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Avocado Farming in Southern Highlands and its Inherent Threats on Staple Crops Access in Tanzania; A Case of Njombe Urban and Njombe District, Tanzania

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Abstract

There has been increased emphasis on avocado production in the Southern Highlands of Tanzania, accompanied by a noticeable shift in farmers' interests from the cultivation of major staple crops to avocado farming. This trend poses a threat to household food access in the Southern Highlands and in other regions of Tanzania that rely on staple crops sourced from these areas. This study was conducted in the Njombe Region with the objective of assessing the rapid expansion of avocado farming in the Southern Highlands and its inherent threats to food access in Tanzania. Primary data were collected through household surveys, focus group discussions, and key informant interviews, while secondary data were obtained through a review of official records. A sample of 385 respondents was used. The results indicated that avocado cultivation is increasingly focused on export-oriented varieties rather than those consumed domestically; the flourishing of avocado farming has led to the conversion of land previously used for staple crop production; the land allocated to avocado farming has been increasing while land for food crop production has been decreasing; and the production of major staple crops is declining amidst the expansion of avocado farming. Projections for 2030 reveal a potentially devastating impact on staple crop production, further threatening food access in other regions of the country. Based on these findings, the study recommends that policymakers and decision-makers take precautionary measures and design appropriate policies and interventions to ensure that the promotion of avocado farming goes hand in hand with the promotion of staple crop production, encourage intensive farming practices to achieve high yields on relatively small plots of land, and provide subsidies for inputs used in staple crop production to encourage continued farmer engagement in this essential sector.

Key words: Avocado farming, Southern highlands, Njombe district, Food access

1. Introduction

For years, the Southern highlands zone has been the top staple crop producer as well as the main staple food source for many regions in Tanzania (Cochrane & D'Souza, 2015; Simbaya, 2020). The zone comprises six regions namely, Rukwa, Mbeya, Iringa, Morogoro, Njombe, and Ruvuma. These regions have been the main producers of maize as well as Irish potatoes in the country (Faria, 2021; Iringa DC, 2015). Moreover, they have been contributing a significant amount of paddy, beans, and cassava to Tanzania's food supply (Iringa DC, 2015). Such a significant contribution on staple crops has been made possible owing to the region's location in a zone with adequate precipitation level, high fertility and suitable climatic conditions favoring production of a diverse variety of crops, hence making the region one of the strategic food basket zones in Tanzania (Simbaya, 2020).

Maize is of significant importance as a dominant staple crop in Tanzania, consumed by more than 70% of Tanzanians (Mkonda & He, 2018). It contains phytochemical as well as Galanthus Nivalis Agglutinin (GNA) compounds (Shah et al., 2016). Phytochemical compound plays a very important role in preventing chronic diseases while GNA compounds are believed to possess potential anti-HIV activity (Shah et al., 2016). Paddy, cassava, beans and Irish potatoes are also important food crops depending on the regional preferences (Mkonda & He, 2018). Staple crops produced in southern highlands are being used as food by households in the regions as well as to feed other regions in Tanzania with adverse climatic conditions

and/or urban areas in which farming is less acceptable (Iringa DC, 2015; Mwakalinga, 2014).

Of recent, there has been a great emphasis on the productions of Avocados which is primarily a cash crop and a gradual shift of interest of farmers from major staple crop production to avocado production has been noted in some areas (Simbaya, 2020; Dailynews, 2022). Such a shift has been fueled among others, by the increasing demand and the soaring price of avocados in both local and international markets (Mwakalinga, 2014). Avocados from the southern highlands are highly demanded in Kenya, the United Kingdom, Zimbabwe, India and South Africa (Simbaya, 2020; Mwakalinga, 2014).

The shift from major staple crop production to avocado production may result in reducing the size of land and/or time committed to staple crop production. This is because land and time are fixed in supply. This scenario may pose a devastating impact on staple crops production and eventually on food access not only to households in these regions but also to regions which have been accessing staple crops from southern highlands. However, to justify the manifestation of these indicators requires more refined and evidence-based information which is lacking in the study area. Many studies concentrate on documenting the economic gains of avocado farming, avocado yield, avocado value chain, suitability of growing conditions, the market for avocado crops and the extent to which farmers can exploit the best of it *(*Mwakalinga, 2014; Juma et al., 2019; Simbaya, 2020; Onyango, 2022; ITC[1], 2020). Their conclusions are generally in the expected direction which is high economic gain with avocado farming while leaving the inherent threat of the shift insufficiently documented.
This study therefore intends to bridge this gap by assessing the avocado farming in the southern highlands and its inherent threats to food access in Tanzania. Specifically, the study shall provide a detailed account of avocado and staple crop farming in the study area; analyze the impact of rapid expansion of avocado farming on land committed to staple crop production and perform an in-depth investigation of staple crop production amidst the flourishing of avocado farming.

2. Literature Review

2.1. Theoretical Review

This study is informed by the Costs-benefit Analysis Theory (CBAT). CBAT draws its origin from the welfare economics of the 19th century (Pearce 1983). Ever since its introduction, the theory has been widely applied to govern decisions on social welfare interventions across the globe. The main premise behind this theory lies in the argument that "*every investment decision should be evaluated in terms of its consequences or costs and benefits in order to avoid unnecessary risks"* (Dreze & Stern, 1987; Pearce, 1983). Although the theory was thought to have its orientation from an economic discipline, it is useful in creating a wake-up call to stakeholders on the inherent threats posed by household inclination on avocado farming, and therefore this study uses the concept underpinning this theory. However, despite the theory being useful in acting as a wake-up call to stakeholders for examining the consequences of any intervention in order to avoid unnecessary risks, yet it is not solely sufficient to describe the actual situation in this study. More evidence-based data that are specific to the studied area are needed to draw a sound conclusion.

