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Farmer's Crop Choices in Urban Farming Under Climate Change Scenarios: A Case of Kinondoni District, Tanzania

***Asnath Alberto Malekela**
ORCiD: https://orcid.org/0000-0001-8795-1519
Department of Geography and History, Mwalimu Nyerere Memorial Academy, Tanzania
Email: asnath.malekela@mnma.ac.tz

Luzabeth Kitali
ORCiD: https://orcid.org/0009-0000-7723-0021
Department of Geography and History, Mwalimu Nyerere Memorial Academy, Tanzania
Email: luzabeth.kitali@mnma.ac.tz

***Corresponding Author:** asnath.malekela@mnma.ac.tz

Abstract
This study investigates factors for crop choices in urban farming. For many years, agriculture was seen as a rural activity but with the increased population in cities, urban farming has become essential for enhanced food security. Farmers have been growing various types of crops, depending on environmental, economic and social factors. The study was conducted in Kinondoni District in Dar es Salaam City. A total of 136 crop farmers formed the study unit. Further, the study used the meteorological data for the past 30 years (1993-2023) collected from Tanzania Meteorological Authority (TMA). Data was meant to provide climate narratives of the study area. The primary data was analyzed descriptively using the Statistical Package for Social Sciences (SPSS). The study found that farmers in the study area selected various crops due to climatic factors, crop yields, prior experience with the crop, supervision of the crop, susceptibility of the crop to pests and diseases, quality of the soil, time taken of the crop to its maturity and marketability of the crop. The study recommends that urban policies and regulations should effectively incorporate urban farming as part of the urban planning. Besides, adoption of improved farming techniques is essential for enhanced resilience of urban farming.

Keywords: Urban agriculture; food security; climate change; crop choices.

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Introduction

In most of the developing countries, agriculture plays a vital role towards economic development and food security. The economy of Africa depends on the agricultural sector, which accounts for 70% of total employment, 40% of exports and 33% of the Gross Domestic Product (GDP) (Greig, 2009; Dagos 2019; Mengstu et al., 2021; Malekela et al., 2024). Farmers can engage in producing various crops of their choice, depending on various reasons. The household's farmland uses and crop choices have a direct impact on output profit, encouraging the protection of the farmland quality, safeguarding the ecological environment, development and utilization of resources in different areas and instigating sustainable development (Wauters & Mathijs, 2014; Wang et al., 2017). Majority of the rural and urban communities engage in farming activities for the purpose of ensuring food security at their households; however, with the current climate uncertainties, farmers are diversifying their crop types as a means of

sustaining their production (Zhang et al., 2016; Paul et al., 2017).

Food production processes of rural households are currently the main spotlight areas of various studies. However, the impact of climate change has lowered production outputs, leading to food insecurity to most communities, especially in developing countries (Li et al., 2025; Wakweya 2025). In most times, urban dwellers depend on food produced in rural areas, but due to climate uncertainties and population increase, urban farming has become one of the important activities that contribute to food security. It has been projected that by the year 2050 about 68% of the world population will be living in urban areas (United Nations, 2018). This calls for increased food production, including urban farming to feed the urban population.

For many years, agriculture was seen as a rural activity but recently, the activity is undertaken in both urban and rural areas. Urban agriculture has been an important element of cities in many developing countries and has gained increasing attention in developed countries due to the rising concerns about food security (Toromade et al., 2024; Gunapala et al., 2025). Urban agriculture encompasses a variety of agricultural practices within or in close proximity to urban areas, including rooftop gardening, community gardens and aquaponics (Al-Kodmany 2018). The practice involves cultivation, processing and distribution of food as well as the raising of livestock and poultry within urban settings (Pfeiffer et al., 2014).

