

Characterization of Urban Agricultural Activities in Khartoum State, Sudan*

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Abstract: With the rapid urbanization occurring in Khartoum, there is an urgent need to produce more food to satisfy the increasing demand of the urban population. While food production in and around the city is not a new phenomenon, it has received only limited attention by scientists and policy makers. Little is known about the socio-economic conditions of the urban gardeners and their production practices. The objective of this study, therefore, was to analyze the structure of the existing gardening systems and to identify areas where further research is needed to enhance their sustainability of production. To this end, a baseline survey was conducted from March to June 2007. Forty households having gardens were purposively selected and heads of households interviewed using a semi-structured questionnaire. Descriptive statistics were used to describe the socio-economic characteristics of the household's sample. A two-step cluster analysis was performed to classify the households into homogeneous groups. Then, the identified groups were characterized using descriptive analysis.

The results revealed that urban agriculture (UA) is the exclusive domain of men. All 40 households surveyed were involved in commercial vegetable gardening, 33% were cultivating fodder crops and 5% were keeping goats and sheep. The gardeners younger than 55 years were 78% and 80% were non-native to Khartoum. Only few of them were landowners whereas 90% were running their activities under the tenant-sharecropping system. Vegetable growing was the main source of income

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generating activity for 83% of the gardeners. Leafy vegetables with short growth cycles such as Jew's mallow (*Corchorous olitorius* L.), purslane (*Portulaca oleracea* L.) and rocket (*Eruca sativa* Mill.) were the most dominant cultivated species. The main sources for irrigation water were the River Nile (60%) and wells (37.5%). Almost all gardeners applied pesticides and mineral fertilizers. Majority of the gardens (95%) were continuously cultivated all the year around without any fallow period. Three groups of gardens were distinguished based on differences in garden activities, origin of the gardener and management practices. These are mixed vegetable-fodder gardens (10%), mixed vegetable-subsistence livestock gardens (42.5%) and pure vegetable gardens (30%).

Key words: garden diversity, management practices, socio-economics, UA, urban agriculture

INTRODUCTION

Urban agriculture (UA) is defined as growing crops and keeping animals within urban environments (Bailkey and Nasr, 2000; Mougeot, 2000; Obuobie *et al.*, 2006). It is a worldwide phenomenon that has lately gained increased attention in both developed and developing countries (McClintock, 2010; Drechsel and Dongus, 2010). In the rapidly growing cities of the world, mainly located in developing countries (Cohen, 2006), UA makes a significant contribution to the livelihoods of urban dwellers, providing food security, employment and income (Howorth *et al.*, 2001; Pearson *et al.*, 2010; Zezza and Tasciotti, 2010). Additionally, it plays an important environmental role by transforming urban wastes into crop amendments (FAO, 2001; FAO, 2010).

Despite many constraints, this very often informal activity is still growing in importance in many sub-Saharan African cities, where it seems to be resilient to changing environments (Drechsel and Dongus, 2010). This is particularly true for Khartoum, where Schumacher *et al.* (2009) observed between 1972 and 2006 a pronounced spatial dynamic and expansion of UA areas. The authors estimated an annual increase of the total urban cultivated area of 172 ha per year in compared to 1300 ha per year in build-up area. Khartoum, the capital city of the Sudan, is situated in the east-central region of the country. It is endowed with rich water resources

from the Blue Nile, the White Nile, the Nile, seasonal streams and underground water. Since several decades' people are migrating to Khartoum given better job opportunities, more settled livelihoods, better opportunities for education, and to escape from violent conflicts and drought (Jacobsen, 2008). In 2003, 40% of the total population of Khartoum was composed of refugees and displaced people from different parts of the country (Breidlid, 2005; Abusharaf, 2009) and neighboring countries (Kibreab, 1995; Elagib and Mansell, 2000). To cope with the increase in settlement demand, there is an expansion of the built-up area at the expense of UA land (Babiker, 1982; Adam, 2007).

Urbanization in Sudan and especially in Khartoum gained momentum with the outbreak of the north-south civil war in 1955 and was further accelerated in the 1980s as a result of droughts and the effect of desertification (Breidlid, 2005; Elagib, 2010). Between 1993 and 2008 the country's population grew by an annual rate of 2.8% and recently urban population reached 29.5% of the total population with 13.5% living in the capital (Central Bureau for Statistics, 2009).

The challenge facing urban planners and decision makers is to manage the increased pressure on natural resources such as fertile soils, water and biomass energy. To satisfy this high and increasing demand for food, available areas are being cultivated intensively. To enhance the sustainability of UA in Khartoum, collaborative efforts of all stakeholders are needed to address these challenges.

The objectives of this study are to provide information on socio-economic characteristics and agricultural practices of UA in Khartoum and to identify areas where further research is needed to enhance its productivity while minimizing negative environmental and socio-economic impacts.