2.2. Empirical Review

2.2.1. History of Avocado and its Growing Demand

Avocado (*Persea americana*) is a nutritious healthy fruit crop that is currently receiving a strong welcome in southern highlands including the Njombe region. The origin of it can be traced back to the 15th century in Meso America (Radha & Mathew; 2007). In Africa, cultivation of avocado was first reported in Mauritania in the18 centuries (Kelly, 2019; Popenoe & Zentmyer, 1963; Schaffer et al., 2013). In Tanzania, the crop cultivation was first observed in Zanzibar in 1892 (Juma et al., 2019).

Recently the consumption of avocados has rapidly increased globally, especially in America, Europe and Asia and avocado now an important fruit in international trade (Premack, 2019; Shahbandeh, 2018). For instance, in 2017/2018 in the United States of America, domestic consumption of avocados increased by 352 percent from 246 million kgs in 2000/01, while European consumption of avocados in 2017/2018 rose by 251 percent

[1] International Trade Centre

from 145 million kgs in 2000/01 (Shahbandeh, 2018; WAO[2], 2018; Naamani, 2011).

2.2.2. Avocado Farming Intensification in Southern Highlands

There have been multiple pieces of evidences suggesting intensification of people's involvement in avocado farming in southern highlands of Tanzania and mostly in Iringa and Njombe regions (Mwakalinga, 2014; Simbaya, 2020; Onyango, 2022; Juma et al., 2019; ITC, 2020). Despite their significant contribution on unveiling Avocado farming in these regions, yet, the inherent threat emanating from people's over-concentration on avocado farming remain insufficiently documented in these literatures. Much of the documentation (Mwakalinga, 2014; Juma et al., 2019) concentrates on investigation of the avocado crop yield, value chain and suitability of growing condition in southern highlands. Other documentations (Simbaya, 2020; Onyango, 2022; ITC[3], 2020) have placed much emphasis on the economic gains from avocado farming, markets for avocado and how farmers can make best of it. Conclusions from these documentations are always elevated on the expected direction that is higher economic gains with increased people's involvement in avocado production while leaving a blurred image on the implication of farmers elevation on avocado production.

Juma et al. (2019) had a clear description of avocado yield and its value chain. On their studies, they observed that data on avocado from most Tanzania Government organizations are inconsistent. They noted some data reported by the National Bureau of Statistics contradicting with those reported by some respective regions' authorities. Similar observations were noted earlier by Mwakalinga (2014) on his attempt to perform avocado value chain mapping in Siha and Njombe.

Presence of such insufficient and inconsistent data makes it difficult to design relevant and appropriate intervention. This suggests a need for a study.

2.2.3. Southern highland as a staple crops' basket zone for Tanzania

Southern Highlands has for years been saving as a potential zone for the growing of staple crops (Simbaya, 2020). The zone is located in the southern part of the country with favourable climatic conditions that favour growth of multiple varieties of crops (URT, 2012). Most parts of the regions are at high to mid altitudes and able to support both tropical and temperate crops (FEWS NET[4], 2018). Most parts of the region experience temperatures below 15^0C for a large part of the year, and rainfall ranges between 900mm to 1600mm per year (Simbaya, 2020; URT, 2012). The relatively warm and wet climate provides a favourable environment for the production of staple food crops (FEWS NET, 2018). Staple crops grown include maize, beans, paddy, cassava, Irish potatoes, sweet potatoes and multiple varieties of fruits.

Maize is a significant food crop in the region, occupying more than 40 percent of the cultivated land and accounting for 91 percent of the total production in the region (URT, 2012). Paddy, beans, Irish potatoes and cassava have also been of significant importance as staple crops not only for the residents but also for other regions in Tanzania including Dar es Salaam, Dodoma and Singida. The staple crop price is always lowest in the southern highlands zone during harvest, hence making other regions easily access it (FEWS NET, 2018). However, the recent emergence of avocado tends to shift orientation from producing staple crops to avocado, a situation that may affect staple crop production in these regions.

Generally, the overall conclusion from this empirical literature suggests that the inherent threat emanating from people's elevation on avocado farming is insufficiently investigated in the study area. Many studies concentrate on economic gains of avocado farming, avocado yield, the value chain, the market for avocado crops and the extent to which farmers can exploit the best of it. Also, there has been several evidence suggesting that data on avocado farming from different government organizations in Tanzania are in most cases, inconsistent. This makes it difficult to design relevant and appropriate intervention, hence suggesting a study to gather relevant and accurate data to inform decision making. All these bottlenecks necessitated the conduct of this study. This study therefore aims at assessing the avocado farming in the southern highlands and its inherent threats to food access in Tanzania. Specifically, the study shall provide a detailed account of avocado and

[2] World Avocado Organization

3 International Trade Centre

[4] Famine Early Warning Network

staple crop farming in the study area; analyze the impact of rapid expansion avocado farming on land committed to staple crop production and perform an in-depth investigation of staple crop production amidst the flourishing of avocado farming.

3. Materials and Methods

3.1. Description of the study area

This study was conducted in two councils of the Njombe region, namely, Njombe Urban District Council and Njombe District Council. The two districts are located in the eastern part of Njombe region and experience almost similar geographical and topographical characteristics. One ward from each district was randomly selected for this study. These wards are Ramadhani from Njombe Urban District and Mtwango from Njombe District. The two districts were selected for this study because avocado farming has recently gained popularity there, making them potential leaders in avocado production compared to other districts in the Southern Highlands. Many farmers and businessmen are now rushing to Njombe for the establishment of avocado farms. Promotion is of high intensity and the crop is currently nicknamed the Njombe green gold.