Various studies have documented the driving factors of household production activity in rural areas, including regional advantages and the natural conditions of the farmland, such as soil conditions, water resources and irrigation conditions. On the other hand, the characteristics and resources of the rural household, including farmers' ages, household types, the family dependency ratio, the structure of labor force, the agricultural income ratio and the characteristics of the market economy influence crop production decisions (Ravnborg et al., 2001; Henderson et al., 2017).

The practice of urban farming differs from that of rural areas due to differences in land sizes and the types of crops grown (Muchelo et al., 2024; Yesuf et al., 2025). Various studies on urban agriculture have, in most cases, focused on its contribution to food security (Toromade et al., 2024; Giyarsih et al., 2024; Gunapala et al., 2025; Mead et al., 2024). However, very little is known about the driving factors for the choice of crops to be grown in various areas of urban settings. Some studies focused on factors that influence decision making and the types of farming practiced (Greig, 2009; Sashika et al., 2024; Adams et al., 2024). These factors can be grouped into physical, economic and personal views of the farmers, crop profiles and availability of resources. Various physical factors, such as soil quality, the relief of the land and the availability of water influence agricultural decision making (Ryder, 2003; Le et al 2024). In addition, financial influences are fundamental towards crop selection. Furthermore, crop profiles, including resistance to pests and growth cycles /maturity dates, are among the potential factors for crop choice. Some crops have exacting pests, diseases or fertility requirements that make the production of the crop difficult or too risky for the farmer (Mihrete & Mihretu, 2025; Kumar et al., 2025). Within these factors, lack of consensus is apparent regarding the importance of factors which influence crop choice specifically in urban areas, whose competition for agricultural land is higher due to the population increase. In addition, changes in climatic condition have great influence on crop choices among farmers. Therefore, this study intended to investigate the social, economic and environmental factors that influence crop choices among urban farmers.

Methodology

Study Area

This study was conducted in Kinondoni Municipal Council, Dar es Salaam Region, Tanzania. Kinondoni is one of the five municipals within the Dar es Salaam region. The Municipality is bordered by the Indian Ocean to the Northeast, Ilala District to the South and Ubungo District to the North. Kinondoni Municipality experiences a modified type of equatorial climate. It is generally hot and humid throughout the year, with an average temperature of 29^0C. The hottest season is from October to March while it is relatively cool between May and August with temperatures around 25^0C. There are two rainy seasons: - short rain from October to December and long rain season between

March and May. The average annual rainfall is 1300mm. The Municipality has a total area of 269.5 square Kilometers. According to the 2022 population Census, the Municipality had the population of 982,328. This area was selected since it is one of the districts in Dar es Salaam region which engage highly in agricultural production of various crops. Thus, the area was suitable for the need of investigating the reasons for selection of certain crop types even though the area is suitable for several crop types.

Design

The study used both quantitative and qualitative research approaches, which complemented each other in providing information on crop production in the study areas. A case study design was used whereby one District among the five Districts of Dar es Salaam region was selected for the study.

Population and Sampling

Kinondoni District had a total of 20 wards. Out of them, two wards, which constituted 10%, were selected for this study, namely Mabwepande and Mbweni. From the two selected wards, a total of five sub wards were selected, including Maputo, Mpiji (Mbweni Ward), Mabwepande, Bunju B and Mji Mpya (Mabwepande Ward). From these five selected sub wards, a total of 136 farmers formed the study sample size.

Instruments

Secondary data was collected from relevant written sources while primary data was collected using survey and participatory rural appraisal (PRA). Specifically, focus group discussions (FGDs) and direct observation were used. Different facets of human activities were observed using a checklist for direct observation. This tool was good at capturing data on social and economic status in the study area. Additionally, climate data of Kinondoni district for a period of 30 years (1992-2023) was obtained from the Tanzania Meteorological Authority (TMA)

Data Analysis

The collected data was analyzed using various methods. Quantitative data from the questionnaire was analyzed descriptively, using the IBM SPSS Statistics. Qualitative data collected through focus group discussions, observations and in-depth interviews was examined and presented in summary form. Climatic data from TMA was analyzed using the Microsoft Office Excel to present patterns and trends of rainfall and temperature in the form of graphs.