MATERIALS AND METHODS

Site description

Greater Khartoum, which is located at the confluence of the White and Blue Niles, is one of Sudan's eighteen states. Situated in the east-central region (15° 47' N, 32° 43' E, 382 m a.s.l), it covers a total land area of 22,142 km² (World-Gazetteer, 2010). Its population was estimated at 5.3

million in 2008 (Central Bureau of Statistics, 2009). Greater Khartoum comprises the three cities of Khartoum, Khartoum North and Omdurman (Fig. 1; Elagib, 2010). Khartoum has a semi-desert climate (Ahmad *et al.*, 2002) characterized by an average annual rainfall of 200 mm (Hamad and El-Battahani, 2005). Peak rainfalls and peak flows of the Niles occur in the period from July to August (Sutcliffe *et al.*, 1989; Anbah and Siccardi, 1991; Barakat, 1995; Hamad and El-Battahani, 2005). Daily average temperatures range from 18 to 27°C between November and February and reach 45°C in May (Eltayeb, 2003). Soils are generally from alluvial origin ranging from clay to lighter silt soil followed by sandy clay soils at the River Nile banks. They are characterized by low organic matter and high water-holding capacity (El-Attar, 1969).

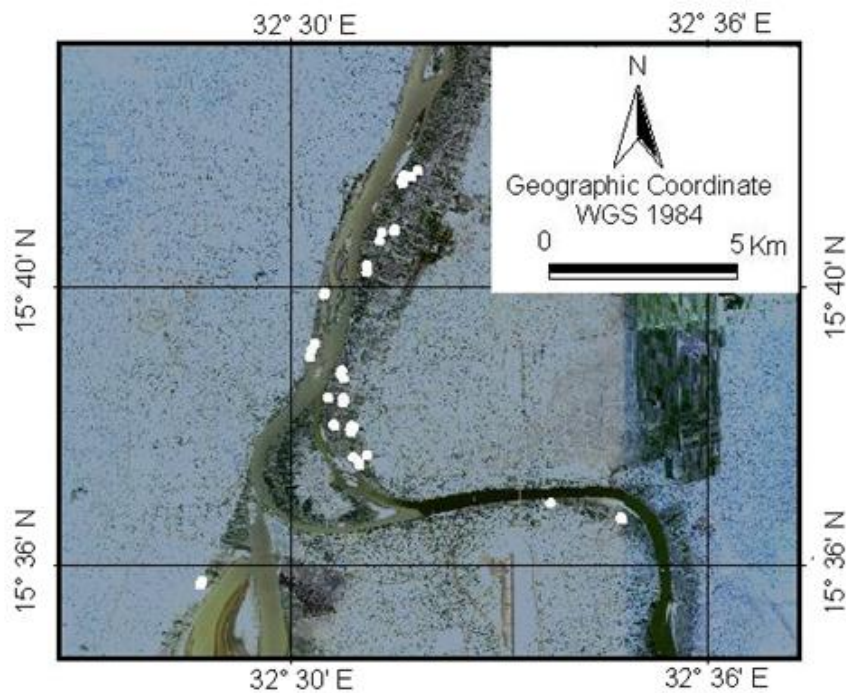


Fig. 1. Satellite images (Google Earth Pro, Google, Mountain View, CA, USA) of Khartoum, Sudan, 2007. The white **dots indicate** the location of the 40 gardens surveyed.

Data collection

A baseline survey using a semi-structured questionnaire was carried out

between March and June in 2007 during which a total of 40 garden households (HH) distributed across the three parts of greater Khartoum (Khartoum North, n=29; Khartoum, n=4; and Omdurman, n=7) were purposively selected and surveyed. The questionnaire included information on the demographic, socio-economic and migratory characteristics of the households (e.g. age, sex and education of household head (HHH), family size, ethnic background) and on their garden activities (e.g. objectives of production, gardening system, cultural practices such as the cropping patterns, methods of soil preparations, source of irrigation water and seeds, use of minerals and organic fertilizers and of other chemical inputs) and the problems encountered.

Table 1. Description of the household variables used to classify the surveyed gardens in urban Khartoum.

Variable code	Description
Numerical	
GARSIZEHA	Gardens area (in ha)
FERKGHA	Applied urea (in kg ha ⁻¹)
AGE	Age of the HHH (in years)
FAMILYLABOUR	Family labor, defined as total numbers of males ≥ 15 years old
Nominal	
NNATIVE	Origin of the households (non-native=1, native=2)
OFF_GARDEN	Off-garden income (no=1, yes=2)
PROD_REL	Production relations (share tenant=1, owner=2)
LIVESTOCK	Livestock keeping (no=1, yes=2)
FODDERGROW	Fodder grower (yes=1, no=2)
N_GARDEN	Number of garden (mono=1, multi=2)
SOIL_PREP	Soil preparation (tractor=1, oxen=2, tractor+oxen =3)
SOURCE_WAT	Irrigation water source (Nile=1, well=2 and Nile+well=3)
CROPP_SYS	Cropping systems (vegetable=1, fodder=2, vegetable+fodder=3)

A handheld GPS (Trimble Geoexplorer II, Sunnyvale, CA, USA) was used to determine the location and the size of the gardens.

