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Farmers' perceptions towards the implementation of agroecological practices for enhancing food availability in Singida Rural District

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This paper delves into the global drive to promote agroecological practices, which have been widely acknowledged for their diverse economic, social, and environmental benefits. Yet, a critical gap persists in our understanding on the impact of these practices on food availability from the perspective of farmers. Our study focuses on farmers' perceptions regarding the role of agroecological practices in enhancing food availability within Singida Rural District in Tanzania. To explore this understudied terrain, we conducted a comprehensive questionnaire survey involving 160 farming households drawn randomly from four villages. Employing a Likert scale methodology, we meticulously assessed farmers' perspectives on the implementation of various agroecological practices. Strikingly, a significant majority (64%) of respondents unequivocally recognized the pivotal contribution of agroecological practices to enhance household food availability. Nonetheless, a nuanced dichotomy emerged, nearly half of the participants (53%) expressed reservations about the perceived ease of integrating agroecological practices. This hesitancy was attributed to the challenges and labor-intensive nature associated with implementation of certain agroecology techniques. Encouragingly, our findings highlight the potential of collective efforts in mitigating labor-related concerns. In light of these insights, we advocate for targeted interventions by local government entities and agroecology stakeholders; by facilitating farmers' access to essential knowledge, skills, and resources, we can catalyze the transformative journey toward agroecology. This shift holds the promise of fostering a more sustainable food system that resonates with the needs of both present and future generations.

Key words: Agroecological practices, food availability, farmers' perception, economic benefits, social benefits, environmental benefits.

INTRODUCTION

Agroecology emerges as a compelling avenue for steering agriculture and food systems toward sustainability. As highlighted by Wezel et al. (2020), this approach not only bolsters social and economic equity but also fosters environmental conservation—the very foundation sustaining agricultural endeavors'.

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Agroecology's distinction lies in its reliance on natural processes such as biological nitrogen fixation, mulching, agroforestry, and recycling, eschewing chemical interventions that pose threats to human health and the environment, often through pollution and water contamination. Amidst the spectrum of agricultural methodologies, agroecology assumes a pivotal role by advocating the utilization of ecological principles through a repertoire of agroecological practices, bolstered by a collaborative social movement (Wezel et al., 2015). This amalgamation not only charts a course toward climate change mitigation and adaptation but also resonates with grassroots initiatives, grounded in ecological production and the pursuit of food sovereignty (Wezel et al., 2009; Delpino-Chamy et al., 2019), as substantiated by an exhaustive literature review.

Agroecology is a concept related to organic farming and conservation agriculture, as proponents highlight, they all focus on providing environmentally sustainable pass way for development and poverty reduction. However, agroecology differs from organic farming and conservation agriculture, in that it achieves the goal by developing agroecosystems with minimal dependence on external inputs (Mockshell and Villarino, 2018). Conservation Agriculture promotes the maintenance of permanent soil cover, minimal soil disturbance, and diversification of plant species (Mockshell and Villarino, 2018 as cited in Kanjanja et al., 2022). Unlike organic and agroecological farming, conservation farming allows the use of external inputs (inorganic fertilizer, genetically modified crops, and industrial pesticides. There are no stand-alone practices of agroecology that are not practiced by organic farming and conservation agriculture. A practice to be considered an agroecological practice depends on the extent to which it is used in agroecological processes as opposed to industry inputs (Food and Agriculture for United Nations (FAO), 2018). Agroecology encompasses the application of ecological principles from the design to the management of agricultural farming systems (FAO, 2018).

