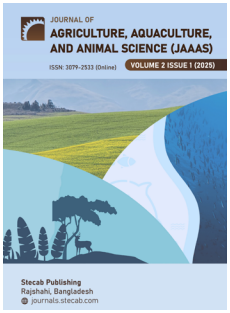

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Research Article

Community Climate Copying Strategies and Food Security Among Small-Scale Farmers: Experiences from Kashitu Community in Kapiri Mposhi, Zambia

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About Article

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ABSTRACT

Around the world, climate change has significantly disturbed agricultural systems, posing threats to food security in developing countries. Small-scale farmers have been the hardest hit by increasing temperatures, unpredictable rainfall patterns and extreme weather. In Zambia, these shifts in climatic conditions have reduced crop harvests, soil ruin, and increased food insecurity. This study examines the approaches used by small-scale farmers in Kashitu, Kapiri Mposhi, Zambia. It goes further to highlight changes made by the community to cope with the effects of climate change. Data was collected from 75 respondents who included farmers, village leaders, and agricultural extension officers using a mixed-method approach. The findings show that farmers use different methods which include preservation, agroforestry, growing a variety of crops, and water harvesting to mitigate climate impacts. Farmers face barriers such as poor access to loans, insufficient extension services, and poor infrastructure which prevent them from fully using of climate resilience strategies. The study reveals that to improve resilience, approaches that combine traditional knowledge with climate-smart agriculture are needed. Additionally, policy interventions, financial support, and capacity-building programs are important in ensuring long-term food security. The findings add to the broader discussion on global climate adaptation, showing the importance of local strategies in strengthening agricultural resilience in vulnerable regions.

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1. INTRODUCTION

Over the years, climate change has greatly disrupted agricultural production and food security. Smallholder farmers who mainly depend on rain-fed agriculture for survival have experienced a lot of pressure due to increasing temperatures and unpredictable rainfall patterns (IPCC, 2021). limited opportunities for farmers to use climate-smart technology, limited resources, and their dependency on traditional farming systems greatly expose small-scale farmers to vulnerability (FAO, 2020).

The sector supports over 70% of rural livelihoods and is highly predisposed to climate variability. Poverty levels continue to worsen because of droughts, infertile soils, and erratic rainfall and this increases food uncertainty among small-scale farmers (Mulenga *et al*., 2021). To cope with these challenges, farmers have resorted to adopting different climate resilience strategies which include conservation farming, growing various kinds of crops, agroforestry, and local agricultural techniques (Chomba *et al*., 2021). These methods provide temporary relief but their long-standing sustainability and effectiveness remain unsure owing to infrastructural challenges, limited access to extension services, and monetary constraints (Ngoma *et al*., 2020).

Kashitu, a rural community in Kapiri Mposhi, provides a serious case study for examining the effectiveness of climate adaptation strategies in increasing food security. Over-reliance on rainfall makes farmers in the region vulnerable to changes in weather patterns (Phiri *et al*., 2019). They use various coping strategies in being resilient, such as the use of drought-resistant crops, conservation cultivation, and rainwater harvesting, to abate climate shocks (Nyanga *et al*., 2022). They continue to face challenges such as poor infrastructure, lack of access to climate information, and changing market conditions deter the widespread adoption of maintainable farming practices (Lipper *et al*., 2018).

This study explores the strategies used by small scale farmers in Kashitu community to cope with climatic changes and what effect they have on their food security. It aims to assess how effective these measures are, identify difficulties faced by farmers, and explore interventions to support community resilience. By drawing understanding such from local experiences, this research contributes to ongoing conversations on climate adaptation and sustainable agriculture in sub-Saharan Africa. The findings provide valuable guidance for policymakers, development practitioners, and farmers striving to enhance food security in the face of climate change (FAO, 2017).

1.1. Research context

Climate change has affected agricultural systems, with smallholder farmers in sub-Saharan Africa (SSA) facing worsened risks because they rely on rain-fed farming (IPCC, 2021). Zambia has experienced inconsistent rainfall, extended dry spells, and rising temperatures which threaten the country's agricultural economy. Smallholder farmers, who contribute significantly to national food security have continued to face challenges in maintaining productivity due to reduced soil quality, increased pest invasions, and changing market conditions (Ngoma *et al*., 2020). The seriousness of these climate-induced stressors varies across Zambia's agro-ecological regions, compelling local adaptation strategies to sustain agricultural livelihoods (Mulenga *et al*., 2021).

2. LITERATURE REVIEW

Study background and Community coping strategies

Climate change threatens food security world over, especially in sub-Saharan Africa, where agriculture is the main source of livelihood for many rural households. The increasingly extreme weather events, including sustained droughts, erratic rainfall, and rising temperatures, has made agricultural production more difficult (IPCC, 2021). Smallholder farmers are among the most vulnerable to climatic changes, as they do not have money to buy irrigation systems, use other modern farming methods, and purchase seeds and inputs that are drought-resistant (FAO, 2020). It is estimated that climate change will reduce crop productivity around the world by up to 25% by 2050, with the most severe impacts expected to affect sub-Saharan Africa (FAO, 2017).

Zambia's agricultural sector is key in ensuring food security, employment, and economic stability. More than 70% of the population consists of smallholder farmers who produce most of the country's staple food, particularly maize (Mulenga, 2021). Despite this, the sector is extremely susceptible to climate change due to its reliance on rainfall which is seasonal. Intermittent rainfall patterns, rising temperatures, and increased prevalences of droughts and floods have also contributed to reductions in agricultural productivity and this has affected food security at both household and national levels (Ngoma *et al*., 2020).

