Urban and peri-urban horticulture in the century of cities

International symposium
Dakar, Republic of Senegal, 6-9 December 2010

Programme and abstracts
Urban and peri-urban horticulture in the century of cities

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PROGRAMME AND ABSTRACTS
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Overview

In 2008, the world's urban population surpassed, for the first time, the number of people living in rural areas. Within 15 years, almost 60% of world population – or 4.5 billion people – will be urban. Cities in low-income developing countries are growing at an especially rapid rate. Kinshasa, capital of one of the world's poorest countries, is now the world's fastest growing future megacity. The United Nations estimates that the number of urban dwellers in sub-Saharan Africa will rise from 320 million to 540 million by 2025, and will exceed one billion people by 2050.

Already, more than one billion people worldwide live in urban slums, with limited access to even basic health, water and sanitation services. The ongoing world economic downturn and the persistence of high food prices affect particularly the urban poor, who spend 60% or more of their income on food.

To help developing countries meet the challenges of massive and rapid urbanization, the Food and Agriculture Organization of the United Nations (FAO) launched in 2001 a multidisciplinary initiative, Food for the Cities, which aims at ensuring the access of urban populations to safe food and healthy and secure environments.

A major component of Food for the Cities is intensification of horticultural production in and around urban areas. Urban and peri-urban horticulture (UPH) cannot meet, by itself, cities' exponentially growing demand for fresh vegetables, fruit and other horticultural produce, and should not divert resources from horticulture in rural areas. However, FAO experience indicates that, where farm-to-market systems are inadequate, it can fill critical gaps and make a significant contribution to urban food supply and livelihoods.

Over the past decade, FAO multidisciplinary programmes and projects in developing and emerging countries have focused on the policies, institutional frameworks, farming practices and support systems needed to optimize the sector's contribution. It has opened a dialogue with national policymakers and municipal authorities on UPH issues and, through synergies with partner organizations, helped develop policies, strategies and technical guidelines.

Symposium objectives

Together with partner organizations, FAO and the Ministry of Agriculture of the Republic of Senegal have convened this international symposium in order to:
- review experiences and lessons learned
- assess UPH's contribution to urban food supply, nutrition and livelihoods
- capitalize on current experiences and knowledge
- foster UPH initiatives and networking
- lay the foundations for increased policy and institutional support for UPH

The symposium is expected to provide guidance for the preparation of FAO's first “Status Report on Urban and Peri-Urban Horticulture in Africa” (SOUPHA), to be published in 2011.
Overview

Topic areas

The symposium will cover key links in the production, supply and value chains including:

- securing access to land and water
- integrated plant production and protection
- post-harvest handling and processing technologies
- product quality and safety
- marketing

Venue

Ngor and Diarama Complex
Route de Ngor
Dakar, Senegal

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Further information

For updates see:
Organization

Symposium convenors

- Food and Agriculture Organization of the United Nations (FAO)
- Ministry of Agriculture, Republic of Senegal

Partner organizations

- Global Horticulture Initiative (GlobalHort)
- International Cooperation Centre of Agricultural Research for Development (CIRAD)
- International Society for Horticultural Science (ISHS)

Committees

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• Ibrahima Niang, FAO, Senegal
• Emile Victor Coly, Institut sénégalais de recherches agricoles
• Cheikh Sadibou Diop, Ministry of Agriculture, Senegal
Programme

Sunday, 5 December

Registration of participants

Monday, 6 December

Opening ceremony

Session 1: The impact of urbanization and the role of UPH

*Keynote speakers:* Norman Looney (Agri-Food Canada), Serigne Tall (UN-Habitat), Laurent Parrot (CIRAD)

Seminars

Tuesday, 7 December

Session 2: Characterization of urban and peri-urban agriculture

*Keynote speakers:* Marielle Dubbeling (RUAF), Gert Gröning (Berlin University)

Session 3: Measuring the contribution of UPH to urban food supply, nutrition, income generation and livelihoods

*Keynote speaker:* Paule Moustier (CIRAD)

Seminars

Wednesday, 8 December

Technical tour

Session 4: Management of natural resources and waste for UPH

*Keynote speaker:* Bernard Keraita (IWMl)

Seminars

Thursday, 9 December

Session 5: Safeguarding food quality and safety and growers’ health, safety and welfare

*Keynote speaker:* Youga Niang (CDH/ENDA-RUP)

Concluding plenary session

Closing ceremony

Post-symposium visit to Gorée Island
Programme in detail

Monday, 6 December

8:00-11:00 / Amphitheatre
Opening ceremony

11:30-13:30 / Amphitheatre
Session 1: The impact of urbanization and the role of UPH
Chair: NeBambi Lutaladio
Rapporteurs: Margaret Pasquini, Tristan Nondah

Keynote speakers
Norman Looney (Agri Food Canada)
   The place for urban and peri-urban horticulture in feeding the urban poor:
   Researchable issues for horticultural science

Serigne Mansour Tall (UN-Habitat)

Laurent Parrot (CIRAD)
   Agriculture and urban development in sub-Saharan Africa

Oral presentations
Maddalena Falletti
   La Grande muraille verte: Mapping strategies for the design of a productive infrastructure
   in the urban region of Dakar

Aimé Fogue Kamga
   Dynamics of the vegetable production systems along the rural-urban continuum
   of Bamenda, Northwest Cameroon – Kamga, A., Kouamé, C.

Yekeen Adeeyo Sanusi
   Analysis of livelihood opportunities of peri-urban horticulture in Nigeria:
   A case study of Minna, Niger State

13:30 - 15:30
Lunch and poster presentations
15:30-17:30

Seminars

IPM – Sustainable production of horticultural crops / Salle Djoudj  
Moderators: William Settle (FAO – Rome), Mohamed HamaGarba (FAO – Senegal)

PROFAV – Promotion of fruits and vegetables for better health and livelihoods / Amphitheatre  
Moderator: Jacky Ganry (CIRAD)

Ganry, J.  
Promoting fruits and vegetables for nutrition and health, a major challenge for developing countries

Ba, A., Aubry, C., et al.  
From urban and peri-urban agriculture to micro gardens: How to attain fresh food security in Dakar

Diouf, M., Ba, C. O.  
Contribution of African leafy vegetables to food security and income generation in Senegal

Ndenga, E. A., Mbugua, G. W. et al.  
Agricultural diversification with indigenous vegetables for cash cropping and nutrition: Lessons from peri-urban communities of the Rift Valley and Central Provinces in Kenya

Onwuka, S., Onunka, B. N. et al.  
Harnessing the socio-cultural, nutritional and economic values of African eggplant by urban households in south-eastern Nigeria

Vegetable production and seed trade in West and Central Africa / Salle Kounghueul  
Moderator: Abdou Tenkouano (AVRDC)

UPH and marketing / Salle des Lions  
Moderator: Olivio Argenti (FAO – Rome)

UPH in emergency situations and rehabilitation / Salle Somone  
Moderator: José Luis Fernández (FAO – Rome)

18:00-20:00

Seminars

Sharing good practices with men and women farmers / Salle Djoudj  
Moderator: Sophie Treinen (FAO – Rome)

Food for the cities: Local food systems and horticulture / Amphitheatre  
Moderator: Julien Custot (FAO – Rome)

Assogba, R. B.  
Typology of market gardens in southern Benin

Bella-Manga, Ndo, E. G. D. et al.  
Fruit supply sources for large urban markets in Cameroon: The case of Douala, Yaoundé and Bafoussam
Tuesday, 7 December

8:00-10:00 / Amphitheatre

Session 2: Characterization of urban and peri-urban agriculture

Chair: Rémi Kahane
Rapporteurs: Paulina Shilunga, Grégoire Mutshail

Keynote speakers

Marielle Dubbeling (RIAF)
Status and challenges for urban and peri-urban agriculture policy-making, planning and design

Gert Gröning (Berlin University)
The meaning of land-use planning for urban horticulture: The example of Kleingaerten in Germany and comparable gardens elsewhere

Oral presentations

Sylvanus S. P. Doe
Advancing vegetable production as a development and sustainability asset in urban and peri-urban savannas

Emmanuel Geoffria
The international plant cluster VEGEPOLYS: Promotion of sustainability and innovation in plants, and initiatives in urban and peri-urban horticulture – Geoffria, E., Delefosse, L.

Ablaye Ndour
The impact of urban and peri-urban horticulture on the development of horticulture in high-potential zones: Example of river valleys

Margaret Pasquini
Characterizing urban and peri-urban production systems for African indigenous vegetables in four cities in Benin and Côte d’Ivoire – Pasquini, M.W., Weinberger, K. et al.

10:00-10:30
Coffee break

10:30-12:30 / Amphitheatre

Session 3: Measuring the contribution of UPH to urban food supply, nutrition, income generation and livelihoods

Chair: Seydi Ababacar Sy Gaye
Rapporteurs: Charlotte Dufour, Thomson Chilanga

Keynote speakers

Olivio Argenti (FAO)
Food supply and distribution to cities

Emmanuel Carrère (AfDB)
Strategic orientations of the African Development Bank on agriculture and urban development

Paule Moustier (CIRAD)
Measuring the food and economic contribution of UPH in Africa and Asia
Oral presentations

Bruno Kitiaka-Mfum’andem
*FAO urban and peri-urban horticulture (UPH) project experience: Security of access to land and water resources in the Democratic Republic of the Congo*

Mogapi Ernest Madisa
*Impact of government financial incentives on peri-urban vegetable production in Botswana – Madisa, M. E., Assefa, Y.*

Lawrence Olajide-Taiwo
*Prospects, challenges and institutional linkages of the vegetable value chain in Ibadan City, Nigeria - Olajide-Taiwo, L. O., Cofie, O. et al.*

Abdoulaye Seck
*Developing intensive vegetable production through soil-less microgardening technology to sustain peri-urban and urban horticulture in The Gambia*

12:30 - 15:30
Lunch and poster presentations

15:30-17:30
Seminars

**IAGU: 10 years of intervention in urban agriculture in francophone West Africa** / Salle Djoudj
*Moderator: Moussa Sy (IAGU)*

**Capacity building in UPH** / Amphitheatre
*Moderator: Cheikh Ndiaye (CFPH)*

**Water management in UPH** / Salle Koungheul
*Moderator: Laurent Stravato (FAO)*

Tfwala, C. M.
*Water accessibility and irrigation of vegetables in Nhlangano, Swaziland*

Nondah, T.
*Evaluation of irrigation practices with lettuce (Lactuca sativa l.) in the dry season in the northern zone of Libreville*

**Urban and peri-urban horticulture and human nutrition** / Salle des Lions
*Moderator: Charlotte Dufour (FAO)*

Crush, J.
*The prevalence of urban food production and food insecurity in southern African cities*

Pascal, P.
*Garden in a sack in Nairobi*

Achigan-Dako, E. *et al.*
*Integrating indigenous vegetables into urban and peri-urban agriculture in West Africa: Relevance, status and research agenda*

**Gender, communication and horticulture** / Salle Somone
*Moderator: Yannick De Mol (FAO)*
18:00-20:00

Seminars

Turning wastes into resources for UPH / Salle Djoudj
Moderator: Hervé Saint Macary (CIRAD)
Houot, S., Cambier, P. et al.

Long term application of organic wastes in agriculture: environmental and sanitary aspects

Tella, M., Chataing, S. et al.
Investigation of trace elements content in organic wastes used for market gardening

N'Diénor, M., Aubry, C. et al.
Déchet urbain-agriculture-environnement (DUAE): Using waste as resource for agriculture

Ramahefarison, H., Rabeharisoa, L. et al.
Market garden production systems in the periurban area of Mahajanga: Determinants of agricultural practices of organic fertilizer for technical innovation

Status of urban and peri-urban horticulture in Africa / Amphitheatre
Moderators: NeBambi Lutaladio, Wilfried Baudoin (FAO – Rome)

Fosso, A.
Integrated initiatives in support of urban and peri-urban horticulture in Namibia: Project achievements

Mutshail, G.
Technical overview on urban and peri-urban horticulture (UPH) in the Democratic Republic of the Congo
Wednesday, 8 December

8:00-14:30 / Dakar
Technical tour

15:30-17:30 / Amphitheatre
Session 4: Management of natural resources and waste for UPH

Chair: Laurent Stravato
Rapporteurs: Mama Touré Dieng, Patrick Kumah

Keynote speaker

Bernard Keirata
*Management of natural resources and waste for urban and peri-urban horticulture in low-income countries* – Keirata, B., Cofie, O. *et al.*

Oral presentations

Edmond Hien
*Impact of the spreading of urban waste on agricultural soil bacterial communities in the periphery of Ouagadougou, Burkina Faso* – Hien, E., Favre-Bonté, S. *et al.*

Hervé Saint Macary
*Ecological intensification of agricultural production systems through waste recycling* – Saint Macary, H., Houot, S. *et al.*

Laurent Parrot
*The determinants of organic fertilizers used in urban and peri-urban agriculture: An econometric analysis* – Sotamenou, J., Parrot, L.

Laurent Thuriès
*Urban and livestock wastes in the tropics: Characterization and modeling of their transformations in soil to better choose their potential utilization* – Thuriès, L., Rabetokotany, N.

Marie-Christine Zélem
*Developing the utilization of organic waste in truck farming in Senegal: Opportunities, constraints and risks* – Tounkara, S., Zélem M. C.

18:30-20:30
Seminars

**UPH and decentralized cooperation** / Salle Djoudj
*Moderators: Italian Cooperation, Municipality of Dakar, Municipality of Milan*

**Impact of urbanization and role of UPH in the Niayes, Senegal** / Amphitheatre
*Moderator: Emile Victor Coly – Institut sénégalais de recherches agricoles*
Thursday, 9 December

8:00-10:00 / Amphitheatre
Session 5: Safeguarding food quality and safety and growers’ health, safety and welfare

Chair: Françoise Assogba-Komlan
Rapporteurs: Judith Kitivo, Faustin Bella Manga

Keynote speaker
Youga Niang (CDH/ENDA-RUP)
Contribution of urban agriculture to food security in Senegal: The case of the city of Dakar

Oral presentations
Nafiu Abdu
Phytoavailability, human risk assessment and transfer characteristics of cadmium and zinc loads in wastewater irrigated urban gardens in Kano, Nigeria – Abdu, N., Agbenin, J. O. et al.

Bernard Keirata
Enhancing adoption of food safety measures in urban vegetable production and marketing systems – Keirata, B., Drechsel, P. et al.

Patrick Kumah
Pesticides usage in cabbage (Brassica oleracea) cultivation in the forest ecozone of Ghana – Amoako, P. K., Kumah, P. et al.

10:30-12:00 / Amphitheatre
Plenary/concluding session:
Recommendations

Chair: Wilfried Baudoin
Rapporteurs: Enoch Achigan-Dako, Rémi Nono-Womdim

Panelists
Marielle Dubbeling (RUAF); Gert Gröning (ISHS); Megan McGlinchy (CRS); Norm Looney (GlobalHort); Emmanuel Carrère (AfDB), NeBambi Lutaladio (FAO); Jacky Ganry (CIRAD); Seydi Ababacar Sy Gaye (MINAGR), Abdoulaye Sow (CCIAD); Neveen Metwally (CLAC); Margaret Pasquini (Universidad de los Andes)

12:00-13:00 / Amphitheatre
Closing ceremony
Poster presentations

Abdu, N. et al.
*Horizontal flux of cadmium and zinc in wastewater irrigated vegetable garden soils of Kano, northern Nigeria*

Affokpon, A. et al.
*Better vegetable production systems in West Africa: Prospects for the use of native antagonistic fungi for nematode management*

Aguiar, A.
*A peri-urban vegetable production area in NW Portugal: How fields were created and how vegetables are cultivated*

Akintoye, H.A. et al.
*Urban and peri-urban vegetable training: Case study of Leventis Foundation Agricultural Schools in Nigeria*

Badji, H.
*Managing fruit fly attacks on Cucurbitaceae crops using natural pesticides in Senegal*

Bassoum, S. et al.
*Sahel Vert: A project of Centre Mampuya, Senegal*

Bella-Manga et al.
*Increasing production and availability of fruits and vegetables in Cameroon: Opportunities, constraints and proposed solutions*

Berton, S.
*Filières agricoles en régions d’Itasy et d’Analamanga: approvisionnement de la ville d’Antananarivo*

Berton-Ofoueme, Y.
*Pression urbaine et disparition des centres maraîchers intra brazzavillois*

Cancela, J.
*Urban agriculture in Portugal: Origins, types and trends*

Diakhaté S. et al.
*Impact on soil microbial properties amended with biosolids derived from sewage treatment processes in Senegal*

Ekwe, K.C. et al.
*Growing and marketing indigenous vegetable species for sustenance in urban areas of Abia State, Nigeria*

Fematouo, T. T.
*Horticulture and sustainable cities: Opportunities and challenges of governance – Case study of Yaoundé’s farming system*

Fematouo, T. T. et al.
*Improving African leafy green vegetable seeds in urban and peri-urban farming systems – Case study of urban horticulture in Yaoundé, Cameroon*

Gueye, M.
*The improved tropical garden: Home production for home consumption*

Kedowide Mevo Guezo, C.
*Characterization and study of dynamics of horticulture in Ouagadougou, Burkina Faso: The case of truck farming 1996–2009*

Kulindwa, Y. J. et al.
*Linking small-scale farmers to markets in urban and peri-urban areas: An evaluation of AMSDP programme in Arusha, Tanzania*
Programme in detail

Kumah, P. et al.
Cold storage: An option in reducing pesticide residue levels in cabbage (Brassica oleracea)

Lagerkvist, C. J. et al.
Consumer food health risk perceptions: A supply chain approach to leafy vegetables from peri-urban farming around Nairobi

Lagerkvist, C. J. et al.
Measuring consumers’ food-quality values at the point of purchase using best-worst scaling: A supply-chain approach to leafy vegetables from peri-urban farming around Nairobi

Larbi, T. O. et al.
Strengthening urban producer organizations for innovative vegetable production and marketing in West African cities: Experiences from Accra, Ghana and Ibadan, Nigeria

Magigi, W. et al.
A quest for urban planning practice, attitudes and policy changes in rapidly urbanizing cities for sustainable development in Tanzania: the case of Moshi

MBengue, I.
Microjardinage [micro-gardening] and the use of natural and biological products for better environmental conservation, human health and protection of vegetables

Mbodj, I. et al.
The use of Paecilomyces lilacinus (nematicidal fungus) as an alternative method to control nematodes in tomato for sustainable production in urban and suburban areas (Dakar, Senegal)

Msoka, C. et al.
Hybrid seeds as an important component of integrated vegetable production and protection in urban and peri-urban horticulture in African cities

Musa, P. D. et al.
Utilization of horticultural crops for better health and livelihoods in Sierra Leone

Ndiaye, P. et al.
Horticultural territories in the urban environment (Dakar, Senegal)

Nhongonhema, R.
Contribution of urban and peri-urban horticulture to livelihoods in Zimbabwe

Nhongonhema, R.
Providing agricultural extension services for urban agriculture in Zimbabwe

Nondah, T.
Space and time dynamics of the evolution of horticulture in Gabon: The case of market-gardening crops in Libreville

Razanakoto, O. R. et al.
Methodological approach to insert a marketing channel: Case of squash marketing in Antananarivo

Sangaré, S. K. et al.
Vertical nutrient fluxes in urban agricultural soils: Measuring and modeling the N, P and K leaching in Bobo Dioulasso (Burkina Faso)

Shah, A.
From beneficiaries to researchers: A distributed model for biological pest and disease control

Sharma, M. K.
Urban and peri-urban horticulture in Rajasthan: Vision 2020

Thuo, A. D. M.
Urbanization in Nairobi’s peri-urban areas: Consequences of land-use conversion
Programme in detail

Torquato Luiz, J.
*Building peri-urban garden regulations: The relationship between community groups and local public administrations, and lessons learned from the field*

Tossou, C. C. et al.
*Spatio-temporal dynamics of land occupation, urbanization and urban agriculture on the Allada plateau in southern Benin*
Monday, 6 December, 11:30-13:30 / Amphitheatre

Session 1: The impact of urbanization and the role of UPH

Chair: NeBambi Lutaladio
Rapporteurs: Margaret Pasquini, Tristan Nondah
Keynote speakers

The place for urban and peri-urban horticulture in feeding the urban poor: Researchable issues for horticultural science

Looney, N. E.¹

¹Board Chair, The Global Horticulture Initiative, Principal Scientist Emeritus, Pacific Agri-Food Research Centre, Summerland, B.C. Canada V0H 1Z0

Key words: horticulture for development; food security; nutrition security

Abstract

The production and daily delivery to market of perishable horticultural crops from smallholder farmers close to large urban centres (peri-urban horticulture; market gardening) have been important for millennia. An assortment of vegetables, fruits, flowers and also herbal and medicinal plants is delivered directly to urban consumers, rich and poor, with little or no official oversight with respect to quality or safety. However, the surge in world population from 2 to 7 billion during the past 70 years, and especially a well-documented rural-to-urban migration, have profoundly influenced both the practicality of traditional peri-urban agriculture and the numbers of the urban poor. Cities have expanded and displaced farmers from their land. Competition for water resources can be fierce and modern food quality and safety expectations increasingly demand better compliance and oversight. One might argue that these various factors constraining peri-urban horticulture, as well as the burgeoning population of the urban poor, have heightened the interest in producing horticultural crops within urban centers, or in other words, in urban horticulture.