Agroecological practices as proponents highlight are agronomic practices that improve agricultural productivity leading to high yields and varieties of crops through the best use of ecological methods and inputs or locally available materials without any additional industrial pesticides (Silici, 2014; Wezel et al., 2020). The most common agroecology practices include no or minimum tillage, biological management of pests, integrated nutrient management, cover crops, mulching, and crop-livestock integration (Palamo-Campesino et al., 2018; Wezel et al., 2020). It is increasingly documented that the implementation of agroecology practices can help accomplish a transition of agriculture to make food systems more sustainable (The Help Level Panel of Experts (HLPE), 2019: Wezel et al., 2020). Agroecological practices are guided by agroecological principles such as nutrient recycling – for maximizing the use of nutrients generated on farms; reduction of external inputs; diversification through the use of local crop varieties and livestock breeds for adaptation to climate change; biodiversity enhancement; improve soil and animal health (Silici, 2014; Wezel et al., 2020). As a result, agroecology is an instrument for realizing some of the 17 Sustainable Development Goals (SDGs), including Goal 1- No poverty, Goal 2 - reduction of poverty and hunger; and ensuring food availability and security; Goal 5- Gender Equality and fairer representation of women. Agroecology can empower farmers and local communities including groups such as women and youth because it requires nor or fewer external inputs (Palomo-Campesino et al., 2018) of which marginalized farmers can afford most of the agroecological practices. It also aligns with Goal 13: Climate Action, which involves regulating, and reducing emissions and promoting renewable energy, as well as Goal 15: Life on Land.

In the agricultural sector, farmers may choose to use either all or just a few of taught agricultural practices, depending on their willingness, ability, and perception. However, farmers argue that its implementation is intensive in terms of labour, and time (Kanjanja et al., 2022). Several studies show that implementation of agroecological practices enhances soil health and subsequently increases crop and animal yields, which contributes to food availability and food security (Silici, 2014; (Third Word Network (TWN), 2015; Oteros-Rozas et al., 2019; Kerr et al., 2021). Diversification as one of the principles and practices of agroecology increases crop outputs, which eventually leads to a large total output.

Furthermore, TWN (2015) and Wezel et al. (2020) show the economic, environmental, and social benefits of agroecology apart from increasing food production. Agroforestry improves the resilience of the farming system and climate change; crop rotations, cover crops, and Farm Yard Manure (FYM) improve soil health and increase water holding capacity, helping to avoid soil erosion. Also, as the level of organic matter increases, which helps to mitigate climate change variability by sequencing carbon into the soil (Therond et al., 2017)? Increases in crop yield and stability lower production costs by discouraging the use of external inputs and lead to an increase in ecosystem services (Paracchini et al., 2020).

The promotion of implementation of agroecological practices in Singida district, where the data for this paper were collected was carried out by the Farmer Research Network (FRN) project, under the Research Community and Organisational Development Association (RECODA), in collaboration with the local government since 2000 (Keya et al., 2021). The project conducted capacity building through FRNs and they use Farmer Field School. Besides, the FRN project supports farmers by providing credit to help farmers in both on-farm and non-farm activities. As Kanjanja et al. (2022) argue the