Zambia's agro-ecological zones are experiencing changes in rainfall patterns, with some regions such as Kapiri Mposhi particularly Kashitu ward receiving less than the average annual rainfall, while others are experiencing excessive rainfall that leads to soil erosion and loss of soil fertility (Chabala, 2021). It has been reported that between 1980 and 2020, the Zambia experienced a steady increase in temperature, averaging 1.3°C, which affected crop growth and productivity (ZMD, 2021). These climatic changes have resulted into reduced crop productivity in terms of the number of bags or metric tonnes produced, food shortages, and more reliance on importing of stuff worsening poverty, and malnutrition especially in rural areas (Nyanga *et al*., 2022).

2.1. Community coping strategies

To cope with these challenges, farmers in Africa have adopted diverse kinds of climate resilience strategies, including conservation agriculture—promoting insignificant soil disturbance, crop rotation, and permanent soil cover which has gained power and is being adopted by many farmers across the continent (Lipper *et al*., 2018). Additionally, planting of trees alongside crops is being widely used, where trees are integrated into farming systems to improve soil fertility and moisture retention (Chabala *et al*., 2021). Water harvesting techniques, such as constructing small dams for water storage and use of irrigation systems, have also been critical in easing the effects of erratic rainfall (Ngoma *et al*., 2020). Indigenous knowledge plays a key role in climate adaptation, with many communities relying on traditional weather forecasting and drought-resistant crop varieties in the absence of weather forecasts (ibid).

In mitigating the negative effects of climate change, smallholder farmers in Zambia have also adopted various climate-resilience strategies. For instance, they have adopted conservation agriculture, which includes minimum cultivation, crop rotation, and maintaining crop residues. This method has been promoted as a sustainable farming method to improve soil health and water preservation (Lipper *et al.*, 2018). Additionally, farmers have ventured into crop diversification through growing drought-resistant crops such as cassava, millet and sorghum. This has become a common adaptation strategy among farmers to maintain soil health and to try different crops where one fails because of climate changes (Phiri *et al.*, 2019).

In Kashitu, farmers have infused multiple adaptation strategies which include agroforestry, rainwater harvesting, and the use of organic fertilizers, to improve food security (Chomba *et al.*, 2021). Agroforestry, which involves planting trees alongside crops, has been particularly effective in improving soil fertility and reducing soil erosion and when used effectively farmers have reduced the use of chemical fertilizers thereby contributing to healthy soils (Chabala *et al.*, 2021). Despite such efforts, challenges such as limited access to agricultural extension services, inadequate financial support, and poor infrastructure continue to hinder the widespread adoption of climate adaptation practices (Ngoma *et al.*, 2020). The Kashitu community further uses a wide a range of climate adaptation strategies to mitigate the impacts of increasing climate variability. These strategies incorporate traditional knowledge with modern agricultural techniques to improve resilience and food security.

In diversifying Farming Practices, farmers adopt varying methods such as mixed cropping and intercropping with drought-resistant crops such as cassava, millet, and sorghum alongside maize. This approach minimizes losses during unpredictable rainfall seasons and ensures that they have nutritious food to feed their famillies (Ngoma *et al.*, 2020).

Agroforestry – The integration of Gliricidia and Faidherbia albida into farming methods has improved soil fertility, enhances moisture retention, and provides shade, strengthening resilience to climate stressors and reduces the use of chemical fertilizers which overtime affects the health and fertility of the soil (Chomba *et al.*, 2021). It further prevents soil erosion.

Rainwater Harvesting – Households apply rainwater collection systems, including rooftop harvesting and small reservoirs, ensuring water is available for irrigation during dry spells (ZARI, 2019).

Conservation Agriculture – Practices such as minimum ploughing, crop rotation, and remainder retention help maintain soil structure, enhance moisture preservation, and improve overall soil health (FAO, 2020).

Use of Organic Fertilizers – Given limited access to synthetic fertilizers, farmers increasingly utilize compost and manure, which enrich soil nutrients and boost water retention (Ngoma *et al.*, 2020).

Seed Banks and Local Seed Saving – Small-scale community seed banks facilitate the conservation and replacement of drought-resistant and locally modified seed variations, ensuring seed availability even under changing climatic conditions (Phiri *et al.*, 2019).

Livestock Diversification – Households diversify income sources by venturing into other means of supporting tier families like raising small livestock such as chickens and goats, which require fewer resources and are able to withstand harsh climatic conditions as opposed to cattle (Chomba *et al.*, 2021).

Community Savings and Loan Groups – Participation in village savings and loan associations (VSLAs) enhances financial resilience and enables them to invest in buying improved seeds, farming tools, and climate adaptation strategies (ZARI, 2019).

Training and Awareness Programs – NGOs as a way of complimenting government initiatives provide training on climate-smart agriculture and resource management, nurturing the adoption of sustainable farming techniques (FAO, 2020).

Seasonal Migration for Labor – During poor harvest seasons, some households move to urban and mining areas for basic jobs, securing supplementary income for food and farming investments (Phiri *et al.*, 2019).