The research needed to inform public policy about how urban and peri-urban horticulture is valued, practiced and utilized to benefit the poor must involve social geographers, demographers, nutritionists, epidemiologists, horticulturists and many other professionals. However, the horticultural science and industry sector can also address some key problems and constraints. It can inform issues about what to grow and where to grow it. This sector knows about marketing – delivering safe and attractive products to consumers. Perhaps most importantly, horticulturists can credibly address issues about land, labour, water and the crop production/protection inputs needed for successful and sustainable production. Examples include developing and introducing varieties and cultivars better suited for urban and peri-urban production and direct marketing, e.g. cultivars resilient to climate change or resistant to key pests and diseases which thus require fewer pesticides; introduction of plant materials and technologies that maximize water use efficiency; and improving crop harvesting, handling and storage practices to permit reliable delivery of safe and nutritious produce.

Agriculture and urban development in sub-Saharan Africa

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Key words: Securing access to land and water; integrated plant production and protection; product quality and safety; marketing

Abstract

This presentation focuses on results obtained from the international workshop “Agricultures et développement urbain en Afrique de l’Ouest et du Centre” [Types of urban agriculture and development in Central and West Africa] hosted in Yaoundé in 2005 in Cameroon. The main partners in this workshop were Senegal, Benin and Cameroon, with the participation of several...
other countries from sub-Saharan Africa. Four main topics were investigated: urbanization and governance; urbanization and city supplies; urbanization and the environment; and urbanization and sanitary issues. Several main areas of research emerged, among which: 1) How can areas in cities for which it is impossible to obtain building permits be rezoned and promoted for agriculture? 2) How can the marketed surplus from urban and peri-urban areas be promoted? and 3) How can agrochemical inputs be better monitored? Among the participants at the workshop there was consensus on the highly heterogeneous situations confronted by urban and peri-urban agriculture. There was also consensus for a wide variety of policies to implement or pursue in order to improve livelihoods and environmental standards for urban and peri-urban agriculture (training, reliable data, etc.). Today, however, despite some case studies, there is still a lack of systematic research concerning institutional urban–rural interconnections. Moreover, little research has focused on the very nature of the currently ongoing transition between the rural and urban worlds. From a transition perspective, future research could thus begin to study the dynamics of agricultural practices; the migration of people in or out of agriculture; or the question of whether or not to adopt intensive systems. In this sense, a complementary area for research from a transition perspective would be the study of substitution factor between inputs (labour, technology, land, credit): for example, the economic and agronomic consequences that would result from recycling municipal solid wastes instead of using agrochemical inputs.

Oral presentations

La Grande muraille verte: Mapping strategies for the design of a productive infrastructure in the urban region of Dakar

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Key words: Productive Urban Landscapes, Dakar, Great Green Wall, Mapping

Abstract

Over the course of the past several decades, efforts have been made to find a way to decrease food insecurity in Dakar by solving specific problems related to soil salinity, water scarcity and the saturation of open space resulting from urban expansion. This paper widens the perspective and sets forth a more complex problem, making use of interpretative and projective mappings of the urban region, and proposes a strategic framework via landscape urbanism. The hypothesis is that today’s food insecurity is one of the consequences of a form of urbanization which has progressively lost its relationship with the landscape and has become both incapable of adapting to the evolving climatic conditions, and unable to mitigate the impacts of globalization on local economies. A first set of interpretative mappings elucidates the most urgent issues affecting territory in connection to urbanization. A second set of projective mappings identifies strategic elements for the infiltration of productive landscapes within a heterogeneous urban fabric, capitalizing upon potentialities embedded in the site and integrating them within ongoing funded projects. The implementation of La Grande Muraille Verte (The Great Green Wall) initiative – a cross-continental vegetal belt 15 km wide that will link Dakar and Djibouti – is developed as a strategic project, regenerating both economy and ecology simultaneously. At the level of urban design, and on a much smaller scale, focusing on a specific – strategic – area identified in the north-eastern part of the Cap Vert peninsula, this paper develops the idea of the Grande Muraille Verte as a “mediator” to ensure the resilience of fishing settlements along the coastline and of existing pockets of urban agriculture located within the dense urban fabric. Projective cartography brings out the interplay between Dakar’s
different scales and different landscapes, and provides a possible starting point for the design of a new productive infrastructure for this specific urban region.

**Dynamics of the vegetable production systems along the rural-urban continuum of Bamenda, Northwest Cameroon**

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Key words: Urbanization, Rural-urban continuum, Production system, Vegetable production, Bamenda, Cameroon

**Abstract**

The increasing urbanization of African cities has caused an increase in food demand, particularly for vegetable production, with concomitant modification of access conditions to means of production. In Cameroon it has been projected that in 2030, two out of three Cameroonians will live in cities. In response to this urban growth, there has been a growth in vegetable production within and around the cities. This survey analyzes the dynamics of the changes within vegetable production systems in what can be termed the rural-urban continuum. A survey was conducted among 150 vegetable producers in Bamenda, distributed equally to producers in rural, peri-urban and urban zones. The data were analyzed using SPSS. The results show that most vegetable producers (34.7%) are young (30–40 years of age). Gender parity between the vegetable producers is respectively 51.3% men to 48.7% women. The majority (48.7%) of respondents had reached a primary school level of education. Land tenure is high in rural and peri-urban zones, where more than 92% of the vegetable producers own their land, compared with 74% in the urban zone. Classifying vegetable production systems by typology showed that the further one moves from the urban centre, the more the cultivated surface increases. Thus, 88% of the respondents in the urban zone possess kitchen gardens with an area less than or equal to 500 m², whereas 76% of the respondents in the peri-urban zone own a vegetable farm situated close to their dwelling with an area between 1000–2500 m², and 48% the respondents in the rural zone own vegetable fields far from their dwelling greater than or equal to 2500 m² in size. In the rural and peri-urban zones respectively, 80% and 86% of vegetable producers sell more than 75% of their vegetable products, compared to 4% in the urban zone, where the vegetable are produced more for home consumption. The constraints of production vary from one zone to another along the continuum. In urban zones, land tenure is the main production constraint for 50% of vegetable producers, whereas in peri-urban and rural zones, the major production constraint is lack of access to agricultural inputs.

**Analysis of livelihood opportunities of peri-urban horticulture in Nigeria: A case study of Minna, Niger State**

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Key words: urban, land resources, livelihood, opportunities, threats, food market
Abstract

Although most pre-colonial urban centres in Nigeria developed as agricultural centres, their economic base has changed over the years since colonialism. While industrialization of the cities is still low, tertiarization of the economy has gradually replaced the traditional major occupation of farming. However, since the end of the 1990s a new trend has emerged in which urban residents seek complementary employment in relatively small agricultural activities within and around the urban centres. Economic necessity, scarce urban land resources and the large urban market associated with increasing urbanization have, among other factors, encouraged investment in horticulture. Horticulture is being practiced on residential plots, within neighborhoods and on the flood plains, but the attention of this study has focused on the flood plains at the peripheral areas of Minna, the capital of Niger State. These plains are found everywhere around the city and make both dry season and rainy season horticultural activities possible. The objectives of the study were to examine the flood plains as a resource for urban farming, to assess the livelihood activities associated with urban horticultural practices, to explore how the Niger State agricultural policy affects urban agriculture, to evaluate threats to urban agriculture as well as adaptation to these threats, and to make recommendations for sustainable urban horticulture practice in Nigeria.
Tuesday, 7 December, 8:00-10:00 / Amphitheatre

Session 2: Characterization of urban and peri-urban agriculture

Chair: Rémi Kahane
Rapporteurs: Paulina Shilunga, Grégoire Mutshail
Keynote speakers

**Status and challenges for urban and peri-urban agriculture policy-making, planning and design**

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Abstract

According to the United Nations Population Fund, the world’s urban population is expected to double from 3.3 billion in 2007 to 6.4 billion by 2050, and it is predicted that by 2030 60% of the world’s population will live in cities. As cities expand, so do the food needs of urban populations, especially families. The urbanization process in many developing countries goes hand-in-hand with increasing urban poverty and growing food insecurity and malnutrition, especially for the urban poor. Changes in climate add to the challenges faced by cities and the urban poor. Many cities are at risk of becoming “disaster traps”, either through the direct effects of floods, hurricanes, or rising sea levels, or through severe food supply problems due to droughts, hailstorms or frosts that affect agricultural production in their hinterlands – and thus the urban food markets. These are urgent and pressing challenges demanding an equally urgent and adequate response from city and national authorities as well as international support organizations. Urban policies, planning and design must incorporate food security considerations and focus on building cities that are more resilient to crises. Urban and peri-urban agriculture will have to feature prominently in urban food security, economic development, land use and climate change strategies and action plans. Several countries and local governments have already taken such initiatives, but in many other countries and cities, new initiatives are needed. This paper will provide a state-of-the-art overview of current national and local policies and experiences in integrating urban and peri-urban agriculture in policy making, planning and design. It will also highlight prospects and challenges that will require attention in future efforts to improve on or upscale these experiences to other cities and countries.

**The meaning of land-use planning for urban horticulture: The example of Kleingaerten in Germany and comparable gardens elsewhere**

Gröning G.¹

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Abstract

Community gardens in Canada and the United States, allotment gardens in England, jardins familiaux in France, Kleingaerten in Germany, shimin noen in Japan, volkstuin in the Netherlands, and ogródek działkowy in Poland have many points in common. City planners, among others, have generally considered them as a temporary and unstable use of the land. However, as examples from many countries around the world show, they are neither temporary nor unstable. It is the goal of this presentation to address aspects of the long-standing struggle to include such gardens as an integral part of urban land-use planning. This struggle includes the need for effective communication via contemporary media to give kleingaerten and comparable gardens a permanent status in land-use planning. The need to organize democratically at the level of the residential neighborhood as well as at municipal, regional, national and
international levels will be emphasized. The Pniowers social program to provide a city of 1 million inhabitants with gardens will be discussed as a prime example of the role of urban horticulture as part of a city-wide open-space policy. The examples presented refer mainly to *kleingaerten* in Germany, but will include gardens from other countries as well, such as Canada, Cuba, Japan and the United States.

**Oral presentations**

**Advancing vegetable production as a development and sustainability asset in urban and peri-urban savannas**

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**Key words**: vegetables, food security, urban savannas, livelihoods, policies

**Abstract**

Vegetable production in cities is growing at varying rates, and now plays an important role in the sustainability of human and environmental subsystems, which in turn benefits the urban development. In most African savanna cities, including Tamale, vegetable cultivation is an increasingly integrated part of people’s livelihoods and food security. Growing vegetables in an urban environment is a key asset in improving livelihoods for those caught in acute poverty and helping to rise to a better socio-economic level; however, the real impact remains a debatable public issue. Urban farmers carry out their activities for a variety of motives. Urban policymakers would like to impose regulations. And donors are continuously (re)searching new strategies so that all players network together to enhance the quality and productivity of vegetables to feed malnourished children, create jobs, turn organic waste into profitable materials, and repackage the activity to appeal to urban management authorities. The multidisciplinary dimension of interests surrounding this activity requires an explicit understanding of the different perspectives and challenges involved, in order to ensure that policies are not just formulated but are also constantly practiced over time to sustainably better urban people’s lives. This paper aims to combine an inventory of field experiences with post-inventory institutional data to discuss important issues connecting development, sustainability and vegetable cultivation within the larger horticultural process in a dry savanna context. It will further examine motivations and ethnic specificities relating to land and water access as well as farm-gate marketing of the fresh vegetables, which will be relevant in sustainable decision-making and practicing of planned policy guidelines.

**The international plant cluster VEGEPOLYS: Promotion of sustainability and innovation in plants, and initiatives in urban and peri-urban horticulture**

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**Key words**: sustainable agriculture, characterization of urban and peri-urban horticulture, management of natural resources
Abstract

In France, 71 structures have been labelled “Pôles de compétitivité” [business and research cluster, or hub] since 2005: in a given area, these structures are associations of companies, research centres and training organizations committed to the partnership approach in the framework of joint innovative projects. Their main aim is to promote innovative projects to obtain government funding. Located in the Loire Valley in Anjou, France, VEGEPOLYS has been recognized as an international plant cluster for the production of eco-friendly and health-promoting plants oriented towards biodiversity, health and the environment. VEGEPOLYS operations are concentrated mainly in the following areas: fruit and vegetable cultivation, seeds, ornamental horticulture, aromatic and medicinal plants, and viticulture, and is thus involved in the production of sustainable plants for food production. VEGEPOLYS supports collaborative projects around 4 main key themes: plant breeding, plants and seed health, health and well-being properties of plants, as well as landscape and urban horticulture. With respect to urban and peri-urban horticulture, VEGEPOLYS focuses on the challenges confronted by countries like France (Northern Hemisphere). The examples presented in the paper illustrate initiatives both for safe local food production and growing role of urban horticulture. Solutions on three different levels are proposed:

- Plant system level: improvement of cultivation practices in the urban context (e.g. innovative plant substrate management, roof gardening);
- Chain level: structuring of players to develop local production of new crops such as quinoa, or local varieties of vegetables;
- Territory level: sustainability of horticultural production and commercialization in urban and peri-urban areas taking into consideration the diversity of actors and land management policies.

The role of clusters such as VEGEPOLYS and perspectives at both research and education levels will be discussed.

The impact of urban and peri-urban horticulture on the development of horticulture in high-potential zones: Example of river valleys

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Key words: horticulture, valley, urban, competition, limits, policy

Abstract

Urban and peri-urban horticulture (UPH) production is rapidly expanding and the good prices that are fetched by the vegetables produced may be explained by reduced transportation costs, the limited number of intermediaries, the use of improved, short-cycle plant varieties and technical facilitation resulting from the reduced surfaces being cultivated. Proximity is, however, a decisive factor for UPH. In contrast, certain high-potential zones such as river valleys show promise of high production, but these will be at a price disadvantage because of higher costs getting the produce to the markets. These two types of horticulture do not present the same structures, as profit margins must be distributed to more intermediaries in the latter case. The loss of income along with the bana-bana and the other intermediaries will negatively affect horticulture from the valley producers. The urban problems of marketing goods from the valley induces other negative effects such as replacing players, financing of production by ban-banas or intermediaries both inside and outside the valley zone, an increase in sharecropping practices and so on. Policy decisions tend to give an advantage to the urban producers, while the opposite should be true. This paper examines the fate of valley horticulture if suitable commercial measures are not taken. Faced with these difficulties, a system of effective cost-
setting must be established, the purpose of which is to grant a minimum income to the horticultural producers of the valley.

Characterizing urban and peri-urban production systems for African indigenous vegetables in four cities in Benin and Côte d’Ivoire


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Key words: African indigenous vegetables; urban and peri-urban agricultural production systems; Benin; Côte d’Ivoire

Abstract

Since the 1990s the benefits of urban and peri-urban agriculture (UPA) have been widely recognized, and there has been extensive research characterizing UPA. However, most research has neglected the role played by indigenous underutilized species, even though increasingly it is recognized that promoting these species (which include African indigenous vegetables – AIVs), will be a crucial factor in the development of more resilient, sustainable farming systems for sub-Saharan Africa. Furthermore, although fewer varieties of AIVs are being used today, certain species are still very popular and in high demand. Understanding to what extent and how AIVs are currently being produced in UPA is an essential step towards developing a coordinated strategy for research and development efforts to support the production of these species. This paper analyses primary data on the production systems for AIVs in UPA in four West African cities: Cotonou and Lokossa in Benin, and Abidjan and Yamoussoukro in Côte d’Ivoire. The AIVs which contribute most to farmers’ income for both countries include Abelmoschus esculentus, Amaranthus spp., Corchorus olitorius and Solanum macrocarpon/S. aethiopicum. Certain locations appear to be specializing in particular AIVs, e.g. C. olitorius in Lokossa. In Côte d’Ivoire, urban locations had higher AIV diversity than peri-urban locations. Intercropping of the most commercially important AIVs was widespread in urban locations in Cotonou, Abidjan and Yamoussoukro. Pesticide use was common in all locations except in peri-urban Yamoussoukro. Inorganic fertilizer was used by 85-100% of farmers in UPA in Cotonou and Abidjan, and in urban Yamoussoukro. Organic inputs were used by over 90% of farmers in urban Cotonou, Abidjan and Yamoussoukro, mainly in the form of chicken manure. Comparison of production practices and farmer motivation suggest that production of AIVs in Benin is more market-oriented than in Côte d’Ivoire. The paper concludes with recommendations for future work.
Session 3: Measuring the contribution of UPH to urban food supply, nutrition, income generation and livelihoods

Chair: Seydi Ababacar Sy Gaye
Rapporteurs: Charlotte Dufour, Thomson Chilanga
Keynote speakers

Food supply and distribution to cities
Argenti, O.¹

¹FAO

Key words: urban food security, food supply and distribution systems, SADA, FSDS

Abstract
The world’s urban population has surpassed, for the first time, the number of people living in rural areas, and will continue to increase. Rapid urbanization is accompanied by an increase in the number of poor people living in urban areas. In most cities in developing countries, the percentage of poor people varies from 50 and 85%. The recent surge in international food prices will exacerbate the difficulties faced by many families in accessing food. Consequently, feeding the growing urban population with affordable and safe food is becoming one of the most daunting challenges to be addressed. This intervention will discuss food supply and distribution systems feeding cities and the role of food transportation. It will then address the need for food supply and distribution policies to be formulated and implemented by local governments and discuss the role of urban planners.

Measuring the food and economic contribution of UPH in Africa and Asia
Moustier, P.¹

¹CIRAD

Key words: urban agriculture, horticulture, marketing, livelihoods, direct sales, proximity

Abstract
Urban and peri-urban horticulture (UPH) is currently a subject of passionate debate regarding how viable it is, how efficient it is compared to rural production in supplying food to cities, and whether the State should protect it from urban expansion. The debate is not, however, being supported by reliable data on the relative contribution of UPH to urban food consumption and income, as compared with other sources of food and income supply. This paper has drawn on the relevant data on the origin of urban food products from consumption and market surveys, and also from surveys and case studies of farmers’ strategies and economic results in various cities in Africa and Southeast Asia. The undeniably patchy results nevertheless show the importance of urban agriculture in two areas: overall supply of the most perishable vegetables, namely, leafy vegetables; and complementarity of UPH with rural vegetable production. The results also show the specific contribution of UPH in the supply of vegetables with specific food safety characteristics, in particular organic vegetables, because when the production of these types of vegetables is combined with direct sales between producers and consumers, the consumers gain a certain level of responsibility in the production process. UPH contributes to livelihoods in a variety of ways, from the unique provision of incomes to urban households with few alternative sources, to an additional source of cash to urban entrepreneurs and civil servants. This paper highlights the need for additional research in economics on UPH in Africa. The available data on food and economic contribution of UPH are incomplete and need to be updated, and comparisons need to be made between cities to understand the reasons for differences. There should be more systematic comparison between UPH and rural horticulture in terms of income generation, price of vegetables, and labour use and energy use. The economic advantages of a multifunctional UPH should be evaluated based on contingent evaluation methods. Finally, the advantages of proximity in terms of increasing consumers’ awareness of
the consequences of their purchase choices on the local economy should be better communicated and publicized.

**Oral presentations**

**FAO urban and peri-urban horticulture (UPH) project experience:**
**Security of access to land and water resources in the Democratic Republic of the Congo**

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Key words: land security, hydro farm works, municipal committee for consultation

**Abstract**

Urban and peri-urban horticulture play key roles in supplying food for cities that are currently undergoing intensified urbanization. But urban and peri-urban horticulture can be carried out only on land with the proper water and agricultural infrastructures. The increasing population in and around large cities accentuates the problem of access to arable land for horticultural activities. An FAO urban and peri-urban horticulture (UPH) project for land tenure security in Democratic Republic of Congo (DCR) provided for the establishment of a Municipal Committee for Consultation (MCC) at the Municipal Bureau of Horticulture (MBH), whose role it is to involve the various services and expertise required to ensure integrated development of the UPH, as well as to manage the steps necessary for procuring the occupancy of good horticultural land. The MCC includes a technical committee composed of experts from MBH, Land Affairs, Cadastre, Urbanism and Rural Development, which is in charge of studying the available means and opportunities for obtaining the market-gardening areas targeted by the Land Law. This work is then forwarded to the MCC plenary for decision and action. To secure access to water, constraints related to access to water are identified by MBH experts. Feasibility studies are carried out by the National Consultant in rural engineering, and a Memorandum of Understanding is set up in order to allow the implementation of construction of hydro-farm works. Treadle pumps and a drip irrigation system are also used for securing access to water. Securing access to land and water requires the involvement of State agencies to ensure its success. It is therefore necessary to continue to inform politicians so that they may give the requisite attention to the problem of land tenure security, which, if not carefully monitored, discourages large numbers of producers.

