

The Effect Peri- Urban Farming on Food Security among Smallholder Farmers in Mbarara Municipality

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Abstract

The study determined the effect peri-urban farming on food security among smallholder farmers in Mbarara Municipality. The specific objectives included to; identify and document the different kinds of agro-enterprises owned by urban farmers; assess the extent of adaptation by farmers to the limited spaces in the peri-urban areas, assess the contribution of peri-urban agriculture towards household food demand and food security, and analyze the challenges faced by peri-urban farmers of Mbarara Municipality. A cross-sectional design using both quantitative and qualitative methods was used for data collection and analysis. Data was captured from 174 respondents using questionnaire and interviews. Data analysis was done using SPSS version 16 to generate both descriptive and inferential statistics. The crop enterprises owned by farmers in the peri-urban areas of Mbarara municipality included maize, vegetables, bananas, fruits and beans. More so livestock enterprises included poultry, cattle, pigs and goats. Farmers of Mbarara municipality used the limited land spaces by carrying out intensive crop production in backyards (compound gardens), along roadsides, tins, pots, sacks and polythene bags or renting land. They had also adjusted to space-constrained livestock systems like small piggery units, zero-grazing, tethering in home compounds, and the keeping of poultry, both in cages and free range, on verandas. Peri-urban farming had a significant role on household food demand and food security by improving food access, stability, availability, food use and utilization, access to diversified and notorious food varieties. Peri-urban farmers of the area were constrained by significant challenges like space, pests and diseases, limited access to credit, seasonality, un-availability of labour, water scarcity, shortage of feeds and pastures as well as lack of market. The study concluded that peri-urban farming had an effect on food security of smallholder farmers though still hampered by different challenges. It was recommended that farmers be trained on aspects of pests and disease control, use of household organic waste as manure, use of high yielding varieties, irrigation, and marketing aspects of commercially viable crops, particularly vegetables. This would help in doubling production which is usually constrained by different factors. In addition, improving access to credit would help farmers establish critical infrastructures such as water reservoirs and agro-inputs, which would facilitate urban farming.

Key words: Peri- Urban Farming, Food Security, Smallholder Farmers, Mbarara, Uganda.

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Introduction

The Food and Agriculture Organization of the United Nations defines peri-urban agriculture as "agriculture practices within and around cities which compete for resources (land, water, energy, labour) that could also serve other purposes to satisfy the requirements of the urban population (Cohen & Garrett, 2010).

Globally, the rapid expansion of urban populations puts direct pressure on food sources and agricultural production; thus, there still exists a serious challenge in supplying enough nutritious and safe food amongst such rapid urbanization (Lappe, 2012). Though there are some global technological and mechanical improvements in food production, hunger and malnutrition remain central issues as poverty continues to be prevalent in many cities around the world (Katongole et al., 2012).

In Africa and particularly Sub-Saharan Africa countries, peri-urban agriculture is practiced in the outskirts of many cities to support urban food systems. Peri-urban farming has shown potential for economic, political and social transformation (Baumgartner, 2013). The transformation of agriculture from a traditional rural industry to peri-urban agriculture has led to significant displays of livelihood changes. Peri-urban agriculture has been adopted as a strategy for fighting urban food insecurity and poverty among urban dwellers (Adeoti & Oladele, 2012).

In Uganda, Urban farming was born out of the political and economic crises of the 1970s and is widely practiced in the fringes of major towns today (Stewart et al., 2013). Vegetable production and livestock keeping primarily poultry, dairy cattle and pigs are the dominant components of peri-urban agriculture (PA) systems, along with the cultivation of cassava and other staple crops in peri-urban areas (Katongole et al., 2012). The peri-urban sector has deep roots into the urban food system and is practiced across low- to high-income classes, and has strong participation from women in the production arena. The sector contributes to nutritional and food security, and the vitality of the informal market, as well as helping to reduce the urban waste stream through productive reuse of organic waste as livestock feed and an input to vegetable production (Lwasa et al., 2014). Despite its important role, peri-urban agriculture is subject to many constraints, which mostly revolve around a lack of adequate space for agriculture in the peri-urban core and loss of valuable cropland to urban expansion in peri-urban areas (David et al., 2010). Other critical concerns include accessing adequate quantities of animal feed, managing animal waste, zoonotic diseases associated with urban livestock keeping, and vulnerability of crops and livestock to flooding.

