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Urban and peri-urban crop farming in Central Uganda: Characteristics, constraints and opportunities for household food security and income

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Urban and peri-urban farming has a potential to address challenges related to food insecurity among city and town dwellers. It provides the urban population with food, nutrition and a source of income and employment, thus reducing on poverty and food scarcity. It has the advantage of proximity to urban markets which saves on transportation costs, thereby increasing farmers' profitability. This study was carried out to establish the current characteristics and trends of urban and peri-urban crop farming in Central Uganda. To accomplish this, a household survey was conducted in Kampala, Wakiso and Masaka districts, Central Uganda. A total of 297 farming households were interviewed on a number of aspects including cropping practices, income sources, home gardening techniques, marketing, irrigation and household waste management. Focus group discussions were also held in each district. Cropping activities were found to contribute on average 40% to the income of farming households, complementing other livelihood sources such as transport business, livestock production, formal employment and other trade. The major crops grown were vegetables, maize, beans, bananas and avocado. A number of home gardening techniques were identified among farmers, for instance, growing crops on food towers, in buckets and bags (sacks). Irrigation and fertilizer application were practiced by 60% of households, mainly on vegetables. Sixty-four percent of the households recycled waste and of these, 75% converted kitchen waste into manure for crop production. We recommend farmers' training on use of household biodegradable waste in home gardening for improved nutrient use efficiency, economical irrigation water management strategies, and other agronomic and marketing aspects of crops that are commercially viable in urban areas, particularly horticultural crops.

Key words: Urban and peri-urban farming, cropping practices, food security, income.

INTRODUCTION

The level of urbanization in Uganda currently stands at 12%, growing at a rate of 4.7% and it is estimated to reach 30% (20 million people) by the year 2030 (UN Habitat, 2011; Lwasa et al., 2014). With population growth comes more need for food for the urban dwellers, some of which can be supplemented through practicing urban agriculture. Farming in the urban areas, referred to as urban agriculture, can complement livelihoods of mainly the urban poor. According to Stewart et al. (2013), urban agriculture refers to "agriculture located within and around cities whose products are at least partly destined for the city and for which alternatives exist between the agricultural and non-agricultural uses of resources". An estimated 40% of agricultural products consumed in urban areas are produced from within urban areas (Draft UNUP, 2013). Urban and peri-urban (UAP) farming provides income and employment opportunities to the population. It supplements the sources of food supply at an affordable price thereby contributing to food security.

Urban agriculture, if managed well, can also contribute to waste management, urban greening and beautification. For instance, 33% of total agricultural production in the Netherlands comes from urban agriculture. Similarly, 10% of the total urban population in the United States of America participates in urban agricultural activities (Brown and Carter, 2003; Indraprahasta and Agustina, 2011). According to Zezza and Tasciotti (2010), urban agriculture has potential to improve livelihoods, particularly in much of sub Saharan Africa and in all those countries where agriculture provides a substantial share of income for the urban poor. Zezza and Tasciotti (2010) found fairly consistent evidence of a positive statistical association between engagement in urban agriculture and dietary adequacy indicators.

In order for urban agriculture to make meaningful contribution to urban livelihoods and avert environmental degradation, there is need to identify production practices that are economically viable and environmentally sustainable. The challenge with urban agriculture is how to ensure that it contributes to sustainable livelihoods without compromising human and environmental health standards of cities. Currently, there is scanty information about crop farming practices in UAP areas of Uganda, including its key characteristics and how these relate to the demographic and environmental aspects of the urban environment. This study provides data from a typical developing country perspective on the nature and extent of urban and peri-urban agriculture. This is crucial information given on-going development of the Uganda National Urban Policy. This policy process could lend support to other cities in the region that may develop similar policies in future. The objectives of this study were to determine the characteristics of current crop production practices within UAP farming systems in Central Uganda and to identify the opportunities and major constraints to further sustainable development of UAP farming in the region.

MATERIALS AND METHODS

Study area

Three districts within Central Uganda were selected on the basis of their location in UAP settings; Kampala (00°19'N, 32°35'E), Wakiso (00°24'N, 32°29'E) and Masaka (00°22'S, 31°42'E) (Figure 1). Kampala and Wakiso were chosen to represent the urban areas, while Masaka district represented the peri-urban area. Kampala is the Capital City of Uganda and it is located within the Central Region of the country. Wakiso is the second most urbanized district in Uganda after Kampala and it borders most of Kampala district (Figure 1).

Stratified random sampling was used to select sub-counties, parishes/wards and villages from each district according to the extent of cropping practices and intensity of settlements (Table 1). Within each district, two sub counties (or divisions) were selected on the basis of existence of significant amounts of agriculture on the advice of local key informants (Local Government Officials and technical personnel).

Data collection

Focus group discussions (FGDs) were held in each division/sub county with a minimum of 12 household heads who were involved in crop production. This was done with the help of local council leaders. This was followed by face-to-face interviews of farmers selected randomly from farmer lists provided by the local council leaders in those villages. A total of 297 farming households were interviewed using a pre-tested structured questionnaire on a number of aspects including cropping practices, income sources, home gardening techniques, marketing, irrigation and household waste management among others.