Data analysis

Firstly, descriptive statistics were used to describe the socio-economic characteristics of the household's sample. Then, a two-step cluster analysis was performed on a total of 13 variables (Table 1) to classify the households into homogeneous groups. Subsequently, the different groups of gardens identified were characterized using descriptive analysis. All statistical analyses were performed with SPSS/PASW version 18.0 statistical package software (SPSS Inc. 2010).

RESULTS

Household socio-economic characteristics

The majority (77.5%) of household heads fall within the age-group of 26-55 years (Table 2). Average household size was about 7 with half of the households surveyed having 6 to 10 members. Fifty eight (%) of the household members were males. Gardening is exclusively undertaken by males and constitutes their main source of income. The production is essentially market oriented. Only 35% of the households' heads had an extra off-garden income source. Off-garden income generating activities include leasing property (5%), pension (2.5%), brick making (2.5%), working in neighboring fields (5%) and small-scale bakeries (2.5%), regular occupation (5%), occasional occupation (5%) and 12.5% have others sources. Surveyed households belonged to 21 different ethnic groups dominated by Ja'alein (20%), Shaigiya and Tama with (7.5%) for each. Only 20% of them were native to Khartoum (Table 2). The rest were migrant families mainly from Darfur and Kordofan (35%), Northern Sudan or Gezira (35%), Singa and Algedarif (central, 10%), where they were involved in gardening activities (Table 2). Most of them (80%) had migrated to Khartoum during the last four decades. The majority of the households surveyed (75%) live in their garden, while the remaining reach the garden by public transport (20%) or on foot (5%, Table 2).

Agricultural practices

All forty households surveyed were involved in commercial vegetable

production, 32.5% in fodder crop cultivation and 5% keep a few goats and sheep (Fig. 2).

Table 2. Demographic and socio-economic characteristics of gardeners and their family members in urban gardens in Khartoum.

Comparison element	Household head (HHH) age structure (n=40)				
	15-25	26-35	36-45	46-55	> 55
HHH (%)	7.5	30	22.5	25	15
	Research population age structure (n=241)				
	0-5	6-15	16-25	26-55	> 55
Male (%)	5	17.5	12.4	20.3	2.5
Female (%)	4.6	9.5	12.4	15.4	0.4
Living in the HH (%)	2	5	6	13	0.8
Educated (%)	-	22.4	21.6	12.4	-
EOM (%)	-	-	2.5	3	-
ERM (%)	-	-	1.2	4.2	-
	Years of resident for the non-native HHH (n=32)				
	>1	1-10	11-20	21-30	31-40
HHH (%)	6	34	19	28	13
	Migration status (n=32)				
	Central	North	West		
HHH (%)	12	44	44		
	Mobility to garden (n=40)				
	Live on garden	On foot	Public transport		
HHH (%)	75	5	20		

EOM: earning occasional money, ERM: earning regular money

Most of the gardeners cultivated just one garden. The majority (90%) of the gardeners manage their gardens in a tenant-sharecropping system while only 10% were landowners. Fallow system was practiced by few gardeners during the period from March to May (Table 3).

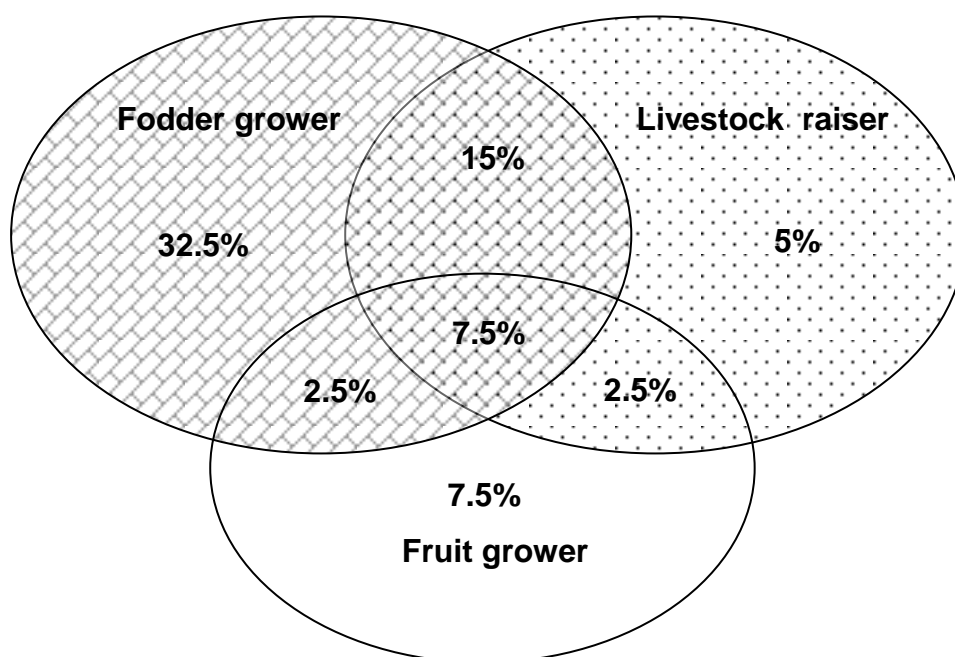


Fig.2. Distribution of agricultural activities among the gardener households interviewed in urban Khartoum, Sudan (n=40).