Mbarara municipality, is the second largest township in Uganda with close to one million inhabitants (Lumu et al., 2013). It has shown potential for economic, political and social transformation. This has made Mbarara and its fringes an attraction for settlement for many inhabitants from other areas across the region (MAAIF, 2010). With such rapidly growing population, access to food by urban dwellers has remained a critical issue given that the largest proportion of the population depend on the market for their food needs. Sustaining household food needs and income through peri-urban production is becoming an issue of significance for residents, policymakers and administrations (Nyapendi et al., 2010). Several agricultural enterprises have been introduced and promoted to boost food security while utilizing limited spaces. However there is still little information on how farmers are using enterprises and little space to enhance food access, availability and stability in the area.

Statement of the problem

Mbarara municipality, is the second largest township in Uganda with close to one million inhabitants (Lumu et al., 2013). The municipality is one of the fastest growing towns in Uganda. This has made Mbarara and her fringes an attraction for settlement of many inhabitants from other areas across the region (MAAIF, 2010). With such rapidly growing population, access to food by urban dwellers has remained a critical issue as the growing population continues to put pressure on food demand. The question of sustaining food supply remains a critical issue of concern for urban residents, policymakers and administrations (Nyapendi et al., 2010). Peri-urban farming has been adopted as a solution to this alarming food demand because of its foreseen potential in addressing challenges related to food shortages among municipality dwellers. There still exists scanty information on how peri-urban farming affected food availability and security among smallholder farmers of Mbarara municipality.

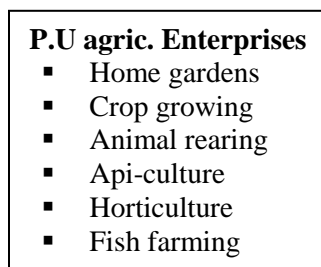
Study objectives

The overall objective of the study was to assess the effect of peri-urban farming on food and security among smallholder farmers Mbarara Municipality. The specific objectives were to; identify and document the different kinds of agro-enterprises owned by urban farmers, assess the extent of adaptation by farmers to the limited spaces in the peri-urban areas, assess the contribution of peri-urban agriculture towards household food demand and food security and analyze the challenges faced by peri-urban farmers.

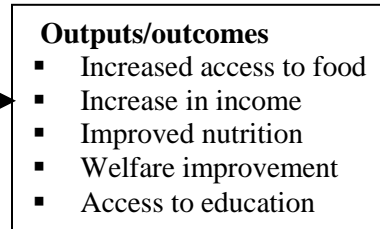
The conceptual framework

The conceptual framework based on a systems model as specified by Ludwig Von Bertalanffy (2011) which provides an analytical framework for development interventions. It was based on a three factor model shown in the diagram below: consisting of a) peri-urban agriculture intervention as the independent variable; b) the outputs and outcomes and c) the intervening variables.

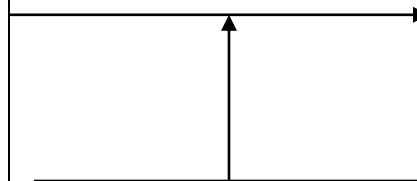
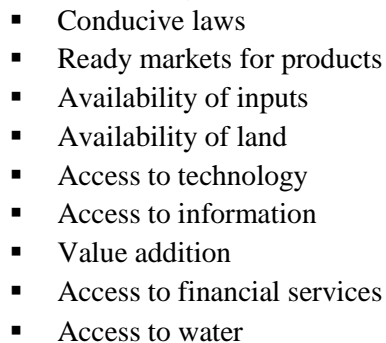
Independent variables



Dependent variables



Intervening variables



Materials and Methods

The study was conducted in Mbarara municipality Mbarara District, South Western Uganda. The area is predominantly peri-urban, with the majority of inhabitants engaged in agriculture. Agriculture is the mainstay of the area's economy and it involves growing crops and rearing of animals on average landholding of 2.5ha – 5ha. With a big population of over 195,013 people (National Population Census, 2014), most of the inhabitants practice subsistence farming to sustain livelihoods through food and income generation. This area was selected because of her potential for agricultural growth and presence of various peri-urban agriculture enterprises.