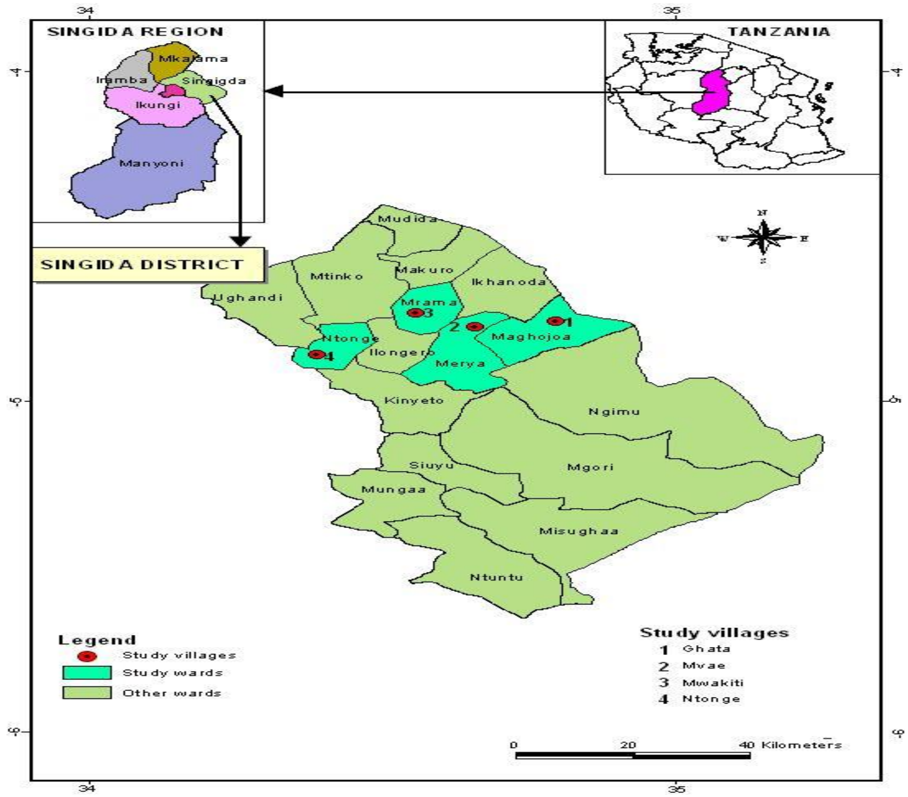

Figure 1. Map showing the location of the study area.
Source: GIS (2021).

implementation of agroecological practices has not been straightforward; it has often resulted in indifferent and unexpected outcomes. Nevertheless, studies on farmers' perceptions of the benefits of implementing agroecological practices in connection to enhancing food availability are missing, in Tanzania in particular.

The literature review revealed that there are many studies about agroecology practices, principles, and benefits. Some of these studies examined farmers' perceptions of specific agroecological practices. For example, Majbar et al. (2021) study investigated farmers' perceptions and willingness to contribute to environmental sustainability through compost production and use. Souza et al. (2018) reported that farmers perceive that the use of agroecological practices, such as green manure improves soil and crop health, allowing the farmer to shift from using industrial fertilisers and agrochemicals in the study which assessed farmers' perceptions of the use of green manure. According to Mamo and Bahiy (2019), farmers in Ethiopia perceive the use of manure as complex and labour-intensive, however, they prefer to use it for soil health enhancement and yield improvement. Another study by Hayran et al. (2018) assessed farmers' perceptions of sustainable agricultural practices. Little is known about how farmers perceived the importance of the implementation of agroecological practices toward enhancing food availability. Against this background, this study seeks to answer the following questions: (i) What are farmers' perceptions regarding the feasibility of implementing agroecological practices? (ii) How does the adoption of agroecological practices correlate with the enhancement of food availability?

METHODOLOGY

Study area

This study was conducted in Singida district, Singida region, Tanzania. The region is located in the central part of Tanzania, and lies between latitudes 3^0 52 ' and 7^0 34 'and between longitudes 33^0 27 ' and 35^0 26 ' East of Greenwich (Figure 1). This district was selected because it is the area where the FRN project was implemented. The district lies in a semi-arid area, and thus experiences low rainfall in a short rainy season from December to March, ranging from 600 to 700 mm per annum. The population of Singida district was 225 521, but the projected population was 255 324 in 2017 (United Republic of Tanzania (URT), 2017). Smallholder farmers grow maize, sorghum, pearl millet, sunflower, groundnuts, and beans as major food crops, while sunflower and onions are cash crops. Also, farmers keep animals, mainly cattle, goats, sheep, donkeys, and local chickens. The FRN project worked in nine wards and nine villages in Singida rural district. We randomly selected two wards (Mrama and Ilongero) and two wards

Table 1. Respondents' overall perceptions on agroecological practices to enhance food availability.

Variable	Score	Frequency	Percentage
Positive	> 28	27	64
Neutral	28	11	25
Negatives	< 27	4	11
Total		42	100

Source: Author

(Ntonge and Maghojoa) from non-FRN project areas.

Research design, sampling procedure, and sample size

The study used a cross-sectional research design whereby primary data were collected from farmers at one point in time. This research design was preferred because it is good in determining the relationship between and among variables at a specific time, and is economical as it serves time and financial resources (Clark and Ivankova, 2016). The study population comprised smallholder farmers, beneficiaries, and non-beneficiaries of the FRN project. A multistage purposeful sampling procedure was applied to select divisions, wards, and villages. In the first stage, one division among the two divisions where the FRN project operates was selected. The second stage involved a random selection of four wards, two wards in the FRN project area and two wards in the non-FRN project area.

The third stage involved a random selection of two villages in each ward to make a total of 4 villages. The fourth stage involved simple random selection of 40 households from each village making a total of 160 respondents. In this study, a household was the unit of analysis.

How a sample size was determined?