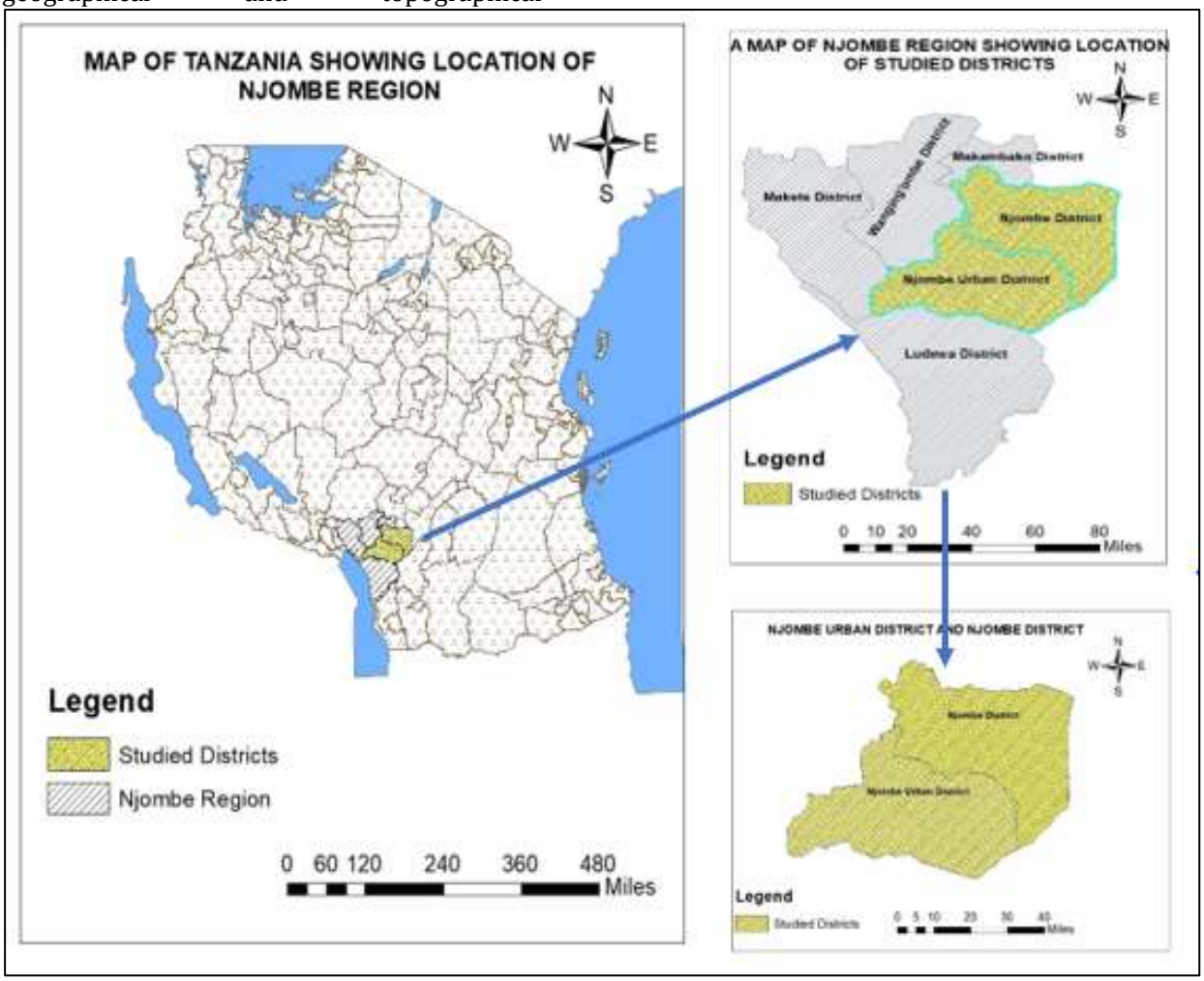

Figure1: Location of the Study Area

3.2. Study Design and Process

The study employed a cross-sectional survey design where detailed data was collected once at time to answer the posed research questions. The choice of this research design was based on the fact that, it enables easy collection of diverse and broad data for multiple variables at a single point in time.

3.3. Sample size, sampling methods and processes/procedures

3.3.1. Sample Size

The sample size used for this study was 385 respondents. This sample size was obtained using the formula proposed by Cochran (1963). This formula is as shown below:

$$n_0 = \frac{(Z_{\frac{\propto}{2}})^2 \, Pq}{(\lambda)^2}$$

Whereby, n_0 is the sample, $(Z_{\frac{\propto}{2}})^2$is the square of the abscissa value of the normal curve at 95% confidence level (the critical value of the desired confidence level) in each tail, P is the proportion of the occurrence of attribute of interest in the population, q is the proportion of non-occurrence of the attribute of interest in the population ($q = 1 - p$) and λ^2 is the square of acceptance margin of error (error the researcher is willing to accept). Since the Z value at 95% confidence level is 1.96, the maximum proportion of the occurrence of variable of interest is 50% or 0.05 which makes $q = 1 - 0.5$ be equal to 0.5 and the acceptance margin of error is 0.05, the substituting these values in the equation, the original sample will be:

$$n_0 = \frac{(1.96)^2(0.5)(1-0.5)}{(0.05)^2} = 385$$

3.3.2. Target Population

The target population for this study was the avocado farmers in both Njombe Urban District and Njombe District. Targeting this population enabled the study to achieve a clear distinction in its findings.

3.3.3. Sampling Frame

The sampling frame for this study was a list of households involved in avocado farming. This sampling frame was obtained from the village leaders of the selected villages.

3.3.4. Sampling Unit and Unit of analysis

The sampling unit for this study was a household. The household was selected from the study area by the aid of sampling frame described in part 3.3.3. The unit of analysis for this study was a household.