With regards to vegetable production, there are three cropping seasons; winter season from October to March, hot dry summer season from April to June and rainy season from July to September. Cultivation during rainy season is very often affected by high flooding, which covers all parts of the floodplain. Leafy vegetables with short growth cycles such as rocket (*Eruca sativa* Mill.), Jew's mallow (*Corchorous olitorius* L.) and purslane (*Portulaca oleracea* L.) were the most common vegetables and grown throughout the three cropping seasons (Fig. 3). They were followed in importance by onion (*Allium cepa* L.) and radish (*Raphanus sativus* L.) which were grown mainly in winter and summer, respectively.

Table 3. Numerical distribution of households' activities and problems encountered by gardeners engaged in urban gardening in Khartoum (n=40).

Variable	Measurement level	Percentage (%)
Production relations	Share tenant	90
	Land owner	10
Fallow system	No	95
	Yes ¹	05
Covered by flood	No	73
	Yes ²	28
Irrigation water source	Nile	60
	Well	38
	Nile + Well	03
Multi- gardens and crops	Gardens	15
	Crops	95
Type of fertilizers	Mineral	93
	Mineral + Organic	08
Problems	Marketing	25
	Irrigation cost	10
	Funding	08
	Labor	05
	Inputs cost	05
	Diseases	03
	Land preparation	03

¹ Fallow system from March to May, ² Flooding time from August to October.

Fruity vegetables like cucumber (*Cucumis sativus* L.), snake cucumber (*Cucumis melo* L.) and tomato (*Lycopersicon esculentum* Mill.) were exclusively grown in winter. Alfalfa (*Medicago sativa* L.), maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* (L.) Moench) were the major

cultivated fodder crops and mostly grown in the winter season. In addition to the vegetables and fodder crops, different species of fruit trees could be identified in 20% of the gardens. These trees included date palm (n=12; *Phoenix dactylifera* L.), grapefruit (n=1; *Citrus x paradisi* Macfad.), guava (n=21; *Psidium guajava* L.), and lime (n=161; *Citrus aurantiifolia* (L.) Swingle). The fruits were mostly used for home consumption, and to a lesser extent for sale.

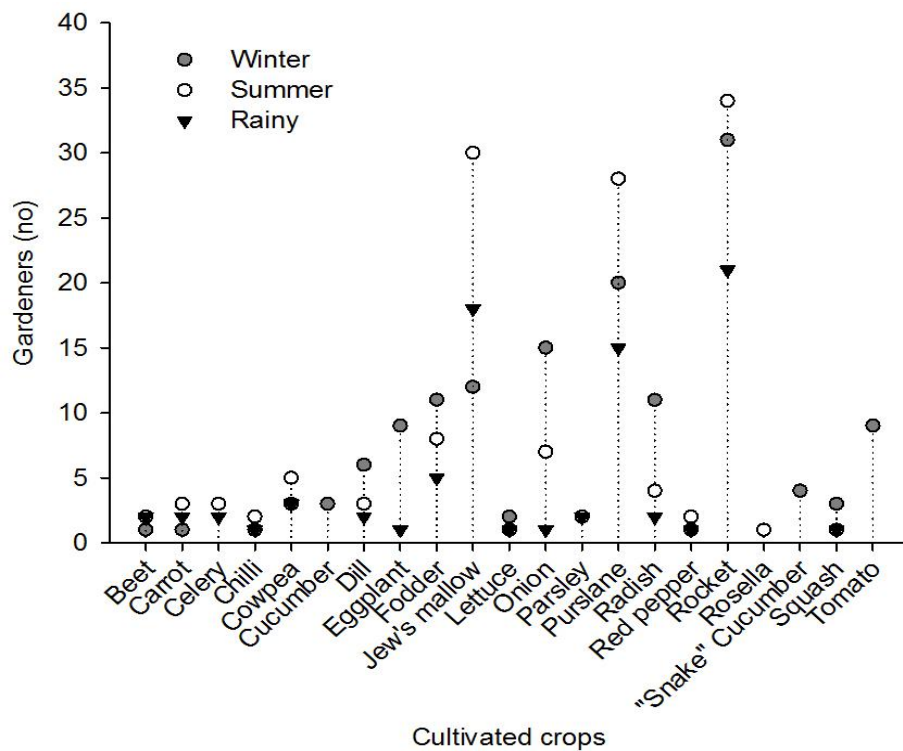


Fig. 3. Number of garden cultivated with the respective plants at the three agricultural seasons of Khartoum, Sudan.