**Impact of government financial incentives on peri-urban vegetable production in Botswana**

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Key words: Botswana, CEDA, financial incentives, vegetable

**Abstract**

In its effort to increase agricultural productivity, the government of Botswana has established financial schemes to improve vegetable production. The Citizen Entrepreneurial Development Agency (CEDA) and CEDA Young Farmers Fund are encouraging farmers to become involved in vegetable production through financial and technical assistance. However, data on the impacts
of these funds on vegetable production in the country are scarce and often unreliable. Very little is known in fact about changes in the quantity of vegetables produced or vegetable produce imported into the country and consumed after these funds were introduced. This paper discusses the impact of these government incentives on farm-land allocated to vegetables, total vegetable production and import of vegetable in Botswana. The increasing interest in vegetable production, the change in demographics and the trend to import production inputs are also discussed.

**Prospects, challenges and institutional linkages of the vegetable value chain in Ibadan City, Nigeria**

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Key words: Urban and peri-urban horticulture, vegetables, value chain, linkages, vegetable marketing

**Abstract**

The entire population of over 2.5 million people living in Ibadan city of Nigeria depends on farmers within and around the city to supply up to 80% of their vegetables, estimated at about 900 tonnes per day. This study was carried out to establish the presence, types, systems and institutional linkages influencing the urban and peri-urban vegetable-value chain in the city. Three local government areas (LGAs), comprising two urban and one peri-urban LGA were chosen among the 11 which make up the metropolitan city for the study. They were selected because of their high number of agricultural activities. From the estimated list of 5,082 farmers in the selected LGAs, 210 respondents were randomly selected. Data were collected from the farmers using a schedule of structured interviews. Marketers, processors and supplies dealers were also interviewed using focal group discussions of between 8 and 10 interviewees per session to generate qualitative data about their involvement in the vegetable-value chain in the city. Other stakeholders, in particular key informants from institutions (academic and research institutions, and extension, health, land and finance services) were interviewed. Because of the exploratory nature of the study, data were analyzed with descriptive (frequency counts, percentages, measures of central tendencies) statistics and rankings. An informal network of producers-marketers-consumers exists for the vegetable value chain in the city. The network provides income ranging from N50,000.00–N500,000.00 (N150 = $1.00) per annum for participants based on activities within the chain. Vegetables (Amaranthus, Corchorus, Celosia, okra and pepper) production accounts for 42% of the crop production enterprise. The crops are planted on roadsides (23%), in backyards (22%), and near streams (14%), among other locations. Inadequate finance ranked highest among the listed constraints, and institutional linkages are weak. Concerted and conscious efforts with enabling policies should be instituted to attain the full potential of the vegetable-value chain in the city of Ibadan.
Developing intensive vegetable production through soil-less microgardening technology to sustain peri-urban and urban horticulture in The Gambia

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Key words: Microgardening, Organic, Urban, Peri-urban, Horticulture

Abstract

The Gambia is a small West African country (11,000 km²) with a population of 1.7 million (40% in urban areas). It is a poor country, ranking 168 out of 182, with 80% of rural women involved in agriculture. Horticulture is successfully developing because vegetable production has risen and imports have been significantly reduced. To reach urban/peri-urban communities (40% poor and land scarce), soil-less technology was introduced in the Gamhort project as training to develop organic horticulture. The technology consists of intensively growing crops on tables using recuperated palettes, through hydroponics or solid substrates (mixture of groundnut shells, rice husks and gravels) and fertilizer solutions. It was aimed at enhancing the livelihoods of the target communities with a focus on unemployed household women and youths including people living with HIV/AIDS (PLHIVs) for food security and poverty alleviation. Successful piloting of the technology resulted in the following achievements:

- 152 direct and 760 indirect beneficiaries actually trained;
- 20 urban and peri-urban sites reached;
- semi-organic vegetables currently being produced, consumed and marketed.

However, some constraints remain: a) dependency on imported accessories and inputs, b) cost of tables for poor communities and c) the need for higher yields. These issues were addressed in collaboration with the University of The Gambia on:

- Crop intensification of hybrid tomatoes through increased plant densities (50,420 plants/ha), preventive pest control and fertilizer application; subsequent yields reached over 50 tons/ha thus enabling significant production cost reductions;
- Action research on cost reduction through affordable practices (e.g.: dug beds filled with groundnut shells, etc.) resulting in encouraging results thus facilitating access to the technology; e.g. excellent plant growth, early maturity and long harvest period (2 months), 160 fruits/m²; maximum fruit weight about 90g; average yields up to 58 tonnes/ha, etc.

This paper provides detailed results and ongoing research including investigations into substrate diversification using local resources, substituting imported fertilizers with manure and compost, etc. Recommendations are formulated for follow-up activities.
Wednesday, 8 December, 8:00-14:30 / Dakar

**Technical tour**

Site I
*Micro-garden project and National Horticulture Training Centre, Cambérène*

Site II
*Regional Centre for Research in Ecotoxicology, Dakar, and Tropicasem, a private research and development centre for vegetables*

Site III
*Intensive vegetable production at Bayak and Lac Rose*
Wednesday, 8 December, 15:30-17:30 / Amphitheatre

Session 4: Management of natural resources and waste for UPH

Chair: Laurent Stravato

Rapporteurs: Mama Touré Dieng, Patrick Kumah
Keynote speaker

Management of natural resources and waste for urban and peri-urban horticulture in low-income countries

Keraita, B.1*, Cofie, O.1, Drechsel, P.2

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Key words: waste treatment, nutrient and biosolid recovery, risk mitigation measures, stakeholder involvement, wastewater reuse

Abstract

Land and water resources used in urban and peri-urban horticulture (UPH) are under increasing pressure from impacts of rapid urbanization. In many growing cities, large volumes of untreated waste, which could provide nutrients and soil conditioning in UPH, are now a major source of contamination to urban agricultural lands and irrigation water. This paper presents a synthesis of various options and models for waste management relevant to UPH in low-income countries. A number of technical options for waste treatment, nutrient and biosolid recovery, soil remediation and health-risk mitigation measures are described. Specific focus has been given to low-cost technologies that have been proven as potentially effective in low-income countries, including pond treatment systems, co-composting, soil phytoremediation and improved application methods for manures and irrigation water. Financial and institutional aspects that facilitate successful implementation of these options have been discussed. In addition, recent prominent concepts fostering agricultural re-use in urban sanitation systems, such as design for service, reverse water chain approach, sanitation as a business, and dry sanitation, have been presented. While further development of potential options is encouraged, attention should also be focused on strategies to enhance adoption of existing options. Participatory development and monitoring, which must involve primary stakeholders like farmers and policy makers, is crucial for successful adoption of these options to safeguard natural resources and enhance sustainable production in UPH.

Oral presentations

Impact of the spreading of urban waste on agricultural soil bacterial communities in the periphery of Ouagadougou, Burkina Faso

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Key words: municipal waste, soil, bacterial community, opportunistic pathogens of humans

Abstract

The objective of this study was to evaluate the influence of anthropogenic activities such as the application of urban waste on agricultural land which can promote the emergence and/or spread of pathogens. An assessment was conducted on the influence of spreading raw municipal waste on soil bacterial communities and the abundance of opportunistic human pathogens. Soils that had been amended with waste was sampled at three sites in the suburban area of...
Ouagadougou (Burkina Faso); unamended soil was used as the control. The impact of pathogens on the total indigenous bacterial community and the risk of spreading the pathogens was assessed by counting culturable bacteria (heterotrophic cultivable microflora, faecal indicator bacteria and pathogenic human species); in addition an analysis of the genetic structure of bacterial community in a culture independent approach (method for automated ribosomal intergenic spacer analysis [ARISA]) was carried out. The results showed a total cultivable bacteria enrichment and modification of the genetic structure of bacterial communities in the amended plots. The lack of detection of pathogens such as enterococci and fecal coliform, Staphylococcus aureus or opportunistic human pathogens (Pseudomonas aeruginosa) suggested that the amendments are not sources of these pathogens and do not select the communities. However, monitoring populations of the species Stenotrophomonas maltophilia, an opportunistic pathogen of humans frequently found in soils, showed the enrichment of these populations in amended plots. This work showed that applying urban waste water on agricultural land may pose health and environmental risks.

Ecological intensification of agricultural production systems through waste recycling


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Abstract

Organic waste (OW) generated by human activity is continuously increasing worldwide. Agriculture generates large amounts of OW derived mostly from livestock farming and agro-industries. Furthermore, OW flows are increasing as a result of urban development—wastewater, sludge and municipal waste may be treated to different degrees. These wastes are often applied on cultivated lands on the outskirts of cities. OW are sources of organic matter that may increase soil fertility and reduce the need for chemical fertilizers, thus enhancing sustainable agricultural production. They may also carry contaminants, and inappropriate application may lead to an accumulation of mineral, organic or metallic contamination, thus degrading soil quality and possibly increasing the risk of pollutant transfer to the harvested crops. The multiplication of product types and the diversity of situations in which they are produced and used are factors that should be considered to enhance OW management in agriculture. The ISARD project aims to develop a global approach for integrating knowledge concerning OW recycling in agriculture. Innovation in this project is related to the territorial approach with organic matter stemming from either agriculture or households, and mainly in suburban areas. The project is being implemented at four locations, with the following specific recycling issues:

- Metropolitan Dakar (Senegal): possible ways of using mixed composts
- Mahajanga region (Madagascar): making and using municipal waste compost
• Versailles area (France): recycling stable manure and wastewater treatment sludge on cultivated plots
• Réunion Island (France, Indian Ocean): organizing and assessing the recycling of various wastes at a territory level

The expected result to be delivered when the project is completed is a generic methodology that will make it possible for agronomists working with rural stakeholders to create highly efficient cropping and farming systems based on the use of a wide range of organic wastes.

**The determinants of organic fertilizers used in urban and peri-urban agriculture: an econometric analysis**

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Keys words: Solid waste, Compost, Mineral fertilizers, binomial Logit, ordered Logit

**Abstract**

Urban poverty, increases in food demand, land pressures, pollution resulting from solid waste generation and from mineral fertilizers uses in urban and peri-urban agriculture, are becoming real issues in agriculture in Cameroon, and there is a growing need for organic fertilizers that result from solid waste recycling. Urban and peri-urban agriculture are potential regular users of large quantities of household wastes and compost; but these organic fertilizers are indeed scarcely used. This study proposes using a binomial Logit model on the one hand, to identify factors to encourage using compost in the urban and peri-urban lowlands in Cameroon, and on the other hand, to highlight the effects of these factors on different levels of fertilization using an ordered Logit model. Using a representative sample of 288 farmers, it was found that 41% of farmers use mixed compost and mineral fertilizer, 22% of them use mineral fertilizers exclusively, and 15% use compost exclusively. However, 23% of the farmers in Cameroon do not use any fertilizers. The binomial Logit model estimations show that variables like membership in farmers’ cooperatives, land property rights, food cultivation, low levels of farm income and the distance between farmers’ dwellings and their farms have an effect on whether compost is used in urban and peri-urban areas in Cameroon. In addition, the ordered Logit model estimation shows that the variables like land-property rights, food cultivation, the available chemical input budget and the distance between dwellings and farms explains fertilization at all levels. In light of these results, a participative solid waste management plan that encourages local composting in the lowlands would help to reduce pollution resulting from solid wastes while promoting the development of the urban and peri-urban urban agriculture.
Urban and livestock wastes in the tropics: Characterization and modeling of their transformations in soil to better choose their potential utilization

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Key words: organic wastes, near infrared spectroscopy, modeling, agricultural recycling, energy biovalorization

Abstract

The exogenous organic materials (EOM) resulting from agricultural activities within the city are numerous. We present here descriptions of these EOMs, and have modeled management problems and competition in disposing and using them (e.g. agricultural recycling vs. production of renewable energies). In the Indian Ocean region (Madagascar and La Réunion Island), both the volume and variety of EOM are increasing. We have developed innovative methods (e.g. near infra-red spectroscopy [NIRS]) to characterize a large variety of tropical EOM and to evaluate the risks involved in either their agricultural or energy utilization. In order to represent the EOM from various origins and of different types, the development of models is carried out on several levels. On the one hand, NIRS models are presented to make use of the technique. Indeed, on a “simple” spectrum basis, one can make predictions of interesting parameters which are difficult to measure according to conventional methods. Many useful data to assess the scenarios of agricultural or energy valorization can thus be quickly produced at lower costs. On the other hand, we have developed models of EOM transformations in soils that are adapted to the tropics. These models can provide scenarios for the agricultural valorization of typical EOM, and can run with entry parameters which have been measured by conventional analyses, or resulting from NIRS models (double modeling). The various scenarios set out for either agricultural or energy utilization must be balanced against possible hazards due to trace elements and the release of N₂O, a powerful greenhouse gas.

Developing the utilization of organic waste in truck farming in Senegal: opportunities, constraints and risks

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Key words: Dakar, urbanization, truck farming, water, land, organic matter, representations, valorization, opportunities, constraints, risks

Abstract

Within a context of demographic and urban growth, and taking ecological requirements into consideration, can urban horticulture be one of the solutions for managing urban waste? How can a process for developing the use of organic matter in peri-urban agriculture be implemented in truck farming in Dakar (Senegal), where agricultural endeavors are frequently undermined by constraints such as access to irrigation water, levels of population pressure and insecurity, and access to supply of organic matter? The physical environment creates a context for utilizing organic matter by truck farmers (i.e. market-gardeners). Many players are involved in this situation, and each brings different rationales and ideas for using the many types of organic matter potentially available for truck farming (compost from cow, horse, sheep, poultry, slaughter-house, or fish manure; groundnut by-products; clarification sludge; etc.). However,
the demand for these organic wastes in other sectors has created a context of competition
between truck farmers and these other sectors. Moreover, there are many constraints in using
these wastes: their physical characteristics (thick granulometry and mud-like character; high
heat of poultry and horse manures; etc.); availability; accessibility; poorly controlled
urbanization; effects of seasonal variation; and so on. In addition, there are health risks to the
population which must be better controlled. This is why, in spite of recommendations from
scientists and NGOs, it is very difficult for truck-farmers to change their habits and use urban
wastes as fertilizers on their peri-urban and urban farms.
Thursday, 9 December, 8:00-10:00 / Amphitheatre

Session 5: Safeguarding food quality and safety and growers’ health, safety and welfare

Chair: Françoise Assogba-Komlan

Rapporteurs: Judith Kitivo, Faustin Bella Manga
Keynote speaker

Contribution of urban agriculture to food security in Senegal: The case of the city of Dakar

Niang, Y. 1

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Abstract

In Senegal, the urban population has grown rapidly since 1960. Because space and water are becoming more limited and scarce, farmers are increasingly using – and misusing – fertilizers and pesticides, as well as raw sewage to alleviate the water shortage. The economic challenge is accentuated by the presence of a permanent wetland located in the nearby town of the city suitable for agriculture. Dakar also has a unique microclimate compared to other areas of the country, with almost year-round moderate temperatures. Agricultural activity is currently being subjected to various constraints that might jeopardize its future. The most recent major constraint – certainly not the least – concerns the land itself. The pressure on land in Dakar has increased to the point that lands reserved for agriculture are dwindling every year in favour of built-up urban areas. It has been recognized that farmers’ lack of secure land tenure is a major handicap to the development of urban agriculture. In the interests of good environmental management, to effectively reduce various types of pollution and to safeguard human and animal health, the public authorities in Senegal have now established an important legal arsenal. Regarding the use of fertilizers, the law says that organic fertilizers, manure and compost can be spread no later than one month before harvest. Pesticides are regulated in their marketing and distribution through laws and regulations at national level and through agreements and conventions at the sub regional and international levels. It is now important to work with farmers to preserve the health of the population.

Oral presentations

Phytoavailability, human risk assessment and transfer characteristics of cadmium and zinc loads in wastewater irrigated urban gardens in Kano, Nigeria

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Key words: Health risk; root-shoot translocation; heavy metals; vegetables; soil pollution

Abstract

Quantitative data about phytoavailability and transfer of heavy metals into consumed plant parts in intensively managed urban vegetable production areas of sub-Saharan Africa are scarce. To close this knowledge gap, we studied the transfer of zinc (Zn) and cadmium (Cd) from soil to roots and subsequent translocation to edible portions of amaranthus, lettuce, carrot and parsley. Samples of soil were collected from gardens (0–20 cm depth) from five garden sites (Katsina Road, Koki, Gada, Kwakwaci and Zungeru) along with corresponding marketable
vegetable crop samples in Kano, Nigeria. The air-dried soil samples were analyzed for total and DTPA-extractable Zn and Cd, and the plant samples for total Zn and Cd. While respective DTPA-available Zn and Cd concentrations ranged from 18–66 mg kg⁻¹ and 0.19–0.35 mg kg⁻¹ in soils, total Zn and Cd were between 8.4–256 mg kg⁻¹ and 0.04–1.7 mg kg⁻¹ in shoot parts. Metal transfer factor (MTF) ratios were higher in Zn (0.2–0.9) than in Cd (0.1–0.6). Our data suggest that total Zn concentration in soil is a reliable indicator to assess its transfer from soil to crop in lettuce, carrot and parsley, while for Cd, the DTPA-extractable concentration may be used to estimate soil–crop transfer of Cd in amaranthus and carrot. For Cd, root–shoot translocation was highest in lettuce, while carrot had the highest translocation factor for Zn. Overall, Cd was more easily translocated to the edible plant parts than Zn. Across the locations the exposure for Zn was in the order Katsina Road ≈ Koki ≈ Gada > Kwakwaci > Zungeru. Calculated daily intake of Zn and Cd from urban vegetables and the target hazard quotient for both metals, although within the international recommended limits for vegetables, may pose a possible health risk to consumers of urban vegetables in Kano in the long run, given continued wastewater irrigation practices.