3.3.5. Sampling Procedures

A multistage random sampling technique was used in this study. This is a sampling technique that involves sequential clustering of units to be studied and may involve the use of various techniques of sampling at various stages (Kothari, 2004; Whittemore, 1997). Sampling began by identifying wards in the selected districts in which avocado farming is more dominant. From these wards, two wards were randomly selected, one from each district. Finally, a proportional random sampling technique was applied to obtain the final sample to be interviewed. A purposive sampling technique was used to obtain key informants and participants for a focus group discussion to provide supplementary information other than information gathered from a random sample. Local people assisted in identifying these participants.

3.4. Data Needs, Collection Methods, Tools and Procedures

3.4.1. Data Needs

Both primary and secondary data were used in this study. Primary data were collected directly from the field through a household sample survey, Focus Group Discussions (FGDs) and key informants' interviews. Secondary data were collected by reviewing official documents, such as books and official records.

3.4.1. Data Collection Methods and Tools

The main data collection methods for this study were Household Survey (HS), Focus Group Discussion (FGD), Key Informant Interview (KII) and Documentary Review (DR). The household survey used questionnaire as a tool for collecting data from 385 households. A checklist served as a tool for data collection during the FGD. A total of 8 focus groups (4 from each district) were conducted in the study area. A checklist was used as a tool for collecting data from key informant interviews. A total of 20 key informants were used for this study. Moreover, a checklist was also used to guide the review of several documents.

3.5. Data Processing and Analysis Plan

Data were processed to meet the demand of various techniques of data analysis. Processing involved entry into data analysis software, data cleaning, binning, merging, recording, splitting, etc. Descriptive statistics was used in the analysis of collected data. Projection was also used to see the position of the study area in terms of staple food production in the future.

4. Results and Discussions

4.1. Avocado and Staple Crops Farming in the Study Area

Findings by this study revealed that both avocado and food crops thrive well in the study area. Favourable climatic conditions in the area offer bilateral harvesting for most of the crops. Cultivation practices are such that some farmers prefer to mix crops in the same farm. As displayed in Table 1, more than (48.6 percent) of respondents claimed to mix avocado with other staple foods. There was also a substantial proportion (28.3) of

respondents who prefer to cultivate the two categories of crops on a separate farm (see Table 1).

Further investigation through an interview conducted with key informants revealed that the use of such a practice is necessitated by twofold reasons. First is the need of farmers to obtain multiple crop harvests without using a lot of energy in the cultivation of an extra piece of land and the scarcity of land brought about by the flourishing of avocado farming.

Table 1: Avocado and staple crop and cultivation practice

Response options	Frequency	Percent
Cultivated in a separate farm	109	28.3
Mixed with food other crops	187	48.6
Mixed with tree other crops	12	3.1
Both 1&2	77	20
Total	384	100

Further investigation through an interview conducted with key informants revealed that the use of such a practice is necessitated by twofold reasons. First is the need of farmers to obtain multiple crop harvests without using a lot of energy in the cultivation of an extra piece of land and the scarcity of land brought about by the flourishing of avocado farming. The practice, though, may have benefits for the crops, especially if the mixed crops are nitrogenous, however, it may have negative implications on the productivity of other crops as the avocado ages. Some studies (Sina et al., 2023; Wasilwa et al., 2004) have also indicated that mixing avocado with some crops may reduce the productivity of avocado.

4.2. Types of Staple Crops Grown

Table 2 shows the types of staple crops grown in the study area. As shown, maize occupied more than 68 percent of all responses, followed by beans (12.2 percent), Irish potatoes (10.1 percent) and sweet potatoes (8.3 percent). Other crops like cassava, groundnuts etc., occupied 1.5 percent of all responses. This implies that maize is a significant staple crop in the study area. Maize is produced for both household consumption and for trading with neighbouring regions.

Table 2: Staple crops grown

Staple crop category	N*	Percent
Maize	379	68
Irish potatoes	56	10.1
Beans	68	12.2
Sweet potatoes	46	8.3
Other	8	1.4
TOTAL	557	100.0

*Multiple Response

4.3. Avocado Variety Grown

Findings from this study revealed that Hass is the most grown variety in the study area. As indicated in Table 3, 78.4 percent of responses (equivalent to 99.5 percent of cases) grew Hass variety. Further investigation revealed that that this variety is mostly preferred for export relative to other varieties as it has a good shelf life. Apart from Hass, Fuerte, Pinkerton and Waiso are also grown. Fuerte, characterized by having green and thin, slightly rough skin, is sometimes exported, though not as much as Hass, as it has a poor shelf life. This perhaps explain why the proportion of its growers is relatively lower (9.4 percent) as compared to Hass. Waiso is a local variety. This variety is characterized by having a good flavour, juicy & resistant to diseases. It is mostly grown for sale at the home market and less demanded for export. On the other hand, Pinkerton is the least preferred variety in the area. It is believed to bear fruits heavily, but it is less demanded for export as it has a poor shelf life.