The formula by Kothari (2004) was used for determining an unknown population size as well as a sample size of 160 respondents. A sample size was determined by a single formula as indicated below:

$$no = \frac{Z^2 Pq}{e^2} \tag{1}$$

This formula is for a sample size for a study with an unknown (infinite) population size. Where: *no* = the sample size needed if the population is unknown, e = the margin error (desired level of precision), P = proportion estimated for the population, q = 1 – p and, Z = the confidence level at 95% (standard value of 1.96).

Z = 1.96, P = 0.5, q = 0.5 e = 0.0775. Thus; $no = \frac{1.96^2 * 0.5 * 0.5}{0.0775^2}$ = 159.9 ~ 160.

The authors also used purposively sampling techniques to select key informants who were project leaders, village leaders, and extension officers.

Data collection

In this study, both quantitative and qualitative primary data were collected for triangulation purposes. A structured questionnaire with open and closed-ended questions (Likert scale type) was used to collect quantitative data. The questionnaire was initially prepared in English and later translated into Kiswahili for effective administration. Before the actual household survey, the researchers pretested the tool with 24 respondents, comprising 12 from FRN villages and other 12 from non-FRN villages, but both villages are under similar field conditions. Thereafter, the tool was modified accordingly. The tool collected various information on farmers' perceptions of agroecology as a means of improving food availability.

Focus group discussions (FGDs) and key informant interviews (KIIs) were used to collect qualitative data in each study village. One FGD per village was conducted. The FGDs participants range from 8 to 12. Consideration was made for sex (female and male), experience, and a clear understanding of agroecology farming. The key informants consist of two leaders from the FRN project, two ward agricultural extension officers, and four village leaders. They provide information about their perceptions of agroecological practices and their benefits. An interview guide guided the interview with the key informants.

Secondary data on stakeholder views about the benefits of agroecological practices and their contribution to improving agricultural crop productivity were gathered from a variety of sources, including project and government reports, journals, and the Sokoine National Agriculture Library (SNAL). The intention of consulting archival material was to get a picture of the uniqueness of the perception of comparatively advantages of implementation of agroecology.ms

Data processing and analysis

A Statistical Package for Social Sciences (SPSS) version 25.0 computer programme was used to analyse quantitative data. Descriptive statistics such as percentages and frequencies were calculated and presented in bar and pie charts.

To assess farmers' perceptions towards the implementation of agroecological practices for enhanced food availability, the Likert scale type of rating questions was used. Fourteen statements about agroecological practices for enhanced food availability were asked, while for perceived easy-to-use practices, 12 statements were asked. The respondents were required to indicate whether they strongly agree (SA), agree (A), neutral (N), disagree (D), or strongly disagree (SD) with each of the statements. Thereafter, the results were computed into three levels from the established five levels. Thus, "Strongly Agree" and "Agree" were grouped as "Agree" and scored (3), Neutral remained the same with a score of (2) while "Strongly Disagree" and "Disagree" were combined into "Disagree" and had a score of 1.

Therefore, the three categories used were: Agree, Neutral, and Disagree. Agreed items were treated as positive perceptions towards agroecological practices for enhanced food availability and disagreements were treated as negative perceptions, while the neutral item showed that farmers had no decision. In the analysis, several assumptions were made. For farmers' overall perceptions, it was said that when a respondent agreed with all 14 practice statements, they would score 42 (that is, 14 x 3). If one disagreed with all the 14 practice statements, one would score 14 (that is, 14 x 1) and if a respondent was undecided or neutral with all the 14 practice statements, then he/she would score 28 (that is, 14 x 2). Thereafter, the scores were combined to give a scale of 14-42. Then, scores below 27 were considered as a reflection of a negative perception meaning agroecology does not enhance food availability, while a score of 28 represented a neutral perception, and scores above 28 represented a positive perception that agroecology enhances food availability, as presented in Table 1.

For farmers' perceptions of the ease of implementation of agroecological practices, 12 statements were asked of the respondents if one disagreed with each of the 12 practice statements, then one would score 12 (that is, 12 x 1). When respondents agreed towards each of the 12 statements, they would score 36 (that is, 12 x 3) and if one was neutral to all 12 practice statements, then one would score 24 (that is, 12 x 2). Thereafter, the scores were combined to make a score range of 12-36. Then scores below 24 were considered as a reflection of negative perception, or not easy to use; 24 scores were considered neutral perception; scores above 24 were considered as a reflection of positive perception or easy-to-use agroecological practices as presented in Table 1.