Data entry and analysis

Data were entered into Microsoft Excel (Microsoft Office, 2007) where preliminary cleaning and exploration was done. Descriptive statistics were performed using the Statistical Package for Social Scientists (SPSS) v19 (SPSS, 2007). Binary logistic regression analysis was used to model determinants of waste recycling and use of manure for home gardening. Weighted ranks were also obtained using the Microsoft excel program. Graphs and charts were generated from the data using SPSS and Microsoft excel

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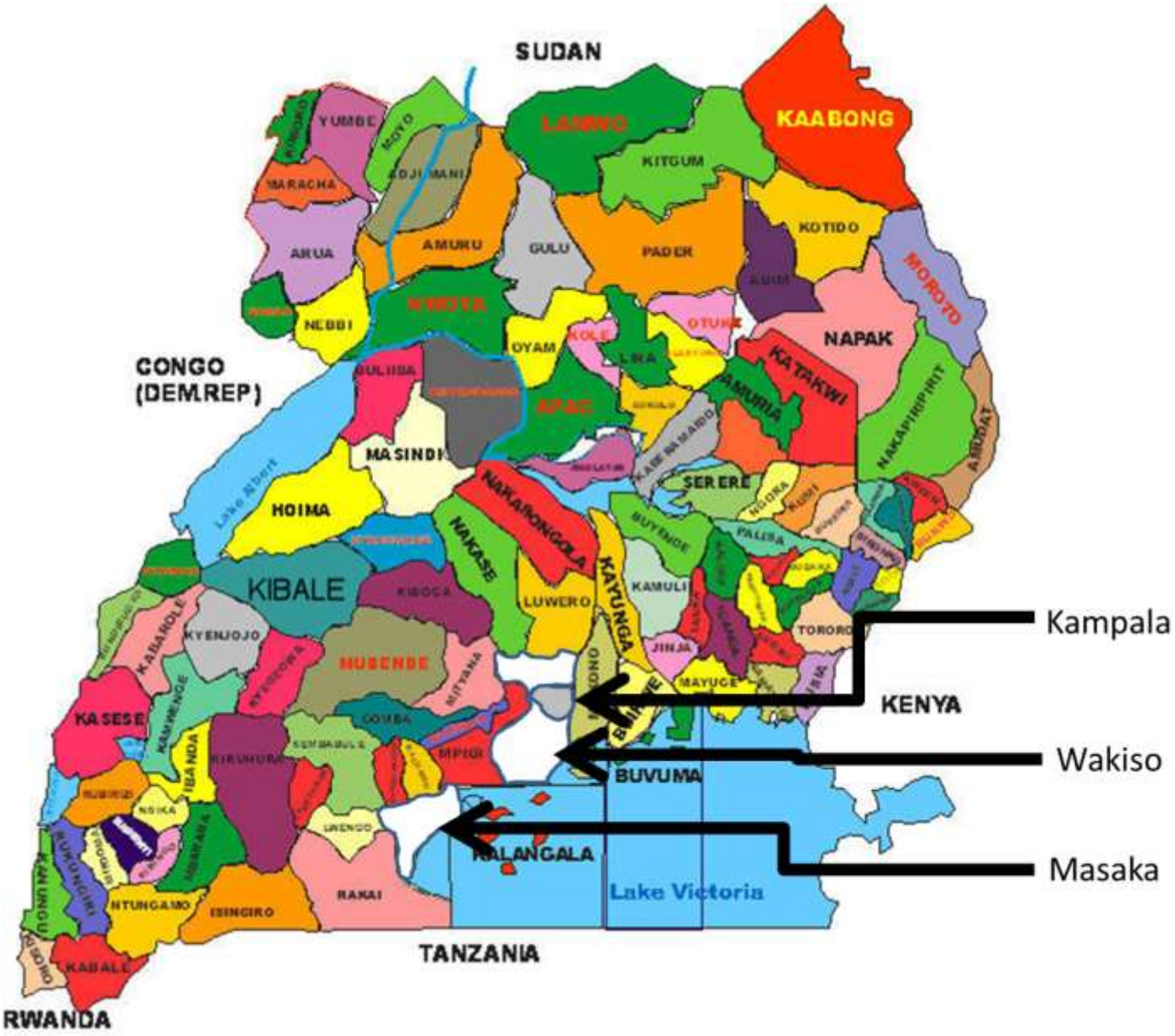

Figure 1. Map of Uganda showing the location of the study districts in Central Uganda.

Table 1. Sites where the household surveys and focus group discussions were held.

No.	District	Sparsely built-up	Densely built-up
1	Kampala	Makindye division (Salaama and Makindye Parishes)	Mutundwe division (Kabowa, Mutundwe and Luwafu Parishes)
2	Wakiso	Nsangi sub county (Nsangi, Musale and Buddo Prishes)	Entebbe Division B (Kiwafu and Kigungu parishes)
3	Masaka	Mukungwe (Kalagala, Samalia and Nyendo Prishes)	Nyendo-Senyange (Senyange A and Senyange B Parishes)

Table 2. Demographic characteristics of UAP farming households in Central Uganda.

