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DOES THE FARM SIZE INFLUENCE THE COMMERCIAL PRODUCTION OF AFRICAN INDIGENOUS VEGETABLES? A STUDY ON SMALLHOLDER FARMERS IN BOBASI SUB-COUNTY, KISII COUNTY, KENYA

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ABSTRACT

The production of African Indigenous Vegetables (AIVs) is of significant importance for smallholder farmers in Bobasi Sub-county, Kisii County, Kenya, contributing to food security, nutrition, and income improvement. However, its predominant focus remains on subsistence farming. This study investigates the influence of farm size on the commercial production of AIVs among smallholder farmers in the region. Employing a descriptive survey research design, the study targeted 6,341 smallholder commercial AIV farmers from two wards in Bobasi Sub-County, with an accessible population of 2,363 commercial AIV farmers. Through proportionate random sampling, 154 commercial AIV farmers were selected from two purposively selected wards. Data collection utilised a semi-structured questionnaire, key informant interviews, and focus group discussions. The research instruments were validated by experts from Egerton University and Kisii University, and their reliability was confirmed through a pilot study in Kitutu Chache South Sub-County, Nyakoe Ward, yielding a reliability coefficient of 0.745. Descriptive statistics were employed for data analysis using SPSS version 25. The AIVs under study were Spider plant (Chinsaga), Black nightshade (Rinagu), Cowpeas (Egesare), and Amaranth (Emboga). Moreover, income level influences farm size for AIV production, with 85% agreeing that farm size significantly impacts their decision to engage in commercial AIV production. Based on these findings, the study recommends targeted interventions to support smallholder farmers in optimizing land use for AIV production, including access to appropriate technologies, training in efficient farming practices, and improving market access. These measures aim to enhance productivity and economic outcomes while promoting sustainable agriculture in the region.

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INTRODUCTION

Agriculture is the backbone of many economies worldwide, particularly in developing countries, where it serves as a primary source of livelihood for millions of people. Within the agricultural sector, the production of vegetables is crucial in ensuring food security, providing essential nutrients, and contributing to economic development (Pawlak and Kołodziejczak, 2020). In the African context, particularly in Kenya, Indigenous vegetables hold significant cultural, nutritional, and economic value, making them integral to the food systems of many communities. Among these Indigenous vegetables, African Indigenous Vegetables (AIVs) stand out for their adaptability to diverse agroecological zones, nutritional richness, and resilience to climatic variability. AIVs encompass a wide range of plant species that have been traditionally cultivated and consumed across Africa for centuries, including but not limited to amaranth *(Amaranthus spp.),* cowpea *(Vigna unguiculata),* spider plant *(Cleome gynandra),* nightshade *(Solanum spp.),* and pumpkin leaves *(Cucurbita spp.).* These vegetables are a source of vital nutrients such as vitamins, minerals, and antioxidants and contribute to African cuisines' cultural heritage and culinary diversity (Mungofa et al., 2022). In recent years, there has been a growing recognition of the importance of AIVs in addressing malnutrition, enhancing food security, and promoting sustainable agriculture.The study focused on AIVs like Spider plant (Chinsaga), Black nightshade (Rinagu), Cowpeas (Egesare), and Amaranth (Emboga).

Consequently, there has been increased interest among researchers, policymakers, and development practitioners in understanding the factors influencing the production of AIVs (Chepkoech et al., 2020). One such factor that has garnered attention is the size of farms where these vegetables are cultivated. The size of farms plays a crucial role in shaping agricultural production systems, including those of AIVs. Farm size can vary significantly, ranging from smallholder subsistence farms to large-scale commercial enterprises. In the context of AIV production, the size of farms influences various aspects of the production process, including but not limited to resource allocation, production techniques, market access, and socio-economic dynamics (Bokelmann et al., 2022a).

A study conducted in Zambia by Ngenoh et al. (2019) revealed that farmers with small landholdings often optimised their limited space by focusing on a selected number of AIVs. This approach was driven by maximizing farm output and achieving higher returns on their investment. In regions where land resources were constrained, smallholder farmers face the challenge of making the most of their available plots (Tarfasa et al., 2018). These farmers allocated resources more efficiently by concentrating their efforts on a specific set of AIVs. This included careful crop selection based on local demand and market prices and implementing intensive cultivation practices.

In Zimbabwe, the impact of land size on crop diversification varies widely, with larger land holdings typically linked to increased diversification and commercialization (Tarfasa et al., 2018). This trend was often seen as larger farms had the resources and capacity to allocate land to various crops. However, exceptions exist, where larger farms specialize in high-value crops to manage risks effectively, as depicted by a study by (Khanal et al., 2020). Furthermore, adopting agricultural technology, such as improved farming practices and crop varieties, tends to be positively influenced by both farm size and the number of plots. According to Kurgat et al. (2018), a study conducted in Kenya, farmers with access to sufficient labor and capital often cultivate substantial areas for AIV production. Such larger-scale operations enable investment in essential resources like quality seeds, irrigation infrastructure, and labor, facilitating efficient management and expansion of AIV plots.