RESULTS AND DISCUSSION

Overall perceptions of farmers on the ability of agroecological practices to enhance food availability at the household Level

The perceptual landscape of farmers regarding the effectiveness of agroecological practices in bolstering food availability is depicted in Table 1. Notably, a significant majority (64%) of respondent farmers held an affirmative stance, perceiving agroecological practices as a potent catalyst for enhancing food availability at the household level. In contrast, a smaller proportion (25%) expressed skepticism, asserting that these practices might not yield the desired results in terms of food availability. A more equivocal standpoint emerged from 11% of respondents, who remained uncertain or neutral in their perceptions. This prevalence of positive perceptions signifies a noteworthy acknowledgment by the majority of farmers regarding the intrinsic potential of agroecological practices to positively impact food availability, coupled with the associated advantages inherent to agroecological approaches.

The qualitative insights gleaned from Focus Group Discussions (FGDs) conducted in Mvae village underscore the manifold environmental benefits conferred by agroecological practices within the study area. These practices emerged as formidable allies in enhancing soil health, curtailing weed proliferation, mitigating pest and disease incidences, and concurrently augmenting crop yields while stemming soil erosion. The convergence of these advantages seemingly underpins the prevailing positive perception among farmers. These findings align with Paracchini et al. (2020), who reported similar affirmative sentiments among farmers in Benin. Their study attributed the constructive perception to improved yields, which directly translated into heightened food availability for households.

Comparable patterns of positive perception are discernible in the study by Hayran et al. (2018), where Turkish farmers exhibited favorability towards sustainable agricultural practices. The authors attribute this optimistic perspective to the manifold benefits reaped from sustainable practices, encompassing enhanced efficiency, nutrient recycling, and escalated crop productivity. The constructive perception was further fueled by the recognition of environmental safeguarding and the prevention of deleterious ecological impacts (Hayran et al., 2018).

These correlative findings collectively underscore the resonance between perceived benefits and the favorable outlook toward agroecological practices, thus corroborating the pivotal role of these practices in shaping food availability.

The prevailing positive perceptions among farmers regarding the efficacy of agroecological practices in enhancing food availability align with similar conclusions drawn by Paracchini et al. (2020) in their study conducted in Benin. Likewise, the parallel drawn between the constructive perspectives observed among Turkish farmers towards sustainable agricultural practices by Hayran et al. (2018) resonates with our findings. These congruences underscore a consistent global trend wherein perceived benefits and positive attitudes intertwine, reinforcing the pivotal role of sustainable agricultural practices, including agroecology, in enhancing food availability while ensuring environmental preservation.

The convergence of these research findings across diverse contexts substantiates the robustness and universality of the link between favorable perceptions and the potential of agroecological practices in augmenting food availability (Paracchini et al., 2020; Hayran et al., 2018).

Furthermore, a statement-by-statement analysis was conducted to determine the mean score of each statement. The mean score was obtained by adding the weights given to each statement by respondents, divided by the total number of respondents for each statement. Based on the mean score obtained, position rankings were allocated.

The study findings ((Table 2) showed that the statement which received the highest rating, with a mean score of 2.97, was "*Crops and livestock integration increase crop productivity.*"

This was contributed by benefits obtained by farmers from integrating crops and livestock. Crop and livestock integration led to the availability of crop residues and animal manure for nutrient recycling and improved soil fertility, as reported by one KII during an interview which was conducted at Mvae village on April 21, 2021.

The second highest-rated statement was "*Crop diversification enhances food availability,"* which scored 2.92. This was followed by a statement that scored 2.91 and read as follows: "*Crop rotation improves soil nutrients and hence increases crop productivity, which in turn enhances food availability."* The fourth highest-rated statement scored 2.90 and read, "*Intercropping allows efficient use of space, leading to increased crop production."*

The higher rating of these practices probably contributed to their benefits in improving crop yield. A study by Chappell et al. (2018) reported that crop diversification, which is comprised of crop rotation,

Table 2. Respondents' statements wise score on perceptions of agroecological practices to enhance food availability.

