



Urban Horticulture Prospective to Secure Food Provisions in Urban and Peri-Urban Environments

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ABSTRACT

According to the latest estimate of the United Nations, the World's urban population is expected to increase at burgeoning explosion from 2.76 billion in 1995 to 5.34 billion in the year 2025 at which time more than half (2.72 billion) will reside in Asian cities. Insufficient intake of fruits and vegetables is the probable reason for micronutrient deficiencies and malnutrition in developing countries. With urbanization, globalization and a growing world population, it becomes imperative and of utmost importance to secure sufficient food supply for the world's population. Many cities are expected to boom in the near future or are already entrenched with nearly insurmountable problems such as employment for often fairly uneducated migrants from rural areas, proper disposal of an abundance of refuse from households, commerce and industry by making available safe and sufficient supply of cheap but nutritious food rich in vitamins and minerals to feed ever increasing the population of these expanding urban centers. Solution to the present situation lies in increased food security among the world's poor through the introduction of fruit and vegetable home gardens, plots for small scale vegetable production which can provide households with sufficient production as well as to serve a source of livelihood. The provision to secure social security by urban horticulture lies in solution through analysis of the economic, sociological, and anthropological situation of urban and peri-urban communities and small and medium-sized farm enterprises (SMEs) in these cities perceived different factors and constraints thereby affecting and limiting the potential for fruits and vegetable production by SMEs should be critically evaluated, sensitized and prioritized. Production technologies for upliftment of the socio-economic scenario and anthropological situation in the dwelling urban communities need to be developed as per the market demand and consumer acceptance.

Key words: Nutritional, Sustainable, Potential, Community, Socio-economic.

INTRODUCTION

In India, peri-urban areas are too often neglected. They are fraught with institutional ambiguity, unplanned growth, poor

infrastructure and environmental degradation. India occupies 2.4 per cent of the total land area of the world, but supports 16.7 per cent of the world population⁸.

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Further, the land available for cultivation was decreasing from year to year in India. Land has always been a major natural resource for generating agricultural based livelihoods in rural India. However, land is now increasingly required for industry, residential and commercial purposes which promotes real estate booming around the fringes of urban areas. In this process, people lost their farmland, their source of food and fodder and all the improvements that had been built up through the generations. But, the question is whether the lands purchased by private parties were utilized for the purpose for which they were purchased or they are keeping the land as not yet constructed plots in order to make huge profit after purchasing it from the farmers with low price. Demographic change without inclusion of key components of environment will be catastrophic in future as global warming is playing havoc throughout the world. Poverty is one decisive factor threatening food security and an important cause for mal- and under nutrition as well as undernourishment. Migration from rural to urban areas and expansion of urban areas attributes to urban poverty but also to increased distance between the traditional sites for food production, *i.e.* rural areas, and consumption. Also the consequence of environmental damage, in terms of global climate change, results in decreasing space suitable for crop production, which feeds growing urban and peri-urban populations. The conflict of land use, particularly food crops vs. energy crops, is another challenge facing food security. These scenarios may vary in different parts of the world. Growing urban reliance on rural sources of food as well as agricultural production occurring in urban areas are important components of livelihoods that operate along a rural-urban continuum^{5,13}.

Fruits and vegetables are the sound basis of a healthy diet; horticultural produce is rich in fibers, minerals and bioactive compounds. With staple foods like cassava, maize and rice, diets must be balanced by consumption of vegetables and fruits in order to avoid chronic diseases among the

population due to deficiencies. Deficiencies of micronutrients like Vitamin A, iron, zinc and iodine are extremely common within urban populations¹⁴. Horticulture is ideal for conditions prevailing in urban areas as it is characterized by high turn-over, high resource efficiency, high yield and good quality as well as flexible land use and production of several crops during one season. Horticultural production provides more efficient land use by allowing substantial cropping in limited areas through efficient low-tech production systems like vertical cropping. For example, production in bag gardens (cultivation in hanging bags filled with soil and manure) has become more utilized and helps to increase food security and eco-social capital for households. Horticulture in urban vicinity is a ray of hope nutured security and eco friendly environment. Urban and peri-urban horticulture not only provides plant-based food of high nutritional and health value, but also offers secure livelihoods. However, to a large extent, urban and peri-urban horticultural production is undertaken without any official recognition. Without support and regulations from governments, there is a risk that optimizing economical returns leads to an unsustainable situation by unregulated use of pesticides and polluted wastewater. Well-managed vegetation cover from urban horticulture has a positive impact on urban environments.