**Enhancing adoption of food safety measures in urban vegetable production and marketing systems**

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Key words: food safety, farm and market contamination, risk reduction, adoption incentives

**Abstract**

Urban vegetable production and marketing systems in low-income countries are prone to contamination from polluted irrigation water, use of manure as fertilizer, unsanitary market conditions and other improper postharvest handling practices. In the recent past, the multiple-barrier approach has been adapted in research to develop measures to reduce contamination at different levels on the food chain. However, adoption of these measures could be constrained by low awareness levels of risks and risk-reduction measures as well as lack of adoption incentives. This paper presents various approaches and practical considerations that could enhance adoption rates of these measures, based on lessons learned from extensive studies carried out in Ghana. These studies include participatory development of risk reduction measures where end-users are actively involved in the process, incorporating their perceptions, needs and constraints. In addition, relevant social marketing techniques, incentive systems, awareness creation/education strategies and appropriate regulation measures are described. However, for optimal adoption, a combined framework of the most relevant approaches is advised.
Pesticides usage in cabbage (*Brassica oleracea*) cultivation in the forest ecozone of Ghana

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Key words: pesticides, banned chemicals, harvesting period, residue levels

Abstract

One of the obstacles to cabbage production in the forest ecozone of Ghana is insect pests. These insect pests are controlled in various ways, with pesticide use prominent among them. The objectives of this study were to (1) document the various pesticides used by farmers in cabbage production, (2) assess the mode of application of these pesticides and (3) determine the safety of the cabbage heads for consumption. Results show that approximately 26 different pesticides are being used by farmers to control insect pests on cabbage, and that 61% of farmers mixed two or more pesticides together without considering either compatibility or active ingredients; trade names alone were considered reliable. It was also revealed that some banned chemicals (e.g. Lindane, Endosulfans, DDT) and pesticides not recommended for vegetables (e.g. Akate Master [bifenthrin], Confidor [Imidacloprid + thiamethoxam] and Cocostar [bifenthrin+pirimiphosmethyl]) were also being used. These results suggest that farmers are clearly misusing pesticides and thus affecting the quality and safety of cabbage for consumption. In addition, 51% of the farmers carried out spraying by the calendar, which means that they treated with pesticides usually at 3-4 day intervals, while the rest of the farmers sprayed only when they noticed the presence of insect pests. Furthermore, 79% of the farmers continued spraying pesticides during harvesting period; hence no waiting period was observed. Only 21% of the farmers adopted a waiting period of 1 week before harvesting, on the average, which is still not enough considering the types of pesticides used. The study concluded that cabbage farmers misused pesticides, in terms of the type used and the quantities applied. In addition, consumers were exposed to high pesticide residue levels due to the limited or non-existent waiting period before cabbage heads were harvested (least-safe harvesting time).
Thursday, 9 December, 10:30-12:00 / Amphitheatre

**Concluding plenary session:**

**Recommendations**

*Chair:* Wilfried Baudoin

*Rapporteurs:* Enoch Achigan-Dako, Rémi Nono-Womdim

**Panelists**

Marielle Dubbeling (RUAF)

Gert Gröning (ISHS)

Megan McGlinchy (CRS)

Norman Looney (GlobalHort)

Emmanuel Carrère (AfDB)

NeBambi Lutaladio (FAO)

Jacky Ganry (CIRAD)

Seydi Ababacar Sy Gaye (MINAGRI)

Abdoulaye Sow (CCIAD)

Neveen Metwally (CLAC)

Margaret Pasquini (Universidad de los Andes)
Poster presentations

Horizontal flux of cadmium and zinc in wastewater irrigated vegetable garden soils of Kano, northern Nigeria

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Key words: Kano, metal flux, urban agriculture, heavy metals

Abstract

The balance and flux of heavy metals, especially in wastewater irrigated gardens, provide vital information on agro-ecosystem contamination, management strategies and sustainability. This article presents the up-to-date situation concerning heavy metal accumulation in soil and vegetables along with annual mass balance of zinc (Zn) and cadmium (Cd) resulting from atmospheric deposition and wastewater inputs on the plot scale in Kano, northern Nigeria. The concentrations of Cd and Zn in Kano vegetable gardens attained unsafe levels with concentrations of 2.3–4.8 mg kg⁻¹ Cd and 13–285 mg kg⁻¹ Zn, respectively. Mass flux of Zn and Cd in five vegetable gardens was also investigated. The primary inputs of heavy metals are through wet and dry atmospheric depositions, fertilizer application and irrigation with wastewater, while crop removal and leaching losses represent the outputs. Irrigation wastewater and fertilizer application were the dominant sources of heavy metals, with an input amounting to 3.7 and 22.3 kg ha⁻¹ year⁻¹ of Cd and Zn, respectively, from wastewater irrigation. Fertilizer application contributed up to 2.1 and 17.6 kg ha⁻¹ year⁻¹ of Cd and Zn, respectively. The lowest inputs of 2 x 10⁻⁵ kg Cd ha⁻¹ year⁻¹ and 0.04 kg ha⁻¹ year⁻¹ Zn were from dust deposition. Despite losses of heavy metals through crop removal and leaching, annual accumulations of Zn and Cd showed positive surpluses in all the gardens, with annual surpluses of 0.29–2.31 kg ha⁻¹ year⁻¹ of Cd and 1.1–15.4 kg ha⁻¹ year⁻¹ of Zn. Heavy metals harvested in vegetables were in excess of authorized threshold limits. Value as high as 1.7 kg ha⁻¹ year⁻¹ of Zn and 0.003 kg ha⁻¹ year⁻¹ of Cd were recorded in the amaranth crop. The high input of Zn and Cd through irrigation water highlights the need for management practices to mitigate the harmful effect of wastewater irrigation to sustain ecosystem health.

Better vegetable production systems in West Africa: Prospects for the use of native antagonistic fungi for nematode management

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Key words: arbuscular mycorrhizal fungi, Benin, biological control, Meloidogyne spp., peri-urban agriculture, pesticide use, root-knot nematodes
Abstract

Four isolates of the free-living antagonistic fungi *Trichoderma asperellum* T-12 (10^{12} spores/m²), *Trichoderma brevicaespactum* T-3 (10^{12} spores/m²), *Pochonia chlamydosporia* Pc-1 (5x10^7 chamydospores/m²) and *Paecilomyces* sp. Pl-3 (10^{12} spores/m²), and two arbuscular mycorrhizal fungi, *Kuklospora kentinensis* M-233 (1000 spores/m²), *Acaulospora scrobiculata* M-353 (1000 spores/m²), all native to West Africa, were assessed for their root-knot nematode control potential on urban vegetable fields in the coastal area of Benin. The fungi were applied individually or in combination using a coconut husk carrier substrate, and were compared with the synthetic nematicide Furadan® (5 g/m²) under a double-cropping system of either tomato-carrot or carrot-lettuce, under farming conditions. Results were variable across sites; however, application of some native microorganisms alone or in combination resulted in significant suppression of nematode multiplication and root galling damage, improving crop yields and quality. Root galling severity on tomato and carrot was reduced by up to 70%, and 30% in tomato-carrot cropping, and 16% and 40% on carrot and lettuce in carrot-lettuce cropping, respectively, compared to the Furadan treatment. Yields of tomato, carrot and lettuce were significantly improved by up to 70%, 57% and 37%, respectively, following the application of various biocontrol agents. This study provides evidence that some beneficial microorganisms native to West Africa provide better protection for vegetables against root-knot nematode damage than the synthetic nematicides. This was observed especially in the poor sandy soils typical of urban and peri-urban sites of coastal cities in Benin, which reflect the situation in most West African countries. The results are highly encouraging, demonstrating the strong potential of the fungal isolates as an alternative to pesticides and a complementary crop protection component for the intensive (peri) urban vegetable systems.

A peri-urban vegetable production area in NW Portugal: How fields were created and how vegetables are cultivated

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Key words: securing access to land and water; integrated plant production and protection

Abstract

In northwest Portugal close to the coast, a land-management system named *masseira* was developed. In this region, the winds coming inland from the sea are frequently strong and carry salt, which is toxic to plants. It would have been almost impossible to grow vegetables here had farmers not created a very efficient system for managing the landscape in order to cope with the salt, namely, *masseira* fields. This was done by removing soil in the form of bowl-shaped fields approximately 5000 m² in size. A *masseira* was a bowl used for kneading dough; it was a standard item in every kitchen in the region in the past. For the past 20 years *masseira* fields have changed in size and shape, but the region is still an important region for vegetable production. Several vegetables are produced year round: lettuce (cultivated in plastic greenhouses), leeks, cabbage and turnips (produced in the open air). Onions, carrots, parsley, pumpkins, tomatoes, cucumbers, green beans, sweet peppers (including small ones named *pradon*), early fresh market potatoes, melons, mangetout-peas, and other vegetables are also produced. The vegetables are sold mainly to supermarkets chains and are also exported. However, intensive agriculture production systems with high inputs of pesticides, fertilizers and water are being used in the region. Water pollution and unsuccessful pest management are visible signs that this production system is no longer sustainable. In this paper we include the history of *masseira* fields – drawings are used to help understand this unique system for modulating the landscape to cope with natural obstacles to horticulture – and also the production system that for decades has been feeding the urban population in northern Portugal and Spain and guaranteeing revenue for more than two thousand families as well.
Urban and peri-urban vegetable training: Case study of Leventis Foundation Agricultural Schools in Nigeria

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Key words: Capacity building, vocational training, urban and peri-urban horticulture

Abstract

The aim of this study was to review the role and importance of education and training of young students in the Leventis Foundation Agricultural Schools in Nigeria. Qualified vegetable farmers are very important for peri-urban vegetable production in Nigeria. The review assessed the training facilities and infrastructures in Leventis agricultural schools, and the suitability of the teachers for vocational training of students in all aspects of peri-urban horticulture. A wide range of relevant documents and administration of questionnaires were examined. Results showed that the schools are effective in providing training in modern techniques of horticulture. However, they could be more effective if they devoted a greater percentage of time and resources towards intensive production of vegetables throughout the year for urban and peri-urban production systems. These schools could also be improved in terms of gender equity, as enrolment of female students in the school needs to be increased because of their roles in horticultural crop production and marketing. It was also concluded that vegetable management practices should be reviewed to accommodate more species from the list of vegetables that are of high economic or nutritional importance in Nigeria, especially indigenous varieties that are currently endangered.

Managing fruit fly attacks on Cucurbitaceae crops using natural pesticides in Senegal

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Abstract

The culture of Cucurbitaceae (i.e. watermelon, melon, cucumber, etc.) is a significant source of income for Senegalese market gardeners. These fruits are highly appreciated in national, regional and international markets. However, Cucurbitaceae suffer from Tephritidae fly (fruit fly) attacks which damage the produce and result in important economic losses. A study to estimate the importance of the damage was conducted in 1994-1995 in two selected sites in the Niayes District in Dakar on 7 Cucurbitaceae: watermelon, cucumber, squash and zucchini, loofah and bitter gourd (Badji, 1998). This study revealed crop losses of 50% or more from fruit fly attacks. In order to deal effectively with Tephritidae, natural and synthetic insecticides were compared on melon crops to test the efficiency of three natural products on these pests. The products used were Azadirachta indica A. Juss.; Procur, a mixture of plant essences and extracts; and the powder of Pachyrhizus erosus (L.) Urban. The effect of these products on Tephritidae was then compared to performance of two synthetic pesticides: Deltamethrine (25g a.i. /l) and Esfenvalerate (50g a.i. /l). Azadirachta indica (15g a.i. /l and 30g a.i. /l), Pachyrhizus erosus (90g a.i. /l) and Procur (50 cc/200 l) were as effective as synthetic products. Protecting crops against Tephritidae attacks by using natural products could be an alternative to using chemical products, considering the danger the latter cause to humans and the environment.
Sahel Vert: A project of Centre Mampuya, Senegal

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Key words: peri-urban, management of natural resources, rural exodus, agro-forestry, tree-nursery, seed-bank

Abstract

Satellite images have revealed that the areas covered by forest in zones of the Sahel near the coast of Senegal have been significantly reduced over the past 50 years. The open forest form of vegetation has practically disappeared. Much of the land in Senegal is unregulated and subject to free collective use. Today the traditional ownership structures that may have made sense in the past have led to overexploitation of land resources and a decline in biodiversity. Uncontrolled land development and the emerging pressure of urbanization from the capital along the coast require that a feasible regional landscape concept (i.e. Sahel Vert) be elaborated in order to protect the remaining resources. Centre Mampuya was founded in 2002 on the Sénou hills close to Toubab Dialaw, a former fishing village 50 km to the east of Dakar. From the beginning it has focused on the reforestation and soil regeneration of 50 hectares through the extensive use of large-scale commons so as to ensure the biodiversity of plants and animals in the entire region. The hill formations of Sénou protected by Centre Mampuya represent a botanical refugium, a kind of living repository of genetic material for both endangered and well-established and flourishing tree species. The Centre has become a model for committed people (most of whom are women) in the region and in the entire country. Since this is a project taking place in the peri-urban area of Dakar, in Toubab Dialaw, it is important to mention the situation around the Centre, which is surrounded by uncontrolled urbanization (i.e. a chaotic layout of half-developed plots going down to the sea). This unregulated urban development is the result of speculation on the part of many local and foreign investors and local field owners (farmers) following the construction of the new airport, located 8 km away; it is also partially explained by the proximity of the sea (Petite Cote). Centre Mampuya has become a model for revitalization, agro-forestry, production and preservation of seeds in specific seed-banks and the production of scions and cuttings of endangered wild plants in a tree-nursery. Working together with farmers, the Centre is developing strategies of self-reliant sustainability (www.sahel-vert.org).

Increasing production and availability of fruits and vegetables in Cameroon: Opportunities, constraints and proposed solutions

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Key words: production, fruits and vegetables, opportunities, constraints

Abstract

Because of the rapid growth of urban populations in the Economic Community of Central Africa States (CEMAC), with resulting high consumer demand, increased production and availability of fruits and vegetables has become imperative. In fact many opportunities for growth exist in Cameroon. The great ecological diversity of this country offers tremendous potential for quantitative, qualitative and variable production of fruits and vegetables. Fruit and vegetable production and distribution chains already provide job opportunities and sources of income as well as nutrition requirements for the population. Local and sub regional demand is clearly greater than supply, which explains current interest in horticulture within the national
agricultural research system. Different production systems exist according to farmers’ means and production objectives. Effectively taking advantage of these opportunities will, however, require taking into consideration a certain number of constraints, among them production, consumption, commercialization and stakeholder organization. Production constraints include land availability, water supply and management, plant disease and pest controls, agricultural input availability, diversification and programming. Taboos and prohibitions, poor knowledge of the benefits of fruits and vegetables and high cost are some of the major consumer constraints. Distribution and commercialization problems include poor harvesting and handling systems, lack of storage facilities and poor packaging and processing. The distribution chain is very long with many middlemen between field and consumer. The lack of professional organization has led to an absence of dialogue between the public and private sectors. Some solution strategies are proposed in this paper.

Filières agricoles en régions d’Itasy et d’Analamanga: approvisionnement de la ville d’Antananarivo
Berton, S.

Filières agricoles en régions d’Itasy et d’Analamanga: approvisionnement de la ville d’Antananarivo
Berton-Ofoueme, Y.

Urban agriculture in Portugal: Origins, types and trends
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Key words: Portugal, Portuguese-speaking African immigrants, urban agriculture types, inter-generational, inter-cultural, horticultural parks

Abstract

In Portugal most urban agriculture (UA) in the Lisbon area is traditionally practiced for economic reasons, mainly by migrants from rural areas within Portugal or by Portuguese-speaking Africans. Although the climate and food habits are very different from migrants’ regions of origin, both groups tend to cultivate similar plants that are adapted to the local climatic conditions. Differences do arise within groups; for instance, maize or sugar cane within the African community are not produced by the Portuguese urban farmers. Currently, various different types of new UA schemes are appearing which are oriented more towards leisure and environmental issues, and with a more formal approach and design. These UA projects are being organized mainly by public companies or local authorities, predominantly in city parks, with the objective of involving the urban population in UA activities. These projects do not have the ownership, water or soil problems that informal urban farmers often face. In some new neighborhoods, strong partnerships among NGOs, the local population and environmental companies are being implemented for inter-generational and inter-cultural reasons and directed towards unemployed people as well as immigrants from Portuguese-speaking African countries. These schemes place emphasis on generating money for low-income families. Many more of the migrants would also like to obtain the more formal plots; however there is not enough land available for the demand. Horticultural parks are already being planned that will provide agricultural space for people from all social strata to have access to a vegetable plot. In order to gain access it is necessary only to have taken a practical organic horticulture course. Social inclusion of vulnerable groups, leisure for urban populations with a strong environmental dimension and income-generating activities and marketable outcomes are the envisioned dimensions for the UA that will be practiced in these new horticultural parks.
Impact on soil microbial properties amended with biosolids derived from sewage treatment processes in Senegal

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Abstract

In Senegal, as in many countries in the Southern Hemisphere, waste management is crucial. Agricultural uses of the organic component of these wastes would be a solution to reduce the environmental impact of municipal wastes. Wastewater treatment has not been developed in Senegal, nor have there been any agronomic studies on using biosolids produced by sewage treatment processes as fertilizers in farming systems. To prevent a negative environmental impact on soil fertility, the effect of biosolids on soil microbial characteristics needs to be assessed. Two types of sludge were collected from sewage treatment stations in Pikine and Cambérène, which produce two type of biosolids: an activated and a stabilized sludge. The two organic products were incubated in soil under laboratory conditions for 28 days at 30 °C. Each week after the onset of the incubation, microbial biomass (fumigation–extraction method), pathogenic germ (salmonellas and vibrios) density, total microbial structure of the communities, and the structure of the ammonia-oxidizing bacteria (AOB) structure were measured in the organic product and soil mixture. This communication presents the main results of this study.

Growing and marketing indigenous vegetable species for sustenance in urban areas of Abia State, Nigeria

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Key words: Indigenous, Vegetable species, sustenance, wealth creation

Abstract

In Abia State, Nigeria, growing indigenous vegetable species is increasing among many poor urban households. Available marginal land spaces in cities as well as peri-urban farmlands are now being put to use for the production of various kinds of indigenous vegetable species as a conscious effort by poor urban dwellers to utilize local resources to combat hunger and poverty in their households. These endeavours have been outstandingly successful, as can be seen from increased vegetable production and income generation as well as enhanced nutrition in urban households. In view of these results, this paper recognizes the emerging and crucial role that enterprises producing and marketing indigenous vegetables could play in addressing poverty and hunger in the area studied. The paper also identifies various potentials, opportunities and challenges associated with such enterprises and recommends a policy agenda which should be set up to optimize them: 1) Seek to promote the systematic and strategic improvement of indigenous vegetable species through research and development studies; 2) Establish urban land use legislation that will control use of available land resources in urban area for farming; 3) Ensure and promote environmental sanitation and sustainabilty; 4) Seek to protect public health.
**Horticulture and sustainable cities: Opportunities and challenges of governance – Case study of Yaoundé’s farming system**

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**Key words:** Urban and peri-urban horticulture, food security, poverty alleviation, waste recycling sustainable cities, governance

**Abstract**

The economic regression that Cameroon has been undergoing for the past two decades as well as withdrawal of state support have meant that higher numbers of Cameroon’s population are falling into poverty levels (40% poverty and more than 30% unemployment in Yaoundé). Urban and peri-urban horticulture (UPH) has developed exponentially as an alternative revenue for households, with vegetables cultivated alone or in association throughout the year on more than 40 production sites. Among indigenous vegetables (*Amaranthus* sp, *Corchorus oliterus*) and horticultural (*Lactuca sativa, Apium graveolens*), a wide variety of species may be observed. The *Programme d’Appui au Développement Intégré de l’Agriculture Urbaine et Péri-urbaine* (PADIAUP), which has recuperated the agricultural extension activities abandoned by the government of Cameroon, has for nearly 15 years been providing technical and to some certain extent financial assistance to more than 3000 urban farmers (48% women, 54% under 35 years of age). Technical focus is on the use of compost obtained from the recycling of organic household wastes (more than 15% of organic waste is recycled annually). Using a concept of “farming and harvesting without going to the farm”, the project has succeeded in bringing vegetable and flower production in jars to the residential areas, using compost (some 2/3 of households are involved). Given the geographic and logistic proximity of markets, perishability and transport risks are reduced, resulting in the improvement of farmers revenues (over US$120 per month during periods of high activity). This sum represents a significant contribution to household income. Despite the multifunctionality of UPH, the activity is facing serious governance issues: absence of a legal and institutional framework, land status, water management, marginalization of research, exclusion from urban planning, and so on. Through partnerships with various research bodies (IRAD, AVRDC), experiments are regularly being conducted on farmers’ fields to improve seeds and cultivation practices. Collaboration between PADIAUP, the European Union and FAO has resulted in the improvement of some water supply systems. The contribution of UPH in building sustainable cities need to be recognized and all the players involved should build up a governance pattern of the activity, taking into account the recognized constraints.

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**Improving African leafy green vegetable seeds in urban and peri-urban farming systems – Case study of urban horticulture in Yaoundé, Cameroon**

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**Key words:** African leafy green vegetable, urban and peri-urban farming system, seed improvement, production process
Abstract

African leafy green vegetables are one of the key components of urban and peri-urban vegetable production in Yaoundé. With a per capita consumption estimated at 6.5 kg/inhabitant/year, for an annual production of 100,000 tones, leafy green vegetables are ranked third in national vegetable production. These vegetables, highly appreciated in Yaoundé for their organoleptic qualities, are cultivated year round by more than 60% of urban farmers (of which, more than 48% are women, and more than 50% are under 35 years of age). The geographic and logistic proximity of markets reduces perishability and transport risks, which means higher profits for the farmers (>US$120 monthly during periods of high activity). This sum represents a significant contribution to household income. Among the frequently encountered varieties are Solanum scabrum, Amaranthus hybridus, Corchorus oliterus, Vernonia amygdalina, and Gnetum africanum harvested (or collected) in the forest belt around Yaoundé. Because little research has been carried out on these species, the urban African leafy vegetable producers rely on their own seeds which are low yielding. The results of a recent indigenous vegetable workshop in Grahamstown, South Africa, emphasized that improving seed systems remains one of the best ways to boost African leafy vegetable production. Through a partnership with AVRDC (VBSS Program), and the participation of vegetable producers, PADIAUP has conducted experiments on farmers’ fields to improve seed system and plant protection. Three improved varieties of amaranth, jute mellow, African nightshade and African eggplant were tested throughout the year with 10 producers in 4 of the major productions sites in Yaoundé. Based on the agronomic performance, disease resistance, and organoleptic and marketing criteria, the producers classified the different varieties of each vegetable and chose the one most suitable for their farm. The follow-up activities are now analysing the entire production chain with the improved varieties.