Consequently, larger farms achieve greater crop diversity and higher yields, contributing significantly to food security and income generation. In addition, according to Bokelmann et al. (2022), in Kenya, smaller-scale farmers face resource constraints that limit the extent of their AIV cultivation. Despite potentially possessing indigenous knowledge and traditional farming practices, they were more vulnerable to weather and market fluctuations. These smallholders often maximize productivity within their limited land by selecting AIV varieties tailored to local conditions and market preferences. Farmers who rely on rain-fed agriculture frequently reduce their AIV cultivation area during dry periods. Water availability was critical for AIV growth, and the absence of irrigation infrastructure confines their cultivation to the rainy season. This cyclic approach to AIV production was prevalent in regions characterized by distinct wet and dry seasons, impacting year-round AIV supply (Krause et al., 2019). Therefore, the study objective aimed to evaluate the impact of farm size on the commercial production of African Indigenous Vegetables (AIVs) among smallholder farmers in Bobasi Sub-County, Kenya.

METHODOLOGY

Characterization of the Study Area

The study was conducted in Bobasi Sub-County of Kisii County, Kenya as indicated by Figure 1.

The Sub- county borders Nyaribari chache to the North, Bomachoge to the East and Nyaribari Masaba to the West. It comprises nine wards namely; Bobasi Chache, Sameta, Bobasi Boitangare, Masige East, Basi Central, Nyacheki, Basi Bogetaorio, Masige West. It covered a total area of 2418 km2 with a total population of 197429 persons and population density of 790 people per square kilometer (Bobasi Sub-County, 2021). Bobasi was located 17.9 km southeast of Kisii town. It lies between longitude 34º 49'59" East and Latitude 0º 46'59" South. Apart from AIVs farming, other crops grown in Bobasi Sub County include maize, avocado, bananas and tea (Kisii County Government, 2018). Additionally, livestock rearing characterize it. The livestock kept include poultry, cattle, goats and sheep (Kisii County Government CIDP, 2020). Bobasi Sub- County falls under agro-ecological zone three of Kenya and receives average annual rainfall that ranges receives yearly average rainfall between 1650 to 1980 mm per year. It was located in an area with an altitude of between 1690 to 1970 m above sea level, which was suitable foragricultural activities (Bobasi Sub-County, 2021). Bobasi was selected purposefully given that most of the farmers in the region focus on the cultivation of African Indigenous Vegetables (AIVs) due to the area's favorable agro-ecological conditions, established agricultural practices, and the significant role these crops play in local food security and income generation.

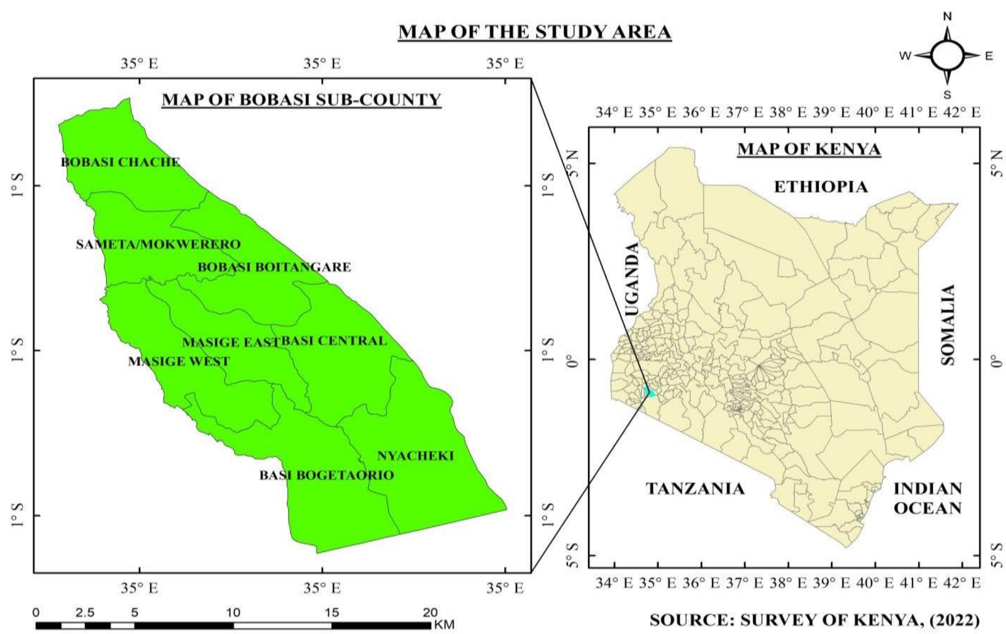

Figure 1. Map of study area.

Research Design

The study used a descriptive survey research design. The design enables the researcher to answer the when, why, and how questions, not "What" questions concerning the study objectives (Dulock, 1993). The design was appropriate for this study because the population was spread across the sub-county. The researcher used a survey research design to collect data on smallholder African Indigenous vegetables (AIV) and to enable the description of the situation as it appears. Therefore, using the survey, the researcher gathered information on farm size's influence on Commercial AIVs production in Bobasi Sub-County.