A cross sectional design that utilized both qualitative and quantitative approaches for data collection was used to collect primary data from women and men involved in peri-urban farming activities and other key informants across the municipality. Non-farmers were excluded from the study. The quantitative approach enabled exactness and clarity in the measurement of the variables while the qualitative approach enabled extensive and deeper investigation into the study issues.

A combination of proportionate stratified sampling and random sampling techniques were used to choose the households from different divisions found in Mbarara Municipality. All households involved peri-urban farming activities constituted a sampling frame. A list of farmers involved in PA was obtained from their respective parishes with the help of division leaders and used in the selection of target households. Random numbers were used to pick households from each division. Purposive sampling was used in the selection of key respondents with specific attributes.

A semi-structured questionnaire with both (both closed and open ended questions) was designed and used to collect data from farmers. The questionnaire was checked for completeness, coded and entered into SPSS version 16 software package for cleaning and analysis. Data was analyzed to generate descriptive and inferential statistics which helped in the interpretation of findings. The generated results were presented in form of statistical tables and figures.

RESULTS

According to the findings in figure 1 below, more than a half (57.5%) of the respondents were female and 42.5% male. The dominance of females compared males in study was a reflection of the agricultural sector in the area where women are small projects like Rabbit keeping and vegetable growing than men.

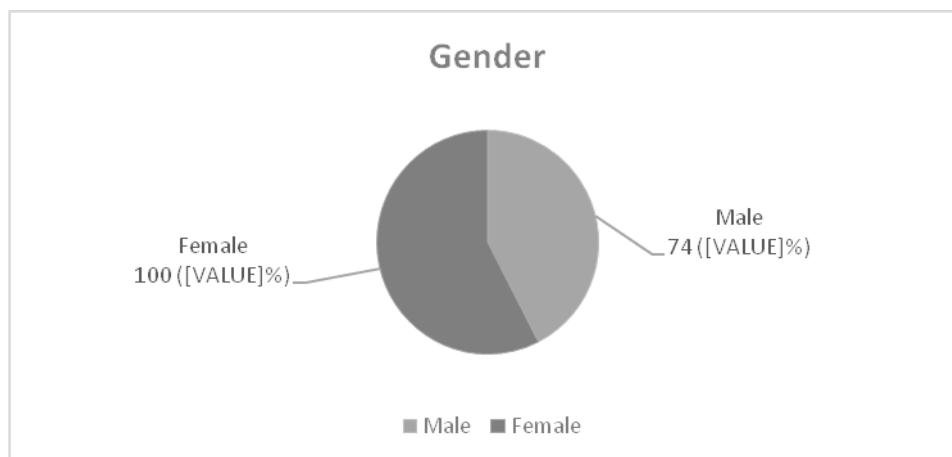


Figure 1: The gender of the respondents

Results in figure 2 below showed that more than a half (62.6%) of the respondents were married, 30.5% single, 4.6% separated and 2.3% widow.