Table 3: Avocado variety grown

Avocado variety	Responses		Percent of cases
	N	Percent	
Hass	381	78.4	99.5
Fuerte	36	7.4	9.4
Pinkerton	1	0.2	0.3
Waiso	60	12.3	15.7
Other	8	1.6	2.1
Total	486	100	126.9

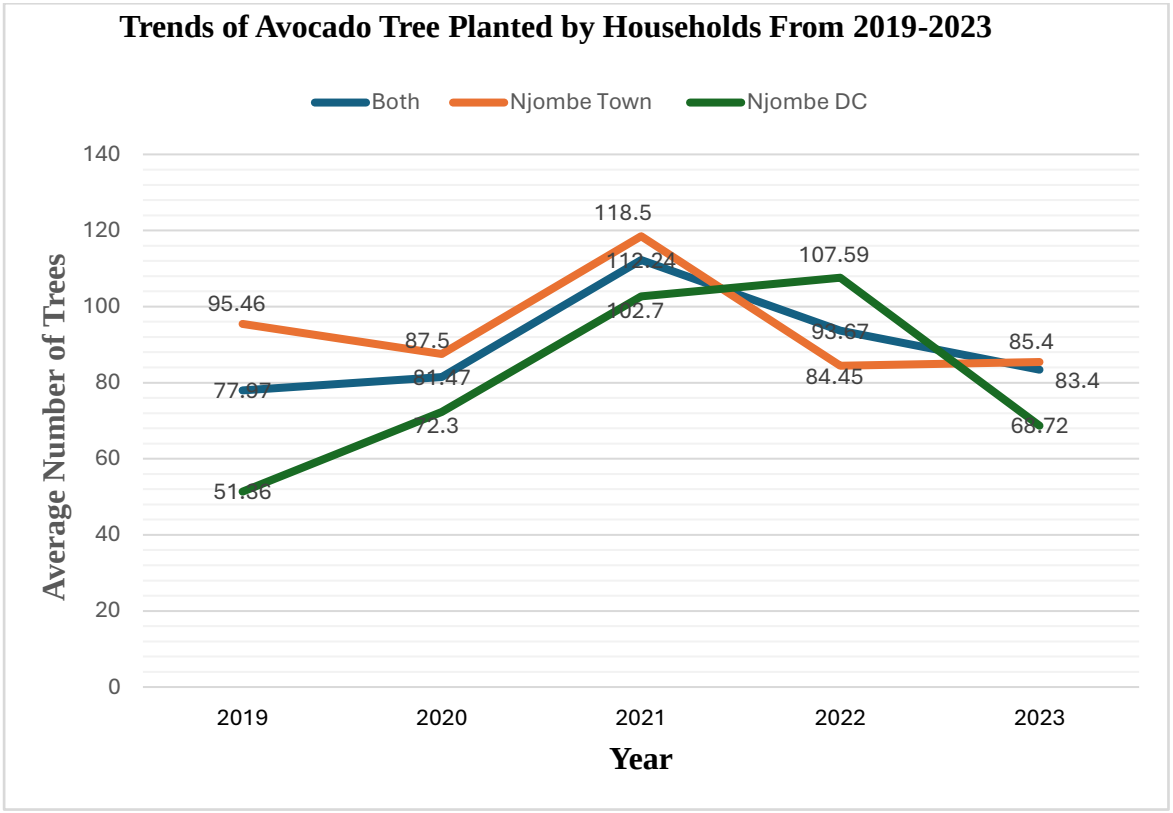

Figure 2: Trends of avocado tree planted by the household from 2019 to 2023

4.4 Avocado Farming and Land Committed into Staple Crops Production

4.4.1. Land size currently committed into avocado and food crop production

This study revealed that, on average, the surveyed household has an average of 10.2 (or 7.01, 5% trimmed mean) acres of land currently committed to avocado production and 3.86 acres (or 3.68 trimmed mean) in food production with a minimum of 1 for avocado and 0 for food crop production and a maximum of 230 for avocado and 20 acres for food crops. This result implies that there is currently more land committed to avocado production than it is for staple crops production.

The district- specific results revealed a similar scenario (see Table 4). The results also reveal that, on average, there are more acres of land per household in Njombe Town (13.03 acres) currently committed into avocado production than there are in Njombe DC (4.72 acres).

Table 4. Land committed into avocado and staple crops

	Avocado	Food crops
Overall		
Mean	10.2	3.86
5% trimmed mean	7.01	3.68
Minimum	1	0
Maximum	230	20
Njombe Town		
Mean	13.03	3.81
5% trimmed mean	10.64	3.63
Minimum	1	0
Maximum	206	20
Njombe DC		
Mean	4.72	3.94
5% trimmed mean	1.56	3.78
Minimum	1	1
Maximum	230	10

4.4.2. Trend of land committed to avocado production

Findings from this study revealed that land committed to avocado production in the surveyed households increased from an

average of 2.11 acres per household in 2018 to 10.2 acres in 2023. (Figure 3). A similar trend was also portrayed by individual district statistics. Njombe Urban District had a relatively higher value as compared to Njombe District.