Ethical Considerations

The study sought authorization from the Regional and District authorities for data collection in their areas. Respondents gave informed consent about their participation in the study and confidentiality was assured.

Results and Discussion

This section provides the results and discussions, based on the research questions as described hereunder.

Research question 1: What is the education level and livelihood activities undertaken in Kinondoni District?

In response to livelihood activities, Table 1 indicates that 67.3% of the respondents with primary education involved in crop farming as their main livelihood activity while those with tertiary education had formal employment.

Table 1: **Livelihood Activities and Level of Education**

Education Level	Livelihood Activities				
	Casual Labor	Crop Farming	Formal Employment	Small Business	Others
No formal education	1(4.8%)	12(57.1%)	0(0.0%)	8(38.1%)	0(0.0%)
Primary Education	3 (3.1%)	66(67.3%)	1(1.0%)	26(26.5%)	2(2.0%)
Secondary Education	1(6.7%)	12(80.0%)	0(0.0%)	2(13.3%)	0(0.0%)
Tertiary Education	1(50.0%)	0(0.0%)	1(50.0%)	0(0.0%)	0(0.0%)

In addition, 57.1% of the residents with non-formal education reported engaged in crop farming. It is important to note that in urban areas, households engage in various activities for raising their income and thus enhancing their lives. In the study area, respondents reported engaging in various activities even though crop farming was their main livelihood

activity. Another notable activity reported was formal employment (50%), specifically for those who had tertiary education.

Furthermore, 26.5% of the respondents with primary education reported to engage in petty business as one of their livelihood activities. The indicated responses depict that majority of urban dwellers, especially those with no formal employment, engage in non-formal activities including crop farming. It is also notable that involvement in certain activities in urban areas is determined by the level of education. Based on the observed findings, it is evident that crop farming in urban areas is part of urban fabric and thus should not be ignored since it is one of the main livelihood activities for some urban citizens. This experience is in harmony with the political economy theory, which values the practice of urban farming, given its contribution to the urban residents. The theory was rooted from the ideas of Adam Smith, which was latter advanced by Alfred Marshall and William Stamley Jevons during the 18th century. In viewing urban farming through the lens of political economy theory, the sector is critical to economic development of the urban households in ensuring availability and accessibility food (Grattan, 2000). In addition, some scholars have acknowledged urban farming to be of vital importance to urban residents (Wiśniewska et al 2023; Yang & Yag 2024; Yuniarsih et al., 2024, Malekela and Nyomora 2018).

Research Question 2: What type of crops are grown in Kinondoni District?

Urban farming involves cultivation in small pieces of land, where various crops are grown. Figure 1 indicates the dominant crops in the study areas, including maize (31%), vegetables (29%) and cassava (25%). The dominance of these crops can be attributed to the location of the study areas. In most cases, areas located a bit far from the city center (peri-urban zones) are not highly occupied compared to city centers, thereby allowing farmers to cultivate crops, such as cassava and maize. With increased urban population, open spaces for urban agriculture are becoming scarce (Bonye et al., 2021; Panotra et al., 2024. The reported unprecedented growth denotes uncertainties in urban farming unless innovative farming practices are initiated. In response, in most of the populated parts of cities, vegetables can be farmed in small spaces.