The improved tropical garden: Home production for home consumption

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Key words: roots development, water utilization, fertility organic, ITG, technology transfer

Abstract

How can urban and peri-urban horticulture (UHP) meet the most urgent needs and contribute to supplying cities with large quantities of food and increased revenues? New gardening technology makes it possible to imagine the following:

• the green house phenomenon is reproduced on a small scale and delivers necessary materials, seeds and training. Basic principles: maximizes roots development (soil ploughed in depth); improved organic soil fertility; optimal water utilization;
• only 150 m² is required to produce 750–1500 kg/yr of vegetables; this is designed particularly for UPH and African families.

This product exists in the concept of the Improved Tropical Garden (ITG) developed by Jardin Tropical Semences (JTS). JTS was founded by Jean Marie Cordier, a researcher at INRA and specialist in seeds and tropical farming methodologies. He decided to create JTS in 1994 to ensure technology transfer between research laboratory and field and thereby improve crop yields. The main JTS goal is to lower levels of poverty and malnutrition with the ITG concept. The impact of ITG is four-fold. First, economical: year-round production, off-season sales, regular incomes, possibility of reimbursing investment within one year. Second, they are nutritional: all the vegetables needs for a family of 10 persons are covered. Third, social: jobs are created, standards of living are improved, and rural flight is reduced. Finally, there are
environmental benefits because there is significant water efficiency, off-season gardening, considerable land-infrastructure improvement and concerted efforts and results with respect to desertification. One of the 500 ITGs can be visited in the suburbs of Dakar at Pikine Guenawaye Rail. JTS is now established in Senegal, Niger, Egypt, Algeria, Haiti and in Asia, and works with many organizations such as Grameen CA, FAO, Pro Natura International, Save the Children Fund, and certain microfinance institutions (e.g. Caurie Micro Finance).


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Key words: Horticulture, truck farming, geographical information system (GIS), Ouagadougou, spatial dynamic

Abstract

The present study describes horticulture and how it is spatially distributed in Ouagadougou, the capital of the Burkina Faso, a Sahelian developing country. In particular, the specific spatial and temporal dynamics of horticulture have been studied for more than a decade. The first studies on truck farming in Ouagadougou were conducted in 1992, with a spatial inventory in 1996 (Cissé, 1997); this corresponds to the period when the activity was prohibited by agrarian and land reform and explains why that year has been taken as the starting point for analyzing spatial dynamics. The results present the spatial distribution of agricultural sites in the city of Ouagadougou between 1996 and 2009, as well as how much land is being cultivated by truck farming according to season. The paper analyses the spatial and temporal dynamics observed according to urban land pressure and to water availability, which is the indispensable factor for ensuring survival of this activity. Based on field work and a study of the existing documentation and the possibilities of acquisition of data and spatial analysis offered by geographical information systems, the results of the study reveal that, over 13 years, in spite of the ban and diverse pressures, the number of agricultural sites in Ouagadougou has continued to increase. Although the location of the large agricultural zones did not change very much, the cultivated surfaces have more than doubled. It follows that the number of farmers and consequently, the number of individuals making their living from this activity, has considerably increased. These are fundamental parameters which justify the conception and the implementation of a sustainable plan for horticulture in the capital.

Linking small-scale farmers to markets in urban and peri-urban areas: An evaluation of AMSDP programme in Arusha, Tanzania

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Key words: Linking smallholder farmers, Urban and Peri-urban areas, participation in markets

Abstract

The objective of this study was to evaluate the impact of institutions supporting the marketing system in urban and peri-urban areas that connect smallholder farmers to markets following market liberalization in Tanzania. In particular, the Agricultural Marketing Systems Development Programme [AMSDP] was targeted as a case study. The study attempted to
identify different factors that influence smallholder farmers’ participation in markets in urban and peri-urban areas in the Arusha region. It was expected that the identification of factors and the extent to which they influence farmers’ participation in the markets could assist institutions to formulate policy interventions for stimulating the participation of smallholder farmers in agricultural markets. The study hypothesized that the decision of smallholder farmers to participate in markets is influenced by transaction costs, household characteristics and the level of market orientation. Transaction costs could have an influence on farmers’ participation in the markets. In order to test the hypothesis, a logit model was estimated using surveys and/or data from 163 randomly selected households. The results show that farmers gained through education of the household by extension officers, which positively and significantly influenced the probability of household participation in the market in the study area. Access to land for agriculture and household size were positively related to household participation in the agricultural market. In contrast, the distance to the market negatively and significantly influenced the probability of smallholder farmer participation in the market.

Cold storage: An option in reducing pesticide residue levels in cabbage (Brassica oleracea)

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Abstract

Laboratory analysis to establish the residue levels of pesticides in cabbage heads harvested from farms in the forest ecozone of Ghana revealed the presence of organochlorines, and further analysis quantified the amounts present. Analysis of organochlorine residue levels in heads of cabbage at harvest indicated alpha-BHC, gamma-BHC (Lindane), beta-BHC, delta-BHC, beta-Endosulfan and Heptachlor residue levels of 0.321 mg/kg, 0.908 mg/kg, 0.883 mg/kg, 0.394 mg/kg, 0.207 mg/kg and 0.140 mg/kg, respectively, which are all higher than the FAO/WHO guideline value of 0.05 mg/kg. However, DDT, DDE, Endrin, Dieldrin and Endosulfan sulphate showed residue levels of 0.017 mg/kg, 0.07 mg/kg, 0.022 mg/kg, 0.010 mg/kg and 0.005 mg/kg, respectively, which are all below the FAO/WHO guideline value of 0.02 mg/kg for DDT and DDE, and 0.05 mg/kg for Endrin, Dieldrin and Endosulfan sulphate, respectively. Analysis of residue levels of the organochlorines, after 14 days of storage in a refrigerator at 5 °C, showed significant reductions (p < 0.05) in pesticide residues in the cabbage heads. All of the pesticide levels fell below the FAO/WHO recommended levels, except gamma-BHC (Lindane) and beta-BHC, whose levels dropped significantly (p<0.05) but were still higher than the FAO/WHO recommended levels. From the results of the analyses, storing cabbage for 14 days could remove all traces of Aldrin, Dieldrin and Endosulfan sulphate. Organochlorine pesticides are banned for vegetable production in Ghana; therefore, the detection of these organochlorine pesticides residues in cabbage samples indicates misuse of agrochemicals among cabbage producers in the forest ecozone, and these cabbages therefore pose health hazards for consumers, particularly if they are consumed soon after harvest.
Consumer food health risk perceptions: A supply chain approach to leafy vegetables from peri-urban farming around Nairobi

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Key words: Food health, risk perception, consumer, supply chain, peri-urban farming

Abstract

Perceived food health risk has been shown to be a significant factor in explaining consumer food shopping behaviour, and the importance of this investigation has been well established. In many developing countries, a significant proportion of fresh produce consumed in the urban areas is cultivated in urban and peri-urban plots. Health hazards or risks imposed within the supply chain can undermine the nutritional and social development benefits of urban and peri-urban agriculture. At the same time, the demand by urban consumers for aesthetic characteristics has encouraged the excessive use of pesticides and chemical fertilizers. This paper seeks to quantify consumers’ importance-weighted subjective assessment of the expected value of inherent risk in the consumption of kale that has just been purchased. This risk assessment involved the processing of 3 dimensions across 7 risk attributes: 1) the severity of the impact, 2) the likelihood of being affected by the source of the risk, and 3) when in time the eventual health impact will present itself. A personal interview was conducted between April and May 2010 with a sampling of 449 people at the time and point of kale purchase. The surveys were conducted at four different market types: 1) roadside (n=84), 2) open-air markets (n=215), 3) supermarkets (n=113), and 4) specialty stores (n=37). Probability proportionate to size (market-type) sampling was used. Results from additive as well as multiplicative risk models were compared. Our findings reveal that the risk density functions are separable across markets. We also provide results from both a regression-tree as well as a multinomial approach to determine market choice based on individual risk indices.

Measuring consumers’ food-quality values at the point of purchase using best-worst scaling: A supply-chain approach to leafy vegetables from peri-urban farming around Nairobi

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Key words: food quality, anchored best-worst scaling, supply chain, peri-urban farming

Abstract

This paper seeks to determine the relative importance consumers place on a variety of food-quality issues within the supply chain for leafy vegetables related to peri-urban farming. These issues include food safety; sensory quality of food; price; environmental friendliness; convenience; hygiene and handling; and nutrition. The recently developed best-worst (BW) scaling approach was used to develop a relative preference ordering for more than 16 food-quality issues. The BW scaling approach has several advantages over rating-based methods,
including an inbuilt trade-off between issues. We further develop the BW approach to include anchored scaling to a common reference point across respondents. A personal interview was conducted in April and May 2010 with a sampling of 449 people at the time and point of kale purchase. The surveys were conducted at four different market types: 1) roadside (n=84); 2) open air markets (n=215), 3) supermarkets (n=113), and 4) specialty stores (n=37). Probability proportionate to size (market type) sampling was used. Individual-based preferences were derived using Hierarchical Bayes estimation with the covariance matrix defined through a two-step cluster analysis over a set of socio-economic characteristics of the respondents. Results revealed that, on average, the values of environmental friendliness, use of clean water for irrigation and hygienic handling were among the most important issues to consumers, whereas washing and sprinkling with clean water at the market place, pre-packing and use of pesticides were among the least important. Furthermore, there was a highly significant correlation among included food quality issues, as well as some correlations ($P > 0.5$) indicating that the set of issues was a reliable set of indices per se.

**Strengthening urban producer organizations for innovative vegetable production and marketing in West African cities: Experiences from Accra, Ghana and Ibadan, Nigeria**

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Key words: Urban and peri urban vegetable production, value addition, food quality and safety, waste (water) for urban and peri-urban agriculture

**Abstract**

Urban and peri-urban agriculture (UPA) is seen as a subsistence-oriented production system. It has been given little formal support or recognition by city authorities in the development plans. Recent development programmes have continued to raise awareness about this phenomenon, and local authorities have begun to understand the role UPA can play in improving urban food supply and reducing poverty. Constraints to UPA such as limited access to land and good quality water, poor farmer organization, participation in policy development, and poor policy support, imply that UPA needs to be productive and profitable through diverse innovations. In Accra, Ghana and Ibadan, Nigeria, 200 urban farmers were organized into 8 producer groups and trained using technical and organizational innovations in vegetable production so as to improve yield and income. The Ibadan groups were predominantly female farmers, while Accra groups were mainly male. Training was delivered through the Urban Producer Field Schools (UPFS) on topics ranging from integrated plant production and protection principles, food safety and risk-minimization in wastewater use for irrigation to value-addition for marketing. Farmers dealt with organized marketing, targeting niche markets. The farmer groups in Accra progressed significantly over a one-year period of group strengthening as became evident in their organized structure and participation in group processes. The Ibadan group lagged behind at the group formation stage, apparently because of the hierarchical nature of the group and personal conflicts. In addition, external factors such as disease infestation affected the group processes in Ibadan. Adoption of innovations was higher among the farmers in Accra, where farmers applied at least 3 out of 6 different innovations, while adoption of innovations among female farmers in Ibadan was low: as less than 30% adopted 2 out of 5 different innovations. In both Accra and Ibadan, considerable improvement in crop performance was recorded.
A quest for urban planning practice, attitudes and policy changes in rapidly urbanizing cities for sustainable development in Tanzania: The case of Moshi

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Key words: agricultural city, food systems, sub-saharan, urban planning practice, policy change, sustainable development, Tanzania

Abstract

The central object of urban planning practice is to ensure that cities are livable. A livable city must be physically planned and safe, with reduced crime rates. It should have a coordinated land access mechanism and be self-sufficient in terms of food supply, health services, infrastructure, and the social welfare of its citizen, and it should attract local and foreign investments. Moshi, among other sub-Saharan African cities, is located in Tanzania. Food is produced within both urban and peri-urban areas. Importation of food into the city is limited, and most of it is exported to the hinterland. Both urban and peri-urban horticulture and other farm activities are predominant. The benefits that result from these agricultural activities ensure urban food security and have a “trickledown effect” to other rapidly urbanizing cities in Tanzania. This paper examines the different forms of agricultural practice, urban agricultural farming and its requirements, and demographic changes. It also discusses how urban planning practices, the attitudes of practitioners and professionals, and urban development policy needs and links are required in creating a viable agricultural city. Negative externalities and the fear generally expressed by policy-makers and other stakeholders interested in sustainable urban development are also documented with a view to the impact of urbanization in city development. The findings can be applied in this specific context but also in other sub-Saharan African cities with the same environment for the development of sustainable cities.

Microjardinage [micro-gardening] and the use of natural and biological products for better environmental conservation, human health and protection of vegetables

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Key words: microjardinage, micro-gardening, natural, biological, quality, preservation, integrated protection, environment, health

Abstract

Microjardinage [micro-gardening] is a simple technology for producing vegetables in small, limited areas. The program initiated in Senegal aims to counter poverty and give families the possibility to maintain horticultural activities close to home, increasing both income and food sources in the process. As with all horticulture activities, microjardinage is subject to pests and diseases, which can reduce production, estimated to be 30 kg/m² (30T/Ha) for individual areas of 10 or 15 m². Any attack can thus compromise production levels. This type of agriculture, close to home and within urban areas, makes it possible to increase the quantitative and qualitative consumption in vegetables within the family; the problem of integrated cultivation methods must be addressed as well, meaning that environmental and human health factors must also be taken into consideration. Thus it is necessary to protect both the garden from pest attacks, and
the individuals who will eat the produce. The best methodology is to ensure the highest level of
d Protection without resorting to chemicals. Indeed, the area in which microjardinage is carried
out, and the preoccupation to preserve both the environment and human health, excludes using
chemicals even if they are perceived as not dangerous. Farm practices must be improved with
sustainable protection of vegetables, which means proper preparation of the land using natural
and biological products in order to achieve high production and the best quality.

The use of Paecilomyces lilacinus (nematicidal fungus) as an alternative
method to control nematodes in tomato for sustainable production
in urban and suburban areas (Dakar, Senegal)

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Key words: tomato, Meloidogyne javanica, Paecilomyces lilacinus, carbofuran, urban agriculture

Abstract

Agricultural activities, especially horticulture, will become increasingly important in areas now
classified as urban or suburban. In Senegal, the practice of urban horticulture is particularly
important since the agricultural sector still has the difficult task of providing jobs, incomes and
food security in much of the population. It is essential to identify the risks posed by urban and
peri-urban horticulture and to provide solutions for farmers as well as research opportunities
for scientists to ensure the sustainability of the system. The aim of this study was to compare
the effects of 5 types of treatments on tomato (Lycopersicon esculentum var. Mongal, sensitive to
nematodes) by analyzing their impact on the yield in kg, the number of fruits and the level of
attack by Meloidogyne javanica at the ISRA research center (CDH) close to Dakar, Senegal under
pesticide-free conditions. The experimental design was set in a completely randomized block
with 5 treatments and 3 repetitions. The product used was PL Gold®, which contains the fungus
Paecilomyces lilacinus (PL) and is proposed by the Foundation Agir pour l’Education et la Santé
for the west African market to control Meloidogyne javanica. The five treatments were: PL1 (0.5
kg/ha), PL2 (1 kg/ha) and PL3 (1.5 kg/ha), a control with Carbofuran (WC) (50 kg/ha) and an
untreated control. PL3 was the most effective treatment since seedlings in this treatment were
not attacked by M. javanica. All the other treatments were susceptible to M. javanica. With
regard to the agronomic parameters, seedlings in the PL2 treatment sprouted earlier and gave
higher fruit yield. The WC treatment gave a better yield (92 t/ha) followed by PL2 (89 t/ha). The
effect of the PL2 treatment in terms of yield, agronomic performance and level of attack by M.
javanica (40% reduction of attack) is discussed in this paper. The use of PL2 (a biological
treatment) as an alternative to WC (chemical treatment) is suggested to improve the
sustainability of soil fertility and crop productivity.

Hybrid seeds as an important component of integrated vegetable production
and protection in urban and peri-urban horticulture in African cities

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Key words: African eggplant, Solanum aethiopicum, hybrid, integrated vegetable production
Abstract

Production of vegetables in urban and peri-urban areas is expanding around most African big cities. This phenomenon is probably due to a higher purchasing power of city dwellers who can afford vegetables. Vegetable production is subject to various diseases and insect pests, and different integrated pest management (IPM) strategies, including biological control, the use of bio-pesticides, and entomo-pathological agents are being used. However, vegetable growers are still overusing synthetic chemicals to properly control these diseases and insect pests, and thus they are creating environmental problems. Most of the farmers are still saving back their own seeds every year or are in the habit of buying poor-quality, low-yield seeds. Hybrid seeds could play a key role in an IMP strategy, because they would combine good fruit quality, higher yields, and higher disease and insect tolerance. Hybrid seeds in combination with adapted production technologies have proven to be the key factor of the thriving vegetable sector of tropical Asia. We are convinced that same strategy can be implemented for urban and peri-urban vegetable growers in Africa. As an example, African eggplant (*Solanum aethiopicum* L.) is a very important fruit and leafy indigenous vegetable grown across sub-Saharan Africa. Demand for African eggplant cultivation is expanding in Tanzania because of its economic and nutritional value. We have bred hybrids that showed higher yield, better shelf life, earlier-yielding and more upright plants and with tolerance to insect pests. The use of these new hybrid varieties in combination with adapted crop management will create reliable income for urban and peri-urban African eggplant growers.

Utilization of horticultural crops for better health and livelihoods in Sierra Leone

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Key words: containerized vegetable systems, health, horticulture, urban population, malnutrition, vegetable garden, urban horticulture

Abstract

Horticultural crops play an important role in basic human nutrition as a major source of vitamins and minerals. Although these nutrients are necessary only in very small quantities, they nevertheless play a crucial role in the physiological and metabolic activities of the human body. Their deficiencies in the human diet are one of the major causes of certain diseases. The urban population is steadily increasing as a result of massive migration from rural communities, added to the high birth rates in developing countries. The supply of healthy vegetables to urban areas is inadequate to meet the demand of an ever-increasing population, with the result that these groups suffer from malnutrition. As urban communities face malnutrition, a project to evaluate the impact of urban, home-managed container vegetable gardens on health and livelihoods is being set up. This type of urban horticulture will utilize locally available inputs, thereby adding to the livelihood of other families while increasing the locally available food supply. Neighbourhoods in four urban areas will be supplied with containerized vegetable systems, and baseline analysis of the neighborhood health will be evaluated and compared to health after implementation. The health in neighbourhoods without containerized vegetable systems will be measured. It is expected that the diversity of vegetables available and their consumption at family level will increase in the areas supplied with containerized vegetable gardens. Information derived from this investigation will be disseminated at workshops for relevant stakeholders and extension personnel to bridge knowledge gaps.
Horticultural territories in the urban environment (Dakar, Senegal)

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Key words: horticulture, floriculture, urban area, producers, incomes, markets, customers, institutional support, organization

Abstract

The large African city is standardized, with the same image as all large cities of the world. Expansion is accompanied by a “brutal abandonment” of rural areas, often following a summary installation preceding allotment. Nevertheless, the rural area survives and adapts perfectly to the city, even to the point of reversing the fate that has apparently been allotted to it. A recuperation occurs simultaneously because the cultural traditions and aesthetic framework for life of African townspeople goes on at the same time. Dakar provides an illustration of the organization of a discrete urban horticulture which is thriving and providing services of significant importance. This city is organizing and improving its services, in spite of lack of public service support. Recent geographical research on urban horticulture in Dakar is presented in this communication. An analysis of territories being invested and horticultural activities being carried out in the urban environment of Dakar is presented, along with organizational rationales of all players, assessment of incomes being generated, and an evaluation of the future prospects of this activity with a context of urban planning and development schemes.

Contribution of urban and peri-urban horticulture to livelihoods in Zimbabwe

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Key words: Urban Horticulture, contribution, socio-economic, livelihoods

Abstract

Urban agriculture has played an important role in food security in Zimbabwe. In this country, urban agriculture is a multidisciplinary dynamic undertaking which ranges from small-scale subsistence production in the backyard gardens to a fully commercialized greenhouse production of vegetables and flowers. In a country where unemployment has risen to 80% in the past few years, the contribution of urban and peri-urban horticulture to livelihoods cannot be overemphasized. In the 1990s urban and peri-urban floriculture was one of the most important sources of foreign currency revenues for Zimbabwe. This paper highlights the socio-economic importance of urban horticulture in Zimbabwe today. The contribution of urban agriculture in mitigating the effects of climate change is highlighted. Urban horticulture leads to improved food and nutrition security, is a source of income for most households, may help in the control of pollution and erosion if properly managed and generally leads to economic growth. The paper also argues that, despite challenges brought about by pollution and the erosion threats from urban agriculture, if carried out in a coordinated manner, urban agriculture has more positive outcomes than negative possibilities. The paper also highlights the deliberate attempts by NGOs and government to promote urban horticulture among poor farmers. Despite government and partner efforts to promote urban and peri-urban horticulture, there is still much to be done. The paper includes an overview of activities taking place in the two largest cities of Zimbabwe, Harare and Bulawayo. It also presents interviews with key...
stakeholders such as government, NGOs, city authorities and the staff of various projects involved in urban agriculture in the two cities. The paper concludes that the contribution of urban horticulture to the social and economic development of this country is immense. It also proposes recommendations for improving the participation of a majority of the population in urban agriculture.