Statement	A=3	N=2	D=1	TS	MS	Rank
Crop and livestock integration increases crop productivity.	158(98.8)	1(0.6)	1(0.6)	476	2.97	1
Crop diversification enhances food availability	148(92.5)	11(6.9)	1(0.6)	467	2.92	2
Crop rotation increases nutrients and interrupts the pest life cycle	151(94.4)	4(2.5)	5(3.1)	466	2.91	3
Intercropping allows efficient use of space	151(94.4)	3(1.9)	6(3.8)	465	2.91	4
Cover crops and mulching provide nutrients to the soil	137(85.6)	9(5.6)	14(8.8)	443	2.77	5
Inadequate knowledge leads to poor practice of agroecology	116(72.5)	40(25.0)	4(2.5)	432	2.73	6
Proper crop choice and rotation practices stabilize crop yield	124(77.5)	23(14.4)	13(8.1)	431	2.69	7
Minimum tillage inhibits root penetration hence poor crop	128(80.0)	8(5.0)	24(15.0)	424	2.65	8
Mixed intercropping increases crop competition	102(63.7)	14(8.8)	44(27.5)	378	2.36	9
Relay intercropping mitigates competition risk for the main crop	77(48.1)	47(29.4)	36(22.5)	361	2.26	10
Integration of crops with timber and fruit trees increases production	53(33.1)	13(8.1)	94(58.8)	279	1.74	11
Agroforestry decreases crop yields due to crop competition	25(15.6)	48(30.0)	87(54.4)	258	1.61	12
Application of crop residue on the farm triggers pests	37(23.1)	20(12.5)	103(64.4)	254	1.59	13
Agroecological farming produces a low yield	22(13.8)	18(11.25)	120(75.)	222	1.38	14

Source: Author

intercropping, and crop and livestock integration, led to an improvement in crop yield. In addition, Hayran et al. (2018) reported that crop rotation and intercropping practices improve soil quality by reducing pest and disease infestation and soil erosion, resulting in increased crop yield.

Moreover, the study findings showed that the majority of respondents highly disagreed with the statement that "*Integration of food crops with timber, fruit, or nut trees increases food availability"* with a score of 1.74. According to farmers, the reason for disagreed is that these types of trees overshade the crops hence reducing the health of crops and leading to low crop productivity.

Also, the respondents disagreed with the statement that "*Agroforestry decreases crop yield due to competition for resources"* with a score of 1.61. They argued that this is a force because agroforestry makes use of trees and shrubs that are necessary for biological processes of nitrogen fixation and production biomass which add organic matter into the soil. Likewise, a statement about "*Application of crop residues triggers pests and diseases hence reducing production,"* with a score of 1.59. They disagreed with this because experiences or evidence show that crop residues are a good source of organic matter, adding organic matter and fertilizer into the soil. Lastly, the respondents disagreed with a practice statement that said *"Agroecological farming produces low yield compared to conventional farming"* with a score of 1.73. According to farmers, the basis for disagreement with this statement is the way that agroecology produces a diversity of crops which in cumulative terms increase crop yield within the same piece of land at minimal cost. These practices were least ranked because they may be less important to farmers compared to their expectations and also due to inadequate knowledge and awareness of those practices. Knowledge and skills about sustainable agricultural methods are important as they increase farmers' ability to get information and improve awareness about the practices.

As informed by Schoonhovena and Runhaar (2018), information about the benefits of agroecological practices enables farmers to increase awareness and understand the practices. Being exposed to different sources of information could bring changes to farmers' perceptions of farming practices and influence their implementation (Girmachew et al., 2020).

Generally, farmers appeared to have a positive perception of agroecological practices that enhance food availability. The positive perception is important as it determines farmers' commitment to promoting and implementing agroecological practices to increase crop productivity. Farmers were aware of the role of agroecology in solving environmental problems and reducing production risks that led to food availability.

Farmers' perceptions of the ease of implementation of agroecological practices

The results based on the analysis of the perceptions of the ease of use of agroecological practices using 12 statements indicated that 53% of the respondents perceived that agroecological practices were not easy to use and 41.5% perceived that they were easy to use. A few (5.5%) had a neutral perception (Table 3). The study findings imply that more than half of farmers had a negative perception of the ease of use of agroecological practices. The negative perception of the respondents was due to their feelings of difficulties in applying

Table 3. Respondents of the ease of implementation of agroecological practices.