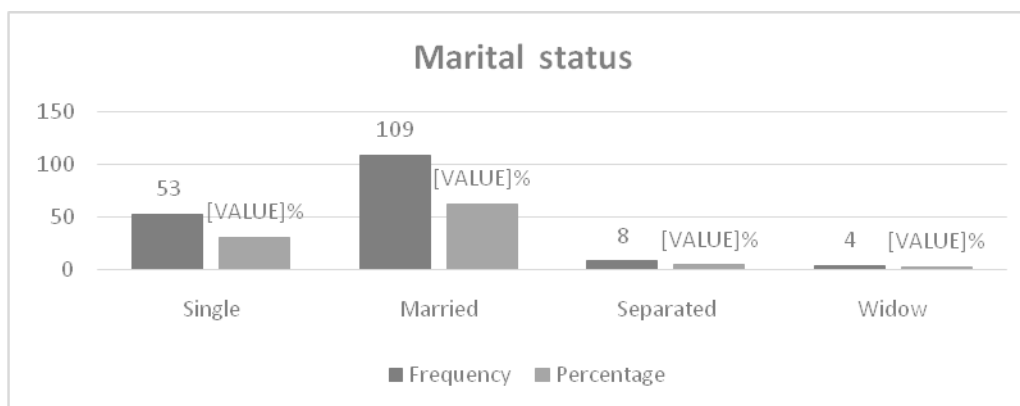


Figure 2: Distribution of respondents by marital status

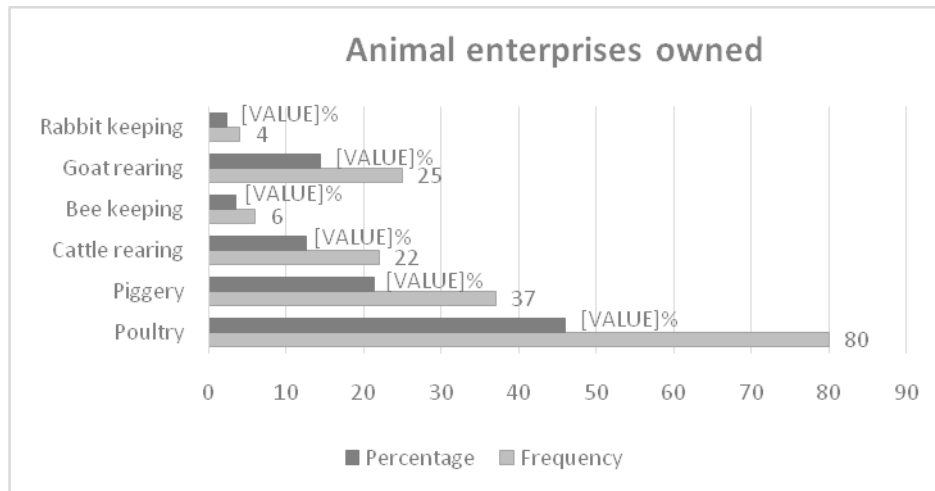
Table 1: Descriptive Statistics of age, education, household size and landholdings

	N	Minimum	Maximum	Mean	Std. Deviation
Age in years	174	18	75	37.14	14.664
Level of education in years	174	1	16	9.42	4.468
Household size	174	2	12	5.63	1.942
Land holdings in acres	174	1.0	14.0	2.184	4.5399

As shown in table 1 above, average age distribution among respondents was 37 years with and minimum age of 18 and a maximum of 75 years. Most respondents were aged 18 – 37 which is regarded as the economically active age ground to undertake agricultural production activities. Average number of years in school were 9 with a minimum of 1 and a maximum of 16. Most of the respondents had studied for between 1 – 9 years in school. An average household comprised of 5 members with the smallest made of 2 and the biggest 12 members. Average household land ownership were 2.18 acres with a minimum of an acre and a maximum of 14 acres.

Different kinds of agro-enterprises owned by urban farmers

Figure 3: Animal enterprises owned



As shown in figure 3 above, majority (46.0%) of the respondent were involved in poultry farming, 21.3% piggery, 14.4% goat rearing, 12.6% cattle rearing, 3.4% bee keeping and 2.3% rabbit keeping.

Table 2: Crop enterprises

Enterprise	Frequency	Percent
Vegetables	51	29.3
Maize	38	21.8
Irish potato	25	14.4
Fruits	19	10.9
Beans	22	12.6
Banana	13	7.5
Others	6	3.4
Total	174	100.0

Table 4.2 above, majority (29.3%) of the respondent had vegetable enterprises, 21.8% talked of maize, 14.4% Irish potato, 12.6% beans, 10.9% fruits, 7.5% banana while 3.4% talked of other enterprises.

Extent of adaptation by farmers to the limited spaces in the peri-urban areas

Table 3: Household land allocation to crop enterprises

Enterprise	N	Minimum	Maximum	Mean	Std. Dev.	Std. Error Mean
Vegetables	174	.1	3.0	.420	.6003	.0455
Maize	174	.75	6.0	.879	1.1845	.0898
Irish potato	174	.3	2.0	.143	.3759	.0285
Fruits	174	.1	5.0	.307	.7237	.0549
Beans	174	.8	3.0	.413	.6247	.0474
Banana	174	.9	6.0	1.210	1.1480	.0870

Results in table 3 above indicated that on average, a relatively bigger portion of land ($1.210 \pm .0870$) was allocated to banana enterprises, followed by maize enterprises ($.879 \pm .0898$), vegetables ($.420 \pm .0455$), beans ($.413 \pm .0474$), fruits ($.307 \pm .0549$), and smallest portion ($.143 \pm .0285$) was allocated Irish potato enterprises.