Population of the Study

The study targeted smallholder AIV farmers from Bobasi Sub-county. There were 6,341 smallholder AIV farmers in the two wards, according to (Bobasi Sub-County, 2021). The number of commercial smallholder AIVs farmers was 2,363. Therefore, the accessible population for the study was 2,363 Commercial AIV farmers drawn from the two wards. The wards were purposively selected because Basi Bogetaorio had the highest number, and Masige West had the least Commercial AIV farmers. The 2,363 smallholder Commercial AIV farmers were distributed in the two wards, as indicated in Table 1.

Table 1. Distribution of target population per ward.

Ward name	Number of farmers
Basi Bogetaorio	1750
Masige West	613
Total	2363

Sampling Procedure and Sample Size

Bobasi Sub-County was chosen purposively as the study location because it was among the leading producers of African Indigenous Vegetables in Kisii County and among the top producers of AIVs in Kenya. The study was conducted in two wards; Basi Bogetaorio and Masige West. A purposive sampling procedure was used to select two wards; Basi Bogetaorio and Masige West based on having the highest and the lowest number of smallholder commercial AIV farmers, respectively. This was because the wards had large farm sizes (Bobasi Sub-County, 2021). A proportionate random sampling technique was used to select smallholder Commercial AIV farmer respondents from the two Bobasi Sub-County wards. The sampling frame consisted of a list of smallholder commercial AIV farmers obtained from the Ward Agricultural Extension officers. Simple random sampling was used to obtain participants from each ward to avoid bias and give all farmers equal chances of participating in the study.

Additionally, the researcher included key informants from the two wards, who were purposively selected. Therefore, a total of two extension officers were interviewed. In addition, the research included focuse group discussions, which were held independently and whose participants were among questionnaire respondents. The respondents were purposefully selected, and the criteria for selecting them were their level of resourcefulness, status as group leaders, and track record as successful farmers. Twenty respondents were selected, with 10 chosen from each ward. The sample size was determined using a formula by Nassiuma (2001) to calculate the sample size needed for a proportionate sampling design. The formula was as follows:

$$\boldsymbol{n = \frac{NC^2}{C^2 + (N-1)e^2}}$$

Where:

n= the required sample size

N = the population within the study area,

C= Coefficient of Variation,

e = Standard error.

$$n = \frac{2363\ (0.25)^2}{(0.25)^2 + (2363-1)(0.02)^2} = 152\ Commecial\ AIV\ farmers$$

The formula considers the population proportion with the characteristics and desired level of precision to determine the sample size needed for the study. The sample size was determined using the coefficient of variation of 25%, a standard error of 2%, as this helped the researcher obtain a large sample size, thus reducing attrition. The accessible population in the study area was 2,363 Commercial AIVs farmers in Masige West and Basi Bogetaorio wards. This meets Nassiuma's (2001) assertion that in most surveys, a coefficient of variation occurs within the range of 21%≤C≤30 % and that standard error occurs in the range of 2%≤e≤5%. Therefore, the stated coefficient of variation and standard error were preferred for this study. The upper limit for the coefficient of variation and standard error was selected to ensure low variability in the sample and minimize the degree of error. The study used 95% confidence (5% sampling error) to obtain a sample size of 154 Commercial AIV farmers. The sample size for each ward was obtained using proportionate random sampling from the population in the study area. Table 2 summarizes the distribution of the sample sizes.

Table 2. Distribution of respondents Per Ward.

Wards	Population (commercial AIV farmers)	Proportion (%)	Sample size
Basi Bogetaorio	1750	74	114
Masige West	613	26	40
Total	2363	100	154

Instrumentation

This study used a researcher-constructed semi-structured questionnaire to collect data from the respondent farmers in Masige West and Basi Bogetaorio wards of Bobasi Sub-County. A semi-structured questionnaire was used because it was an efficient and cost-effective way to gather a detailed large amount of data from a large number of respondents in a relatively short amount oftime, while providing standardization, which allowed easy comparison of responses across different farmers and regions (Hove and Anda, 2005). The researcher also used a developed Focus group discussion checklist/guide. Additionally, the researcher used key informants from various wards (extension officers). The FGDs helped provide an in-depth understanding and acquired knowledgeable and confidential information that other sources may not have been able to provide. The information collected through the FGD schedule and key informant interviews was used for triangulation.

Validation and Reliability

Validation of Instruments: The research instruments were validated by experts from Egerton University and Kisii University. These experts reviewed the content of the questionnaires, the FGD guide, and the key informant interview questions to ensure they accurately captured the necessary information related to the study's objectives. Their feedback helped refine the instruments to improve clarity, relevance, and comprehensiveness.

Achievement of Reliability: To achieve reliability, the instruments underwent a pilot study conducted in Kitutu Chache South Sub-County, Nyakoe Ward. The pilot study included a small sample of respondents who were not part of the main study population. This process was crucial for identifying any ambiguities or inconsistencies in the instruments and for making necessary adjustments before the main data collection.

Reliability of Instruments: The reliability of the instruments used for data collection was confirmed through the pilot study. A reliability coefficient of 0.745 was obtained, indicating an acceptable level of internal consistency. This coefficient suggests that the instruments were reliable and could consistently measure what they were intended to measure.

Data Analysis

The data collected was coded and entered into the Statistical Packages for Social Sciences (SPSS V25). Descriptive statistics was used to measure mean and standard Deviation. Thematic analysis was done to extract themes from focus group discussions and interviews.