Characteristics	Categories	Masaka	Kampala	Wakiso	All	% of All
Sex of household head	Male	61	66	63	190	64.2
	Female	37	30	29	96	32.4
Age of household head	Mean	54.1	55.6	51.5	53.7	-
	Std. Deviation	14.7	15.2	13.36	14.4	-
Education level of household head	No formal education	2	4	0	6	2.2
	Primary	30	18	29	77	28.1
	Ordinary level	21	25	29	75	27.4
	Advanced level	11	10	13	34	12.4
	Certificate graduate	12	4	0	16	5.8
	Diploma graduate	10	15	6	31	11.3
	Degree graduate	11	19	5	35	12.8
Marital status of household head	Single	9	6	9	24	8.9
	Married	54	65	58	177	65.6
	Divorced	1	3	3	7	2.6
	Widowed	21	20	9	50	18.5
	Separated	6	1	5	12	4.4
*Age distribution of household members	M <5	29	51	57	137	6.3
	M 5-15	72	97	77	246	11.3
	M 16-35	112	135	121	368	16.9
	M 36-65	80	62	67	209	9.6
	M >65	21	13	13	47	2.2
	F <5	41	57	49	147	6.8
	F 5-15	89	93	80	262	12.1
	F 16-35	196	135	133	464	21.4
	F 36-65	102	73	76	251	11.6
	F >65	12	21	8	41	1.9

*M=Male, F=Female.

software.

RESULTS AND DISCUSSION

Household demographics

Approximately 33% of the sampled households were female-headed and the average age of the household heads was 54±2 years (Table 2). The education level of most household heads (~70%) was ordinary level, one quarter of whom had either diplomas or were university graduates. Two thirds of the sampled household heads were married and close to 25% were widowed. About 60% of the household members were within the active age groups (16 to 65 years) and the distribution between males and females was comparable. This presents an opportunity for enhanced production and marketing within the study areas especially since most household members are within the active age groups.

Income sources

The study only ranked, not directly quantified the financial contribution of urban agriculture to livelihoods. However, on a percentile scale, the rankings of agriculture showed it to approximate between 30 and 50% contribution to livelihoods. Overall, crop production was ranked the most important livelihood source in all the districts surveyed.

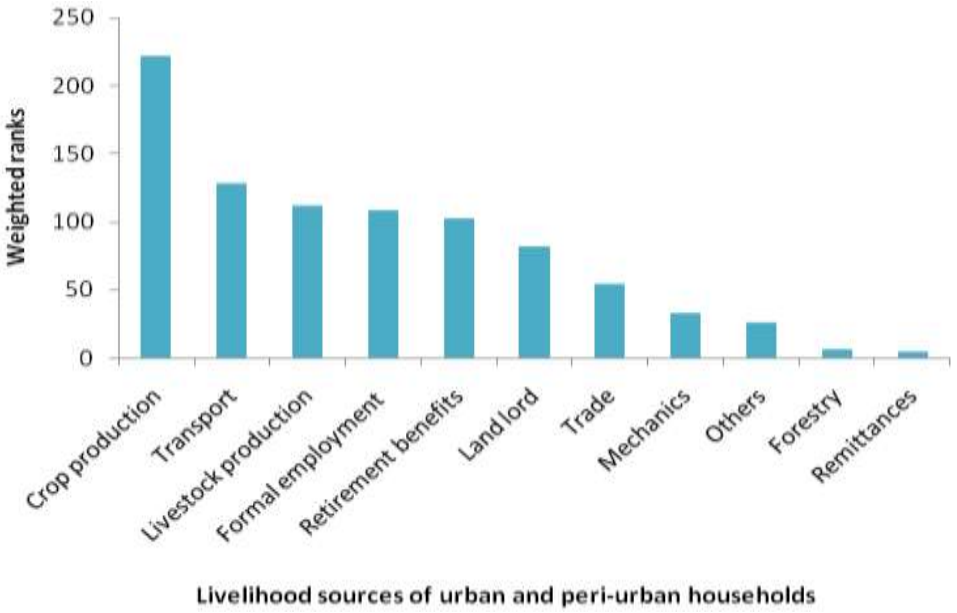

Figure 2. Weighted ranks of livelihood sources of UAP households in Central Uganda.

Table 3. Ranking of crops for food security in UAP areas of Central Uganda.

Rank	Vegetables		Perennial		Fruit trees		Annual	
	Crop	Score	Crop	Score	Crop	Score	Crop	Score
1	Nakati	113	Bananas	1009	Avocado	120	Maize	528
2	Tomatoes	89	Cassava	532	Oranges	18	Beans	448
3	Cabbage	72	Coffee	92	Mangoes	17	S.Potatoes	406
4	Sukuma	46	Sugarcane	52	Pawpaws	15	Yams	84

This was followed by livestock production while transportation came fourth (Figure 2). Generally, transport, livestock production, formal employment and retirement benefits/pension ranked high among the livelihood sources. Previous studies by Zezza and Tasciotti (2010) showed that compared to cities in developed countries where agriculture contributes less than 5% to household income, in developing countries, UAP agriculture contributes a high proportion (30 to 71%) to the income of households engaged in it. It is therefore not surprising that crop production ranked high in its contribution to household income in UAP households in Uganda. The high contribution of transport in Wakiso could be related to the emergence of motorcycle transport, locally known as "*Boda boda"*, which employs a large number of youth who seek for housing in the outskirts of the town and nearby capital city, Kampala.