**Providing agricultural extension services for urban agriculture in Zimbabwe**

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Key words: extension, urban horticulture, sustainable horticulture production

**Abstract**

Extension service in urban areas is a highly complex undertaking which neither government nor the private sector have taken seriously. The most common assumption is that urban farmers are somehow “socially upscale” farmers with access to modern technology, and that other means of communication, telephone, Internet, and the media will improve productivity. This assumption does not hold for Zimbabwe, where most of the urban production is being carried out by resource-poor farmers who rely on government and NGO extension services for production information. This paper highlights that, although Zimbabwe has made inroads in providing public extension to urban farmers, the appropriate and most effective extension approaches and methodologies are still a challenge. It also argues that extension approaches developed for rural farmers are not very appropriate for urban farmers because these latter are rarely organized. Although much research and technology has been invested in urban horticulture elsewhere in the region, Zimbabwe has not benefited from it because of weak extension links within urban agriculture. This study argues that horticulture production in urban areas is a specialized field which requires attention to technology and how to use it. Without proper extension methods, the expansion of horticulture to the majority of potential farmers will remain an elusive goal. Participatory extension approaches such as Farmer Field Schools are proposed as one of the effective extension approaches for urban agriculture. A brief review of extension methods that have been used by both public and private extension providers of urban agriculture in Zimbabwe is included. Interviews with key extension providers for urban agriculture on the extension, methods they have been using their strengths and challenges are presented. In conclusion, policy recommendations to improve on urban agriculture extension are provided.

**Space and time dynamics of the evolution of horticulture in Gabon: The case of market-gardening crops in Libreville**

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Key words: horticulture, development, urban and peri-urban areas, vegetables

**Abstract**

With a significant but little exploited potential for development since national independence, the Gabonese horticultural sector is currently undergoing profound change. The experimental farms of the 1960s in the outskirts of the capital city Libreville, along with various productive structures added during the 1990s until the present, including production projects conceived during the 1970s incorporating irrigated plots, have been noted. Farming methods have gradually been forced to adapt to various constraints related to production. The size and
number of farms vary now according to demand from urban markets. Libreville and its environs barely numbered 10 market-gardening farms until 1990, compared with nearly 1000 today. Aubergines, okra, basil, pepper and lettuce were the only fresh produce available in the past, whereas today the stalls of the markets and supermarkets are well stocked in various local products. Initially located only in remote urban outskirts, today these farms are much closer to the urban centre. This situation is a direct consequence of the evolution of food habits resulting from a rapid increase in population in the urban areas, and has contributed heavily to the alteration of the entire horticultural context. Production, marketing and services are now intertwined in the entire urban economy. This paper thus focuses on an analysis of the evolution of horticultural practices in a country known especially for the relative wealth of its basic products and the exploitation of its raw materials.

**Methodological approach to improve a marketing channel:**

**Case of squash marketing in Antananarivo**

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Key words: Marketing, farmers, squash (**Cucurbita moshata** D.), income, supply and demand

**Abstract**

In Madagascar, vegetable producers or farmers rarely fix the price of their products. Moreover, their price does not necessarily follow the law of supply and demand. Because of external factors, farmers do not master the marketing process. It seems difficult for them to produce a significant added value which may ensure the sustainability of their livelihoods. This study aimed to help producers to choose a more beneficial method of marketing. Instead of proposing solutions, we decided to lead a squash (**Cucurbita moshata** D.) cropping campaign in Ambohimangakely, a village located 10 km to the east of Antananarivo, and to sell the harvested products and assess the economical results taking into consideration the chosen marketing channel. A sector analysis was previously conducted through an informal survey in the markets of the Capital of Madagascar, in order to balance supply to demand. Market analysis of squash has shown an opportunity of about 2,300 t of demand gap. The most interesting marketing channel for better agricultural income is the shortest one, which includes the producer, the wholesaler/retailer and the consumer. In that case, the carrier function may be supported by the producer or the seller. However, marketing opportunity depends not only on the choice of differences between supply and demand. With vegetables, our experience also revealed the high resiliency of the squash with respect to hail, and its capacity to be conserved for more than a year in appropriate conditions.
Vertical nutrient fluxes in urban agricultural soils: Measuring and modeling the N, P and K leaching in Bobo Dioulasso (Burkina Faso)

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Key words: urban horticulture, resources management, nutrient leaching, groundwater pollution, production quality

Abstract

This study aimed at (i) conducting detailed characterization of water and nutrient management strategies in conventional urban horticulture; (ii) quantifying the leaching of N, P and K \textit{in situ} and through modeling; and (iii) evaluating the opportunities for increasing resource efficiency and preventing groundwater pollution. In two representative gardens, four vegetable crops were evaluated (tomato, cabbage, carrot and lettuce) after three treatments: i) the usual fertilization practices of the gardener; ii) 30 \% reduction in fertilizer input, and iii) no fertilization, during 24 months. Water and nutrient inputs and soil properties were closely monitored. Sites were equipped with weather stations, TDR probes, pan lysimeters and ion exchange resins for monitoring the leaching of N, P and K. Gardening practices indicate low nutrient use efficiency as a result of the high input of organic and mineral fertilizers, which greatly exceeded nutrient export through harvests. Irrigation water exceeded crop evapotranspiration, mainly during the rainy season. About 3\% and 6\% of the input water was lost to runoff at Dogona during 2008 and 2009, respectively, and 8\% at Koden, mostly during the rainy season, although at Koden runoff also occurred during the dry season. The study also showed that nutrient inputs may be reduced by up to 30\% without significant ($P< 0.05$) adverse effect on yields. Results underlined the need for better coordination between crop needs and the water and nutrients that are applied. Modeling makes it possible to propose better management practices for preventing risks of groundwater pollution and ensuring production quality.

From beneficiaries to researchers: A distributed model for biological pest and disease control

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Key words; agroforestry, permaculture, farmer field school, organic, IPM, sustainable agriculture, community research, south-south co-operation, economic independence, swadeshi, cooperatives, food security

Abstract

With increasing global awareness of the risks associated with the dependence of industrial agriculture on chemical farming methods, small farmers around the world are being encouraged to return to various aspects of “traditional” agriculture, under the name of “agro-forestry” or “permaculture”. In this shifting paradigm, the importance of empirically-tested local, traditional knowledge in at least two domains is confirmed: a) using locally sourced plants as bio-pesticides; b) combining annual vegetables, perennial vegetables, and leguminous trees and shrubs in “polycultivation”, optimizing for cooperation, not competition. Unfortunately, in urban areas in general and in the West African context in particular, urban migration and civil unrest of the past generations have resulted in large populations interested in agriculture but ignorant of traditional knowledge. Many of these farmers have been educated into thinking that agriculture without chemicals is impossible. Effective use of bio-pesticides requires data under
a wide range of conditions and combinations. These data, as far as we know, have not been tested and confirmed in the local context. In this paper currently operating farmer groups were interviewed to gain feedback as to which techniques do and do not work for farmers. The focus is to transform networks of beneficiaries into cadres of researchers, reporting back to their Lead Farmers and Facilitators with the results of the experiments. Local universities can provide basic organizational support and analysis for the new “researchers”, creating a database of solutions to share. Students will gain field experience and could apply their work towards independent-study credit or internship experience. We present a model aimed at building a distributed team of farmer-researchers, capable of spotting combinations that are cost- and labor-effective for their local context, in order to develop comprehensive and repeatable strategies for disease and pest management.

Urban and peri-urban horticulture in Rajasthan: Vision 2020

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Key words: Production, securing access to land and water and integrated plant production

Abstract

Rajasthan is the largest state India, covering an area of 342,239 km², or 10.5% of the country's geographical area; it has only 1.15% per cent of its water resources. The total population of Rajasthan is 56,473,122 people according to the population census of 2001, and the current population of the state in 2010 is estimated at 58 million. The climate conditions in most of the state (60-75%) are harsh arid and semi-arid, with 168 lac ha total area under cultivation, of which 113 lac ha are rain-fed, so even a modest alteration in the intensity, frequency and duration of rainfall causes serious problems for farmers of horticultural crops. The total area under horticultural crop cultivation in Rajasthan is only 10.39 lac ha with an annual production of 28.63 lac MT in 2009–2010, which is not sufficient to meet the demand for horticultural products in the state. Due to effects of climate change, repeated drought has affected certain areas, which recorded lower horticultural crop yields and over-exploitation of underground water, and consequently poverty levels have increased in the state. To cope up the situation, the Government of Rajasthan has started to provide 60–80% subsidies on the total cost of greenhouse and shade net house construction and cultivation of horticultural crops to the cultivators with special emphasis to urban and peri-urban growers for protected cultivation. The complex and multidimensional nature of urban and peri-urban horticulture requires a long-term, well-organized and coordinated research planning and actions involving all the stakeholders. The present study will highlight the ongoing efforts of state government and non-governmental organizations in managing effects of climate change and increasing the productivity levels of horticultural crops through protected cultivation with special emphasis on urban and peri-urban horticulture in the state.
Urbanization in Nairobi’s peri-urban areas: Consequences of land-use conversion

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Key words: Land, land use, peri-urban, urbanization, agriculture

Abstract

The process of urbanization is one of the most important dimensions of economic, social and physical change. It is often said that the planet’s future will be an urban one. The largest and fastest-growing cities are in developing countries, and Kenya is not an exception. Rapid urban population growth means an increasing demand for land. This land is not available within the city, but in peri-urban areas, for various reasons. The conversion of agricultural land to residential uses is leading to rapid transformations in agricultural production, spatial structure, social structure, land ownership and land markets in these areas. In the peri-urban areas of Nairobi, the land used for agricultural production is being gradually encroached upon and reduced, as it is increasingly being used for urban activities, and particularly for residential land uses. This squeezing out of agricultural land continues, despite the fact that Kenya’s economy is predominantly agricultural-based. Given the country’s scarcity of arable land, this is one of the observations that indicates a contradiction in what one would expect to happen compared with what is really taking place; the situation requires urgent and immediate attention. This paper, based on an empirical research, explores various aspects of land use and changes in the Nairobi’s peri-urban areas. The major question guiding the discussion is, “Why is agriculture being squeezed out by non-agricultural land uses in Nairobi’s peri-urban areas?”

Building peri-urban garden regulations: The relationship between community groups and local public administrations, and lessons learned from the field

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Key words: standardization, land use and occupation, dialogical process, peri-urban horticulture, Lisbon Metropolitan Area

Abstract

Using ongoing research into the role of peri-urban gardens in Portugal this paper focuses on the experiences and lessons learned from the creation and implementation of peri-urban garden guidelines and regulations in various social and political contexts, such as the city of Lisbon – one of the most important cases of peri-urban gardens in Portugal. Most of the plots have been cultivated in public and private vacant land for at least 30 years by various social groups. The majority are (i) migrant communities from Cape Verde, or even from rural areas of Portugal, who are cultivating land in urban areas of non-official urban planning in the Lisbon Metropolitan Area. Recently, these activities have come under scrutiny by the public administration because of a lack of planning applications and building guidelines and regulations. This situation is a result of recent emergency urban garden policies from local governments. However, these new norms are not the only purpose of regulation for urban gardens. Some local community groups have been establishing different rules and guidelines and proposing alternatives to the official regulations. Within this context, the three main issues of the debate are as follows: (i) reviewing the social and political context of the regulation drafting process of peri-urban gardens with regard to different processes, namely a regulation
set up by a local community group as opposed to a regulation set up by the local public administration; (ii) the possibility (or not) of dialogue in both cases; and (iii) the experiences and lessons learned by the process of standardizing access to and use of land, exemplified by access to resources like water and energy in the urban space for horticulture activities.

**Spatio-temporal dynamics of land occupation, urbanization and urban agriculture on the Allada plateau in southern Benin**

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Key words: Strategic Communal natural resource management scheme, housing estate, sustainable development, urban forestry

**Abstract**

This article aims to assess the spatio-temporal dynamics of land occupation, urbanization and urban agriculture on the Allada Plateau in southern Benin. The Allada Plateau is a well-known rural area that produces fruits and vegetables for the major cities in Benin. However, the increasing pressure from human settlement is a real threat for farming activities in this region. In order to understand the phenomenon of spatio-temporal dynamics of land occupation, map projections for the following years are presented: 1959, 1972, 1992 and 2006. A rapid diagnosis of plot ownership by group makes it possible to clearly see how land is currently being utilized. Basic ownership and water usage units remained stable. Declining ecosystem units are rain and semi-evergreen rain forests and palm oil crop rotation; increasing units are crops, fallow land, industrial plantation of teak, palm oil, fruit trees and built-up areas. A new form of peri urban farming activities representing 13.61 % of the total area is emerging. In the context of new land ownership, tree planting stabilizes the land, raises money and provides shade. Natural resource consumers, urbanization and preservation and/or protection of natural resources are not necessarily in conflict. However, the inclusion of urban agriculture and afforestation in urban planning has become a challenge for the sustainable development of urban expansion.
Seminars

Monday, 6 December, 15:30-17:30 / Salle Djoudj
IPM – Sustainable production of horticultural crops

Moderators
William Settle (FAO – Rome)
Mohamed HamaGarba (FAO – Senegal)

Monday, 6 December, 15:30-17:30 / Amphitheatre
PROFAV – Promotion of fruits and vegetables for better health and livelihoods

Moderator
Jacky Ganry (CIRAD – Montpellier)

Since 2003, FAO and WHO have been collaborating in an initiative to promote fruit and vegetables in developing countries. The overall objective is to mobilize decision-makers from the domains of health/nutrition, education and horticulture to discuss and develop national and multi-sectoral action plans. Since the formulation of a global framework in March 2005, six regional workshops have taken place. In parallel, several global networks and tools have been launched, such as the Global Horticulture Initiative, a worldwide programme that aims at fostering more efficient and effective partnerships and collective action among the stakeholders. However, many constraints remain to be addressed all along the horticulture value-chain and in a multitude of diverse food systems – for example, the underestimated and neglected potential of indigenous species, limited access to inputs and markets, and social and cultural barriers. The purpose of the workshop is to contribute in addressing some of those issues, which are crucial in expanding urban areas, and to advocate for more attention being paid to the role of fruits and vegetables in urban food and nutrition security and livelihoods.

Promoting fruits and vegetables for nutrition and health, a major challenge for developing countries

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Key words: fruits, vegetables, availability, health, education, nutrition

Abstract

It is now recognized that a high consumption of fruits and vegetables (F&V) is an important component of a healthy diet, and can help prevent micronutrient deficiency or degenerative diseases. According to a report by WHO in 2002, low F&V intake is considered to be a high-risk factor. In this context, WHO and FAO have decided to combine their efforts to promote F&V within the Kobe Framework, encouraging interdisciplinary action and national initiatives based on health-agriculture-education-trade partnerships. GlobalHort is now strongly involved in such initiatives. There are only a few clear, simple science-based messages: increased consumption of F&V is desirable to ensure better general dietary habits; 400 g per person is a minimum daily intake of a variety of F&V. In spite of poor documentation on F&V consumption which must be
urgently addressed, it may be assumed that F&V consumption is too low in many developing
countries; this is backed by global supply data and by local supply and consumption surveys, in
places where these surveys have been carried out. An example is the critical situation in Africa
where the average per capita F&V supply is far too low. Increasing the availability and
consumption of F&V in African countries is a major challenge because of increasing
urbanization, nutrition transitions, increasing prices and food safety concerns. One of the ways
to increase public and institutions’ awareness and promoting national initiatives is to organize
and set up workshops, all over the world, especially in developing countries, organized in the
framework of the Promotion of F&V for Health (PROFAV) initiative. Such workshops would be
aimed at boosting multisectoral actions, in agriculture, health and education in order to address
supply and demand deficits simultaneously and through coordinated campaigns based on two
major supporting actions: development of a competent, efficient F&V supply chain, and public
awareness about importance of F&V in balanced diets. As an introduction to the PROFAV
workshop, this paper will present the main achievements of the initiative to date, along with
expected actions.

From urban and peri-urban agriculture to micro gardens:
How to attain fresh food security in Dakar

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Key words: Urban and peri-urban agriculture, typology, location, sustainability, multi-
functionality, observatory, microgardens, migration, Dakar, Senegal

Abstract

Depending on the city and its socio-geographical context, urban and peri-urban agriculture
presents different types of production systems. Considered as a way to alleviate poverty, this
type of agriculture has gradually acquired a certain legitimacy in urban projects. In a study
carried out in the Dakar region, we investigated six categories of stakeholders – from the
agricultural and policy-making sectors– to determine their perception of this type of agriculture
in areas like Niayes, and characterize production systems. By adopting an innovative analytical
approach, we were able to highlight the following:

• a typology of farms representing the diversity of production systems and household
activities,
• an analysis of their location in 4 agricultural zones differentiated by urban proximity,
• the variability of the internal and external sustainability of farms,
• an analysis of multi-functionality of agriculture and agricultural areas based on the
perception of the six categories of actors.

These elements provide new insights into various stakeholders. However, in order to provide
solutions for the various problems faced by this type of agriculture, we suggest scientific and
technical solutions such as the creation of an agriculture observatory. Moreover, the physical
realities of the Dakar region – a peninsula with an area of 550 km² and very high demographic
pressure – and the search for fresh food security for city dwellers have led us to propose a
project with innovative research into microgardens and their functions for the households, and
the involvement of Senegalese migrants in Europe in urban and peri-urban agriculture. This
multidisciplinary project with six research axes will involve researchers from various
Senegalese and French research institutions and entities as well as producers; consumers,
agents of technical staff and elected people. Other regions such as Thies and St Louis could also
host the project in order to provide comparison with the Dakar region.
Contribution of African leafy vegetables to food security and income generation in Senegal

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Key words: African leafy vegetables, production, urban, income, consumption

Abstract

African leafy vegetables (ALV) can play an extremely significant role in food security and efforts to reduce malnutrition and poverty in Senegal. However, leafy vegetables are often overlooked by the scientific community. The objective of this research was to analyse the status of African leafy vegetables in Senegal prior to proposing action for future research and development of these species. Participatory surveys were carried out in order to inventory the various ways leafy vegetables are used, along with their constraints. Production and marketing are both exclusively ensured by women. Leafy vegetables are produced mostly in urban and peri-urban areas on small plots of less than 600 m². Traditional cultivation methods are often used to grow African leafy vegetables. The seeds used by farmers are a mixture of cultivars. African leafy vegetables are used as food and for medicinal purposes. They are consumed like spinach or as condiments accompanying the main course. Average daily intake is estimated at 2.3 g/person, which is comparable to the rate of consumption in sub-Saharan Africa (24 g/person). The average price of these vegetables is US$ 0.30, which is generally higher than other vegetables (US$ 0.19). Their contribution to the income of households can be as high as 100%. The development of ALV production is limited, however, by constraints, the most important ones being the reduction in gene-pool of certain species, poor cultivation practices, and lack of organization among stakeholders for marketing ALV. Involvement of policy-makers at the institutional and governmental levels is needed to reduce these constraints, improve production and consumption levels, and encourage access to export markets.

Agricultural diversification with indigenous vegetables for cash cropping and nutrition: Lessons from peri-urban communities of the Rift Valley and Central Provinces in Kenya

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Key words: Crops diversification, knowledge uptake, peri-urban agriculture, production, consumption, commercialization

Abstract

Diversification of agriculture has frequently been proposed as a way to improve the livelihoods of smallholder farmers. However, information on how local communities respond to modifications of their production systems has rarely been adequately explored. This paper summarizes the response to the promotion of traditional vegetable crops with respect to the cultivation, diet and economic systems of peri-urban communities in central Kenya and the Rift Valley.
valley. Group discussions and structured questionnaires were used to evaluate a post-intervention situation in which spider plant (*Cleome gynandra*), African nightshade (*Solanum scabrum*) and amaranth (*Amaranthus cruentus*) were encouraged for increased production, consumption and income. At the time of the survey, over 90% of the respondents cultivated at least one of the three vegetable species, compared to 10% before the intervention. Knowledge about the importance of indigenous vegetables and production techniques has increased. In addition, the proportion of non-participant farmers increased from 2006–2009 for all three vegetable species. The size of vegetable plots were usually small (0.041 ± 0.03 ha for nightshade, 0.045 ± 0.03 for spider plant and 0.034 ± 0.05 ha for amaranth). Area allocations for vegetable production varied according to both region and sex. However, there were no differences between participants and non-participants for area allocation for any of the species. Amaranth was the most frequently consumed vegetable, with 87% respondents reportedly consuming it, while spider plant was the least consumed, with only 29% of respondents. Over 66% of the respondents were engaged in selling the vegetables. A majority of them (55%) sold at local markets, while 38% sold to people from their own neighbourhoods. Poor access to markets prevented the farmers from benefitting from growing demand in urban areas. The positive response from farmers with respect to diversification and challenges offered by commercialization presents a strong background against which further improvement of peri-urban agricultural systems can be built.