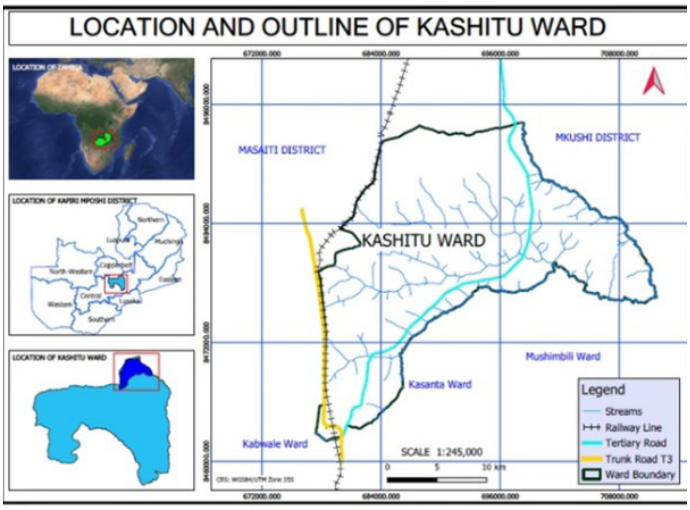

Figure 1. Map of Study Area

3. METHODOLOGY

This study employed a mixed-method approach to comprehensively assess climate resilience strategies in Kashitu. A descriptive research design was used for quantitative data collection, while a case study approach provided in-depth qualitative insights. The study focused on Kashitu Ward in Kapiri Mposhi District, with a sample of 75 respondents, comprising 70 farmers, 4 village headmen/women, and 1 agricultural extension officer, selected through systematic and purposive sampling.

Data collection involved structured questionnaires for quantitative data and in-depth interviews for qualitative perspectives. Descriptive statistics were used to analyse quantitative data, while thematic analysis identified key patterns and insights from qualitative responses. This methodological triangulation ensured a robust understanding of climate resilience practices in the study area.

4. RESULTS AND DISCUSSION

4.1. Demographic Characteristics of Respondents

This section shows descriptive statistics of small-scale farmers and key informants who responded to the quantitative

questionnaire and interviews, respectively. The demographic characteristics include values such as gender, age of respondent, educational level, and farming experience. The results derived from the research are explained using figures and tables. This research captured 75 respondents using systematic random sampling which was used to interview the small-scale farmers in Kashitu. The list of small-scale farmers from two villages in Kashitu was collected from the agriculture camping officer and every Kth was selected. Purposive sampling was used for the key informants. These people had in-depth knowledge of agriculture, climate resilience, and food security in Kashitu. The sample size of respondents interviewed was seventy (70) farmers from two villages (Chitakata village and Lupingu village) and 5 key informants. The key informants were referred to as Ministry of Agriculture Official 1 being the extension officer from the Kashitu Ward, Key informants 1,2,3 and 4 being the village headmen and women.

4.2. Gender of Respondents

The total number of respondents was 75 these included small-scale farmers, village headmen and women and agricultural camp officers. The gender of respondents was investigated because it provided valuable insights into how gender influences experiences, perspectives, and behaviors when it comes to climate resilience and food security. Incorporating gender analysis enriched the quality of the findings and helped in creating inclusive and impactful solutions. Furthermore, gender plays a critical role in research on food security and climate resilience in Kashitu Ward, Kapiri Mposhi, as gender dynamics have a significant impact on how people and communities experience, react, and recover from the effects of climate change.

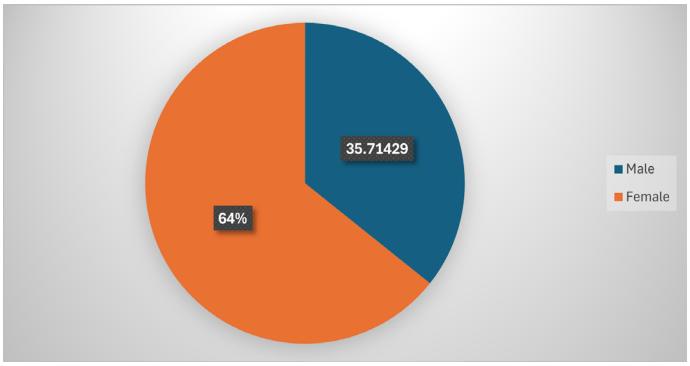

Figure 2. Gender of Respondents
Source: Field work, 2024

Figure 1 reveals that 36% of respondents were men and 64% of respondents were women. The purpose of the study was to determine which gender engaged in small-scale farming most frequently. The demographics also show how women predominate in fields like agriculture, food security, and climate resilience, which are frequently run by women in rural areas. The gender gap in societal norms or structural factors that affect participation, like males moving for jobs or having different availability to participate in the survey, are also reflected in the pie chat.

4.3. Age of Respondents

The age of respondents was investigated to determine whether age had any bearing on the ability to practice small scale farming and it provides a more comprehensive understanding of how different generations perceive, adapt to, and implement strategies in response to climate change. Furthermore, the experiences and expertise of persons of different ages are frequently divergent. For example: While older respondents might rely on conventional knowledge about farming, resource management, or coping mechanisms for climate-related difficulties, younger respondents might embrace modern or innovative approaches. This diversity enriches the research by providing a holistic understanding of the issue.

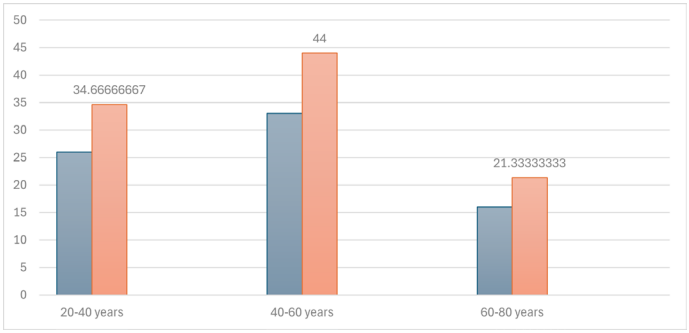

Figure 3. Age of Respondents
Source: Field work, 2024

The results as depicted by Figure 5 show that most small-scale farmers fall withing the age range of 40-60- years which is represented by 44%(n=33). Those ranging between the age range of 20-40 years represented 35% (n=26). Finally, small-scale farmers in the range of 60-80 years represented 21% (n=16). Based on the percentage distribution shown in Figure 3, many small-scale farmers are middle-aged and fall between 30-40 years old. Key informants interviewed fell in the ranges of 40-60 years and 60-80 years.