Table 4: Descriptive Statistics for household land allocation to animal enterprises

Enterprises	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error Mean
Poultry	174	.1	1.2	.476	.3433	.0260
Piggery	174	.2	1.0	.545	.2665	.0202
Cattle rearing	174	.5	9.0	1.539	1.3923	.1055
Goat rearing	174	.3	5.0	.643	.6286	.0477
Bee keeping	174	.01	.2	.014	.2494	.0215
Rabbit keeping	174	.1	.9	.307	.2783	.0211

Results in table 4 above showed that an averagely bigger portion of land was allocated to cattle rearing enterprises ($1.539 \pm .1055$), followed goat rearing ($.643 \pm .0477$), piggery farming ($.545 \pm .0202$), poultry farming ($.476 \pm .0260$), rabbiting keeping ($.307 \pm .0211$) and bee keeping ($.307 \pm .0211$).

Effect of peri-urban agriculture on household food demand and security

Table 5: Contribution of peri-urban agriculture towards household food demand and security

Contribution of peri-urban agriculture	Frequency	Percentage
Food stability	25	14.4
Timely food access	39	22.4
Food availability	44	25.3
Food use and utilization	37	21.3
Access to diversified food varieties	19	10.9
Access to notorious food varieties	10	5.7
Total	174	100.0

According to the results in table 5 above a quarter (25.3%) of the respondents revealed that peri-urban agriculture contributed to food availability, 22.4% revealed that it enhanced timely access food, 21.3% said it contributed to food use and utilization, 14.4% said it improved food stability, 10.9% cited access to diversified food varieties and 5.7% talked of access to notorious food varieties.

Challenges faced by peri-urban farmers

Table 6: Regression estimates for peri-urban crop production challenges

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.057	6.774		2.666	.008

Space and land tenure	4.083	1.545	.206	2.642	.000**
Seasonality	1.068	1.038	.139	1.792	.005*
Water shortages	.261	.146	.127	1.792	.075
Low Prices	-.161	.298	-.038	-.540	.590
Low fertile soils	-1.871	1.451	-.096	-1.289	.199
Un-availability of labour	3.935	1.531	.202	2.570	.001*
Pests and diseases	2.657	1.584	.131	1.677	.002**
Limited access to credit	3.531	1.565	.207	2.979	.000**
Access to extension services	.399	1.526	.117	.516	.234
Un-availability of inputs	1.865	1.748	.096	1.067	.287

*, **, *** statistically significant at 10%, 5% and 1% significance level

Regression results for the challenges associated with peri-urban crop farming in Mbarara municipality were presented in table 6 above. Of the 10 hypothesized challenges, five were statistically significant at 10%, 5% and 1% respectively. These included; space and land tenure (p=.000), seasonality (p=.005), un-availability of labour (p=.001), pests and diseases (p=.002) and limited access to credit (p=.000).

Table 7: Regression estimates for peri-urban animal production challenges

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	32.540	3.935		8.269	.000
	Shortage of space	4.292	1.885	.176	2.277	.001*
	Pests and diseases	3.047	1.012	.134	2.046	.003**
	Water shortages	1.260	3.096	.132	.997	.048*
	Shortage of feeds and pastures	2.931	1.746	.146	1.533	.024*
	Lack of credit access	-1.588	1.865	-.068	-.851	.396
	Lack of market	1.867	1.124	.147	1.661	.005*
	Poorly quality breeds	1.743	3.501	.041	.498	.619
	Low prices	-.482	4.570	-.009	-.106	.916

*, **, *** statistically significant at 10%, 5% and 1% significance level

Table 4.7 above showed results of the regression model assessing the peri-urban animal production challenges in Mbarara municipality. Eight (8) challenges were postulated challenges and only five remained statistically significant at 10%, 5% and 3% respectively. The significant challenges included; shortage of space (p=.001), pests and diseases (p=.003), water shortages (p=.048), shortage of feeds and pastures (p=.024) and lack of market (p=.005).