RESULTS AND DISCUSSION

Gender of AIV Respondents

Figure 2 shows that women comprised 71% of the respondents, compared to men's 29%, among the farmers polled. Figure 2 indicates female farmers were more than males by 42%. Many factors contribute to women's significant presence in farming communities, such as their active participation in agricultural labor, cultural expectations, and their frequent role as primary caregivers responsible for household nourishment. In addition, although it varies by area, females' control and access to land play a major part in their prominence in agricultural output. These results are consistent with a study by Jabeen et al. (2020) in Pakistan on women's traditional household food security activities, indicating that women play a vital role in agriculture. The study indicated women's roles in farming go beyond simple participation; they also include their vital contributions to household economies, food security, and the general sustainability of rural communities. Similar to the findings of the study, a study by Lelea et al. (2022) in Southwest Ethiopia highlighted that women in agriculture frequently handle a variety of tasks, from crop cultivation to post-harvest management, and that they are essential to the well-being of their families and the resilience of their communities.

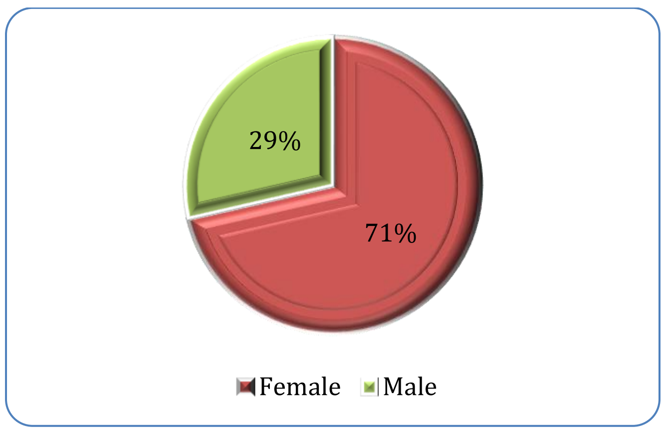

Figure 2. Gender of respondents.

Land tenure system of AIV Farmers

Figure 3 shows that 75% of smallholder AIV farmers inherited their land. This heavy reliance on land passed down through the generations indicates a significant continuation of farming within families. Given how common inherited land is among AIV farmers, it seems likely that land is passed down through the generations. This trend of inheritance indicates how agricultural knowledge and methods are being passed down through families from one generation to the next. The maintenance of indigenous agricultural knowledge and sustainable farming practices is facilitated by the continuity of land ownership and cultivation techniques, which also cultivates a sense of attachment and awareness of the intricacies of the land. Furthermore, the high percentage of inherited land can point to future issues with younger generations' access to and ownership of land. According to Chigbu et al. (2019), land inheritance is a deeply ingrained practice essential to families' agricultural continuity across many African regions. The importance of land inheritance practice was emphasized by Sharma et al. (2020), which focused on how it maintains traditional farming practices, advances agricultural knowledge, and instils a strong feeling of land stewardship in future generations.

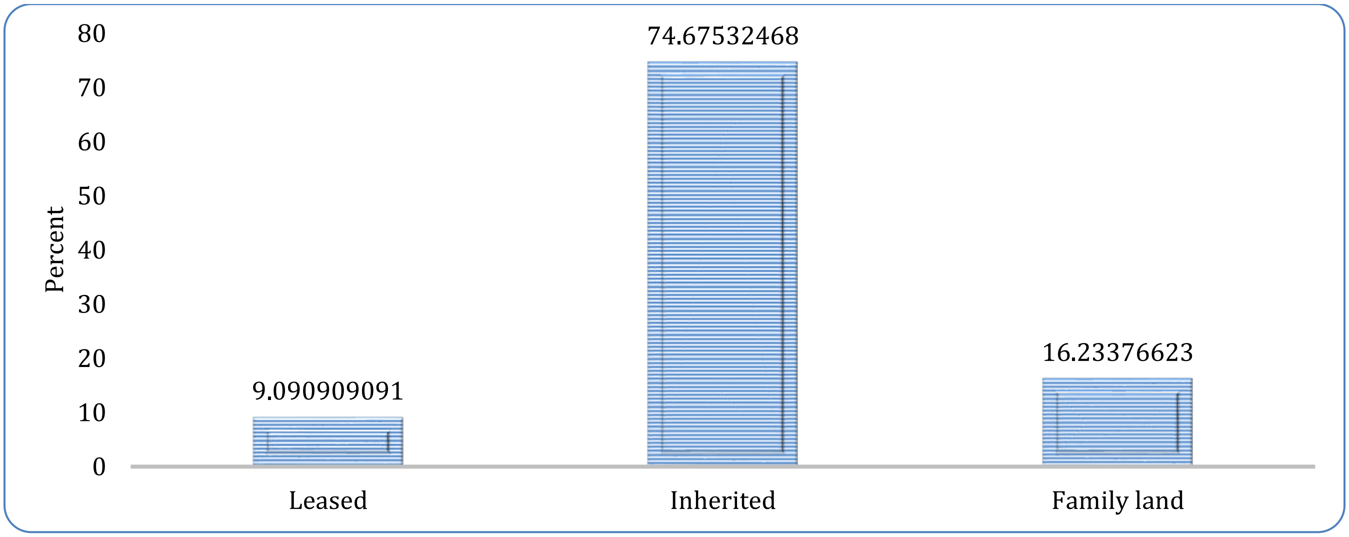

Figure 3. Land tenure system of AIV Framers.