Challenges and Obstacles

Food production through urban horticulture illustrates obstacles at different societal levels and is strongly interrelated. It displays a classic example of the judicious use of common pool resources in many cases, are coupled with an uncertain situation regarding land use. The lack of institutional structure and permits regulating land use results in less focus on long-term strategies to govern and maintain public or common sites used for growing food crops in urban areas; in turn, this has substantial consequences for sustainability, both for urban environments and for cropping systems. However, sustainability is not only at stake due to land use for urban horticulture, it

is also affected by the general institutional structure for sustainable development within the country, as common pool resources such as water, soil or air may be signed keeping cognizance of environmental pollution. This puts food safety and thereby public health and food security at risk. Such issues need to be addressed critically with viable solutions.

Opportunities

Food security is over hauled by different indicators based on static and dynamic determinants describing availability, physical and economic access, utilization, vulnerability, and outcomes, in terms of access and utilization. The presence of infrastructure results in production of fruit and vegetables in urban areas that increases access to fresh produce of high nutritional value; this impacts the quality of diets and, consequently, supports the struggle against undernourishment. In developing countries, urban horticulture offers another dimension to secure food as it contributes to livelihoods¹². Furthermore, closure of resource flows within urban areas may display an attractive approach to sustainable city environments. Also, horticultural cropping systems in urban areas may be linked to production of animal proteins in aquaculture through the use of aquaponics, where fish production is linked to horticultural crop production. Urban horticulture also contributes to ecosystem services other than food provisioning; it affects ecological processes and dimensions in cities, including climatic factors such as, air quality, biodiversity and water management. Depending on the choice of cropping system and site, it also affects energy provisions. However, the multi-complex nature of synergies achieved through urban horticulture does not always go hand in hand with high food quality and efficient use of resources. It requires action not only on a local, but also on a national and international level. Fruits tree with low inputs have dual purpose *i.e.* environmental enrichment as well as source of income to the population.

One of the main benefits of urban agriculture worldwide is the production of

horticultural goods. According to Orsini *et al.*¹¹, urban horticulture is the most competitive branch of urban farming. Due to the high cost of urban land, vegetables with their high water and fertilizer efficiency are more profitable than growing other crops. They further have the advantage of having a special nutritional value as well as short life span and that no further processing after harvest is needed. As vegetables have a very short cycle, they can supply growing demands very quickly. For example, after a catastrophe, some vegetable species can be harvested just 60–90 days after sowing and when cultivated with seedlings, even less⁴. Dubbeling *et al.*⁴ report an achievable yield of up to 50 kg a year on only 1 m² with fruit and vegetable cultivation. In comparison to other crops, this is a very high yield. As Hamilton *et al.*⁷ reported, the amount of land currently used for global cereal production in developing countries is approximately ten times the land occupied by cities worldwide, whereas global vegetable and fruit production each cover an area roughly equivalent to that of cities. This leads to the assumption that vegetables are suitable for urban cultivation, both for high-tech equipment as well as for the self sufficient supply of poor urban residents, and that urban horticulture has the potential of a certain degree of self-sufficiency for nutritional feeding of residents.

A. Traditional growing systems

Globally, there are various approaches of urban and peri-urban horticulture such as allotments for self-consumption, large-scale commercial farms, community gardens, and even edible landscapes. There are lots of vacant spaces which can be used for urban horticulture such as rooftops, fallow land, and smaller areas like roadsides or private balconies. The availability of fresh, healthy, nutritional and cheap food is a major reason to engage in urban and peri-urban horticulture. Locally produced food is usually fresher, early accessible and more nutritious than imported food and therefore has the potential to increase the overall food intake and improve nutrition.

This is of particular importance for household members with special nutritional needs.