Gardening entirely depends on irrigation. All surveyed gardens used surface irrigation utilizing fuel or electric pumps to lift water from the Nile (60% of gardens) or from wells (37.5% of gardens). One gardener was using water from both sources (Table 3).

Thirty nine gardeners used tractors either exclusively (36%), in combination with oxen (46%) or with manually operated local device (18%) to prepare the soil. One gardener used exclusively oxen-drawn ridge for land preparation.

The large majority (92.5%) of gardeners applied only mineral fertilizers. The remaining 7.5% used manure to supplement mineral fertilization application (Table 3). The most commonly used mineral fertilizers were urea, super phosphate and foliar sprays. One or combinations of these fertilizers were applied during the cropping cycle (Table 3).

Aphids (*Aphis gossypii*), whiteflies (*Bemisia tabaci*), jassids (*Empoasca lypica*), and leaf beetles (*Microtheca ochroloma* Stål) were the most common pests reported by the gardeners (Fig. 4). Most of the gardeners (90%) stated that they use pesticides as pest control strategies. The crops most exposed to pesticides application as reported by gardeners were rocket, Jew's mallow and purslane (Fig. 5).

Input items were categorized according to their expenses into three categories (high expenses (I), medium expenses (II) and low expenses (III); Fig. 6). About 53% of the gardeners reported seeds and fertilizers as high expenses input, followed by 25% considered irrigation as the high expense input. While, 22.5% of the gardeners were reported medium costs for seeds and fertilizers (Fig. 6). The most frequently mentioned production constrains, which were marketing (43%) followed by input costs (26%), lack of capital (17%) and low labor availability (8%, Table 3).

Garden typology

Three groups of urban gardens were distinguished by the cluster analysis: mixed vegetable-fodder gardens (MVF), mixed vegetable- subsistence livestock gardens (MVSL) and pure vegetable gardens (PV).

The most discriminating variables were those related to the diversity of garden activities, the origin of the household, and the garden management practices (Table 4).

Table 4. Frequency distribution of the variables used to distinguish between the household gardens in urban Khartoum, Sudan.

Variables	Gardens		
	MVF (n=10)	MVSL (n=17)	PV (n=12)
	Mean \pm SD		
Garden area (ha)	2.2 ^a \pm 0.8	1.5 ^b \pm 1.4	1.5 ^a \pm 1.0
Family labor	2.1 ^a \pm 1.9	1.5 ^a \pm 1.2	1.7 ^a \pm 0.7
Gardens activities	Percentage of households (HH)		
Livestock keeping			
Yes	30	53	0
No	70	47	100
Fodder grower			
Yes	90	65	25
No	10	35	75
Origin of the HH			
Native	50	0	17
Non-native	50	100	83
Garden management practices			
Soil preparation			
Tractor	0	53	100
Oxen+Tractor	100	47	0
Cropping systems			
Vegetable	0	53	83
Fodder	0	6	8.3
Mixed	100	41	8.3
Irrigation water source			
Nile	90	29	83
Well	10	71	8.3
Mixed	0	0	8.3

^{a-b} Means (\pm SD) on the same row with different superscript are significantly different ($P < 0.05$).

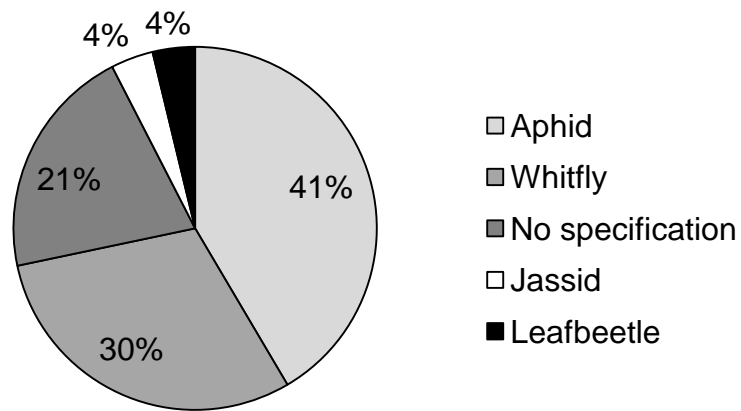


Fig. 4. Common insects identified by gardeners within urban gardens in Khartoum, Sudan.