Respondent's Size of Farm in Acres

As indicated by Figure 4, 38% of the farmers questioned had 2 acres of land, making the majority of farmers. Subsequently, 29% were 3-acre farms, and 26.0% were 1-acre and below. Four-acre farms made up the lowest percentage of responders (7%). The distribution presented here highlights that African Indigenous Vegetables (AIV) farmers often own modest to medium-sized landholdings. Figure 4 shows that most smallholder farmers (64%) continue to work on land of not more than 2 acres. The results of this study agree with a study conducted by Geng et al. (2023) in china on the share of land among smallholder farmers in rural areas, confirming the tendency of dispersed land ownership and the dominance of small-scale farming in smallholder agricultural communities. The study's findings about the prevalence of 2 and 1 acre farms are consistent with the conditions that smallholder farmers encounter, where the scarcity of available land frequently restricts them due to population increase and confront difficulties in optimizing productivity in these limited areas. Furthermore, the research conducted by Giller et al. (2021) highlighted the resourcefulness and tenacity of smallholder farmers, emphasizing their capacity to maximize productivity despite land limits. Similarly, the study's findings that 1 to 3-acre farms are more common demonstrate the flexibility and resourcefulness of AIV farmers in making effective use of their limited land.

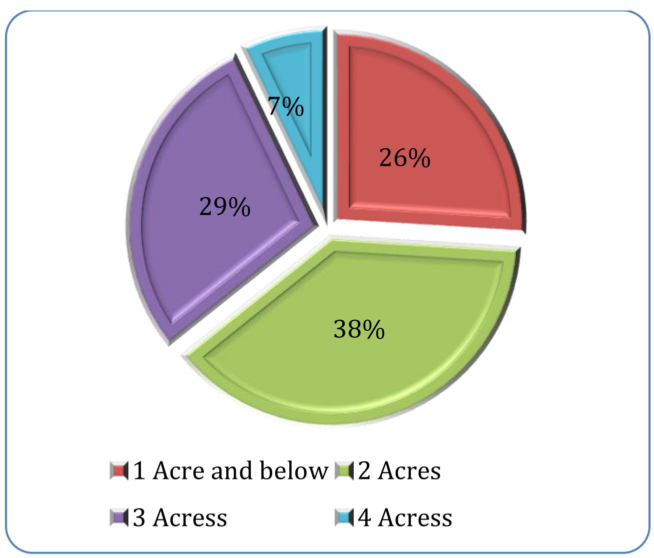

Figure 1. Respondent's Size of Farm in Acres.

Size of the farm Allocated for Various AIV Crops

About the size of land allocated for each AIV, the results were as indicated in Table 3. Where 1= (Less than 0.5Acres), 2= (0.6-0.9 Acres), 3= (1-1.4 Acres), 4=(1.5-1.9 Acres) and 5=(More than 2.0 Acres).

The distribution of land sizes allocated to various types of African Indigenous Vegetables (AIVs) is illustrated by the percentages of Spider plant (Chinsaga), Black nightshade (Rinagu), Cowpeas (Egesare), and Amaranth (Emboga) across distinct categories. The cultivation proportions for different African Indigenous Vegetables (AIVs) vary significantly across land size divisions. Spider plant (Chinsaga) is distributed among different land sizes as follows: 7.2% for less than 0.5 acres, 25.5% for 0.6-0.9 acres, 23.5% for 1-1.4 acres, 40.5% for 1.5-1.9 acres, and 3.8% for more than 2.0 acres. Black nightshade (Rinagu) showcases percentages of 9.7%, 20.1%, 46.1%, 18.2%, and 5.8% across land sizes from less than 0.5 acres to more than 2.0 acres, respectively. Cowpeas (Egesare) are distributed as 5.2%, 31.2%, 54.2%, and 9.4% in land sizes from less than 0.5 acres to 1.9 acres. For Amaranth (Emboga), the percentages reported are 6.3% for less than 0.5 acres, 93.8% for 0.6-0.9 acres, and no data for larger land sizes. These diverse distributions illustrate farmers' strategic decisions, considering different land sizes when cultivating specific AIVs. These choices likely account for soil suitability, market demand, cultural significance, and agronomic practices concerning each vegetable type across distinct land size categories. Several plausible factors could influence the substantial proportion of 40.5% of farmers dedicating land sizes between 1.5 to 1.9 acres for cultivating Spider plant (Chinsaga). Spider plant is known for its adaptability to various soil types and climatic conditions, allowing for its successful cultivation in moderately-sized plots. However, its sprawling growth habit and relatively high yield potential per acre could be a primary reason for farmers allotting larger areas for its cultivation. Due to its growth characteristics, Spider plants might require more space to flourish due to their growth characteristics, especially considering their branching and leafy nature. relation to FGD, the AIV farmers indicated that the Spider plants' vegetable's expansive growth necessitates sufficient room to prevent overcrowding, ensuring adequate sunlight exposure and airflow for healthy development and optimal yields.