Crop production

Crop production was ranked according to whether the main objective was food or cash. Bananas remain high in priority for both food and cash (Table 3). Banana is an important crop in Central Uganda because it is both a food and cash crop. Besides, it can be grown in compounds for aesthetic value while contributing to food security in the household. This possibly explains the overall high ranking of this crop. Cassava, which is increasingly becoming an important food security crop in Uganda, was ranked highly especially in Wakiso district. Vegetables generally were also a highly ranked group due to the relatively small spaces required to cultivate them, together with the relatively high contribution they make to food and nutrition security at household level. They are also capable of being cultivated throughout the year, providing regular income to the households that grow them. Avocado, a common fruit tree, emerged strongly as a cash crop in UAP areas of Central Uganda (Table 4). Despite the limited land available to farmers in Urban and peri-urban areas, planting one or two fruit trees such as avocado could possibly make a difference providing not only food but also income for these families. However, this might not be possible for those with very

Table 4. Ranking of crops for income security in UAP of Central Uganda.

Rank	Cash crops	Scores			
		Masaka	Kampala	Wakiso	Over all
1	Avocado	259	136	251	646
2	Bananas	244	126	262	632
3	Beans	181	98	214	493
4	Bitter berries	114	52	114	280
5	Cabbage	55	40	47	142
6	Carrots	24	4	0	28
7	Maize	14	0	0	14

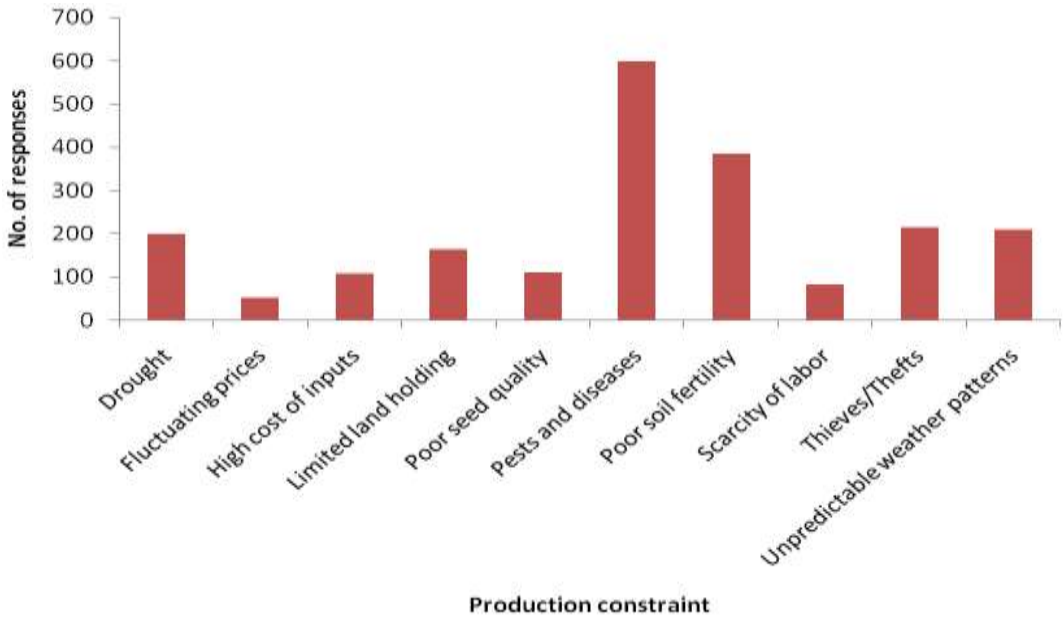

Figure 3. Major constraints to crop production among UAP farmers in Central Uganda.

small pieces of land.

Farmers identified and ranked several production constraints. The most prominent of these were incidence of pests and diseases particularly banana bacterial wilt. Unfavorable weather was also prominent in Wakiso and Kampala areas (Figure 3).

Home gardening techniques

Home gardening techniques existed in several forms including food towers, pots, sacks, polythene bags and ridges in farmers' backyards. The major reasons advanced for use of these techniques included the ease to establish and manage them, space optimization, no special skills required and affordability by many farmers. Other additional benefits such as food security and aesthetic value of the homestead were also mentioned. The major crops preferred for home gardening were mainly vegetables (Figure 4).

Eighty percent (234) of the farmers that were involved in home gardening practiced irrigation, fertilization or fertigation (combination of irrigation and fertilizer application). The practice of irrigation, fertilization and fertigation among farmers having home gardens varied across sites (Figure 5) with Masaka and Wakiso exhibiting higher rates of irrigation compared to Kampala. Ironically, more farmers in Kampala used fertilizers compared to either Masaka or Wakiso.