1. Home gardening

One way of responding to future food demands as well as to the hidden hunger can be the ancient food production strategy of home gardening. This food production system has been more or less overlooked during the industrialization of agriculture and the green revolution, but has gained attention again from development agencies since the 1980s. Home gardens include the mixed cropping of fruits, vegetables, trees and condiments that serve as supplementary sources of food and income. The home gardens vary in size and complexity from a small creeper growing on a fence to large organized cultivation plots. The distance between residence and home garden can differ from just next to the residence to kilometers away. Small plots can provide food and improve the nutrition of rural families as well as increase options for income generating activities and to raise a household's status in a community.

Home gardening is a worldwide popular phenomenon perceived through all levels of society and is the most common form of urban agriculture³. Proximity to the home of the growers, the cultivation of various vegetables and the use of low-cost inputs are generally considered fundamental characteristics of home gardens. The production is usually more supplementary than being the main source for the consumption⁶. This type of urban horticulture is seen by many people as a hobby and an opportunity to spend time outdoors for aesthetic beautification and production of pot pourrie⁹. Enabling urban poor to produce their own food would allow them to save a great amount of money and has a positive impact to their happiness index. To achieve sufficient yields and a healthy produce, adequate and sufficient irrigation is necessary. Source for this can be rain, harvested water, tap-water, or wastewater. Using untreated wastewater can pose a great risk to human health, and unfortunately, modern treatment technology remains too expensive for poor farmers⁷. If

used untreated or inadequately treated, epidemics can be caused by eating the contaminated food¹⁰. Roof top gardening is another new vista for urban dwellers having limited land space which is mainly used for cultivation of vegetables.

2. Community gardening

Community gardening means a collective cultivation of plants by various people on a shared area. The garden organizations range from very close-knit associations along with interactive mutual activities to loosely organized ones which only share the facilities³. The close-knit associations which act on a larger scale often have small shops or cafes where self grown products are sold. Community gardens also differ in the way they are cultivated. Some gardens do not have any private vegetable patches but are completely cultivated on a collective base. The shared areas of community gardens are mostly urban open spaces. These can be roof-tops and other fallow land in a city and range from small plots to larger areas. Limited access to land, lack of tenure on property and insufficient infrastructure and services for urban growers are among the main restrictions of urban horticulture according to Lovell⁹. Community gardens can be either supported through non-governmental organizations, municipalities or financed through a private sponsor or various donors. In other gardens, individuals or groups own or rent a private patch and share the facilities with the other gardeners. In this way, unusual areas can also be exploited, and there is no risk of plants becoming contaminated through polluted soil. This is a simple form of plant cultivation in "growing media" that theoretically could be applied everywhere. This means in closed-up or cemented areas of the city such as city squares, bushes walls or terraces. Community gardens exist all over the world in both developing and industrialized countries. In developing countries, the matter of food security plays an important role and community gardens are often established because of poverty and necessity for employment generation. Through community gardens, a resident have the opportunity to use

shared or subsidized land and thus enhance their nutrition and gets nourished through aesthetic parts and gardens with crop cafeteria.

3. Continuous productive urban landscapes

Continuous Productive Urban Landscapes, or “edible cities,” are holistic approaches of making urban infrastructures more sustainable by integrating urban horticulture, green corridors, and areas for leisure outdoor activities into cities’ infrastructures as essential elements. Within continuous productive urban landscapes, cultivation practices usually range from small-scale gardening to high-yield commercial gardening¹. This would make the city environmentally more sustainable and would also improve its social and economic performance. The intention is to improve the overall dimensions of the city and connect it to the rural area to improve supply chains of agricultural produce⁹. In order to implement it in cities without a lot of vacant land, infrequently used roads could be converted into a continuous productive urban landscapes green space with enough space for a pedestrian and bicycle path to enrich the nature. The army units in their cantonment area are maintaining farms for fruit and vegetables production for soldiers.

B. Innovative cropping systems

Low soil quality and water availability, the need for yield maximization, and reducing environmental impact are still current issues in horticultural production. New cropping technologies have been developed in order to address these issues and make horticulture more sustainable. These cultivation systems are very intensive and are usually found in urban areas with limited cultivation space. The people inhabiting in canal command areas have the potential to develop horticulture with profuse water availability.