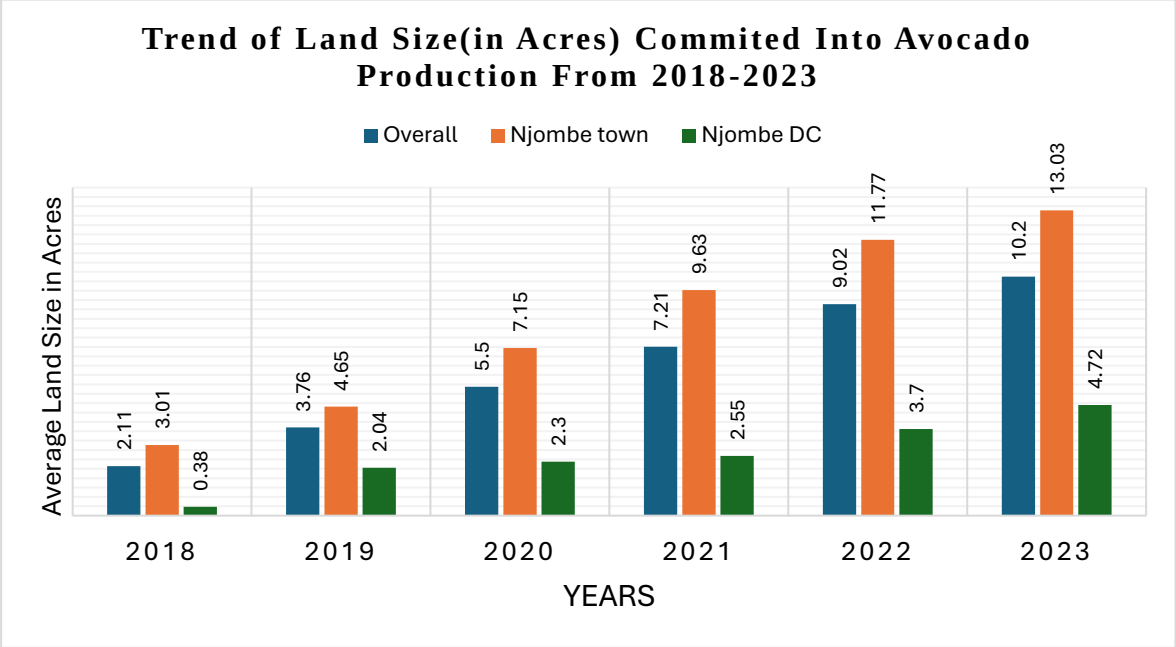

Figure 3: Trends of land size committed into avocado production

Table 5. Annual growth of land committed into avocado production

Year	Both		Njombe Urban District		Njombe District	
	Mean (Kgs)	AGR	Mean (Kgs)	AGR	Mean (Kgs)	AGR
2018	2.11	-	3.01	-	0.38	-
2019	3.76	0.78	4.65	0.54	2.04	4.37
2020	5.5	0.46	7.15	0.54	2.3	0.13
2021	7.21	0.31	9.63	0.35	2.55	0.11
2022	9.02	0.25	11.77	0.22	3.7	0.45
2023	10.2	0.13	13.03	0.11	4.72	0.28
AAGR		**0.39**		**0.35**		**1.07**

AGR=Annual Growth AAGR=Average Annual Growth Rate

4.4.3. Sources of land used for avocado production

This study investigated the sources of land used for avocado production in the study area. Results (Table 6) revealed that although a large proportion (40. Percent) of farmers claimed to have taken land used for tree crop cultivation, there was a substantial proportion (28.3 percent) of farmers who used land that was previously used for staple crop production.

Table 6: Source of land used for avocado production

Table 6. Sources of land used for avocado production

Categories	Responses	
	Frequency	Percent
Reducing land size used in cultivation of staple crops	140	28.3
Reducing land size used in cultivation of cash crops	22	4.4
Reducing land size used in cultivation of tree crops	198	40.0
Using idle land	14	2.8
Purchasing land from another private owner	100	20.2
Land inherited from parents	21	4.2
Total	495	100.0

Findings from this study revealed that a total of 821 acres of land used for avocado production in the study area have been acquired by farmers from other land owners. Therefore, this study sought to understand the land's previous use before farmers purchased it. Results from this study (Table 6) revealed that, more than a quarter (28.3 percent) of responses were of the opinion that the landowner has been using land for the production of cash crops, hence supporting the findings in Table 6.

Table 6. Use of land purchased from another private owner

Land use	Frequency	Percent
Cultivating staple crops	37	37
Cultivating tree crops	44	44
Idle land	11	11
Don't know	8	8
Total	100	100

4.5. Staple Crops Production amidst flourishing of avocado production

4.5.1. Trends of major staple crop production

The trend of major staple crops (maize, Irish potatoes, and beans) production in the study area was investigated in this study. Results are displayed in Figure 4. As displayed in this figure, all three major crops displayed a declining linear trend. Maize was the most affected staple crop, declining at a very rapid rate relative to other crops (see Figure 4).