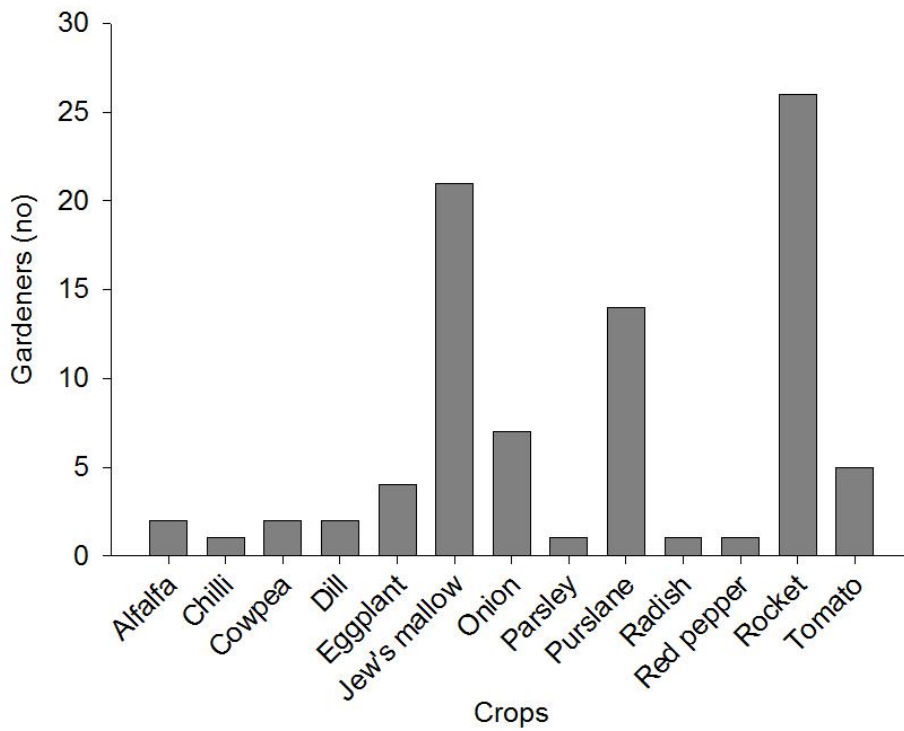


Fig. 5. **The most treated crops by pesticides** within urban gardens in Khartoum, Sudan.

The mixed vegetable-fodder gardens had significantly higher average garden size (2.2 ha) than the two other types. In addition to growing vegetables, most of the gardeners (90%) grow fodder and raise a few animals mainly for household consumption. They mainly used tractor and animal power for land preparation and water from River Nile for irrigation. The majority of landowners fell in this group, which included native and non-native gardeners.

In comparison, the mixed vegetable-subsistence livestock gardeners were less inclined to growing fodder. All gardeners in this group were non-native to Khartoum and were managing their gardens in a tenant-sharecropping system. In contrast to their peers in the first group the majority of gardeners (71%) in this group utilized water from wells for irrigation.

The pure vegetable gardeners did not keep livestock. Only a few number of them produced fodder for commercial purposes. Most of them were non-native to Khartoum. Compared to the other two groups, they had significantly smaller average garden size (1 ha) and were all using tractor for land preparation. Most of them were using water from the River Nile for irrigation.

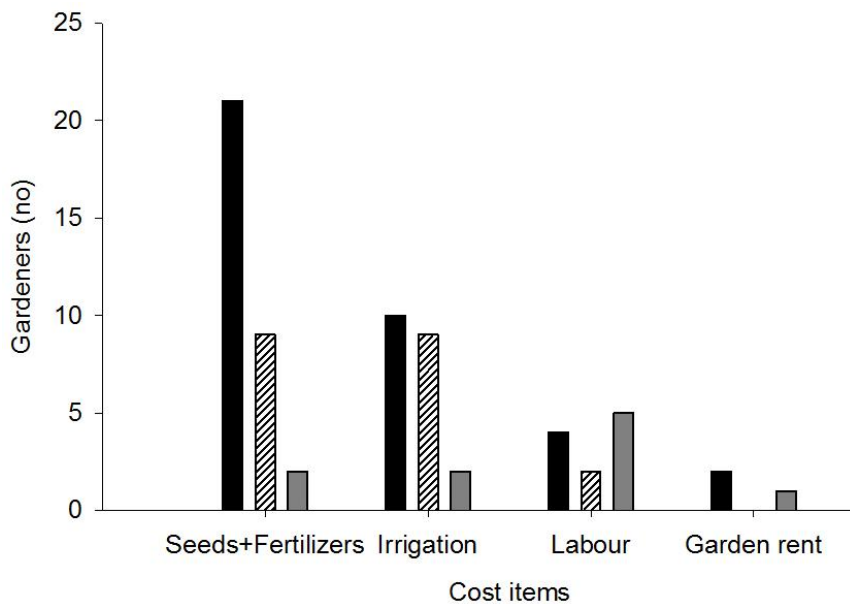


Fig. 6. Expenses of urban gardeners in Khartoum, Sudan.