Table 8: Strategies for addressing peri-urban agricultural challenges

Strategies	Frequency	Percentage
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Facilitating credit extension	23	13.2
Streamlining extension services	24	13.8
Creating market linkages	24	13.8
Promoting farmer group formation	23	13.2
Technology and innovation	25	14.4
Research and development on new animal breeds and crop varieties	20	11.5
Land use planning	18	10.3
Diversification	17	9.8
Total	174	100.0

Results for the strategies of addressing peri-urban agricultural challenges in Mbarara municipality were highlighted in table 8 above. Most (14.4%) of the respondents suggested promotion technology and innovation, 13.8% streamlining extension services and creating market linkages respectively, 13.2% articulated facilitating credit extension and promoting farmer group formation, 11.5% proposed research and development on new animal breeds and crop varieties, 10.3% advocated for reforms on land use planning while 9.8% talked of diversification.

Discussions

The study identified the different kind of crop enterprises owned by peri-urban farmers in the fringes of Mbarara municipality including vegetables, maize, Irish potato, beans, fruits and banana. These crops were commonly grown in mono-crop systems. Vegetable maize, Irish potato, and beans were the dominant enterprises owned because of their smaller space requirement. Practicing of crop enterprises differed across households due to natural capital assets like space of land available for farming and access to water for irrigation. For instance, occupants in the areas of Kisenyi had access to nearby wetlands for farming, whereas three-quarters of farmers in peri-urban grew crops on very small plots around homesteads. These study findings agree with Lwasa, (2010) who argued that categories of crops differ in their systems of production. There are more farmers growing only crops in the peri-urban areas, and these mainly grow sweet potatoes and cassava. In peri-urban areas, farmers mainly grow bananas and vegetables. Vegetable growing is however much less common in urban than peri-urban areas, which is positively associated with land accessibility

Livestock projects owned by peri-urban dwellers of Mbarara municipality included; cattle, goats, piggery, poultry, rabbiting keeping and bee keeping. Chicken, goat cattle and pig keeping were common commercial activities for peri-urban households. Peri-urban farmers mainly kept poultry, with only a few keeping dairy cows. Pig keeping was much common in peri-urban compared cattle. Urban livestock keeping was an important economic activity in Mbarara that cut across income groups, and one that had increased substantially in the past decade. Poultry rearing was the most widespread livestock activity in peri-urban areas, followed by cattle, pigs, goats, sheep and rabbits. The predominance of poultry rearing is consistent with earlier studies (Danso et al., 2013) on urban livestock keeping in developing countries, which found that readily available market opportunities and quick returns on investments were important motivators for poultry and egg production. Also there are fewer social tensions associated with keeping poultry

in urban centres compared to other livestock. The efforts of the National Agricultural Advisory Services (NAADS) have also contributed to the high numbers of chickens reared within Mbarara municipality.

Extent of adaptation to the limited spaces by farmers in the peri-urban areas

Peri-urban farmers had adapted to the limited spaces in different ways. For example crop farmers were utilizing space by allocating a bigger portion of land to banana enterprises, followed by maize, vegetables, beans, fruits, and Irish potato. Similarly, animal farmers utilized space through allocation of a bigger portion of land to cattle rearing, followed by goats, piggery, poultry, rabbits and bee keeping. Given the tremendous pressures from peri-urban encroachment, limited space were ranked the most critical challenges facing PA. Peri-urban farmers coped with space constraints by carrying out intensive crop production in backyards (compound gardens), roadsides, swamps, tins, pots, sacks and polythene bags or renting land in other areas surrounding the municipality. These findings agreed with findings by Nyapendi et al., (2010) who contended that the use of sacks is a common practice among vegetable growers: they mix small stones, to ensure good aeration, and manure or compost are added to the soil to improve its fertility.

Space-constrained livestock production systems were more common in peri-urban areas. These include small piggery units, zero-grazing, tethering in home compounds, and the keeping of poultry, both in cages and free range, on verandas. These study findings are comparable to findings by UBOS & MAAIF, (2011) which stated that peri-urban agriculture in Kampala is practiced in diverse locations including home compounds, along roadsides, in undeveloped plots, in wetlands/swamps, under power lines, on waste dumpsites, and on other public and private land. Free-roaming livestock scavenging around the city are a common sight. Public lands roadsides, open spaces, wetlands, and around power lines and infrastructural projects—are used illegally, with no or informal tenure arrangements.