Additionally, the critical informant cited popularity and demand for Spider plants in local markets prompted farmers to allocate more extensive land sizes to meet these market needs, aiming to capitalize on its market value and profitability. Moreover, the Spider plant's longer harvest duration or extended cropping cycle might encourage farmers to allocate larger plots to streamline harvesting and maximize overall yield efficiency.

Table 3. Size of the farm Allocated for Various AIV Crops.

Type of AIVs	Percentages				
	1	2	3	4	5
Spider plant (Chinsaga)	7.2	25.5	23.5	40.5	3.8
Blacknightshade (*Rinagu*)	9.7	(20.1	46.1	18.2	5.8
Cow peas (Egesare)	5.2	31.2	54.2	9.4	0
Amaranth (*Emboga*)	93.8	6.3	0	0	0

This result aligns with the findings of research conducted in Nigeria by Chataika et al. (2020), highlighting farmers' inclination towards cultivating Spider plants due to their economic advantages. According to Alulu et al. (2021) it was emphasized that farmers favor Spider plant cultivation owing to its high market price and consistent demand. The profitability associated with Spider plant, stemming from its popularity in local markets or cuisines, encourages farmers to allocate larger land areas to meet the demand and capitalize on its economic viability. The observed trend in land allocation for Spider plant cultivation corroborates with the notion that farmers strategically dedicate larger plots to crops like Spider plant that offer better economic returns and steady market demand, substantiating the alignment of this study's results with existing literature.

The substantial proportion, 66.1%, of farmers dedicating land sizes ranging from 0.6 to 1.4 acres for cultivating Black nightshade (Rinagu) might be influenced by several reasons. Black nightshade, known for its adaptability and relatively compact growth, might not require as much space as Spider plant for its cultivation. Its compact growth habit and potentially higher yield per acre could have influenced farmers to allocate smaller land sizes for its cultivation compared to Spider plant. From the FGD the market demand and local preferences for Black nightshade might be conducive to smaller-scale production. This vegetable is often used in various local cuisines or traditional dishes, with consistent but perhaps not as high demand or market value as Spider plant. Hence, farmers may cultivate Black Nightshade in smaller areas to cater to local demand without overproducing, ensuring efficient utilization of land resources. Moreover, Black nightshade could have a shorter growth duration or harvesting cycle than Spider plant, allowing farmers to rotate crops more frequently or utilize smaller plots for this vegetable. For instance, some farmers cited that the black nightshade mostly dried up after first harvesting, reducing the acreage.

A study by Ntawuruhunga et al. (2020) highlighted that crops like Black nightshade, despite their economic viability and local culinary importance, are often cultivated in smaller land areas than certain high-yield or economically lucrative crops. This implies that vegetables like Black nightshade, while valuable in local cuisines, may not always command the same market value or demand as other high-value crops. Hence, farmers tend to allocate smaller plots for their cultivation.

Moreover, a study by Sangija et al. (2021) suggests that Black nightshade's compact growth habit and adaptable nature allow for successful cultivation in smaller land areas, influencing farmers to optimize their land utilization. The distribution of land sizes for Cowpeas (Egesare) cultivation showcases varied percentages across different categories. A notable proportion of 54.2% of farmers dedicate land sizes ranging from 1 to 1.4 acres for Cowpeas cultivation, followed by 31.2% in the 0.6 to 0.9 acres category. This distribution might be influenced by several factors specific to cowpea cultivation. Cowpeas are recognised for their adaptability to diverse soil and climatic conditions, making them suitable for cultivation in varying land sizes. Their moderate growth habit and potentially moderate yield per acre could be a contributing factor to farmers allocating moderate-sized plots for Cowpeas cultivation.

Furthermore, Cowpeas are commonly used as a subsistence crop and possess nutritional value, making them an essential dietary component in many regions. This consistent demand for Cowpeas for household consumption could influence farmers to allocate moderate-sized plots, ensuring a continuous supply for personal consumption and local markets. Cowpeas are known for their nitrogen-fixing abilities, contributing to soil fertility (Kebede, 2021). This characteristic might encourage farmers to include Cowpeas in crop rotation practices within limited landholdings, hence allocating varied land sizes.

The data indicates a stark pattern for Amaranth (Emboga) cultivation, with a significant majority of farmers (93.8%) allocating land sizes less than 0.5 acres for its cultivation. Several factors could contribute to this concentrated allocation of smaller land sizes for Amaranth cultivation. Amaranth, known for its leafy greens and high nutritional value, often thrives in compact spaces and does not require extensive land for cultivation. Its efficient use of space and adaptable growth characteristics might encourage farmers to cultivate it in smaller plots than other crops with more expansive growth habits. According to study by Bhatta et al. (2021) Amaranth typically has a rapid growth cycle, allowing for quicker turnovers and repeated planting cycles within a smaller land area. Its fast maturity and continuous harvesting potential could enable farmers to optimize yields within limited space, prompting them to allocate smaller plots for its cultivation.