DISCUSSION

Although the data presented in this study are preliminary in nature, some characteristics of UA in Khartoum could be identified. The first one is the simple observation that men gardeners were predominate urban food cultivation in Khartoum. This is in contrast to the findings of studies in Uganda (Maxwell, 1995; Binns and Lynch, 1998), Ghana (Danso and Drechsel, 2003), Cameroon (Goekowski *et al.*, 2003) and Senegal (Kessler *et al.*, 2004), where women are the main actors in UA. The observed case in our study could be due to the fact that Sudanese communities generally consider gardening to be a male business, though females are involved in vegetable marketing as their primary means of generating income for household expenditure.

UA in greater Khartoum State is practiced by different ethnic and age groups. The gardeners are from various tribes in Sudan. This finding corroborates the recent work of Thompson *et al.* (2010). The majority of the gardeners in our study are migrants from different parts of Sudan who might have migrated for several reasons, including local conflicts and environmental causes such as desertification and the effects of droughts (Eltayeb, 2003; UNEP, 2007). The study points to the fact that migration processes are dominated by men, who constitute more than half of the household's population. This is similar to the finding of Eltayeb (2003) who reported that 54% of the Khartoum populations were males aged from 15 to 64 years. The average family size reported in the present study was slightly above the average for urban Khartoum between the years 1973 and 1993 (6 and 7), as reported by Elbushra (1987) and Ahmad (2002), but was almost equal to the country average of 7 in 1999 as reported by the Central Bureau of Statistics (2009). Despite this, quite a large number of gardeners depend on hired labor in executing garden operations, which could be due to the possibility that family members prefer non-garden activities with higher income. This was the case in a study by Ogungbile (1998) in Nigeria, who reported that family labor contributed only 36% to the labor force leading to gardeners' relying heavily on hired labor. However, in the current study not all members of the household live together, which could be responsible for the use of hired labor by Sudanese gardeners. The concept of households in Khartoum, therefore, deviates from the definition of Smeeding and

Weinberg (2001), who assumed that all household members live within the same dwelling unit.

UA is practiced intensively on narrow strips along the River Nile because of the fertile land and irrigation water. They are affected by high input costs for seeds, fertilizers (minerals and organic) and pesticides as well as the limited availability of farm land. The gardeners were found to cultivate only very small gardens. Which, were to a large extent, resemble the open-space production system practiced, for instance in Kumasi, Dar es Salaam and Harare. Where, they cultivate mixed leafy vegetables, often the only source of income for the households (Cofie *et al.*, 2003; Drechsel *et al.*, 2006). To overcome and reduce risks from fluctuating market prices, gardeners cultivate a mixture of crops and by doing so returns tend to be higher than from sole cropping (Ogungbile *et al.*, 1998).

Limited areas were grown with fruit-bearing vegetables such as tomato, eggplant (*Solanum melongena* L.) and cucumber. Gardeners were reluctant to grow large areas with these crops due to risk of crop theft by passers-by. They, therefore, adopt a strategy where they cultivate crops that ripen faster or look like non-edible weeds.

A high percentage of the gardens are managed on a tenant system by migrant gardeners resident in Khartoum. To cope with insecure land tenure, gardeners adopt techniques such as low investment, restricted tree planting and livestock raising (Drechsel and Dongus, 2010; Thompson *et al.*, 2010). Under the given circumstances growing leafy vegetables is easy, fast and their market potential is high due to the freshness of the product which can be easily transported to city center and market places. Green leafy vegetables are consumed as fresh salad or processed into sauces, which are commonly cooked.

The majority of the interviewed household heads applied pesticides irrationally without caring about the quantity, which may cause contamination to the product. Information concerning the use of pesticides was received from merchants as well as from gardeners. Leafy vegetables like Jew's mallow, purslane and rocket are the most crops treated by pesticides because they were the most crops susceptible to insect infestation. Gardeners' statements varied with regard to time of

insect infestation especially for aphids and whitefly. Generally it was high during transition months from winter to summer (February and March), and for jassid and leaf beetle they emerge during the humid months between July and December.

Urea is the most widely used fertilizer with high variation among gardeners in terms of quantity applied. The amount applied by each gardener is based on personal judgment rather than research recommendation. Very few gardeners use farm yard manure (FYM) irrespective of its benefits to crop growth as well as its known effects on improving the soil condition. Some argued that FYM is not readily available due to competition with the highly profitable brick making that uses animal manure as a raw material and biomass fuel (Omer and Fadalla, 2003; Alam and Starr, 2009). A few of them believed that FYM is conducive to the spread of soil borne diseases.

The cropping seasons are organized according to the flood cycle. At its peak, the flood is covering the entire floodplain to a depth of 1.5 meters on average. When the water recedes by early October, it leaves behind well-watered fields, naturally fertilized by the rich silt carried down from Ethiopia's highlands and deposited on the floodplain. Reliance on supplementary irrigation from the River Nile, utilizing energy, for low value subsistence crops could result in raising production costs. Pumping the irrigation water from the River Nile or a well requires substantial cash expenditures, adding to costs for seeds and fertilizers (Thompson *et al.*, 2010).