Irrigation is used mainly for vegetables including *nakati*, cabbage, tomatoes and *sukuma wiki* in that order. On the other hand, fertilizer is reportedly applied to mainly bananas (90), maize (34), nakati (23), tomatoes (19) and cabbage (17). The various attributes of farmers practicing

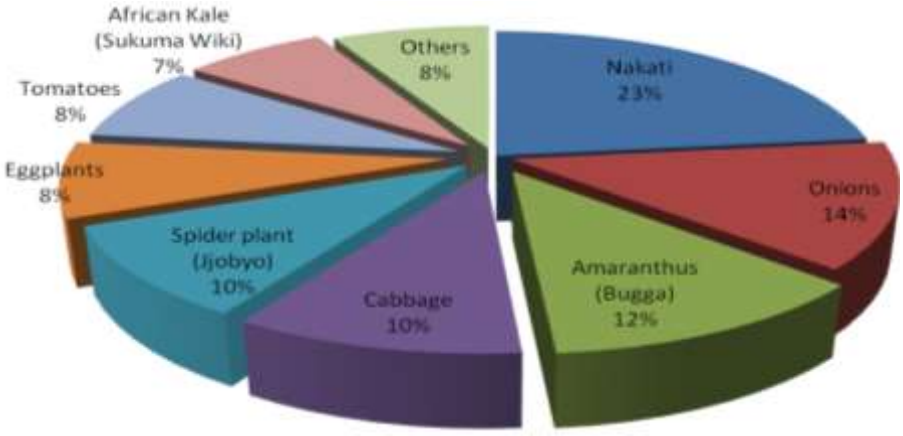

Figure 4. Preferred crops for home gardening in UAP farming in Central Uganda.

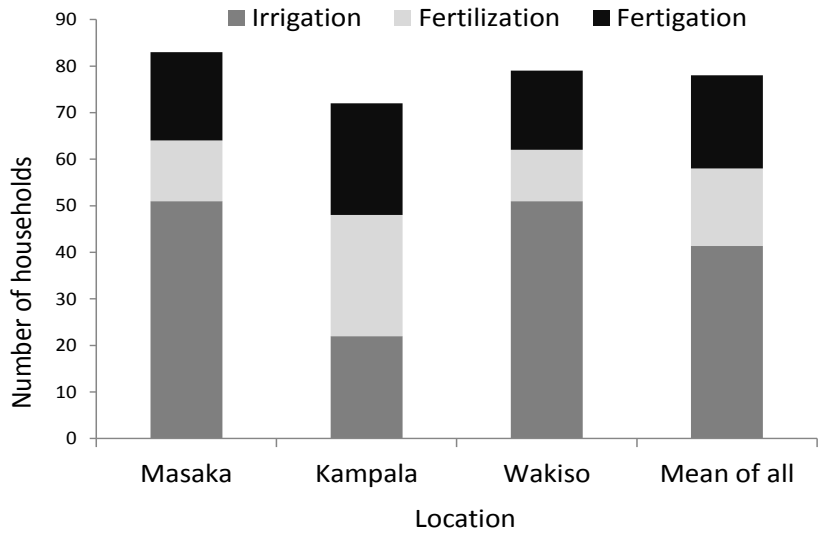

Figure 5. Use of irrigation, fertilization and fertigation among UAP farmers in Central Uganda.

irrigation in home gardens are indicated in Table 5.

Waste management

It was determined whether households recycle waste or not, and for those who use it for agricultural production, whether the main type is kitchen or animal manure. Sixty four percent (64%) of the households recycled waste in one way or another. Of those who use manure for gardening, 75% used kitchen waste. The major problem with the waste was broken glasses which were usually disposed of by burying in the ground while plastics were burnt to ashes. The most common type of waste, however, is kitchen and animal waste, which some farmers use as manure for cropping.

In the logistic regression, the household-level factors affecting waste recycling were assessed as well as the major type of manure used in home gardening. Table 6 shows the factors that were hypothesized to affect waste recycling and major type of manure used in small gardening technologies. The regression analysis showed that households in Masaka were more likely to recycle waste compared to those in either Kampala or Wakiso, and that those in Wakiso were the least likely to recycle household waste (Table 7).

It was also found that the higher the level of education of the household head, the more likely the household would recycle waste. This was with the exception of the primary-level educated household heads; that had less tendency to recycle compared to those with no formal education. Larger household sizes are also less likely to

Table 5. Irrigation attributes in UAP farming in Central Uganda.

Attribute	Water sources							
	Tap water	Rain	Bore hole	Wells	Ponds	Swamps	Rivers	Lakes
Site								
Masaka	45	22	2	15	0	2	0	0
Kampala	32	16	0	1	0	0	0	0
Wakiso	22	22	1	15	2	9	1	6
Uses								
Gardening only	2	4	3	8	5	12	7	16
Gardening & livestock	2	4	0	1	2	9	0	2
Multiple uses	19	13	2	12	0	1	0	1
Harvesting method								
Trenches	0	0	0	1	0	0	3	0
In-situ	5	4	0	2	0	1	0	0
Gutters	8	48	0	0	0	0	0	0
Drainage channels	2	2	0	1	0	0	0	1
Taps	11	0	0	0	0	0	0	0
Jerry cans	10	0	2	12	0	0	1	3
Pipes	3	0	0	0	0	0	0	0
Storage methods								
Jerry cans	21	4	1	18	2	4	1	3
Water drums/tanks	34	34	2	9	0	0	0	0
Underground reservoir	12	19	0	1	0	1	0	0

Table 6. Variables used in the Binary logit models for waste recycling, and manure types used in UAP agriculture in Central Uganda.