**Harnessing the socio-cultural, nutritional and economic values of African eggplant by urban households in south-eastern Nigeria**

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Key words: socio-cultural, nutritional, African garden egg, urban households

**Abstract**

The African eggplant, commonly known as garden egg, is considered a minor crop, but it holds a strategic and prominent place in the socio-economic affairs of most households in south-eastern Nigeria. Many urban households that were studied in this paper place a high value on this crop both for its rich cultural and traditional associations as well as its nutritional merits. This paper reveals that in the study area, African eggplant (locally named *Anara*) possesses certain nutritional, medicinal and economic values often utilized by urban households to improve their wellbeing. It also has special traditional recognition with which the people of Igbo extraction (a major ethnic group in the study area) express their cultural identity during social functions even in urban environments. The paper therefore posits that: a) the medicinal and nutritional potentials of African eggplant should be developed to provide cures for certain illness and nutritional deficiencies among urban dwellers; b) the socio-cultural values of the crop should be further promoted and accorded a national relevance to sustain the expression of cultural attachment of a people to the crop even in the cities; and c) consideration be given to strategies suggested in this paper for harnessing the income generation and employment potentials of the crop in the urban areas of south-eastern Nigeria.
Vegetable production and seed trade in West and Central Africa: Unleashing the potential of the African vegetable seed industry

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Abstract

The majority of the world's population lives in urban areas. Each day, almost 180 000 people move into cities; in developing countries, most will settle in urban slums and derive their livelihoods from horticulture, dominated by vegetable production and trade.

Vegetable production mostly targets urban markets. However, vegetables are highly perishable, with up to 50% of the harvest lost from the field to the fork and 10-30% substantial pre-harvest loss to pests and diseases. Control with inappropriate pesticides and irrigation with biologically or chemically polluted water constitute major human health concerns in urban areas.

Vegetable produce supply chains involve mainly women, who connect farmers to urban markets amidst constraints such as lack of storage facilities, poor roads, and difficult transport conditions. Although apparently well-integrated, these supply chains are poorly understood, particularly for indigenous vegetables, which can be a major source of nutrition and income. Vegetable seed trade is also a lucrative business but access to quality seed of adapted varieties remains a major challenge.

This seminar will discuss options for enhancing and sustaining vegetable produce and seed trade in West and Central Africa. A moderated panel will follow to formulate policy and technology recommendations that can help achieve a stable, year-round supply of accessible, affordable, safe, and nutritious vegetables for consumers, increase profits for vegetable growers, and make cities greener and more liveable.

Programme

Moderator
Abdou Tenkouano
(Regional Director for Africa World Vegetable Centre)

15:00 Brief introduction of keynote presenters and panel of experts (A. Tenkouano)
15:20 Keynote 1: Streets of plenty: Vegetable production in cities for food and nutritional security, community development, and a healthier environment (J.D.H. Keatinge, Director General, AVRDC)
15:40 Keynote 2: Regional strategies for unleashing the potential of horticultural crops (H. Roy-Macauley, Director of Programmes, CORAF/WECARD)
16:00 Panel Discussion
17:00 Summary by moderator, closing statements by J.D.H. Keatinge, P. Sereme (CORAF/WECARD) and N. Lutaladio (FAO)
17:30 Close
**UPH and marketing**

*Moderator*

Olivio Argenti (FAO – Rome)

As urban expansion accelerates, the overall cost of supplying, distributing and accessing food – and, with it, the number of food insecure households – is likely to increase. The challenge is to facilitate consumer access to food and ensure that investments are made in increasing food production, processing and distribution capacities and services under hygienic, healthy and environmentally sound conditions.

**Programme**

- Presentation of selected papers and experiences by workshop participants;
- Group discussions facilitated by Olivio Argenti, Marketing Economist, FAO;
- Conclusions and recommendations.

**UPH in emergency situations and rehabilitation**

*Moderator*

José Luis Fernández (FAO – Rome)

**Sharing good practices with men and women farmers**

*Moderator*

Sophie Treinen (FAO – Rome)

**Food for the cities: Local food systems and horticulture**

*Moderator*

Julien Custot (FAO – Rome)

Cities and their surrounding areas have to guarantee food and nutrition daily for all their citizens, relying on agriculture production and food supply, appropriate education, health and social policies. In addition, cities need to be resilient, with good management of natural resources, in order to offer healthy environment and enable sustainable development and growth. Holistic approaches need be developed at local level, bringing together all stakeholders – from public and private sectors, and civil society. In this way, all can contribute to a local food system centred on the urban areas. Horticulture, which provides fresh fruit and vegetables, is an important component of any local food system.

Primarily, a local food system needs infrastructures, markets, storage place and processing facilities. It is a physical connection within a territory, particularly between the rural and urban areas. It needs to be adapted to the specificities of each territory. All components supporting horticulture production and processing need to be integrated, from the seeds to the table.
A local food system connects producers and consumers, either directly or through long and complex food supply chain. Consumers are the drivers of the system. But they are often not educated regarding their choices, especially in terms of nutrition and dietary diversity. An important role is also played by indigenous horticultural produce, adapted to local culture and traditions, which constitutes the biodiversity of the local food system, and contributes to the preservation natural resources. The diverse needs, preferences and expectations of consumers regarding horticultural produce need to be expressed, to be relayed by retailers, and listened to by producers.

The local food system has a permanent dynamic, with many interconnected flows related to agricultural inputs, products and goods, money and people, from rural to urban areas and vice versa. There are complex patterns of flows connecting food and agriculture to many other economic domains, supporting to and at the basis of local and territorial development. The flows linked to horticulture produce are particularly sensitive, since it is perishable and has high nutritional and monetary value.

Policies are needed to articulate individual choices (by consumers and citizens) and collective choices within the local food system. Local authorities have a key role to play and all stakeholders need to take part in the process. Short term and long term choices need to be proposed and discussed to make the cities more resilient. The local food system needs to be placed on the political agenda – and horticulture is a starting point.

**Tentative programme**

18:00  Introduction to seminar objectives and participants (Julien Custot, FAO – Food for the Cities facilitator)

**Introduction**

18:10  A local food system approach for horticulture (Rémi Kahane, GlobalHort)

**A territorial approach**

18:20  Typology of market gardens in southern Benin

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**Keywords:** Truck farming, typology, southern Benin

**Abstract**

Market gardening plays a significant role in the social and economic life of the population in urban environments in Benin. Today, the vegetable production sector is in full expansion. However, supply of market-gardened produce in the principal cities remains largely below demand. This study is one step in the direction of shedding light on the situation of supply of vegetables from market gardens in Benin. Specifically, it aimed at identifying and characterizing the various types of market gardens in southern Benin. The study was carried out in two agro-ecological zones, namely the Sudano-guinean zone and the littoral/sandy zone. A sample of 136 market gardens was surveyed in both zones. The method of hierarchical classification based on the algorithm of Ward was used to analyse the collected data. Some of the criteria used for the study were cultivated area, ecological site, labour, type of equipment, access to credit, types of vegetables produced, types of fences or frames around the gardens, pest elimination methods, etc. The results of the study reveal that the vegetables production in southern Benin come from three types of market gardens presenting these specific characteristics:

- Type 1: traditional gardens in valleys (Valley of Ouémé, Grand Popo);
- Type 2: modern gardens in intra-urban zones (Cotonou, Porto Novo);
Connecting consumers and producers

18:35

Fruit supply sources for large urban markets in Cameroon: The case of Douala, Yaoundé and Bafoussam

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Keywords: Supply sources, fruits, markets, urban centers

Abstract

The supply of fruit to cities can be improved through interventions that focus on the production zones. This study targeted 25 markets located in the western, central and coastal regions of Cameroon and determined the origins of the main fruits sold on the markets of Douala, Yaoundé and Bafoussam. The data show that there are three categories of profitability among the fruits studied. Orange and papaya provide the highest income to retailers; pineapple, African plum and avocado provide intermediate income; and tangerine and mango offer the lowest income. The arrangements made by retailers for supply vary according to fruit type. The supply of citrus, the least perishable fruits, comes from wholesalers and temporary markets. The supply of highly perishable fruits, including mango, African plum and avocado, comes directly from producers. Some fruits are linked to specific origins. Citrus come mostly from Moungo, Mbam and Inoubou, Nyong Ekelle, Nkam and Meme. Avocados are produced in Bamboutos, Noun, Mifi, Menoua and Ndé. Mango and African plum come mostly from the Lékié, Fako and Mbam regions. Fruit retailers have definite preferences for specific origins including Moungo, Mbam and Inoubou, Nyong-Ekellé for citrus; Wouri, Lékié, Noun and Ndé for mango; Bamboutos, Noun, Menoua and Mifi for avocado, and Lékié, High Nkam, Fako, and Moungo for African plum. These production zones are located mainly in rural and peri-urban areas. Some of these zones present comparative advantages for specific fruit varieties in terms of quality sought by retailers and consumers.

Flows within the local food system

18:50 Food supply of horticulture products in cities (Olivio Argenti, FAO)

Policies supporting local food systems

19:05 Study and examples from some African cities (Marielle Dubbeling, RUAF)
19:20 Discussion
19:55 Conclusion and follow-up

Tuesday, 7 December, 15:30-17:30 / Salle Djoudj

IAGU: 10 years of intervention in urban agriculture in francophone West Africa

Moderator
Oumar Cisse (Director, IAGU)

The African Institute for Urban Management (IAGU) is an NGO engaged for more than 10 years in promoting urban and peri-urban Agriculture (UPA) in West Africa through the creation of networks and implementation of projects. The seminar will review main achievements, progress and challenges to be considered by IAGU. The overall objective of the seminar is to
Seminars

promote a constructive exchange on the integration of UPA in municipal and national policy design. Experiences on innovative approaches used in implementing urban agriculture initiatives will be shared. The key factors for a sustainable UPA and the new strategic orientations will be identified.

Programme

- Review of IAGU initiatives on UPA (Moussa Sy, IAGU)
- Advantages, constraints and challenges in coordinating a UPA network: The case of Benin (Françoise Assogba Komlan, INRAB)
- Lessons learned and challenges of policy design process for UPA: The case of Pikine, Senegal (El Hadji Ale Seck, City Council of Pikine)
- Which approaches for development of value chains? The case of cabbages and tomatoes in Bobo-Dioulasso, Burkina Faso, and Porto-Novo, Benin (Florent Noudahikpon)
- Sustainable development of UPA in Niayes: the experience of Malika, Dakar (Marie Sophie Ndione, IAGU)
- Main characteristics of UPA activities in the Commune of East Rufisque, Dakar (Ibrahima Diedhiou)

Tuesday, 7 December, 15:30-17:30 / Amphitheatre

Capacity building in horticulture

Moderator
Cheikh Ndiaye
(Director, Centre de Formation Professionnelle Horticole, Senegal)

It has been demonstrated that specialized training in horticulture plays a major role in the growth and sustainability of producers’ performance. The Centre de Formation Professionnelle Horticole (CFPH) will share its experiences in agricultural education in general, and especially horticultural training. Presentations will review developments in agricultural training in Senegal over the last 50 years, address the specific case of horticultural training in Senegal, and report on the situation in Africa, particularly South Africa and some North African countries.

Programme

Vocational agriculture in Senegal, 50 years on: Challenges and prospects

Abdourahmane Faye
Chief, Office of Professional Agricultural Training, Ministry of Agriculture

Rural training occupied a prominent place in the socialist, self-management ideology dominant in post-independence years. However, agricultural training has faced several difficulties: unexpected shocks in the 1970s and the crisis of structural adjustment. This was followed by the “decline” of public institutions, the birth of farmers’ training initiatives, and the new role of farmer training. The conclusion of this presentation will examine prospects for Senegal over the next 50 years, focusing on the development of cities, the countryside, people, the food they need, jobs etc. This reflection will lead directly to the second presentation, which outlines some solutions in which the contribution of Vocational Horticultural Training is crucial.
Horticultural training in Senegal and Africa: Stock-taking and prospects

Demba Mbaye Farba
Director of Research, Institut Sénégalais de Recherches Agricoles

Rapid urbanization, the lengthening of marketing chains and more elaborate food processing, rising demand for high-quality produce, and concern over environmental problems, all point to the inevitability of horticultural development and the relevance of a vocational training system associated with it. The author reviews the three major periods that have marked the life of the CFPH from 1960 to today. The CFPH is the only training facility specializing in the field of horticulture in the whole West African sub-region. It is from this observation that it has been recommended that ways be explored to help establish the CFPH as a truly sub-regional centre. Naturally, this recommendation needs the support of the State of Senegal, FAO, sub-regional organizations and all actors in the field of horticulture.

Tuesday, 7 December, 15:30-17:30 / Salle Koungheul

Water management in urban and peri-urban horticulture

Moderator
Laurent Stravato (FAO – Rome)

The seminar aims at deepening understanding of measures needed to improve water management for urban and peri-urban horticulture (UPH). It will examine how local authorities and water managers can assist urban horticulturalists in accessing safe water for production, and how vegetable producers can cope with the decreasing quantity and quality of water resources while improving their crop productivity. Presentations will describe the fierce competition among urban water users and the need for integrated water and sanitation planning strategies to ensure that adequate quantities of safe water are available for horticultural production. The seminar will also focus on water supply management for horticulture, present sustainable and safe alternative water sources, and describe measures for adapting horticultural production in order to minimize health risks. It will present activities and strategies applied by urban horticulturists to reduce health risks along the food chain and to optimize their water utilization. Case studies from Gabon and Burkina Faso will be presented.

Programme

15:30 Opening and key remarks (Laurent Stravato, FAO)
15:40 Part I: The challenges of urban water management for UPH
  Chair: Ibrahima Mbodji, Global Water Partnership
15:45 Water management and planning for urban horticulture in Senegal
  (Amadou Seydou Dia, Senegalese Water Agency)
16:00 Water accessibility and irrigation of vegetables in Nhlangano, Swaziland
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Key words: water, accessibility, conveyance, irrigation, Nhlangano
Abstract

An investigation was undertaken to determine access to water, the technologies used to collect and convey water for irrigation, and the irrigation methods employed for vegetable production in Nhlangano, the third largest city in Swaziland after Manzini and Mbabane. The study involved a field survey of the production sites and the technologies for water collection and irrigation practices. A questionnaire was used to ascertain the required information from 33 households within the city. The findings showed that 82% of households use the tap water supplied by the Swaziland Water Services Corporation (SWSC), which is being provided rather for domestic use; 15% obtained water from nearby streams; and only 3% were using rainwater for irrigation. One household among those using tap water was also using waste water. Buckets are being used by 61% of the households to collect and convey water from source to garden, while 36% used hose pipes. These conveyance methods were also used for the actual irrigation in the gardens. The only household which used a canal to convey water from the stream used furrow irrigation. Irrigation scheduling in all the households was found to be based on observed soil and crop assessments. The major factors limiting vegetable production were cited as land by 70% of households and water by 18% of households. Only one household (3%) mentioned both resources as limiting factors. The remaining 9% cited chickens and wild birds to be pests to their vegetable farming. Water used for irrigation was mainly the tap water intended for domestic use. It was recommended that rainwater harvesting technologies should be promoted within the city following the finding that only one of the 33 households involved in the study used rainwater for irrigation.

16:15 Part II. Sustainable alternatives for water supply management

Chair: Malick Gaye, ENDA Senegal


16:35 Rainwater harvesting and ecological sanitation supporting horticulture: CREPA’s experiences in West Africa (Youga Niang, Centre Régional de l'Eau Potable et de l'Assainissement à Faible Coût)

16:50 Part III. Safe and efficient use of water for UPH

Chair: Mama Touré, FAO Senegal

16:55 Evaluation of irrigation practices with lettuce (Lactuca sativa L.) in the dry season in the northern zone of Libreville

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Key words: irrigation, lettuce, dry season, urban markets

Abstract

The market-gardening production systems in the urban and peri-urban areas of Libreville give preference to lettuce (Lactuca sativa L.) production because of its adaptability and high added value (average price from 1.80-2.80 € per kg). However, the production of this crop during the dry season in Gabon (from June to August) is highly affected by lack of water in the northern zone of Libreville (92% of farmers), which provides from 35-40% of supply of fresh vegetables to urban markets. The unreliability of the water supply for crops, which is connected to the quality of extraction materials (e.g. manual watering-cans), has the following results: decrease in activity during this period and concomitant reduction in farmers’ incomes. The significance of this analysis is in the establishment of an inventory of the various practices and irrigation strategies, but also in the identification of the constraints related to these practices particularly with respect to water, which affects vegetable production year-round.
Seminars

17:10 Experiences with drip irrigation in urban horticulture (David Ivanovic, Hub Rural)
17:20 Discussion
17:30 Close

Panel members

- Ibrahima Mbodji, Global Water Partnership
- Malick Gaye, ENDA Senegal
- Mama Touré, FAO Senegal

Tuesday, 7 December, 15:30-17:30 / Salle des Lions

Urban and peri-urban horticulture and human nutrition

Moderator
Charlotte Dufour (FAO – Rome)

The objectives of the seminar are to share lessons learnt regarding UPH projects and their role in improving nutrition, and to propose recommendations for the design, implementation and impact evaluation of horticulture and nutrition projects in urban areas. A major challenge in the 21st century is meeting the nutritional requirements of growing urban populations. Poor diet diversity and low micronutrient intakes are common among the urban poor. Urban populations are also increasingly affected by chronic diseases such as cardio-vascular diseases and diabetes. Poor dietary intake is usually the result of insufficient physical and economic access to diverse and nutritious foods, as well as poor dietary practices associated with changing lifestyles. UPH can play a key role in improving human nutrition and achieving the human right to food, by making fresh fruits and vegetables more widely available to urban populations. It can also be a source of income and livelihoods that enable families to purchase what they need to lead a healthy and active life. Presentations and discussions will focus on:

- The nutrition situation in urban areas and the role of urban food security and nutrition assessments in UPH project cycle management
- Lessons learnt from UPH projects designed to improve nutrition

Programme

15:30 Introduction
15:35 The importance of UPH in improving nutrition: Experience from Senegal (Khadidiatou Dieng, Coordinator, Cellule de Lutte Contre la Malnutrition, Senegal)

Part I: Nutrition situation in urban areas and the role of urban food security and nutrition assessments in UPH project cycle management
15:50 Urban food security and nutrition situation and impact assessments: Tools and lessons learnt from case studies in India and Tanzania (Charlotte Dufour, FAO/AGN)

16:10

The prevalence of urban food production and food insecurity in southern African cities

Crush, J.1

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Key words: urban food supply, food insecurity, nutrition, poverty, urban livelihoods
Abstract
In 2008-2009, the African Food Security Urban Network (AFSUN) undertook a household food security survey in 11 cities in 8 Southern African Development Community (SADC) countries. This rich database provides unprecedented insights into the current state of urban food insecurity across the southern African region. It also provides invaluable information about the state and prevalence of urban agriculture in the region. This paper presents and discusses the findings of the survey on urban and peri-urban horticulture (UPH) and its contribution to urban food supply, nutrition, income generation and livelihoods. The survey shows that the extent and contribution of UPH varies considerably from city to city, but that in all cities there is considerable potential for growth and a need to rethink how UPH can best contribute to lowering current epidemic levels of food insecurity.

Part II: Lessons learnt from UPH projects and their impact on nutrition
16:30
Garden in a sack in Nairobi
Pascal, P. 1
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Abstract
Following shortages after the post-election violence in Kenya in early 2008 and faced with soaring food prices, Solidarités International, a French NGO, implemented a “sack garden” project in Nairobi’s slums where more than 60% of the population lives. Solidarités International main strategy was based upon two major objectives: 1) to increase access to food using the “garden in a sack” concept; and 2) to increase the income available for household use through the sale of vegetables from the garden in a sack. The project implemented by Solidarités International involved planting vegetable seedlings on the surfaces of earth-filled sacks which are placed on doorsteps. Each sack has a volume of 0.1 to 0.5 m³. Vegetables are planted at the top of the sack and on the sides by means of small holes. The sacks are prepared by members of the households, who have to find or buy a plastic bag (these are very common in the markets) and fill it with soil. Once the bags are ready, Solidarités community mobilizers give them the seedlings. On average, one single sack can be planted with 30–40 seedlings of kale or spinach and 20 tomato plants. The most appropriate crops for the bags are leafy vegetables since they keep on growing even after the leaves have been harvested. The crops planted (spinach, sukuma wiki [kales], tomatoes and onions) are familiar to the communities. Families who are producing vegetables using these sack gardens are able to prepare a full meal from their own produce 2–3 times a week. Households who have taken up the program and who have access to three or more sacks now have access to additional income generated from the sale of the vegetables.