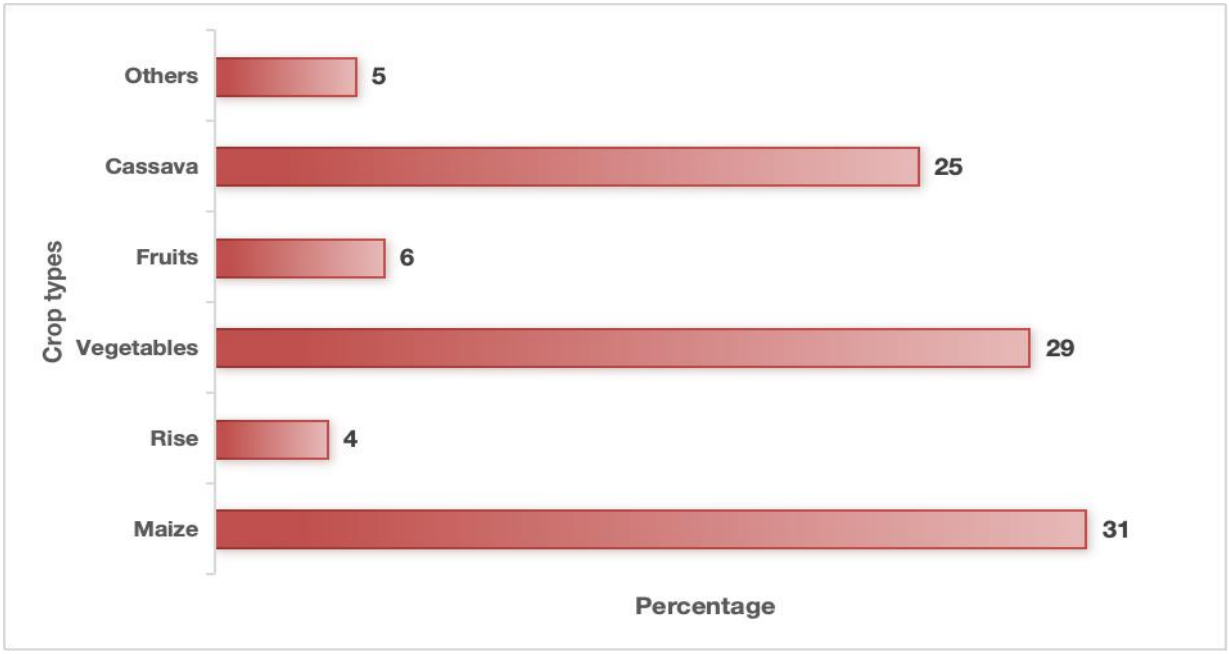

Figure 1: Crop types Farmed in the Study Area

Research question 3: What are factors for crop choices in Kinondoni District?

In urban areas, various crop types are grown, depending on various factors perceived by the farmers. It is worth noting that, in most urban settings, not all crop categories can be grown. In this regard, Table 2 indicates factors that influenced farmers to choose certain crops to be grown in the study area. The factors listed include climatic factors, crop yields, prior

experience with the crop, supervision of the crop, susceptibility of the crop to pests and diseases, quality of the soil, time taken of the crop to its maturity and marketability of the crop. The amount of expected crop yields was reported to be one of factors for crop choice, whereby farmers opted to those crops which could bear large amount of yields and thus raise their profit. The choice of crops to be grown in a certain area can be determined by various factors, which can be financial factors, geographical factors and personal factors. There is a need to consider the dynamic interactions between farmers and the socio-economic and biophysical environment in which they are operating (Kremmydas et al., 2018; Le et al., 2024). Various studies have reported that crops that bear higher yields are likely to be more selected by farmers than those crops with lower yields (Comoé and Siegrist, 2015; Le et al., 2024).