Factors controlling gardeners' selection of land preparation are, first of all, their financial situation whereby the cost for hiring a tractor is 40 to 50 SDG per hour (1 US\$ = 2.09 SDG, in 2007) irrespective of the area and the soil type. Of similar importance is the wetness of the land. Wet land will restrict seed germination given the compacted nature of the soil. The last factor of importance is the crop type, whereby gardeners prefer to use a tractor for deep rooting crops. The marketing of vegetables is mainly through retailers who buy the growing vegetables in the field. The produce is transported by hired pick-ups or lorries for sale at the nearby marketplaces. In most cases, a whole plot of cowpea or Jew's mallow, for example, may be sold to such traders, who visit the garden to negotiate a

price prior to arranging for the harvest and transport of the produce to the larger city markets. The quoted obstacles, which gardeners face from year to year, include marketing problems, low output price, high input cost, lack of labor, land shortage and pest attack. Most of the products are leafy vegetables, which are highly perishable and cannot be kept for long time without processing or cold storage. Most gardeners complained about the lack of credit for purchasing inputs like seed, fertilizers and pesticides.

CONCLUSIONS AND RECOMMENDATIONS

In Khartoum UA is dominated by fast growing leafy vegetables yielding immediate cash income for the gardeners. Enhanced crop diversity may help gardeners overcome the strongly fluctuating market prices, and thereby strengthen the contributions of UA to the overall food supply to the city. In this context a better understanding of the factors that influence nutrient balances is needed.

ACKNOWLEDGEMENTS

The authors are grateful to the Alexander von Humboldt Foundation for financial support of this study within the framework of a partnership between Agricultural Research Corporation (ARC, Sudan) and the University of Kassel. Also, sincere thanks are due to the UA gardeners of Khartoum, Sudan for their response and patience.

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خصائص أنشطة الزراعة الحضرية في ولاية الخرطوم، السودان*

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مستخلص البحث: ظاهرة تحول المناطق الريفية حول المدن إلى مناطق حضرية، أوجدت حاجة ملحة لإنتاج المزيد من الغذاء لتلبية الطلب المتزايد من سكان المناطق الحضرية. حيث أن إنتاج الغذاء في المدن وما حولها ليس ظاهرة جديدة، إلا أنه حظى باهتمام محدود من قبل العلماء وصانعي القرار.

ما يعرف عن الظروف الاجتماعية والإقتصادية للمزارعين في المناطق الحضرية وممارسات الإنتاج الخاصة بهم قليل. لذا كان الهدف من هذه الدراسة، هو تحليل بنية الأنظمة البستانية الحالية وتحديد المجالات التي تحتاج إلى مزيد من الأبحاث لتعزيز إستدامة الإنتاج بها.

لتحقيق هذا الهدف، تم إجراء مسح أولي في الفترة من مارس إلى يونيو 2007، حيث تم اختيار عدد أربعون جنينة أسرية وتم عمل مقابلات مع رؤساء الأسر باستخدام أستبيان شبه منظم. كشفت النتائج أن الزراعة الحضرية (UA) حصرية على الرجال وجميعهم يزرعون الخضروات التجارية، 33% منهم يزرعون محاصيل العلف، و 5% يربون الماعز والأغنام. حوالي 78% من رؤساء الأسر كانوا أصغر من 55 سنة و 80% منهم ليس من سكان الخرطوم الأصليين. عدد قليل منهم مالك لأرضه في حين 90% منهم يديرون أنشطتهم في ظل نظام الإيجار والمشاركة. تعتبر زراعة الخضر هي المصدر الرئيسي للدخل لحوالي 83% منهم. الخضر الغالب زراعتها هي الخضر الورقية ذات دورات النمو القصيرة مثل الملوخية (*Corchorus olitorius* L.)، الرجلة (*Portulaca oleracea* L.) والجرجير (*Eruca sativa* Mill.). المصادر الرئيسية لمياه الري هي نهر النيل والأبار. جميعهم يستخدمون المبيدات الحشرية و يضيفون الأسمدة المعدنية. تمارس الزراعة على مدار العام دون توقف في 95% من الجنائن. قسمت الدراسة الجنائن الي ثلاث مجموعات بأستخدام التحليل العنقودي على أساس الاختلافات في أنشطة الجنائن، أصل الجنائن وطريقة إدارة الجنينة. المجموعات هي: جنائن مختلطة للعلف والخضر، جنائن مختلطة من الماشية والخضر و جنائن للخضر فقط.

* جزء من أطروحة تقدم بها المؤلف لجامعة كاسل بالمانيا لنيل درجة الدكتوراة
أستاذ باحث مساعد، محطة بحوث سوبا، هيئة البحوث الزراعية