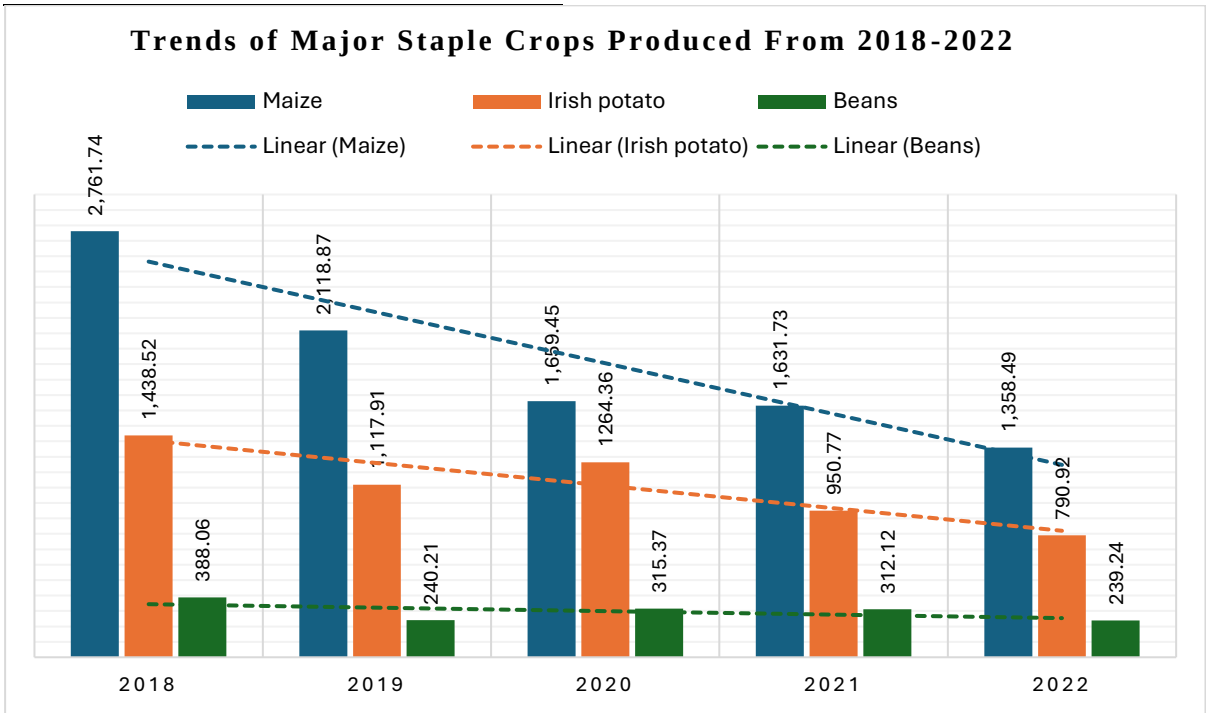

Figure 4: Trends of Major staple crops production from 2018 to 2022

4.5.2. Annual Growth of Major Staple Crops Production

The study investigated the annual growth of major staple crops in the study area. Three major crops, namely; maize, and Irish potatoes were subjected to scrutiny. Other crops such as cassava and sweet potatoes, which are also grown in the area, were not included because of a lack of reliable data. This is because these crops are mostly grown for home consumption and are usually harvested gradually depending on daily demand. In this case, it created difficulty for famers to estimate the quantities harvested in a year. Findings in Table 7 indicate that, with the exception of 2020 Irish potato production, which portrayed a positive annual growth rate (AGR=0.13), production of three major staple crops (maize, Irish potatoes and beans) for the rest of the years portrayed a negative annual growth rate. The annual average (AAGR) indicated a negative growth

rate for all three staple crops, implying that production was declining.

Table 7: Annual Growth of Major Staple Crops Production

Year	Maize (Kgs)			Irish potatoes (Kgs)			Beans (Kgs)		
	Sum	Mean	AGR	Sum	Mean	AGR	Sum	Mean	AGR
2018	1,030,128	2,761.74	-	87750	1,438.52	-	74,120	388.06	-
2019	790,340	2,118.87	-0.23	72664	1,117.91	-0.17	64,980	240.21	-0.12
2020	618,975	1,659.45	-0.22	82183	1264.36	0.13	64,020	315.37	-0.01
2021	605,371	1,631.73	-0.02	61800	950.77	-0.25	63,360	312.12	-0.01
2022	505,358	1,358.49	-0.17	51410	790.92	-0.17	48,566	239.24	-0.23
AAGR			-0.16	AAGR		-0.11	AAGR		-0.10

AGR=Annual growth AAGR=Average Annual Growth

4.5.3. Projection of Major Staple Crops Production from 2023 to 2030

A projection was made to investigate the position of three major crops production in the study area from the year 2023 to 2030. In the making projection a linear growth was assumed by this study. It was also assumed that an average annual growth rate will prevail throughout the growth period. Then the projection was made using the model $P_t = rP_{t-1} + P_{t-1}$ were r=Average Annual Growth Rate (AAGR), P_t=Projected production and P_{t-1}=production in the year preceding the projection period.

Results revealed that the production of three major staple crops went on declining year after year. By 2030, only a quarter of the maize produced by the surveyed households in 2022 shall be available in the area for export to other regions and for their own consumption and by this time, a household in the study area shall be producing an average of 339 Kgs of maize, an amount which is not worth enough to feed a household with an average family size of 5. Irish potato production in 2030 shall be cut off by 61.1 percent as compared to 2022. This is an alarming message to lovers of chips snacks especially women and students. Moreover, Ben's production by 2030 shall be cut by 56.9 percent from 2022.

Table 8. Projection of Major Staple Crops Production from 2023 to 2030

	Maize (Kgs)		Irish Potato (Kgs)		Beans (Kgs)	
	Sum	Mean	Sum	Mean	Sum	Mean
2023	424,907	1142	45,536	701	43,929	215
2024	357,263	960	40,332	620	39,735	194
2025	300,388	807	35,724	552	35,942	174
2026	252,567	679	31,642	491	32,510	157
2027	212,359	571	28,026	437	29,406	141
2028	178,552	480	24,824	389	26,599	127
2029	150,127	404	21,987	346	24,060	114
2030	126,228	339	19,475	308	21,762	103

5.0. Discussion, Conclusion and Recommendation

5.1. Discussion

5.1.1. Avocado and Staple Crops Farming in the Study Area

Table 1 displays the findings for avocado and staple crop cultivation practices. As shown majority of farmers prefer to mix avocado with other staple crops, a situation that is driven by the scarcity of land brought about by the flourishing of avocado farming as well as the desire by farmers to get multiple crop harvests with no extra energy spent on the cultivation of an extra piece of land. The tendency of mixing avocado with other crops has, in most cases, been a common farming practice among farmers in East Africa. Sina et al. (2023) and Wasilwa et al. (2004) observed similar practices in Ethiopia and Kenya, respectively. In their study in Kenya, Wasilwa et al. (2004) reported avocado being intercropped with cowpeas, tomato, groundnuts, maize, sorghum, banana, citrus, guava and mango in Kenya. Similarly, Sina et al. (2023) observed enset (*Ensete ventricosum*), banana (*Musa acuminata*), coffee (*Coffea arabica*), mango (*Mangifera indica*), chat (*Chat edulis*), maize

(*Zea mays*) and tef (*Eragrostis tef*) being intercropped with avocado in Ethiopia. The practice though, may have benefits for the crops, especially if the mixed crops are nitrogenous; however, it may have negative implications on the productivity of other crops as the avocado ages. Some studies (Sina et al., 2023; Wasilwa et al., 2004) has also indicated that mixing avocado with some crops may reduce the productivity of avocado.