Variable	Frequency	Percentage
Not easy	22	53
Neutral	18	42
Easy to Use	2	5
Total	42	100

Source: Author

Table 4. Respondent's statements wise score on Perceived ease use of agro-ecological practices**.**

Statement	Agree	Neutral	Disagree	TS	MS	Rank
Organic fertilization reduces the use of synthetic fertilizers	157(98.1)	2(1.3)	1(0.6)	476	2.97	1
Agroecological practices are not labour intensive	46(28.7)	8(5.0))	106(66.3	260	1.62	8
Organic fertilizer is bulky hence difficult to transport	125(78.1)	2(1.3)	33(20.6)	412	2.57	3
Adoption of agroecological practices needs investment costs	30(18.75)	9(6)	121(76))	229	1.43	11
Biological control of pests is not difficult	50(31.3	11(6.9)	99(61.9))	271	1.69	6
Cover crops and mulching are easy ways to suppress weeds	151(94.37)	4(2.5)	5(3.13)	466	2.91	2
Agroforestry is not intensive	30(18.75)	16(10)	114(71.25)	236	1.47	9
Agroecological practices are simple cropping system	49(30.63)	13(8.12)	98(61.25)	271	1.69	4
Natural pesticides for pest control are not easily available	27(16.88)	12(7.5)	121(75.62)	226	1.41	12
Integration of different crops in rotations requires high skills	51(31.9)	9(5.6)	100(62.5)	271	1.69	5
Zero tillage requires machinery to open furrows for seeding	49(30.6)	11(6.9)	100(62.5)	269	1.68	7
Difficult to manage different crops in the same field	32(20.5)	8(5.0)	120(75.0)	232	1.45	10

Source: Author

agroecological practices. This is probably attributed to high labour requirements and the amount of time needed. During FGD, the participants agreed that:

"Applying mulch or constructing ridges in the farm to control soil erosion and conserve water, as advised by agroecology experts, takes time, especially if you don't have enough labour or income to hire labour." It was also agreed that... *"In the nine-seeded hole practice, you can't dig holes in a large farm and look after them when you are alone"* (FGD, Mwakiti village, 17 April 2021).

These results agree with a study by Vermue (2017), who reported that farmers perceive agroecological practices as a complex farming system. Also, a study by Durham and Mizik (2021) showed that the majority of farmers in Senegal perceived that the implementation of agroecology was labor-intensive. However, as mentioned above, farmers in the study area, despite perceiving labour intensiveness, implemented agroecological practices since they have large family sizes, making labour available for their farming and also because the implementation of agroecology enhances food availability. The study's findings are similar to the findings of a study done by Oyetunde-Usman (2021), who found that the majority of farmers practicing agroecology had large families and relied on family labour supply.

This is also supported by Ullah et al. (2018), who reported that the probability of implementation of agroecology practices is high in households of large size since they provide a workforce (labour) for farming activities and reduce the need for hiring labour. On the other hand, Teixeira et al. (2018) reported that farmers with small families had to hire out people to add manpower and meet the demands of implementing agroecological practices. Yet it is the emphasis that for a farmer to adopt and implement agroecological practices he/she needs support from other people.

A statement-wise analysis was done to gain more insights into farmers' perceptions of the perceived ease of use of agroecological practices. The results in Table 4 show that the statement with the highest mean score was "*Organic fertiliser reduces the use of synthetic fertilizers"* with a score of 2.97. This indicates that farmers prefer to use organic fertiliser as a means of improving soil fertility while reducing the cost of buying inorganic fertilizers.

During field visits, it was observed that in areas where the soil was bad, whether pure stone or very sandy, the incorporation of organic manure helped to improve soil quality with high levels of organic matter. In addition, during the FGD held at Mvae village on April 20, 2021, the participants agreed that:

"The soil in their area is very sandy. Therefore, application of animal and compost manure to a large extent has helped us to improve the soil to become more productive".

Also, one KII (Ward Agricultural Officer) said that:

"...our farmers prefer to use organic manure because they can't afford the price of inorganic fertiliser, which is approximately eighty thousand per bag of 50 kilograms."