Variable name	Category	Category code	Logit1: Waste recycling		Logit2: Main manure type	
			Frequency	%	Frequency	%
District	Masaka	1	58	29.1	43	39.4
	Kampala	2	83	41.7	45	41.3
	Wakiso	3	58	29.1	21	19.3
Education level of household head	None	0	5	2.5	4	3.7
	Primary	1	55	27.6	31	28.4
	Ordinary	2	70	35.2	33	30.3
	Tertiary	3	69	34.7	41	37.6
Main livelihood source	On-farm	0	119	59.8	64	58.7
	Off-farm	1	80	40.2	45	41.3
Practice home gardening	Yes	1	124	62.3	80	73.4
	No	2	75	37.7	29	26.6
Main source of labor for farm activities	Family	1	94	47.2	48	44.0
	Hired	2	12	6.0	4	3.7
	Both	3	93	46.7	57	52.3
Use of irrigation and/or fertilizer	Yes	1	166	83.4	90	82.6
	No	2	33	16.6	19	17.4

Table 6. Contd.

Participation in training	Yes	1	103	51.8	70	64.2
	No	2	96	48.2	39	35.8
Access to credit	Yes	1	74	37.2	46	42.2
	No	2	125	62.8	63	57.8

Table 7. Logistic regression analysis of factors affecting (a) recycling of household waste and (b) major type of manure used in home gardening in UAP areas in Central Uganda.

Factor	Logit 1: Recycling of household waste						Logit 2: Major source of manure for home gardening					
	B	S.E.	Wald	df	*p*	Exp(B)	B	S.E.	Wald	df	*P*	Exp(B)
District	-	-	20.98	2	0.000	-	-	-	5.59	2	0.061	-
District(1)	-1.58	0.52	9.33	1	0.002	0.21	-1.17	0.74	2.49	1	0.114	0.31
District(2)	-2.01	0.49	16.98	1	0.000	0.13	-1.58	0.69	5.26	1	0.022	0.21
Educhhd2	-	-	4.48	3	0.214	-	-	-	4.23	3	0.237	-
Educhhd2(1)	-1.52	1.70	0.00	1	0.099	0.00	-1.37	1.31	1.10	1	0.295	0.26
Educhhd2(2)	0.56	0.49	1.34	1	0.246	1.76	-0.88	0.58	2.29	1	0.130	0.41
Educhhd2(3)	0.93	0.44	4.48	1	0.034	2.54	-0.99	0.55	3.23	1	0.072	0.37
Hhsize	-0.07	0.06	1.45	1	0.229	0.93	-0.03	0.07	0.19	1	0.662	0.97
Lisource12(1)	-0.07	0.38	0.04	1	0.846	0.93	-0.21	0.53	0.16	1	0.689	0.81
Sgarden(1)	-0.15	0.42	0.13	1	0.721	0.86	0.34	0.59	0.34	1	0.557	1.41
Irrifert(1)	0.15	0.52	0.09	1	0.766	1.17	0.64	0.63	1.02	1	0.312	1.89
Labour	-	-	2.80	2	0.247	-	-	-	2.40	2	0.301	-
Labour(1)	0.40	0.40	1.03	1	0.311	1.49	0.72	0.47	2.35	1	0.125	2.06
Labour(2)	1.14	0.72	2.52	1	0.112	3.13	0.72	1.17	0.37	1	0.541	2.05
Training(1)	-0.41	0.49	0.71	1	0.400	.66	0.31	0.69	0.20	1	0.654	1.36
Associatn(1)	-1.42	0.53	7.22	1	0.007	.24	0.68	0.68	0.98	1	0.321	1.97
Credit(1)	0.31	0.48	0.42	1	0.518	1.36	-0.26	0.56	0.22	1	0.640	0.77
Constant	0.89	0.82	1.19	1	0.276	2.43	0.36	1.01	0.13	1	0.721	1.44

recycle household waste. As would be expected, there are higher chances of recycling waste if the major livelihood source for the household is on-farm rather than off-farm. Compared to use of only family labour, use of either hired labour or a combination of hired and family labour increased the probability that a household would recycle waste. This suggests that large household sizes do not necessarily imply more farm labour availability, as is expected in UAP areas. Access to farmer training and membership to farmer groups all increased chances of households recycling household waste.