The majority of small-scale farmers (44%) are between the ages of 40 and 60. This implies that middle-aged people, who are probably at the height of their financial and physical productivity, are the main farmers in this area. Thirty-five percent (35%) of farmers are between the ages of twenty(20) and forty(40). Younger farmers are evidently present, indicating a certain degree of youth involvement in agriculture. Twenty percent (21%) of farmers are between the ages of 60 and 80. This shows that older people are still involved, maybe because of or a lack of other sources of income. The majority of the key informants questioned are between the ages of 40 and 80. This is a reflection of their wealth of knowledge or their leadership positions in the community.

4.4. Level of Education

The level of education was investigated to determine the effect of educational status on the ability to practice small-scale agriculture. Awareness of sustainable farming methods, food security tactics, and climate change can all be influenced by educational attainment. While farmers with less education might rely more on conventional methods, individuals with

more education might be better able to understand technical or scientific knowledge on climate-smart agriculture.

Table 1. Educational Level

Level of Education	Frequency	Percentage
Diploma	20	27
Degree	0	0
Masters	0	0
PHD	0	0
Secondary	33	44
Primary	5	7
None	17	23
Total	75	100

Source: Field work, 2024

Table 1 shows that out of 75 respondents the majority have attained secondary education represented by 44%(n=33). Respondents that attained education at Diploma level are represented by 27% (n=20). Those that attained primary education were represented by 7%(n=5) followed by those without any level of education represented by 23%(n=17). The results show that literacy levels among small-scale farmers in Kashitu are low. This can be deduced from the fact that twenty three percent (23%) (n=17) have no form of education.

A significant portion (27%) of respondents have obtained a diploma, indicating a higher level of technical knowledge or specialized skills, which may make them better equipped to adopt advanced farming methods, understand market dynamics, or take on leadership roles in the community or cooperatives. Only seven percent (7%) of respondents have completed primary education, indicating that a small proportion of farmers have completed basic education. Most respondents (44%) have completed secondary education, indicating that they have access to formal schooling up to high school. It is likely that this group has basic literacy and numeracy skills, which can help them comprehend and adopt new farming techniques, participate in training programs, and interact with agricultural extension services.

Further, twenty three percent (23%) of respondents have no formal schooling. When it comes to getting information about modern farming methods, food security plans, and climate resilience, this population might encounter major obstacles. They could be more dependent on conventional approaches and have trouble embracing fresh ideas or notions.

4.5. Farming experience

Farming experience was investigated to understand how long respondents have been practicing small scale agriculture and to determine years of experience. The number of years of experience has a bearing on the willingness and ability of farmers to use climate resilience strategies in their farming methods. Experienced farmers are more likely to have faced and adjusted to a variety of economic or climatic shocks, including floods, droughts, and market swings. Responses from the small-scale farmers offer insightful information on tactics that are effective in the local setting, which help to improve the design of policies and interventions.

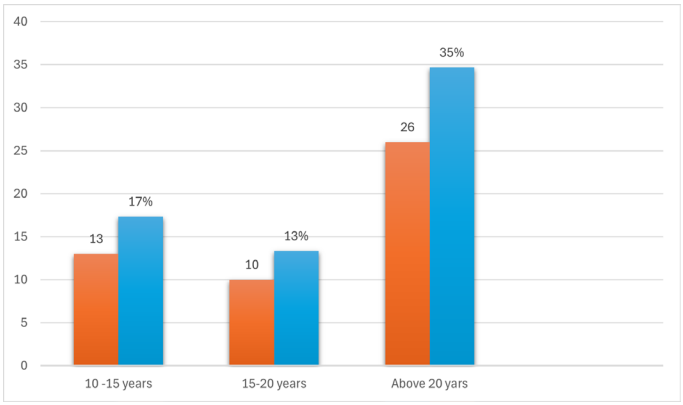

Figure 4. Farming Experience
Source: Field work, 2024

The graph in Figure 4 shows that respondents with the highest experience in farming were those with over 20 years of experience represented by 35% (n=26) followed by those having 5-10 years' experience represented by 17% (n=13) and least being those with experience between 15-20 years represented by 13% (n=10). Findings show that most small-scale farmers have been farming for quite a few years (more than 20 years).

Farmers with 0–15 Years of experience might still be experimenting with farming methods or limited by resources like inputs and market access. They may not yet fully adopt advanced practices or climate resilience strategies. Those with 15–20 Years of experience are in a transitional stage, applying lessons learned but still facing limitations due to external factors like fluctuating rainfall or access to credit. The smaller gap between orange and blue suggests a leveling off progress for some farmers. Farmers with experience above 20 Years have likely mastered traditional practices and incorporated modern techniques, making them more resilient to challenges such as climate variability. They may also have better access to farming resources, subsidies, and markets due to their established reputations or networks.

Types of Climate Change Resilience Strategies used by farmers.

To get information on climate resilience strategies used by the farmers, farmers and key informants were asked what kind of crops small-scale farmers grow and if the crops are grown all year round, the methods they use to grow the crops, how they prepare for farming periods and if they receive any form of assistance with knowledge on how to continue growing crops despite changes in rainfall patterns.