Additionally, a study by Akinola (2021) amaranth is a common vegetable in local diets and is often cultivated for household consumption or local markets rather than large-scale commercial purposes. Its regular demand for household nutrition rather than significant commercial value might influence farmers to allocate smaller land sizes for its cultivation, catering to personal or local community needs rather than extensive market requirements. Furthermore, smaller land allocation for Amaranth could also be influenced by farmers' strategies to diversify crops within their limited landholdings, ensuring a variety of produce for household consumption or local markets.

Influence of Size of Farm on Commercial Production of African Indigenous Vegetables

The study sought to determine whether the size of the farm influenced the commercial production of AIVs among the farmers in Bobasi Sub-County. The responses were recorded as shown in table 4. A five-point Likert scale was used Where 1=strongly disagree, 2=disagree, 3=not sure, 4=agree and 5=strongly agree.

Table 4. Influence of Size of Farm on Commercial Production of African Indigenous Vegetables.

Farm size characteristics	1	2	3	4	5
	Percentage				
The size of the farm allocated to my AIVs always remains constant regardless of the weather seasons	6.5	37.7	20.8	13.3	22.1
The size of the farm under AIV production is influenced by market demand		22.1	7.8	70.1	0
The size of the farm influences your decision to participate in commercial AIV production		7.1	7.8	77.9	7.1
The size of the farm allocated to my AIVs is influenced by income level	7.8	20.8	0	64.3	7.1
The size of the farm under AIVs production is influenced by the number of years have been in commercial AIVs production	7.8	35.1	0	57.1	0

About Table 4, the data illustrates a divided perspective among farmers regarding the consistency of farm size allocated to African Indigenous Vegetables (AIVs) despite changing weather seasons. Most farmers, constituting 44.2%, disagreed with the notion that farm sizes remain constant regardless of variations. This group emphasizes the influence of weather on farm allocations, suggesting a tendency to adjust farm sizes in response to climatic fluctuations. Additionally, a notable 20.8% expressed uncertainty, indicating varied or ambiguous opinions among respondents concerning the impact of weather on farm size. On the contrary, a combined 35.4% (13.3% +22.1%) who strongly agreed suggested a belief in the constancy of farm sizes despite changing weather patterns. Multifaceted factors might influence the varying responses. Farmers often adjust farm sizes due to weather changes and in response to market demands, economic considerations, or personal preferences. Some might believe that altering farm sizes optimizes production, while others may prioritize stability in their agricultural practices. The findings partially align with prior studies that emphasize in adjusting farm sizes based on weather conditions, as cited by a study conducted by Shahzad and Abdulai (2020). However, the division of opinions within this study highlights the complexity of decision-making processes among farmers. It indicates that while a substantial portion believes in adjusting farm sizes according to weather variations, there remains a significant group that adheres to consistent allocations of farm size regardless of weather changes to increase crop profit. The data reveals interesting insights regarding the influence of market demand on the size of farms dedicated to African Indigenous Vegetables (AIVs) among farmers. Notably, 70.1% of respondents strongly agreed that the size of their farms under AIV production is indeed influenced by market demand. This resounding agreement signifies a collective acknowledgement among most farmers regarding the pivotal role of market dynamics in determining the farm sizes dedicated to AIVs. The agreement could stem from a fundamental understanding among farmers that aligning farm sizes with market demand enhances profitability. Farmers likely adjust the acreage allocated to AIVs based on market signals, aiming to optimize production to meet consumer needs and capitalize on market opportunities. Moreover, in a competitive market scenario, where demand fluctuates, farmers might be inclined to scale their productions accordingly to avoid surpluses or shortages. On the contrary, a small proportion of respondents, 7.8%, disagreed with the influence of market demand on farm size dedicated to AIV production. This dissenting group may have various reasons for their stance. Some farmers might prioritize self-sufficiency or traditional practices over adapting to market fluctuations. Additionally, logistical constraints or limited access to market information could deter some farmers from tailoring their farm sizes based on market dynamics.

These findings resonate with a study conducted in Northern China by Sheng et al. (2019), highlighting the interplay between market demand and farm size adjustments. Studies often emphasize the significance of market orientation in guiding farmers' production decisions, underscoring the importance of aligning agricultural practices with consumer preferences and market trends. According to Table 13, the majority of farmers, constituting 85%, acknowledged that the size of the farm significantly influences their decision to partake in commercial African Indigenous Vegetable (AIV) production. This resounding agreement underscores the prevalent belief among farmers that farm size plays a pivotal role in shaping their engagement in commercial agricultural activities. The substantial agreement might be attributed to various factors. For instance, larger farm sizes are often associated with increased productivity and profitability due to economies of scale, encouraging farmers to opt for larger-scale AIV production for enhanced economic returns.

Moreover, sizable farm operations might offer more opportunities for diversification, allowing farmers to cater to diverse market demands and fluctuations. However, a small proportion, accounting for 15% (7.8% disagreed and 7.1% were uncertain), expressed dissent or uncertainty regarding the influence of farm size on their decision-making in commercial AIV production. These farmers may prioritize other aspects, such as specialized production, unique market niches, or innovative cultivation techniques, over the sheer size of the farm when considering engaging in commercial AIV cultivation.