Marketing

Approximately 60% of the households market more than 40% of their crop produce. However, the proportion of produce sold varies widely by crop and by location. Overall, vegetables ranked high among the marketed crops, the proportion ranging from 0.5 to 1. Farm gate, road side, sub-county and urban markets are the major markets to which farmers sell their produce. Approximately, one third of the farmers (131) sell their produce at farm gate. Some of the farmers use multiple market channels such as roadside kiosks and direct transport to market centers. Most farmers prefer selling at farm gate reportedly because they avoid having to incur transport costs and taxes in the markets besides saving time for other activities.

Information access

Seventy six percent of the households reported that they

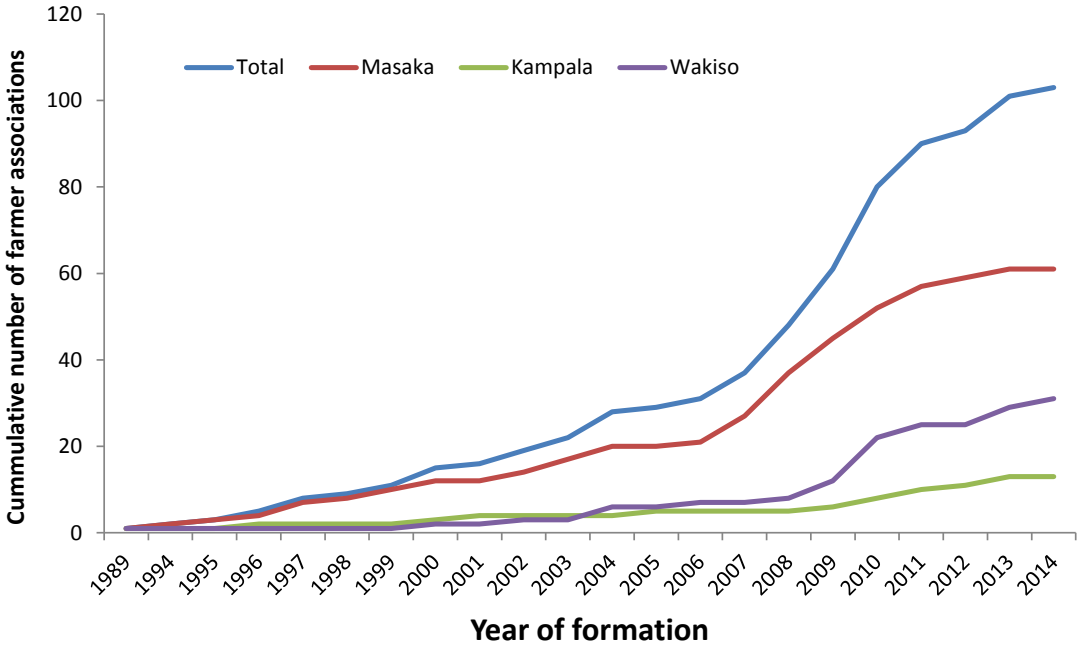

Figure 6. Cumulative number of farmer associations formed over the last 25 years in Central Uganda.

had access to some agricultural information. Of those who accessed information, 19, 17, 12 11 and 11% reported to have accessed information on crop agronomy and production, animal production, pest and disease control, banana production and vegetable production, respectively. These results are consistent with those reported by FAO (2014). The proportion of farmers accessing information was higher in Masaka, followed by Wakiso and least in Kampala.

Public extension, the former National Agricultural Advisory Services (NAADS), was reported to be the most frequently used source of information acquisition (39%), followed by radio, television and farmer-to-farmer knowledge transfer. This pattern was consistent for all the studied districts. Only few (<10%) of the farmers reported to have obtained agricultural information from such sources as farmer associations, newspapers/print media, the National Agricultural Research Organization (NARO), NGOs, study tours, the internet and agro-input shops. The percentage of households where at least one member had received training was 44%. More farmers in Masaka had received training (53%) than those in either Wakiso (30%) or Kampala (16%). A range of topics were offered for training to UAP farmers. The major topics were crop production, pest and disease management and vegetable production.

Membership to associations

Overall, membership to farmers' associations in UAP areas of Central Uganda stood at 44%. Disaggregating membership by districts revealed that Masaka has significantly higher membership (61%) compared to Kampala (11%) and Wakiso (29%) districts. The number of associations has been growing since 1989 and saw a dramatic rise in 2007 (Figure 6). All groups have some form of membership fee payable annually. The fees vary from US$ 10 to 20 depending on the nature of the group.

These results suggest that use of farmer groups, as is recommended, may not yield as good results as would be in Masaka. Ninety three percent of the former associations were registered at various levels including sub-county, district and national. Participation in farmer groups depended on the nature of the activity, with males dominating where saving and credit activities were the main focus of the group compared to other activities like training, marketing and group farming (Figure 7).

Access to credit services

Thirty seven percent of the farmers reported that they had accessed credit within the past year. There were a number of sources from which farmers accessed their credit and the amount obtained per farmer ranged from approximately US$ 100 to 2,000 (Figure 8). This usually serves to rent office space, pay registration fees to local governments and sometimes provide quick loans to members in case of emergencies.