4.6. Types of Crops Grown by farmers

The study sought to investigate which specific crops are grown by the farmers in the area. The types of crops grown in the area are related to the type of soils found in the area and to the availability of drought-resistant inputs and variety of seeds based on the type of crops grown.

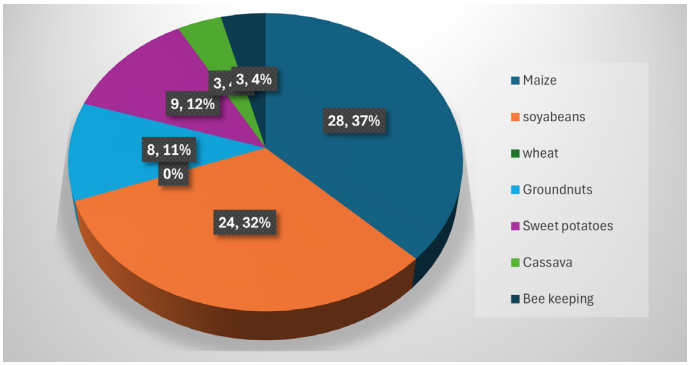

Figure 5. Crops Grown
Source: Field work, 2024

The pie chart in Figure 5 shows crops grown by respondents with the highest being Maize represented by 37% (n=28) followed by Soya beans represented by 32% (n=24), Sweet potatoes are represented by 12%(n=9) followed by groundnuts at 11% (n=8, and Cassava and bee keeping are both at 4%(n=3) and Wheat is at 0%. The results show that Maize and Soya beans respectively are the most crops grown in Kashitu by small-scale farmers. Findings also correspond with observations made that most farmers grew maize and soya beans with some farmers also venturing into bee keeping as an extended type of agriculture. The findings also corresponded with information given by the extension officer who said:

"There are four different types of soils in this ward, we have clay soils which are heavier, retain water well, and can become waterlogged during the rainy season. They tend to be fertile but require good drainage for optimal use. It is good for growing crops like rice, maize, and vegetables when irrigation and drainage systems are applied. The sandy soil is light-textured, well-draining, low in organic matter and nutrients and is suitable for growing drought-resistant crops like sorghum, millet, and cassava with proper nutrient management. The loamy soils are a mix of sand, silt, and clay, providing a balance of drainage and fertility. Loamy soils are typically more productive than sandy or clay soils alone. They are suitable for a wide range of crops, including maize, beans, and ground nuts. Finally, the lateritic soils are rich in iron and aluminum oxides, often reddish in color, and may form a hardpan when exposed to prolonged dry conditions. They are common in areas with significant weathering. Can be cultivated with proper soil management practices, including adding organic matter to improve fertility. Because of this types of crops grown by farmers include maize, soyabeans, groundnuts, cassava and sweet potatoes. There is also a lot of vegetable gardening of vegetables such as tomato, rape, pumpkin leaves and bean leaves." (Ministry of Agriculture official)

4.6.1. Preparation for Farming Periods

The study sought to find out how farmers prepared for farming seasons and what activities are undertaken during this period. The type of activities undertaken by farmers would show whether they incorporate climate resilience as they prepare for farming periods. Finding the actions farmers take to guarantee good planting and harvesting, such as: Land preparation (ploughing, clearing, or fertilizing), is made easier by looking at preparation activities such as obtaining tools, seeds, and other supplies and coordinating communal assistance or labor. This gives information on the strategies they employ and the tools they depend on.

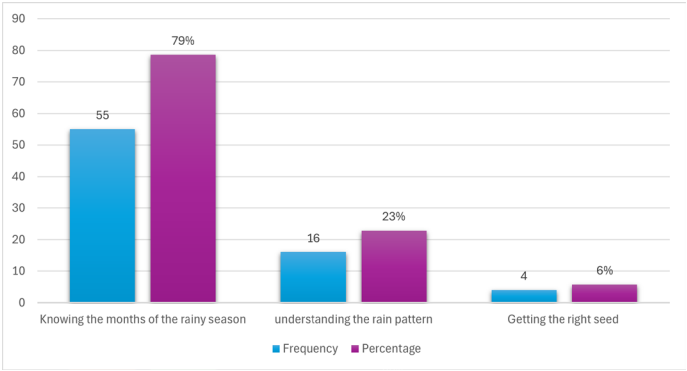

Figure 6. Preparation for Farming Seasons
Source: Field work, 2024

The graph in Figure 6 shows the preparation methods used by farmers during the farming season. The highest being knowing the months of the rainy season represented by 79%(n=55) followed by understanding the rain pattern at 23% (n=16) and the least being getting the right seed at 6% (n=4). Figure 6 shows that farmers mostly prepare for farming periods by knowing which months the rainy season begins. Farmers prepare for farming periods by getting information on which months the rain is likely to start. It was also revealed that information on which months the rains were likely to come was obtained from the weather reports given by the Metrological Department and through the radio, which is a common form of media used by farmers. When asked how farmers prepare for farming periods the extension officer and key informants had the following to say:

"To prepare for farming periods, farmers engage in various activities such as clearing vegetation, often manually, to prepare the land for planting. This involves cutting bushes or burning vegetation. Using hoes, cows to plow, they till the soil to loosen it and make it ready for planting. Based on market demand, family needs, and climatic conditions farmers decide what crops to grow with the common crops including maize, soyabeans, cassava, groundnuts, and vegetables. Crop rotation practices are sometimes adopted to maintain soil fertility and reduce pests. There is also purchase or sourcing of seeds, fertilizers, and other farming inputs. Some access government-subsidized fertilizers and seeds under programs such as the Farmer Input Support Programme (FISP). Farmers may prepare trenches or ridges to manage water flow and reduce soil erosion, especially in areas prone to heavy rains. Farmers consult agricultural extension officers for advice on improving yields, pest management, or adopting climate-smart techniques. Some farmers perform traditional ceremonies or prayers to seek blessings for a successful farming season. With unpredictable weather patterns, farmers now rely on radio broadcasts, mobile alerts, or indigenous knowledge to determine the optimal time for planting." (Ministry of Agriculture Official)

"We either purchase seeds or preserve seeds from earlier harvests. To increase crops and yields, we also purchase inputs.