This alignment with previous studies resonates with existing literature emphasizing the significant role of farm size in shaping farmers' decisions related to commercial agricultural activities, as reported by Saint-Cyr et al. (2019)'s study in Britain. The prevailing agreement reaffirms the widely recognized notion that farm size remains a critical factor influencing farmers' choices in entering and sustaining commercial AIV production endeavors. The key informant supported the farmers' observations;

"*Farm size Some farmers could be grateful that there is land available for growing vegetables commercially, particularly if they have access to enough suitable acreage to expand their farming operations. Small land size impedes commercial production i.e no room for expansion."* Key informant.

In examining Table 4, the data signifies that 71.4% of farmers acknowledged that their income level influences the size of the farm allocated to African Indigenous Vegetables (AIVs). This substantial agreement underscores the perceived impact of financial considerations on farm size allocation. The predominant alignment suggests that a significant portion of farmers' factor in their income when determining the acreage dedicated to AIV cultivation. This concordance between income level and farm size allocation can be attributed to various reasons. Limited financial resources might restrict farmers from expanding their farm sizes, compelling them to work within constrained acreage. Conversely, higher income might allow for more substantial investments in AIV production, enabling farmers to expand their operations.

Additionally, higher-income farmers might be more willing to take risks associated with larger-scale production, influencing their decision to allocate more land to AIVs. However, 28.6% of respondents either disagreed (7.8%) or were uncertain (20.8%) regarding the influence of income on farm size allocation for AIVs. These dissenting opinions or uncertainties might stem from various factors. Some farmers might prioritize factors other than income, such as land availability, soil suitability, or technological advancements when deciding on farm sizes. Additionally, certain farmers might have diversified income sources or access to support programs, minimizing the direct influence of income on their farm size decisions.

These results agree with a study by Ren et al. (2019) that underscores the multifaceted influence of income on farm size allocation. Understanding this connection between income and farm size allocation is crucial for policymakers and agricultural support organizations. Tailoring interventions and programs focusing on enhancing income opportunities could empower farmers to expand their AIV cultivation, leading to improved agricultural productivity and livelihoods. Moreover, providing financial literacy and access to credit might further assist farmers in making informed decisions regarding farm size allocation for AIV production (Ngenoh et al., 2019b).

In addition, Table 4 indicates that 64.9% of respondents agreed that the size of the farm under African Indigenous Vegetables (AIVs) production is influenced by the number of years they have been engaged in commercial AIVs production. This substantial agreement suggests that experience is crucial in determining the farm size dedicated to AIV cultivation. The alignment between farm size and years of experience can be attributed to several factors. Farmers with more experience might have gained better insights into market demands, optimal crop management practices, and suitable land allocation for AIV cultivation. Consequently, they might be inclined to adjust farm sizes based on this accumulated knowledge, expanding or contracting based on their learning from previous years. However, 42.9% of respondents either disagreed (7.8%) or were uncertain (35.1%) about the influence of the number of years in AIV production on farm size allocation. These dissenting opinions or uncertainties might be attributed to varying contexts or perspectives. Some farmers may not perceive a direct correlation between their years of experience and the optimal farm size for AIVs. Factors such as fluctuating market demands or changes in production techniques could contribute to these differences in opinion.

The result of this study is congruent with prior studies that underscore the significance of experience in determining farm size in agricultural production, as cited by (Sheng et al., 2019). Experienced farmers make more informed decisions regarding farm sizes based on past successes and challenges in vegetables production, as reported by a study conducted in Sri Lanka (Mahindarathne and Min, 2019). Understanding this connection could assist agricultural extension services in offering targeted guidance and support to newer farmers, facilitating knowledge transfer and aiding them in making informed decisions about farm size allocation for AIV cultivation.

CONCLUSIONS AND RECOMMENDATIONS

The study revealed a predominant presence of female farmers in AIV cultivation, highlighting the significant role of women in agriculture and their contributions to household economies and food security. The inheritance of land among smallholder AIV farmers signifies the intergenerational transmission of agricultural knowledge and practices, which is essential for the sustainability of farming communities. The distribution of farm sizes among AIV farmers indicates a prevalence of small to medium-sized landholdings, reflecting the resourcefulness and adaptability of farmers in optimizing productivity within limited land areas. Furthermore, the study highlighted the influence of various factors such as market demand, income level, and years of experience on farm size allocation for AIV production. Market dynamics are crucial in shaping farmers' decisions regarding farm sizes, emphasizing the need for market-oriented approaches in agricultural planning and interventions. Additionally, farmers' income levels and years of experience significantly influence their farm size allocation. Based on the study findings, recommendations include providing targeted support and training programs to enhance women's participation and empowerment in African Indigenous Vegetable (AIV) cultivation and agricultural decision-making processes. Facilitating access to land tenure security and promoting land use planning strategies are essential to ensure sustainable land management practices among smallholder AIV farmers. Strengthening market linkages and value chain development initiatives is crucial to align AIV production with market demand and enhance farmers' income opportunities. Additionally, offering extension services and capacity-building programs is necessary to support farmers in optimizing productivity and adopting sustainable farming practices based on their years of experience in AIV production.

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