16:50
Integrating indigenous vegetables into urban and peri-urban agriculture in West Africa: Relevance, status and research agenda
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Key words: indigenous vegetables, promotion, urban and peri-urban agriculture, research agenda

Abstract

African indigenous vegetables (AIVs), both cultivated and wild species, play an important role in the food systems of West Africa. There is significant untapped potential in AIVs in terms of developing diversified, more sustainable and adaptable farming systems, for nutritional and health security and income generation. Re-promoting AIVs, particularly in urban and peri-urban agriculture (UPA) systems could therefore have considerable benefits. Recent studies, however, have raised the concern that the use and associated knowledge of a wide range of AIVs is declining, particularly in urban settings. Moreover, there are huge knowledge gaps such as how and to what extent AIVs are currently being produced in UPA; the agronomic requirements of several widely-produced as well as candidate species; their contribution to farmer livelihoods; their integration into the market system; and consumer attitudes. Combining data from published sources and grey literature, and taking into account current research and development priorities of the national agricultural research systems, this paper will propose a research agenda for the next ten years to lay the groundwork for an improved use of AIVs in UPA in the West Africa region. We suggest that a resource and perception map for indigenous vegetables be developed for West Africa. This will highlight promising species for various agro-ecological conditions and consumer preferences in urban and peri-urban settings.

17:10 Discussion and recommendations
17:30 Close

Tuesday, 7 December, 15:30-17:30 / Salle Somone

Gender, communication and horticulture

Moderator
Yannick De Mol (FAO)

FAO Dimitra is a participatory information and communication project which builds the capacities of rural populations, particularly women, through information dissemination and the exchange of experiences. It aims at helping rural women and their organizations to make their voices heard at national and international levels.

How gender mainstreaming in horticulture has improved rural women’s livelihoods through the creation of a new value chain

Mutshaila, G.

A new marketing strategy has been created in Lubumbashi, Democratic Republic of the Congo: the commercialization of fresh vegetables by women. The city of Lubumbashi counts about 3 million inhabitants who consume about 43% of the vegetables produced in the horticulture sector organized by the FAO/SENAHUP project. The commercialization system is vital in the market gardening sector and various mechanisms are being put in place to lighten the burden of women in the transport of fresh vegetables towards market places. The mamans carotte (“mama carrots”) are women of all ages who purchase fruits and vegetables directly from the fields. They work all seasons, from Monday to Saturday, all year round. As they deal with perishable products, their prices are nearly standardized: high in the morning, stable at midday and low in the evening. The results of this initiative are very interesting in terms of communication and information on the prices of the vegetables. The benefits are distributed throughout the horticulture sector, from the inputs sellers to the producers, without forgetting the transporters.
and the saleswomen of the markets. The mamans carrotte have increased their income nearly as quickly as the women producers.

**Tuesday, 7 December, 18:00-20:00 / Salle Djoudj**

**Turning wastes into resources for UPH**

**Moderator**
Hervé Saint Macary
(CIRAD)

**Long term application of organic wastes in agriculture: environmental and sanitary aspects**

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Key words: Urban agriculture, environmental risk, trace elements, pathogens

**Abstract**

A synthesis of results obtained on the behavior of trace elements, organic compounds and pathogens in a long term field experiment in France will be presented.

**Investigation of trace elements content in organic wastes used for market gardening**

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**Abstract**

While agricultural recycling is recognized as an alternative to stockpiling or incineration, the benefits of the use of organic wastes as fertilizers and soil amendments should be assessed together with potential environmental and toxicological impacts due to the presence of trace elements (TE). While these considerations are common in Northern countries, issues and problems involved in waste management are increasing in developing countries. Within the framework of the ANR project ISARD, designed to set up methods to ensure suitable agricultural intensification based on the recycling of organic wastes, this study investigated the contents of major chemical elements and TE in various composts, from sewage sludge, household refuses, animals manure and garden rubbish, applied on market-garden crops on the outskirts of cities in various countries (Saint Denis, La Réunion, France; Majunga, Madagascar; and Dakar, Senegal). Organic waste contents are various and depend on the geographic origin and type of wastes (e.g. Pb = 0.82–2100 mg kg⁻¹ dry matter). Half of the organic wastes that were examined exhibit very high TE concentrations, and are above the limits set by European legislation and found in the literature data for organic wastes designed for market gardening. Size fractionation of organic wastes exhibited a fairly large enrichment in TE in the smaller solid fraction (0.2-20 μm) in comparison with raw wastes. This result suggests that TE were potentially associated with organic matter in the 0.2-20 μm fraction, which is the most reactive to degradation of micro-organisms. The use of such organic wastes for market gardening could consequently be
potentially harmful with respect to TE phytoavailability and phytotoxicity. However, total concentrations of TE in organic wastes and of TE dynamic in amended soils will be crucial to predict TE phytoavailability.

Déchet urbain-agriculture-environnement (DUAÉ):
Using waste as resource for agriculture

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Key words: Urban Waste, Urban Agriculture, manure

Abstract
Increasing agricultural production sustainably implies the use of organic fertilizer. Urban wastes in developing countries are rich in recyclable organic matter and they increase as urbanization increases. A recent project carried out in Dakar analyzed the potential contribution of urban organic waste (OW) to urban horticultural production. A research project was conducted in order to 1) carry out farm surveys to understand local fertilization practices; 2) identify and characterize locally available organic wastes chemically; and 3) carry out experiments with these wastes in greenhouses and farms to evaluate their agronomic potentialities and their implementation in local farmers’ practices. Horse and poultry manure are the main OW used by farmers around Dakar; however, these may become less available and/or more expensive in the future. The OW obtained after sifting through other sources of urban wastes (i.e. compost) could provide an alternative and unlimited source of organic matter. However, chemical analyses of this compost show that organic matter and nitrogen levels are weak compared to manure. Experiments were therefore conducted in greenhouses with the two representative soils of the region, a sandy-clay soil (Deck) and a sandy soil (Dior): these showed no significant effect of compost on the early growth of tomatoes compared to treatment without compost, but rather a light-positive effect at the end of the tomato-growth cycle, consistent with the analytical properties of the product. The fertilizing value of this compost is low and will require the addition of other fertilizing inputs. On-farm tests have been carried out on tomato in the same soils, where the agronomic values of treatments combining compost, manure and other local organic inputs are compared. The initial results are now under study (available December 2010).

Market garden production systems in the periurban area of Mahajanga:
Determinants of agricultural practices of organic fertilizer for technical innovation

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Key words: Madagascar, farming systems, leafy vegetables, organic inputs

Abstract
The development of urban agriculture as market gardening is essential because it can provide food and incomes for growing populations. But urban market gardening systems are hampered by various constraints, among which is difficult access to mineral and organic fertilizer inputs.
Urban areas offer a diversity of organic resources that could be used in cropping systems: but before proposing and testing fertilizers in urban agriculture, it is necessary to have an accurate description of the farming systems and soil fertility management practices of farmers, as well as the agronomic characteristics of locally available organic resources. In Mahajanga, Madagascar, a study was carried out to characterize market gardening systems with a focus on fertilization practices and their alternatives with the town resources. Cultivation and fertilization management were recorded weekly on a sample of farms \( n=12 \) during two years, and the results were then tested through a survey on a larger sample of farmers \( n=30 \). The market gardens were usually located around a waterhole (close to lakes or in lowlands). After the rainy season, plots of leafy vegetables, 12-14 m² in size, were planted progressively following the rice crop and as flood waters dried up. Each farmer had only a small plot of land and had to crop intensively. Most of farmers cultivated plants with short growing cycles (e.g. 21 days), predominately Brassicaceae. Concerning soil fertility management practices, organic inputs (manure) and mineral nitrogen (urea) were mainly used. The organic or mineral fertilizer was always spread on the soil surface after crops had been transplanted, and were renewed at each planting cycle or each cut of long-cycle leafy vegetables. It is expected that fertilizers ensure three functions: fertilizer, amendment and mulch. All these functions have to be taken into account to propose new organic fertilizers as municipal wastes compost to respond to the scarcity and high cost of manure and urea.

**Tuesday, 7 December, 18:00-20:00 / Amphitheatre**

**Status of urban and peri-urban horticulture in Africa**

**Moderators**
NeBambi Lutaladio (FAO – Rome)
Wilfried Baudoin (FAO – Rome)

**Summary**

During the past two decades, many African cities have grown at an especially rapid rate. Kinshasa, capital of one of the world’s poorest countries, is now the world’s fastest growing future megacity. The United Nations estimates that the number of urban dwellers in sub-Saharan Africa will rise from 320 million to 540 million by 2025, and will exceed one billion people by 2050. Urbanization in sub-Saharan Africa is accompanied by high levels of poverty, unemployment, hunger and malnutrition. Therefore, to meet their food needs and to supplement their incomes, many urban dwellers are involved in urban and peri-urban horticulture (UPH) production. Though UPH competes for scarce urban resources of land, water, energy, and labour that are in demand for other urban activities, African countries and local governments need to recognize the opportunities offered by UPH, and its important role in improving urban food and nutrition security and livelihoods. UPH is a major component of the Food for the Cities, a multidisciplinary initiative launched in 2001 by the Food and Agriculture Organization of the United Nations (FAO) with the goal of assisting member countries meet the challenges of massive and rapid urbanization. In the framework of this multidisciplinary programme, FAO is providing guidance and assistance to member countries, through the incorporation of UPH into existing programmes for agricultural development and national food security, as well as ensuring technical support for on-going field projects. Building on these achievements, and to capitalize current experiences and knowledge, FAO recently solicited the inputs of partners from various African countries to:

- assess institutional support to UPH
- review on-going UPH projects
- provide information on the characteristics of UPH production systems (institutional frameworks, major stakeholders, cultural practices, value chains, land issues)
• evaluate the contribution of UPH to urban food and nutrition security, employment and improved livelihoods

Inputs received from some 50 countries are being used to prepare the first FAO "Status report on urban and peri-urban horticulture in Africa" (SOUPHA) which will serve as a measuring and monitoring tool for the sustainable development of UPH. UPH is emerging as a key component in FAO strategies to meet the challenges of massive and rapid urbanization in the 21st century.

Programme

• Presentation on "Growing greener cities" (FAO AGPML)
• Status report of UPH in Côte d’Ivoire (Akoua Malik, Ministry of Agriculture; Hortense Djidji and Lassina Fondio, CNRA)
• Urban and peri-urban horticulture in Namibia (P. Shilunda, Ministry of Agriculture, Water and Rural Development; Albert Fosso, UPUH Consultancy)
• Urban horticulture in DR Congo (Grégoire Mutshail, Ministry of Rural Development)
• Status report of UPH in Tanzania (Judith M. Kitivo, Ministry of Agriculture Food Security and Cooperatives)
• La situation de l’horticulture urbaine et péri-urbaine en Tunisie (Hichem Rejeb, Ministère de l’Agriculture et des Ressources Hydrauliques et de la Pêche et, Ministère de l’Enseignement Supérieur)
• Results of country reports on the “Status of urban and peri-urban horticulture” and the way forward for the publication of a SOUPHA report in 2011 (Rémi Nono-Womdim and Wilfried Baudoin, FAO/AGPML)
• Debate

Integrated initiatives in support of urban and peri-urban horticulture in Namibia: Project achievements

Fosso, A.1

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Key words: Objectives, pilot sites, beneficiaries groups, activities, achievement

Abstract

The Integrated Initiative in Support of Urban and Peri-urban Horticulture (UPH) in Namibia was a project of the Ministry of Agriculture Water and Forestry (MAWF), sponsored by the Kingdom of Belgium, and with technical expertise from FAO. The project was implemented from August 2005 to December 2007. The objective of this project was to promote small-scale, intensive agriculture in urban areas, adapted not only to local environment conditions, but also to the needs of local producers and consumers for improved food security, nutrition and income generation. Hydroponics production techniques were extensively used to save water and to make production possible for people without land. The project set up two pilot sites, one in Windhoek (central Namibia) and another in Rundu (northeast Namibia). Activities such as micro-gardens, vermi-compost production, drum-and-drip irrigation, mushroom and fruit tree production, integrated fish farming, and good agricultural practices were undertaken. By December 2007, the project had trained many people including technicians from MAWF. The project also monitored research projects by graduates from the Polytechnic University of Namibia and captured the data into the Hortivar database. People living with HIV/Aids also benefited by improving their nutrition. Others were able to supplement their incomes by selling surplus produce at the market. The project established partnerships with local NGOs, UN sister agencies, government institutions, and community based organisations (CBOs). The project won a gold medal as the Best Exhibition Indoor at the Windhoek Agricultural Society Show in
October 2007. At the end of the project, the UPH concept had been adopted by the government and funds were provided to continue the project.

**Technical overview on urban and peri-urban horticulture (UPH) in the Democratic Republic of the Congo**

Mutshail, G.¹

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**Abstract**

For over 10 years, the Democratic Republic of the Congo’s horticulture programme has operated through the National Support Service for Urban and Peri-urban Horticulture (SENAHUP), receiving financial support from the Kingdom of Belgium for the three phases of the project, which started in 2000 and will conclude in 2011. It has also received technical support from FAO for the implementation of the GCP/028/DRC/BEL project with the assistance of the Ministry of Rural Development. This programme focuses on a five-strategy approach for urban and peri-urban horticulture (UPH) development, which supports the country’s horticultural technologies by securing 1) access to resources (land and water); 2) high-quality horticultural produce; 3) political and institutional participation by all stakeholders in the UPH sector; 4) increased consumption of fruits and vegetables and securing market outlets; and 5) access to and dissemination of information. The program in DRC has provided the following outcomes and results:

- existence of a diagnosis-assessment (inventory) of the horticulture sector in 10 cities of the DRC;
- existence of a formal commitment from public authorities;
- existence of an implementation plan of concrete actions in more than 5 cities;
- existence of information systems (reliable data in the procurement field, indicators measuring the effect of urban production on prices and diet) in 5 cities;
- existence of directories and mapping schemes covering more than 5 000 ha;
- existence of directories of more than 500 UPH growers’ associations;
- existence of directories of NGOs and partners;
- existence of directories of service providers;
- direct project intervention on 2 614 ha with 22 566 direct beneficiaries ensuring 451 320 jobs;
- 142 161 indirect UPH beneficiaries;
- a contribution of ± 240 000 tonnes of fresh quality vegetables per year with an average income of $226/ares/crop/month;
- 16 130 beneficiaries of horticultural micro-credit; and
- a climatic capacity which allows the production of crops throughout the year.
UPH and decentralized cooperation

Programme

- Introduction to FAO’s decentralized cooperation programme and projects in support of UPH initiatives (FAO/TCSR and FAO/AGPM)
- The micro-garden project Milan-Dakar (Municipality of Dakar and Mme Penda Diouf)
- Use of GIS applications for the UPH mapping (Tommaso Sposito, University of Milan)
- Social and economic benefits of micro-gardens in Senegal (Franco Sangiorgi, University of Milan and NGOs ACRA/COOPI)
- Opportunities for micro-garden initiatives in other cities of Senegal (Direction de l'Horticulture du Senegal)
- Debate

Introduction to FAO’s decentralized cooperation programme and projects in support of UPH initiatives

FAO/TCSR and FAO/AGPM

Keywords: micro-gardens, local authorities, decentralized cooperation

Local authorities (LAs) are increasingly involved in development cooperation. Among UN specialized agencies, FAO was the first to launch a Decentralized Cooperation (DC) Programme, as follow-up to the World Food Summit: 5 years later in 2002. The programme began with an agreement between FAO and Italy’s Ministry of Foreign Affairs to mobilize the social, human and financial resources of Italian LAs (regions, provinces and cities) in favour of food security projects. The DC programme is now also working with LAs in Spain, France and Belgium and currently involves 40 projects with a total budget of US$25 million. Projects are fully funded or co-funded by LAs. Projects focus on concrete action and are based on long-term multi-level partnerships. FAO’s DC projects are usually linked horizontally and vertically to larger FAO projects funded by other sources to maximize impact. Active participation of all actors is essential. Priorities are given to urban and peri-urban horticulture, water management, food security, support to decentralization process, institutional capacity building, and territorial development. Success stories of city-to-city cooperation include projects on micro-gardens in the cities of Dakar and Teresina, Brazil, and a UPH project in Kigali. LAs are crucial to mobilizing different stakeholders to work together, thus generating collaborative approaches for attaining common development goals. Due to their proximity and territorial presence, and knowledge of local needs and expertise in traditional sectors linked to poverty reduction, LAs can help maximize the effects of development assistance by bilateral and multilateral donor/partner institutions.

The micro-garden project Milan-Dakar

Municipality of Dakar and Penda Diouf

Keywords: women, nutrition, income generating activity

The concept of “women and nutrition” has to be understood within the context of the role rural women play in African society. In the past, women were confined in secondary, labour-intensive roles. Today, thanks to micro-garden technology, they are able to grow vegetables on a small
area. Micro-gardens help women to increase their incomes, which improves the living conditions in the household. Vitamins and minerals present in the vegetables they grow provide excellent nutrition. Micro-garden technology is well developed and, at this stage, in Dakar, it needs only increased resources to have greater impact. Vegetable production through micro-garden technology could offer a wide range of fresh produce on the family table for an extended period in the year. In addition, micro-gardens represents for some women an income-generating activity which helps the household to better meet its daily needs.

Use of GIS applications for UPH mapping

Tommaso Sposito, University of Milan

Keywords: urban horticulture, micro-gardens, GIS

Urban and peri-urban horticulture is progressively taken into account in urban planning. Geographical Information Systems (GIS) can be a suitable tool for urban planners and for decision making processes that involve stakeholders and local administrations. In the framework of the Milan-Dakar micro-garden project, a GIS was created containing information about micro-gardeners in Dakar city, the Training and Demonstration Centres (CFD) and some social-economic indicators. Among other things, the GIS aimed to fill the gap of reliable data on the extent of micro-gardens in Dakar. The creation of the GIS was conducted in 3 main phases: (1) acquisition of a satellite image of Dakar through Google Earth (raster image); (2) geo-referentiation of the raster on a GIS; (3) integration of the raster with existing geo-coded GIS layers and other data from different sources (field investigation, technical reports, literature, etc.). Once the database was completed, interpretation of features was carried out easily and quickly. Indeed, GIS proved to be very useful for the interpretation of potentialities, weaknesses and opportunities offered by different CFD geographical positions. Moreover, the GIS "buffer" tool gave useful information about CFD areas of influence, and helped in the identification of areas in Dakar municipality where the installation of new CFDs was necessary or strongly recommended. A further integration of data into GIS could provide new features. Data on water supply systems and water quality of each district can help identify water-related weaknesses. Data on ripening and harvesting of micro-garden products can help realize a functional collection system. GIS for urban horticulture allows dynamic mapping, which is suitable and easily adaptable to a constantly evolving society. The limit of this tool is represented by the need for continuous updating of data.

Social and economic benefits of micro-gardens in Senegal

Franco Sangiorgi, University of Milan and NGOs ACRA/COOPI

Keywords: micro gardens, nutritional, income generating activity

Micro-gardens produce vegetables “outside the ground”, on small spaces. Containers used can be tables or recycled recipients adapted to the cultivation. This technology is employed in large cities that do not have enough land to produce vegetables for self-consumption. Such is the case for Dakar, where land is becoming more and more scarce due to urbanization. Two types of producers have been identified: (a) those who concentrate mainly on production for home consumption and are concerned by the quality aspects of the produce (since the family is the main consumer); (b) those who are using micro-gardens to grow vegetables for sale, as an income generating activity. Among their social impacts, micro-gardens reinforce solidarity among groups of women who share the same production unit. This common facility allows them to learn production methods and the production cycles of food consumed daily. Micro-gardens are also used as decoration and to create micro-climates. When vegetables are grown using easy-to-learn techniques, the economic impact is excellent from the stand-point of quality and quantity. Research show micro-gardens produce has high nutritional value, and present no health dangers, because no pesticides are used.
Wednesday, 8 December, 18:30-20:30 / Amphitheatre

Impact of urbanization and role of UPH in the Niayes, Senegal

Moderator
Emile Victor Coly (ISRA)