These findings were consistent with those of Durham and Mizik (2021), who found that the costs of inputs in organic farming are lower compared to the costs of inputs in conventional farming. This is because agroecological farming limits the use of synthetic inputs. Alemayehu et al. (2020) added that organic fertilisers increase soil water retention, offer good drainage, help to avoid land degradation, and offer a better response to drought and floods.

The second statement with a high score (2.91) was "*Planting cover crops and applying mulch help to suppress weeds on the farm."* This indicates that farmers had knowledge about the benefits of mulching and had the potential to plant cover crops on their farms. Also, it was revealed during FGD at Mwakiti village, which was conducted on April 17, 2021, that the participants said that they had been trained about cover crops and their benefits, and they had been introduced to crops that were not grown in their areas, such as lablab and cowpea, which help to prevent soil erosion and conserve moisture. Similarly, Gu and Anex (2015) found that cover crops and mulching have benefits such as efficiency in nutrient recycling, reducing soil erosion, and pest suppression.

Looking into the statements with the least scores, according to the study findings in Table 4, the statement *"Agroforestry systems do not require high labour and management"* received a score of 1.47 and ranked 9th. *"It is not easy to manage different crops in the same field due to dissimilar requirements,"* scored 1.45 and ranked 10th, followed by "*Zero tillage requires specific machinery for cutting and opening furrows for seeding.*" "*Adoption of agroecological practices requires high investment costs,"* scored 1.443 and ranked the 11th, and "*Natural pesticides for weed, pest, and disease control are not difficult to prepare and not easily available,*" scored 1.42 and ranked 12th.

These practices received low scores, which may be due to a lack of experience for farmers since they are not implemented to a large extent. As supported by Bongole et al. (2020), experience plays a significant role in the implementation of Climate Smart Agriculture practices (CSA). He further explains that farmers with high experience have accumulated skills and knowledge that influence them to increase the usage of practices. Amare and Simene (2017) emphasize that experience increases the likelihood of farmers implementing conservation practices and enables farmers to perceive and understand the impact of farming practices.

Conclusion

This study contributes novel empirical insights into the perceptions held by farmers regarding the implementation of agroecological practices to enhance food availability, which is a pathway to food security. Farmers exhibit a positive and discerning perspective regarding the pivotal role of agroecology in enhancing food availability within households. This optimism is fundamentally underpinned by the manifold advantages intrinsic to agroecological practices, encompassing pest management, soil fertility enhancement, and the augmentation of agroecological services. These amalgamated benefits collectively serve to elevate crop productivity, culminating in an improved state of food availability. However, amid this prevailing optimism, certain complexities emerge, wherein select agroecological practices are perceived as intricate and arduous due to the requisites of heightened knowledge, skill, and labor-intensive involvement.

Encouragingly, our findings underline the ameliorating influence of collaborative endeavors, particularly within Farmer Research Networks (FRNs), which alleviate the intricacy of demanding tasks and instill motivation among smallholder farmers to actively embrace agroecological practices.

Recommendations

Guided by these findings, it is imperative to orchestrate targeted support and incentives, propelling farmers toward the successful adoption of agroecological practices. A central tenet of this endeavor should involve fostering a culture of collaborative teamwork, an approach proven to alleviate the complexities associated with certain agroecological techniques. The facilitation of collective actions, as exemplified by the FRNs, can serve as a pivotal motivator, thereby streamlining the implementation journey. This collaborative spirit is further nurtured through strategic interventions orchestrated by Non-Governmental Organizations (NGOs) and local governmental authorities, focused on capacitating farmers with teamwork skills. Equally pivotal is the provision of comprehensive capacity-building training and extension services, elucidating the tangible gains attainable through agroecological practices.

In broader strokes, this study underscores the imperative of supporting and incentivizing farmers to embrace agroecological practices, not only for the potency they harbor in engendering social and economic equity in food access but also for their pivotal role in nurturing a harmonious interplay between suitable ecosystem services and environmental preservation. By collectively harnessing these elements, a more resilient and sustainable agricultural landscape can be charted, echoing benefits that extend beyond individual households to reverberate throughout the broader community.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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