Table 2: Crop types and factors for crop choice

Crops Farmed	Factors for crop choice								
	Climatic factor	Crops yields	Prior experience with the crop	Supervision of the crop	Susceptibility of the crop to pests and diseases	Quality of the soil	Time taken to crop maturity	other	Marketability of the crop
Maize	38	32	43	16	3	22	14	17	32
	33.0%	27.8%	37.4%	13.9%	2.6%	19.1%	12.2%	14.8%	27.8%
Rice	14	1	1	2	0	5	0	0	2
	93.3%	6.7%	6.7%	13.3%	0.0%	33.3%	0.0%	0.0%	13.3%
Vegetables	31	29	48	10	6	15	16	18	31
	29.0%	27.1%	44.9%	9.3%	5.6%	14.0%	15.0%	16.8%	29.0%
Fruits	10	7	9	2	1	6	6	0	10
	47.6%	33.3%	42.9%	9.5%	4.8%	28.6%	28.6%	0.0%	47.6%
Cassava	26	29	37	17	6	16	12	16	23
	27.4%	30.5%	38.9%	17.9%	6.3%	16.8%	12.6%	16.8%	24.2%
Others	7	5	8	1	0	0	3	2	4
	35.0%	25.0%	40.0%	5.0%	0.0%	0.0%	15.0%	10.0%	20.0%
Total	44	39	50	18	6	22	16	22	36

***Percentages go beyond 100 due to multiple responses**

Furthermore, some respondents reported to involve in farming certain crops due to their prior experiences with the crop. This was highly reported by those who engaged in farming vegetables (44.9%), Fruits (42.9) and maize (37.7%) as seen in Table 2. Some farmers have been farming similar crops over the years; this has negative implications for food security since the environment undergo various changes and that sometimes soil gets exhausted and can no longer support certain crops (Garibaldi et al., 2017; Kau et al., 2024). Based on this observation there is need for encouraging farmers to diversify crops for enhanced crop yields.

Furthermore, Table 2 indicates that, among other factors, climate change was reported to be one of the pressing factors towards crop choice. Climate change is one of the most pressing challenges facing the world today. The agricultural sector has been highly affected because the activity depends on rainfall, whose trends keep changing and important rivers for irrigation are drying up (Dahiya, 2023, Malekela et al., 2025). In the study area, respondents mentioned climate as one among the factors that affect the choice of certain crops. For instance, crops such as maize and rice need a considerable range of rainfall and temperature. Respondents reported to experience changes in rainfall and temperature, which have affected crop production and thus sometimes farmers opt for crops such crops as cassava, which can grow even when there is little rainfall. The

reported information on the changes of climate formed a substantial baseline in comparing with meteorological data. Studies done in Cote d'Ivoire revealed that climate conditions influenced crop choice (Comoé & Siegrist, 2015).

In corroborating with responses given by the farmers on climate uncertainties as one of the factors for crop choice, the study used 30 years (1993-2023) meteorological data for adequate credibility. The data show that the area experiences variations in temperature and rainfall for the period between 1993 and 2023. The data exposed a successive inconsistency of temperatures, whereby in 1993 the minimum average temperature was 21.0°C; this changed to 23.3°C in 2023. Likewise, the average maximum temperature changed from 30.5°C in 1993 to 31.4°C 2023 as shown in Figure 2.