Finding further revealed that maize is a magnificent staple crop grown by the majority in the area, both for home consumption and for being traded with other regions in Tanzania (Table 2). Other crops, including Irish potatoes; beans and sweet potatoes also stake a sufficient proportion. Major consumers of staple crops from Njombe have been regions including Dar es Salaam; Dodoma and Singida and neighbouring countries Kenya (NBS et al., 2018; NBS & Njombe District Council, 2016). On the other hand, avocado farming has been oriented towards the export avocado variety (Hass) rather than the home consumed variety (Waiso and Pinkerton). A comparison drawn by this study on land committed to avocado and land committed to staple crop farming (Table 4) revealed that, on average, a household has a relatively large proportion of land currently committed to avocado production compared to staple crop production. That is, for every acre of land cultivated with staple crops, there are nearly three acres of land cultivated with avocado. The larger the land currently committed to avocado farming compared to land committed to staple crop farming perhaps supports evidence from literature (Simbaya, 2020; Dailynews, 2022) that farmers are gradually shifting their interest from growing major staple crops to avocado.

5.1.2. Impacts of avocado farming on land committed to staple crop farming

This study has revealed that land committed to avocado cultivation has been growing year after year, although at a slower pace in the Njombe District than in the Njombe Urban District (Figure 3 and Table 5). The difference might be due to different promotional intensity of the crops in the two districts. More than a quarter of farmers used land previously committed to staple crop farming (Table 6 and 7). Considering that land is fixed in supply, the prolonged trend of this scenario poses an immense threat to staple crop access not only in Njombe but also in other regions that have been accessing these crops from Njombe.

Evidences gathered by this study indicate that avocados thrive well in tropical and sub-tropical climate with moderate to high humidity and precipitation levels; conditions that also favors staple crop production as well as other cash crops like coffee and tea (Tesfaye et al., 2022; URT, 2020). It is through this fact that areas which are famous for staple crops, coffee and tea cultivation are also major growers of avocados. These encompass regions including Kilimanjaro, Mbeya, Iringa, Rukwa and Songwe. Further evidence revealed that similar conditions are possessed by regions including Kagera; Ruvuma, Morogoro, some parts of the Geita region and Kigoma. This implies that if no care is taken, these regions are also in danger of falling into major avocado production which eventually may reduce the size of land set for the production of staple crops, hence escalating the negative impacts on food access in Tanzania.

5.1.3. Staple crop production amidst the flourishing of avocados

It was observed that the trends of major staple crop production are declining in the study area following the flourishing of avocado farming (Figure 4 and Table 7). Moreover, the 2030 projection revealed that if the current trend of decline persists, a household in the study area shall be producing an average of 339kgs of maize per year, an amount which is not good enough to feed a household of more than 4.3 people (URT 2022). Only 38.9 percent shall be available for their own consumption and for sale to other regions. Similarly, beans produced shall be cut off by 56.9 percent from 2022. This scenario poses a great threat to food access in the future not only to households in the southern highlands but also to those regions that have been depending on the southern regions as a staple crop outsource. If no measures are taken to counteract the deficit, this might end up causing a devastating effect on food access in Tanzania.

Various studies (Wadhwa et al., 2017; Mosser& Felton, 2007; Ayaviri-Nina, et al., 2022) have insisted on the roles of accumulated resources in moderating the effects of food insecurity. Their arguments lie on the fact that the power to access food is influenced by the capability to use accumulated resources to access food. This implies that households may apply resources accumulated through selling of avocados to purchase food and therefore bounce back from food shortages. However, even if this is true, it

may apply to households in the studied area and be less applicable in other regions that have been accessing staple crops from southern highlands. These regions shall continue to experience poor staple crop access unless alternative measures are applied. Not only that, but also experience has shown that most households, especially those residing in rural areas with no regular income, do not have the tendency of setting apart cash for use during food crises.

5.2. Conclusion

A gradual shift from staple crop-oriented production to export-oriented crops is obvious in the study area. Avocado production is gradually substituting the previously existing cash crops, including maize. Irish potatoes, sweet potatoes, beans, tree crops, etc. Unacceptable intercropping of avocado with other staple crops has been observed, driven by scarcity of land and the need to obtain multiple varieties of crop harvests with no extra energy spent. This may negatively impact the productivity of either avocado or the crops intercropped with avocado. Cultivation is elevated towards export oriented avocado varieties rather than the home consumed varieties. The Hass variety, which is primarily an export crop has overridden the avocado production in the study area. Moreover, the flourishing of avocado has driven the use of land previously used for staple crop production. Land committed to avocado production has been increasing while land committed to staple crop production has been decreasing. The prolonged increase in the price of avocados in the world market and the prevailing promotion of avocado farming pose a danger of other regions falling into avocado production and overuse of land set for staple crop production hence escalating the problem. Production of major staple crops is declining in the study area amidst the flourishing of avocado production. The 2030 projection reveals a devastating impact on the production of major staple crops, hence threatening access by other regions in Tanzania.

5.3. Recommendation and policy implications

Based on the findings from this study, it is recommended that promotion of avocado production should go hand in hand with promotion of staple crop production. If possible, a slogan of one acre of avocado for one acre of staple crops should be applied to encourage farmers to cultivate staple crops too. Policy and decision-makers should take precautions, design policies and interventions to rescue the situation. This study recommends encouraging the use of intensive cultivation to ensure high yield on a relatively small piece of land. Inputs used in staple crop production should be subsidized and/or provided in loans that farmers could pay back upon harvest. This shall encourage farmers to dwell in the production of staple crops. This study also recommends deliberate investment in sensitization and emphasis in the production of food crops.

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