for growing avocados [25]. A moderate adoption rate indicated that while some farmers recognize the benefits of agroforestry, barriers like a lack of knowledge or resources may hinder wider

implementation. Pruning practiced by only 15% of the respondents was the least adopted, despite being the key to maintaining tree health, improving aeration, maximizing sunlight exposure, and ensuring optimal fruit production. Few farmers understand the importance of pruning; studies by Badrulhisham and Othman [26] reported that many farmers were unaware of proper pruning techniques. The limited knowledge about pruning may stem from a lack of information on its benefits or cultural preferences for less invasive farming methods.

Adding organic matter to soil is a crucial soil management technique that avocado farmers used to facilitate green growth practices. Avocado farmers in Rungwe mixed their soil with leaves and other debris during weeding; they also added banana leaves to the soil to enhance its nutrient content. This finding aligned with qualitative insights expressed by several farmers regarding the importance of organic fertilizers in adopting green practices. One farmer noted, "In contrast to artificial fertilizer, which decomposes quickly, we mostly employ organic manure in the soil since it lasts longer". This practice is essential as organic amendments improve soil structure and enhance moisture retention [27]. Avocado farmers in the SAGCOT are adopting practices such as cover cropping and organic fertilization to enhance soil structure and nutrition, in order to avoid soil erosion, promote biodiversity, and enable a healthier ecosystem [28].

(a) (b)

Figure 3. Photos of farming methods, (a) Mulching, and (b) Mixed cropping method

4.3 Factors Influencing Avocado Farmers to Adopt Green Growth Practices

Access to information and knowledge is an important factor influencing the adoption of green growth practices by farmers. In Table 4, this relationship is statistically significant at $p = .001$, with a positive coefficient at $B = 3.229$. Farmers are more likely to adopt green practices when they are well informed of their benefits, as dissemination of information was one of the key determinants in promoting sustainable agricultural practices. This finding agreed to the existing literature, in which Liu et al. [29] attested that awareness and information influenced farmers' decisions. The impact of cooperative membership on adoption was insignificant at $p = .307$; however, it tended to raise the likelihood of adoption as indicated by $OR = 4.413$. This means that even though membership in a cooperative society may not necessarily be directly related to increased adoption rates. Access to resources, shared knowledge, and collective bargaining power might be useful to farmers in their pursuit of sustainability. Cooperatives can build capacities of farmers through training and support in adopting new technologies [30]. The "access to training" variable presents slight statistical significance at $p = 0.089$, and a positive relationship as shown by $B = 2.932$. This suggested that access to training increased the likelihood of adopting green practices and the marginal significance suggested that efforts might be required to enhance this relationship. Shahir et al. [31] reported that the knowledge and abilities of farmers about adopting green technologies could be achieved with training; such findings have been evidenced in other literature, where it has been realized that training is vital to sustainable practices.

On the other hand, farmers' perception of avocado demand significantly influenced the adoption of green growth practices ($p = .023$). Specifically, those who perceived the demand to be low were markedly less likely to adopt such practices ($p = .012, OR = 0.123$). This finding underscored the critical role of perceived market dynamics in shaping agricultural decision-making. When farmers believe that consumer demand for their produce is unsatisfactory, even if this perception does not reflect actual market conditions, they may opt for short-term production strategies that compromise long-term sustainability. Therefore, addressing these perceptions through targeted consumer education

and market development initiatives could help align the economic motivation of farmers with environmentally sustainable practices.

4.4 Factors Affecting the Avocado Yields

The multiple regression analysis showed that avocado farm size positively and significantly affects avocado yields, with $B = 10.787$ and a p-value of .000. This indicated that as the land area used for avocado farming increased, yields also increased significantly. This finding aligned with agricultural principles, as larger farms often benefitted from economies of scale, more efficient uses of resources, and better management practices [32]. The age of avocado trees also played a vital role in enhancing yields, with a coefficient of $B = 26.258$ and a p-value less than .001. A similar result was reported in the study [33], where older avocado trees typically reached peak productivity between 10 and 20 years of age, thus yielding more due to their developed root systems and expanded fruit-bearing capacity. This suggested that farmers with older trees were likely to have higher production, implying tree age a key factor in avocado farming. Conversely, chemical fertilizers had a negative and significant impact on yields, with $B = -4.340$ and a p value of .043. Past studies have raised similar concerns regarding excessive or improper use of chemical fertilizers, which adversely affects tree health and fruit quality [34], resulting in reduced avocado productivity and nutrient imbalances in the soil. Farmers should adopt balanced fertilization practices that support rather than hinder yields. Generally, observations indicated that farmers who applied merely chemical fertilizers experienced lower yields, compared to those who used organic fertilizers or a combination of organic and chemical fertilizers. As another farmer explained, "*More education is needed in using the pesticides since most of us do not know how to apply pesticides well*". This indicated inadequate access to technical advice, which not only threatens crop quality but also threatens environmental sustainability through agrochemical misuse. The implementation of a green economy in the SAGCOT has also been contentious regarding the use of pesticide and its potential risks, thus emphasizing the need for improved regulation, training, and monitoring [35].

5 Conclusions

This study examined the adoption of green growth practices and its impact on avocado farming among smallholder farmers in the Southern Agricultural Growth Corridor of Rungwe. Findings showed that its adoption was influenced by farm size, access to information, and market perception but was not greatly influenced by gender. Mulching and organic manuring were the mostly employed sustainable practices, citing growing awareness of green strategies. Chemical fertilizers had, nevertheless, a negative impact on yields, while tree age substantially influenced productivity to a great degree. These findings reinforced the plea for intensified knowledge transfer and farmer training in order to promote sustainable practices that enhance environmental conservation and avocado productivity. Improved access to information and market-oriented incentives can be factors for wider green growth adoption and rural economic stability.

Developing inclusive training for farmers in respect of sustainable practices is a critical imperative for enhancing the avocado farming sector in Tanzania. The training program should involve various stakeholders, including government agencies, agricultural associations, non-governmental organizations, and the SAGCOT. Coordinating market incentives with environmental objectives will allow Tanzania to develop a truly sustainable avocado industry.

Author Contributions

Conceptualization, D.C.K., J.M.A., and K.M.; methodology, D.C.K. and J.M.A.; software, D.C.K.; validation, D.C.K., J.M.A., and nd K.M.; formal analysis, D.C.K.; investigation, D.C.K. and J.M.A.; data curation, D.C.K.; writing—original draft preparation, D.C.K. and J.M.A.; writing—review and editing, D.C.K. and J.M.A.; visualization, D.C.K. and J.M.A.; supervision, J.M.A.; project administration, K.M.; funding acquisition, K.M. All authors have read and agreed to the published version of the manuscript.

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Data Availability

The data used to support the research findings are available from the corresponding author upon request.

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Conflicts of Interest

The authors declare no conflict of interest.

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