We also purchase equipment for planting and ploughing, like hoes, ploughs, and machetes. "Key informant 4(56-year-old village headman)

"We save money or sometimes take loans or sell livestock or other assets to purchase inputs and meet farming expenses. "Key informant 1(54-year-old village head man)

4.6.2. Knowledge on growing Crops Despite Change in Rainfall Patterns

By investigating Knowledge on growing Crops Despite Change in Rainfall Patterns the study sought to determine if the farmers were aware or not that even with changing weather patterns, they could still grow crops. Reduced yields can result from farming cycles being disrupted by changes in rainfall patterns. Knowledge of adaptable methods puts farmers in a better position to maintain productivity and provide food security for their communities and homes.

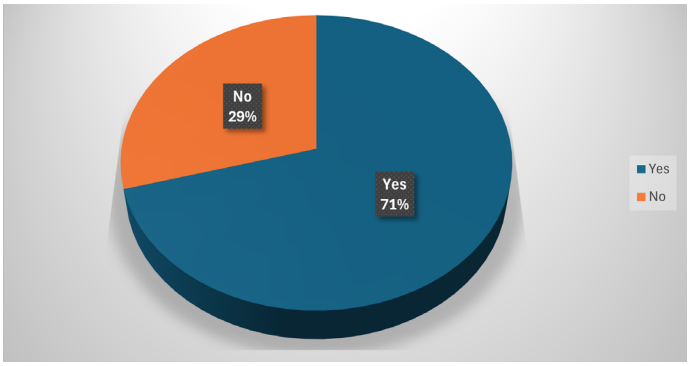

Figure 7. Knowledge on Growing Crops Despite Change in Rainfall Patterns
Source: Field work, 2024

When asked if they receive assistance in terms of knowledge on how to continue growing crops despite changes in rainfall patterns, 71% of small-scale farmers said yes while 29% said no. This means that most farmers received information on the use of climate resilience strategy to increase food security during climate change. When asked where information is obtained from, participants cited community meetings, cooperatives, the extension officer, and discussions with NGOs on climate change and how communities can adapt to climate. Regarding Knowledge on Growing Crops Despite Change in Rainfall Patterns the key informants and officials from the Ministry of Agriculture had the following to say:

"During community meetings and meetings organized by NGOs farmers are given information on climate change and how they use other strategies to continue their farming even with changes in weather patterns. There is also information on radio regarding climate change and how to grow crops that survive the extreme weather." Key informant 1 (54-year-old village head woman)

"Extension agents instruct farmers in methods such as crop diversification, irrigation, and water conservation. However, understaffing can make it difficult to access extension services in rural locations. To observe adaptive techniques in action, farmers occasionally participate in hands-on workshops on model farms. "Key informant 2 (67-year-old village headman). *"We receive weather forecasts on radio that help farmers plan planting and harvesting schedules.* "Key informant 3 (60-year-old village head woman)

"Crop rotation, covering, conservation farming, and other climate-resilient techniques are taught to farmers. Extension officers set up plots to demonstrate to farmers how to increase crop yields despite unpredictable rainfall." (Ministry of Agriculture Official)

"To reduce reliance on single crops that could fail because of rainfall fluctuation, we are encouraged to produce a range of crops." Key informant 4 (56-year-old village headman)

4.6.3. Strategies used to cope with changes in the climate

To demonstrate how farmers are addressing climate-related issues such as erratic rainfall, droughts, and floods, the study looked into coping mechanisms. Their ability to adjust and sustain agricultural productivity in the face of shifting environmental conditions is demonstrated by these tactics. Further. researchers and policymakers can encourage effective adaptation techniques that could be expanded or duplicated in other regions by identifying which approaches are effective.

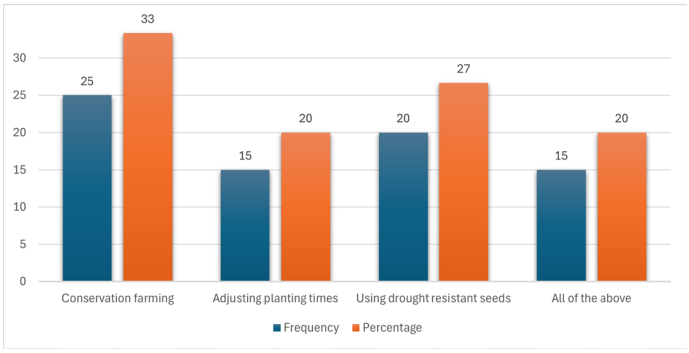

Figure 8. Strategies used to cope with changes in the climate
Source: Field work, 2024

When asked about the climate resilience strategies they have been informed about, the small-scale farmers gave responses as highlighted by figure 7, 33% (n=25) cited conservation farming while 27% (n=20) cited use of drought resistant seeds. 20% (n=15) cited adjusting planting times to changes in rainfall patterns. Finally, 20% (n=15) cited the above three strategies. The results in figure 7 show that farmers are aware of the strategies that can be used to mitigate the effects of climate change. The findings on what resilience strategies farmers have been informed about were also further confirmed by participants during interviews in the study area.