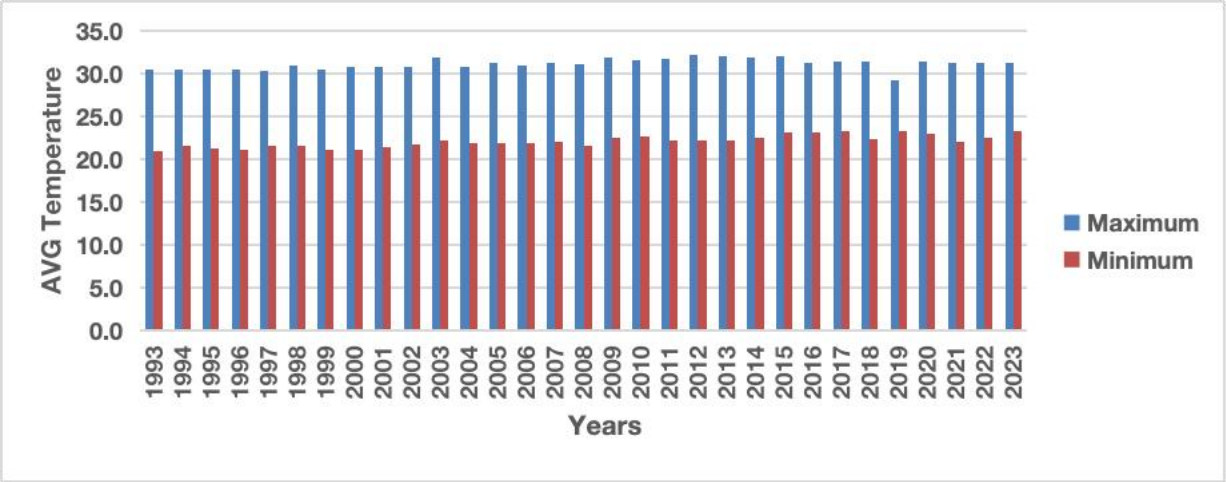

Figure 2: Minimum and maximum temperature in the study area from 1993-2023.

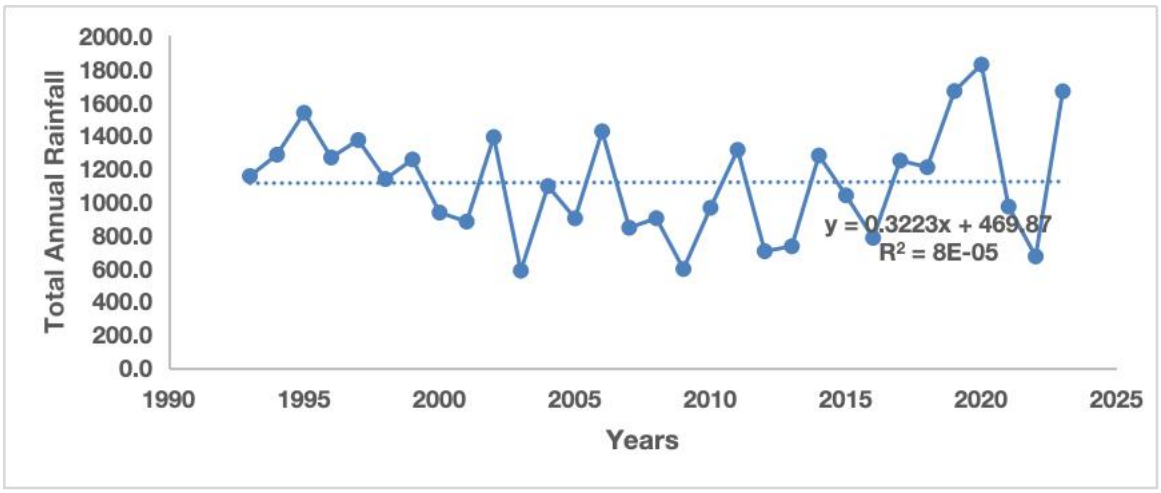

Figure 3: Total annual Rainfall in the Study Area from 1993-2023

Figure 3 demonstrates a frequent variation in rainfall over the past 30 years (1993-2023). The area experienced changes in rainfall over the years. Some years received considerable higher rainfall i.e. above 1200mm, for instance, in the years such as 1996 (1266.9mm), 1997 (1376.2mm), 2002 (1390mm), 2014 (1278.9mm), 2019 (1666.9mm) and 2023 (1665.5mm) while in some years, the area received low rainfall below 700mm including 2003 (585.4mm), 2009 (595.6mm) and 2022 (671.5mm). Such variations in rainfall totals have direct impact to crop producers thereby influencing crop choice.

Moreover, variations in the onset and cessation of rainfall affected crop farmers in different locations. Respondents reported to have witnessed variations in rain seasons and thus they become unable to determine the exact time for sowing crop seeds. The climatological data over past 30 years, covering the period between 1993 and 2023 confirmed such variations. The months expected for crop growing are between November and December,

and January to February, depending on the type of crop to be grown. However, it is unfortunate that in some years, there was very little rainfall, and very high rainfall, in some years, which could not support crops growing at such seasons. For instance, in the year 2001, the recorded monthly rainfall for November was 15.5mm but in November 2023, the monthly rainfall was 557mm.