Contribution of peri-urban agriculture towards household food demand and food security

Peri-urban agriculture significantly contributed towards household food demand and food security. Most respondents were quoted saying that peri-urban farming had donated to household food availability by giving peri-urban dwellers an opportunity to have sufficient quantities of food stuffs like vegetables, fruits and cereals consistently. In addition meat and milk from animals make the best deities for most households in the area. This study finding concurs with Word Bank, (2014) which stated that PA improves the quality of urban diets through diversification, by adding horticultural and animal products to the basis of staple food. This allows urban dwellers to consume a more balanced diet that is not only sufficient in energy, but also in protein and micronutrients required for body growth and maintenance.

Respondents revealed that peri-urban agriculture enhanced timely access food. This is because it offered a variety of crop and animal products that were sold in markets, roadside and big shops like supermarkets. The availability of numerous agricultural foodstuffs in market places, roadside and supermarkets gave urban residents a chance to access food stuffs whenever they needed them. This study finding is in line with Mwangi, (2015) who cited that peri-urban agriculture has a significant share in the food supply of many cities in Sub-Saharan Africa (SSA) and takes special care of urban diets, which include exotic or perishable vegetables, fresh milk and poultry products. In this way, PA is significantly contributing to a higher variety of foods on the city markets, contributes to employment, livelihoods and poverty alleviation.

Respondents further mentioned that peri-urban farming enhanced food use and utilization among urban dwellers. Food use and utilization includes having access to safe and nutritious food that meets the dietary needs of the community. Food utilization therefore covers a range of aspects that hinge on the consumer's understanding of what foods to select and how to prepare and store them. Availability of and access to food is not enough, peri-urban supports urban dwellers with safe and nutritious food". Peri-urban agriculture has offered food varieties that provide sufficient energy to the urban community. This study finding is comparable to findings by Nyapendi et al., (2010) who argued Peri-urban agriculture is often a crucial method of achieving food security for the urban poor. With increasing food prices in the past few years, the number of undernourished people in the world is steadily climbing.

Respondents stated that peri-urban agriculture has improved food stability. Food stability exists when all people have timely access physical, social and economic access to sufficient, safe and nutritious food to meet dietary needs and food preferences. The World Food Summit says that stability must be present "at all times" in terms of availability, access and utilization for food security to exist. This finding is comparable to findings by Ackerman et al., (2014) who argued that the direct impact of PA on household diets is increased when the income raised through vending PA products is used to buy food items, such as cooking-oil, which can further improve the quality and quantity of the diet. The benefits of PA on nutrition will be further increased if people are given the information needed to make appropriate use of this food, through nutrition education, including promotion of balanced and affordable diets, child feeding, general hygiene, food safety, and appropriate household resource management.

Challenges faced by peri-urban farmers

Regression results indicated that limited space and land tenure was a positive and significant challenge to peri-urban crop farming at 5% level of significance. The implication was that large areas of land gave farmers more opportunities to practice more crop than small land holdings. As a result of overpopulation in peri-urban areas of Mbarara municipality, space for growing crops continues to be reduced. The fragmented nature of land in the area due to population pressure has reduced land meant for agricultural projects like crop and animal production. This is in line with Lwasa et al., (2014) who argued that in urban areas, some farmers are forced to grow vegetables in tins, pots, sacks and plastic bags as a way of coping with the space constraint.

Similarly seasonality was a positive and significant challenge to peri-urban crop farming at 10% level of significance. Seasonal changes characterized by extended droughts cause crop failures and pest incidences hence affecting food production. On the other hand short erratic rains cause floods with related instances of diseases and flooded crop gardens etc. This study finding is comparable to Beach, (2015) who argued that the situation is no different for the urban and peri-urban farmers who compete over the sources of water to support the continuance of their agri-business and communities. Unfortunately, the local sources of water that farmers depend on, such as ground water, piped water, urban drainage and waste water, are likely to be severely contaminated due to the concentration of habitation, rudimentary sanitation and discharging of industrial and civil waste in inappropriate ways. These increase the risk of the spread of disease in both the producers and the consumers

Findings further indicated that un-availability of labour was a positive and significant challenge to peri-urban farming at 10% level of significance. Labour is one of the key factors of production. Given the small scale nature of households in peri-urban vicinities, it always difficult

for households to meet the labour requirements for agricultural and therefore production has largely remained small scale constrained by labour.