Of the 25 farmers, 33% mentioned conservation farming as a tactic they were aware of. Reduced tillage, covering, and crop rotation are examples of conservation farming techniques that are intended to increase soil fertility, retain moisture, and lessen erosion. The significant proportion of farmers who are aware of this tactic indicates that its significance in enhancing soil health over the long term and lessening the consequences of droughts and irregular rainfall is well recognized.

The use of drought-resistant seeds was mentioned by 27% of farmers (n=20). This demonstrates that a sizable segment of the farming community understands the significance of choosing

crops that are resistant to dry spells. In regions where climate change has made rainfall patterns less predictable, drought-resistant seeds are essential for sustaining crop harvests. The farmers' awareness of the necessity to modify crop choices in response to shifting environmental conditions is also reflected in this. 20% of farmers (n=15) said they had received information about changing the timing of their plantings to better correspond with changing patterns of rainfall. This tactic is especially helpful in areas where rainfall is erratic or delayed. Farmers can lessen the chance that crops will fail because of ill-timed rains by changing the dates of sowing. This demonstrates an awareness of the necessity of adjusting farming schedules to accommodate changing weather patterns.

Using drought-resistant seeds, conservation farming, and timing plantings were the three techniques that the remaining 20% of farmers (n=15) mentioned. This implies that some farmers are strengthening their resilience to climate unpredictability by combining several different approaches. By using a comprehensive strategy, they may be better equipped to lessen the effects of climate change, enhancing farm sustainability and overall food security. The Ministry of Agriculture Official and Key informants had the following to say about strategies used to cope with changes in the climate:

"Farmers receive information on the reduction of cutting down trees to contribute to preserving the environment. Also, farmers are also given information on how to take care of animals and venture into bee keeping." (Ministry of Agriculture Official)

"At least they can use these strategies, for example when the best time to plant crops is looking at shifts in rainfall patterns e.g., waiting after 20th November when the rains fall heavily and using early maturing variety seeds." Key informant 3 (60-year-old village head woman)

"When we follow the strategies given to us, we have higher yields and we can provide nutritious food for our families. For example, during the last farming season there was a lot of maize and sweet potatoes although we experienced poor harvests when it came to soya beans because of too many rains in the beginning." Key informant 2 (67-year-old village headman)

The findings further reveal that farmers are not only aware of one strategy but many strategies and this is evident from the 20% (n=15) of the respondents who cited having to know strategies such as conservation farming, use of drought resistant seeds and adjusting planting times to changes in rainfall patterns. This shows that farmers are aware of the possibility of using more than one method to adapt to climate change thereby increasing their food security.

4.6.4. Methods used to deliver information on strategies to use to grow crops

The study investigated the methods used to deliver information on strategies for growing crops during extreme weather conditions or changes in weather patterns to gain insight into the methods used to disseminate information on climate resilience strategies. Examining the dissemination of information aids in determining if farmers can easily obtain pertinent climatic and agricultural guidance. The efficiency of the information dissemination will be hampered if the techniques are inaccessible (for example, farmers in distant areas without internet or radio access).

It is critical to determine whether the techniques and resources employed are intelligible and suitable for the farming community's literacy levels and languages.

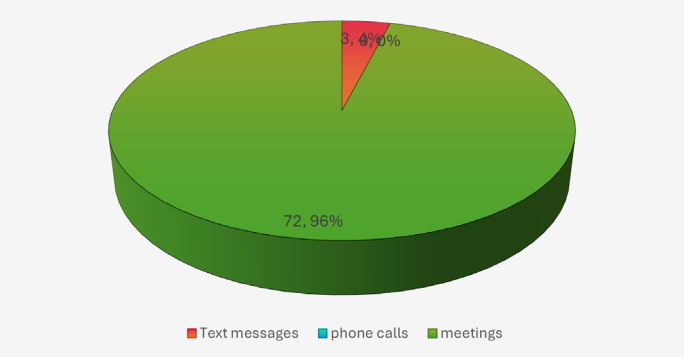

Figure 9. Methods used to deliver information on strategies to use to grow crops
Source: Field work, 2024

The pie chart in figure 8 depicts the methods used by the Ministry of Agriculture. 96%(n=72) cited in person meetings while 4%(n=3) cited text messages. The findings show that information on climate resilience strategies and adaptation is disseminated during meetings with farmers.

"The information is disseminated through group meetings and individual visits by the extension officer." Key informant 1 (54-year-old village head woman)

"Over cutting down of trees the information is not being used properly. Use of resistant seed is being used to enhance crop yields. Regarding bee keeping many small-scale farmers have started venturing into the business to help them provide basic needs (food, clothing, and shelter) for their families even in periods where they have low yields." Key informant 3 (60-year-old village head woman)

"We typically receive information about new farming techniques through community-led seminars, farmer gatherings, and village meetings." Key informant 2 (67-year-old village headman)

"As village heads, play an important role in disseminating information about agricultural strategies to our communities and we take advantage of community meetings." Key informant 4(56-year-old village headman)

It was observed that many of the respondents did not have phones and this could be attributed to the study area being a rural area with most parts not having access to electricity and poor network connectivity. This can also be the reason behind the 3.4% (n=15) who cited receiving information through text messages. Furthermore, it can also be said that the 0% with regards to receiving phones calls to disseminate information on climate adaptation strategies can also be attributed to very few people having mobile phones. On the other hand, 96% (n=72) of respondents citing meetings to receive information is attributed to the fact that it is a way of life for information to be disseminated through meetings either at church or other community meetings because many people are in one place at the same time. It was also observed that a lot of meetings happen in the study area on different issues, for example cooperatives,

village meetings, PTC meetings, social cash transfer meetings and meetings convened by other NGOs working in the area. It is through such meetings/gatherings that information on climate resilience strategies is disseminated.