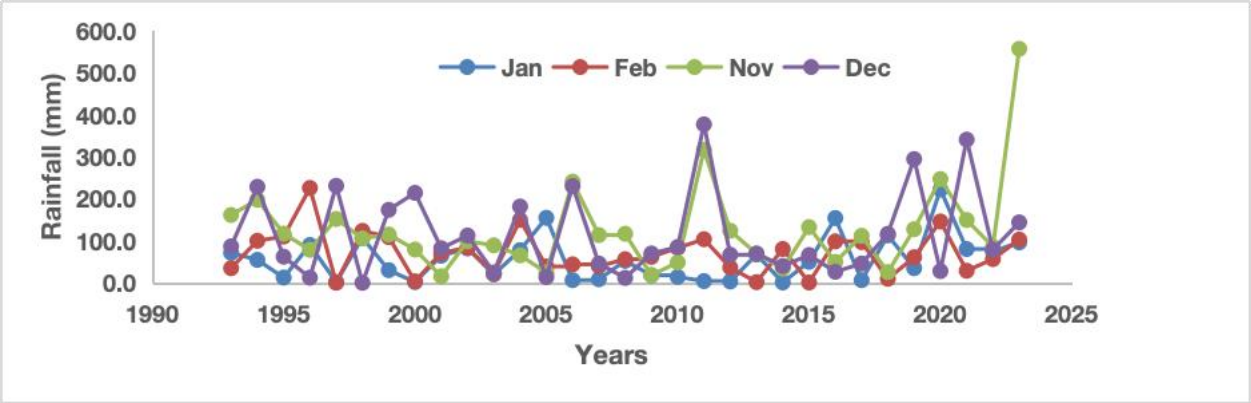

Figure 4: Monthly Rainfall between November, December, January and February (1993-2023)

Likewise, the total monthly rainfall recorded for December in 1998, 2008 and 2021 was 0.00mm, 11.7mm, and 340.9mm respectively. On the other side, the total monthly rainfall for the month of January kept fluctuating over the years, for instance in 1997, 2000, 2014 and 2020 the recorded rainfall was 1.7mm, 1.8mm, 0.9mm and 222mm. For the month of February, the area has experienced variations in rainfall as the climatological data indicates that for the years such as 1996, 1997, 2004, 2015 and 2020 the total monthly rainfall for the month of February was 225.8mm, 0.3mm, 149mm, 0.8mm and 146.1mm respectively as indicated in Figure 4. The fluctuation on monthly rainfall affects crop farming. Similar observations were also reported by Kilembe et al. (2012; Malekela et al., 2024).

Conclusion and recommendations

Urban farming is one of the main activities practiced by urban residents, especially those with primary and non-formal education. Most people in the study area depended on urban farming to sustain their livelihoods. Among the cultivated crops include maize, rice vegetables, cassava and fruits. However, vegetables dominated in the area than other crops. The dominance of vegetables among other crops is attributed to the nature and size of farms available for urban farming. The unprecedented increase of urban population has created high demand for residential land thereby diminishing the agricultural land. This has made vegetables to dominate in urban areas as it can be farmed even in small pieces of land. However, various factors influenced crop choices, including climatic factors, prior experience with the crop, susceptibility of the crop to pests and diseases, time taken for the crop to its maturity and marketability of the crop. Besides, the increased climate uncertainties and its attendant impacts triggered crop farmers to choose crops that are resilient to a certain climatic condition. Therefore, climate mitigation and adaptation initiatives need to be enhanced.

The study recommends that urban farming should be part of urban planning due to its potential contribution to food security. Urban policies and regulations should incorporate effective ways that enhance urban farming despite the increased urban population. In addition, adoption of improved farming techniques in urban areas should be considered so that the available small spaces are utilized sustainably for enhanced resilience in urban farming.

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