CONCLUSIONS AND RECOMMENDATIONS

In this study, we set out to understand the characteristics

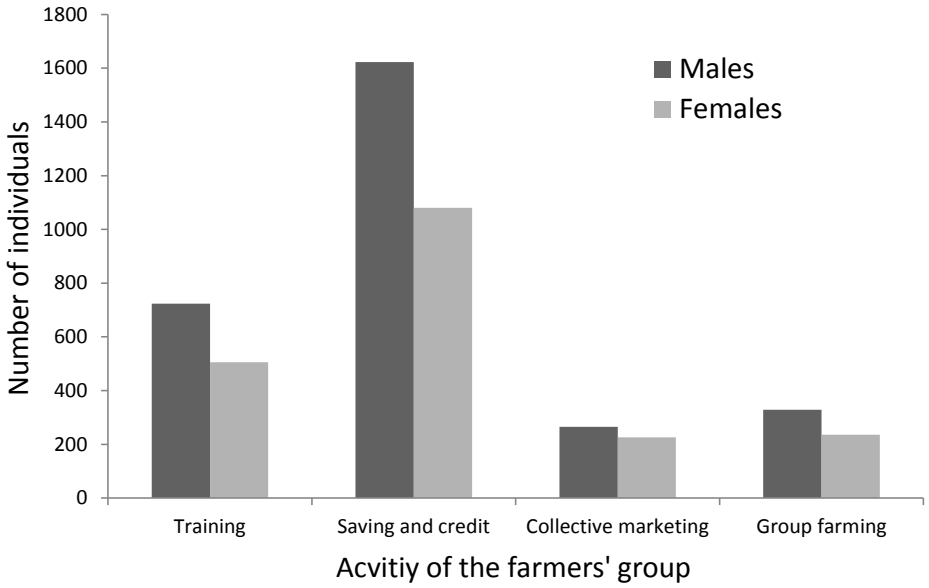

Figure 7. Sex-disaggregated data for participation in group activities among urban and peri-urban farmers in Central Uganda.

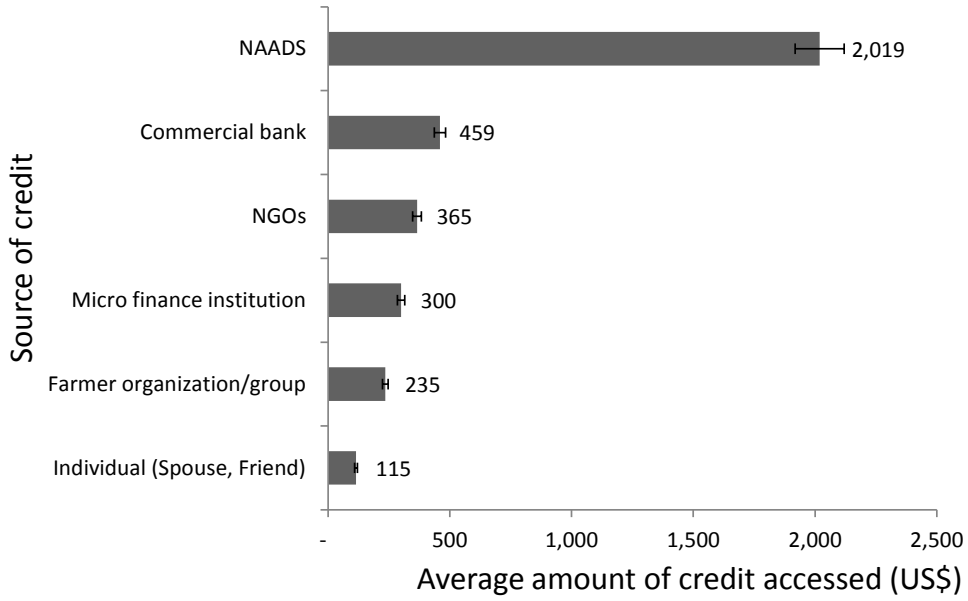

Figure 8. Amount of credit accessed from various sources by urban and peri-urban farmers in Central Uganda. Error bars are standard deviation (N=296).

and current trends in crop productivity within urban and peri-urban farming systems in Central Uganda. It was found that agriculture contributes to the livelihoods of urban and peri-urban farmers to a fairly good extent. However, they are faced with a number of constraints. The major ones include theft, weather changes (unpredictable weather pattern), pests and diseases, high cost of inputs and poor seed quality. There is opportunity to recycle household biodegradable waste for use as manure for enhancing copping practices. Overcoming investment costs for rain water harvesting infrastructure can be achieved through micro-credit schemes to ensure continued production of high value crops, particularly vegetables. This can enhance household food security

and income using small space technologies such as kitchen technologies and backyard gardens.

In order to improve UAP agriculture in Central Uganda, there is need to train 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. Farmers within Kampala should be targeted since the study had shown that they have had less exposure to training compared to their counterparts in Wakiso and Masaka study areas. In addition, improving access to credit can help farmers establish critical infrastructures such as water reservoirs and agro-inputs, which would facilitate urban farming. Studies are required on improved use of household biodegradable waste in home gardening and economical irrigation water management strategies for increased crop yields. This would lead to enhanced productivity and economic viability of urban and peri-urban cropping practices in Central Uganda.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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