4.7. Effectiveness of Climate Coping Strategies in Kashitu

The findings of this study highlight that small scale farmers have the ability to adapt by using various methods in response to climate variability. Despite the effects of climate change farmers have adopted various climate resilience strategies, including conservation agriculture, agroforestry, rainwater harvesting, and crop diversification. In so doing the efforts by small scale farmers align with broader climate adaptation efforts seen in sub-Saharan Africa as well as national efforts, where smallholder farmers practice agriculture with the use of traditional knowledge with modern agricultural techniques to improve productivity amid changes in climatic conditions (FAO, 2020).

4.8. Conservation Agriculture: A Promising but Limited Strategy

The study highlights conservation farming as one of the widely used strategies by farmers in Kashitu to cope. It revealed that 33% of respondents practice minimum digging, growing a variety of crops, and covering to improve soil fertility and moisture retention. These methods have proven to improve soil fertility and water retention (Chomba *et al.*, 2021). It was noted from the study also that the adoption of these methods is not being used often because farmers do not have the resources to implement these methods because they require an investment in labor and technical know-how. Ngoma (2020) reports that farmers in other rural communities in Zambia face similar challenges when transitioning from conventional farming methods to reduced over-digging because of not having the right equipment and lack of financial support.

4.8.1. Agroforestry: Enhancing Soil Fertility and Microclimate Control

Another commonly used adaptation measure in Kashitu is planting crops alongside trees such as Gliricidia septum and Faidherbia albida which promote soil fertility, give shade and act as wind breakers, reduce damage from extreme temperatures and improve moisture retention.(Nyanga *et al.*, 2022).Despite these benefits, the study highlights barriers to adoption of this method by many small scale farmers because of challenges such as land tenure insecurity and resistance to such methods by farmers due to them not wanting to move to newer ways of doing things because they do not want to abandon traditional methods of farming. This challenge is coherent with findings in other Zambian studies, where uncertain land rights discourage farmers from venturing into in climate-smart agriculture (Mulenga *et al.*, 2021).

4.8.2. Crop Diversification: Strengthening Food Security through Drought-Resistant Crops

The study found that 27% of respondents have shifted from maize dependency to cultivating drought-tolerant crops, such as cassava, millet, and sorghum. Adopting this approach reduces risks improves household food security even when there is erratic rainfall or even periods of droughts (FAO, 2020). The uptake of crop diversification is slow because farmers do not have the resources to buy drought resistant seed varieties and also they have limited access to markets. Many farmers in Kashitu still prioritize maize due to higher market demand and government support through subsidies, despite its vulnerability to drought (Soko *et al.*, 2025; ZARI, 2019).Finding align with broader policy discussions in Zambia, where the heavily subsidized maize sector discourages mall scale farmers to diversify into growing other crops because they are more expensive to buy as opposed to maize (Phiri *et al.*, 2019).

4.8.3. Rainwater Harvesting: Addressing Water Scarcity but Facing Infrastructure Gaps

Rainwater harvesting has been partially adopted, where some households use simple collection rooftop harvesting and have built small reservoirs to collect water. Crop survival rates have improved because this method increases the availability of water for irrigation of crops as well as gardens where farmers grow vegetables. However, the study identified poor infrastructure and financial limitations as key challenges inhibiting farmers from fully venturing into water harvesting (Chabala *et al.*, 2021).

Limited government investment in irrigation infrastructure has further increased these challenges. Zambia, despite its abundant water bodies, records one of the lowest irrigation adoption rates in sub-Saharan Africa, with only 6% of its arable land under irrigation (FAO, 2020). The findings from Kashitu reflect this is not just being faced in the ward but it is being faced in many communities nationwide.

4.8.4. Community-Based Financial Strategies: Enhancing Economic Resilience

The study found that community savings and loan groups play an important role in sourcing funds to help them implement measures toward climate adaptation. Farmers use these financial networks to pool resources, access credit, and invest in drought-resistant inputs including seed varieties. These findings align with global evidence showing that providing financial support to farmers significantly enhances climate resilience among smallholder farmers (Lipper *et al.*, 2018).

However, limited formal credit access and high interest rates from financial institutions continue to discourage small scale farmers from venturing into climate smart agriculture. Many farmers in Kashitu rely on informal savings groups due to the strict surety requirements imposed by commercial banks as well as financial lending institutions (Mulenga *et al.*, 2021).

5. CONCLUSION

The climate resilience strategies employed by small-scale farmers in Kashitu demonstrate their adaptability and innovation in coping with climate variability. While traditional methods remain valuable, integrating modern practices and enhancing support systems through policy interventions and financial assistance is essential.

1. Government Support: Introduce input support programs if they are not there and strengthen already existing initiatives to

support farmers in using climate resilience strategies.

2. Financial Assistance: Accessible schemes with realistic collateral agreements should be developed by financial institutions to allow more small-scale farmers to access loans for inputs.

3. Infrastructure Development: Improve rural road networks to improve access to markets for farmers.

4. Capacity Building: Conduct training programs on climate-smart agriculture and traditional knowledge and how farmers can combine both methods to cope with climate variation.

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