Pests and diseases were a positive and significant challenge to peri-urban crop and animal production 5% level of significance. A farmers' decision to adopt peri-urban farming changed with pest and disease incidences in the area. This is because pest and diseases significantly affected both animal and crop production levels by altering performance, quantity and quality.

Limited access to credit services was a positive and significant challenge faced by peri-urban farmers 5% level of significance. Credit is important because it affects farmers invest capacity. Farmers with access to credit have more opportunities to invest in improved crop varieties and animal breeds production technologies than those without access to credit. This study findings was in line with Tenkouano, (2011) who argued access to credit facilities determines household food security, because it gives the household an opportunity to be involved in income-generating activities, which can increase their financial capacity and purchasing power, to escape the risk of food insecurity. Moreover, it helps to smooth consumption when households face a temporary food problem

Water shortage was a positive and significant challenge to peri-urban animal production in Mbarara municipality at 10% level of significance. Water is an important element of agricultural production as it supports crops and animal lives, and it used in other aspects like spraying. Given the increasing population nature in the peri-urban vicinities, water sources have increasingly become difficult to reserve due to competition for water resources. The finding was comparable with findings by Rogerson, (2013) who argued that trying to provide a constantly accessible, clean water supply for millions of people is hard enough. Trying to provide clean water for a growing city plus a growing number of farms within that city is even more challenging. To this end, many urban growers employ drip or underground irrigation systems, which allow growers to trickle measured amounts of water to plants directly at the roots where they need it instead of spraying a hose that waters the air more than the crops and uses much more water to do it.

Shortage of animal feeds and pastures was a positive and significant challenge to peri-urban animal production at 10% level of significance. The justification for this was that a unit decrease in animal feeds and pastures directly affected a farmers' decision to invest in peri-urban animal production.

Conclusions

There are numerous animal and crop enterprises owned by peri-urban farmers of Mbarara municipality. Common crops enterprises owned include; maize, vegetables, bananas, fruits and beans whereas livestock enterprises include poultry, cattle, pigs and goats.

Farmers have adapted to limited spaces through crop production systems like backyard gardens, roadside farming, growing crops in tins, pots, sacks and polythene bags. Livestock space-constrained livestock systems are also being used like small scale piggery units, zero-grazing, home compound tethering, cages for poultry and free range.

Peri-urban agriculture has played a critical role on household food demand and food security by improving food access, stability, availability, use and utilization. It has further promoted access to diversified and notorious food varieties.

Peri-urban farmers in the fringes of Mbarara town still encounter significant production challenges like space, pests and diseases, limited access to credit, seasonality, un-availability of labour, water scarcity, shortage of feeds and pastures as well as lack of market.

Recommendations

In order to improve peri-urban agriculture around Mbarara municipality, more farmer training is needed for farmers on aspects such as pests and disease control, use of household organic waste as manure, use of high yielding varieties, irrigation, and marketing aspects of commercially viable crops, particularly vegetables.

Improving access to credit could help farmers establish critical infrastructures such as water reservoirs and agro-inputs, which may facilitate urban farming. Government should put in place a well-functioning credit scheme for farmers to allow farmers borrow funds for boosting crop and animal production.

Agriculture technologies are needed to effectively deal with the problem of using recycled urban organic waste which do exist in large quantities. Such technologies include the biological treatment of wastewater for irrigation purposes, use of improved seeds and animal breeds.

Access to land is one of the major obstacles of peri-urban farming. Therefore farmers should be encouraged to use buckets and sacks for crop growing.

The government may provide agricultural inputs to farmers through its programmes like OWC (operation wealth creation). If this is done, productivity can rise. Agricultural productivity can rise if farmers switch over from “traditional” to “modern” agriculture in very large numbers, involving the use of high-yielding varieties of seeds, organic manure, chemical fertilizers, insecticides, better implements and animal power.

Policy is needed to integrate PA in the Municipality Development Plans. Peri-urban agriculture is a significant contributor to the food supply that serves urban slum dwellers, but it faces many obstacles and challenges. Integrating PA into the Municipality Development Plans can lead to more sustainable urban food production, which in turn could help enhance food security for the urban poor.

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