1. Soilless cultures

The term “soilless culture” is defined as the cultivation of plants in systems without soil “in situ.” In recent years, a multitude of innovative cultivation procedures using bags, mats, and containers, in addition to nutrient solutions, have been developed. These

cultivation methods include systems without a solid medium, as well as aggregate systems, in which inorganic or organic substrates and additions are used. In addition, an adaptation of cultural management to the specific cultural system of soilless culture, as well as crop demand, can further result in an improvement of the quality of horticultural products. With the steady increase of soil erosion and the loss of arable land, the importance of soilless cultures is likely to increase in the near future. Because of their light weight and their sustainability in terms of resource efficiency, soilless systems are especially suitable for urban areas. In hydroponic systems, vegetables are grown in water which contains minerals and nutrients needed by the plants. This makes an exact dosage and application of nutrients possible. This technology is suited for growing high value vegetables like tomato, capsicum, lettuce, water melon, musk melon *etc.* and fruits like strawberry. The countries like Israel and Netherlands are using this technology successfully.

C. Indoor farming systems

Due to risks of contamination, some locations in urban areas or even entire cities are rather unsuitable for large scale urban horticulture outdoors. Indoor farming systems use the combined effort of agricultural production and buildings and create an integrated whole within the protected environment of a building. They can be established as leveled indoor farms in multistorey buildings, or as storefront greenhouses using such technologies. There are many different approaches of integrating indoor farming systems in urban areas. The important visitors need to integrate essential components of architecture along with gardening.

1. Building integrated agriculture

The major aspects that lead to the idea of integrating vegetable production into existing buildings are the saving of resources and higher resource efficiency. Caplow² sees rooftops of schools, hospitals, hotels, prisons, supermarkets, and shopping malls as ideal settings for building integrated agriculture. These rooftops can be used for the installation

of greenhouses. Suitable greenhouses for the positioning on rooftops could be hydroponic systems because of their light weight compared with conventional greenhouses². To achieve a sustainable level of efficiency, it is important to integrate efficient management cycles. Efficiency can be achieved through different means such as proper management of resources, energy consumption, nutrient delivery, waste management and of course land use through sustainable cropping patterns. Nowadays, there is a broad range of highly efficient greenhouse systems which are being used worldwide. By linking these greenhouses to the energy cycles of buildings, emitted energy such as waste heat from air-conditioning systems and refrigerators can be reused and recycled. This is a special advantage in temperate climates as it could secure appropriate heating of the greenhouses during colder months². Furthermore, it is possible that the water requirements of the greenhouses can be covered by using recycled or harvested rain water. In terms of nutrition and fertilizing, the use of organic waste in the form of animal waste, plant residues, or waste from food industry or households can be considered. When placing greenhouses on rooftops, it is important that the weight-carrying capacity of the building has been examined. Therefore, it is necessary that greenhouse materials such as roof covering materials are light weight. Another factor for static reasons is the wind which is especially important with taller buildings. The material used for greenhouses therefore must meet several requirements. They must be energy-saving, suitable for high-quality products, and suitable for static reasons in terms of recycling. The great challenge material that combines all these characteristics in terms of optimum output is to find suitable.

Factors Involved In Urban and peri-urban Horticulture

1. People

Large part of the people involved in urban and peri-urban horticulture is the urban poor. In many cities, one will often also find lower and mid-level government officials, school

teachers and the like involved in agriculture, as well as richer people who are seeking a good investment for their capital. Women constitute an important part of urban farmers, since agriculture and related processing and selling activities, among others, can often be more easily combined with their other tasks in the household. Women have high work efficiency vis a vis men in terms of deliverance in key operations of agriculture.

2. Location

Urban and peri-urban horticulture may take place in locations inside the cities (intra-urban) or in the peri-urban areas. The activities may take place on the homestead (on-plot) or on land away from the residence (off-plot), on private land (owned, leased) or on public land (parks, conservation areas, along roads, streams and railways), or semi-public land (schoolyards, grounds of schools and hospitals). The proper connectivity with the main stream is must for proper transportation and handling of the produce.

3. Food Products

Urban and peri-urban agriculture includes food products, from different types of crops (grains, root crops, vegetables, mushrooms, fruits) and animals (poultry, rabbits, goats, sheep, cattle, pigs, guinea pigs, fish, etc.) as well as non-food products (like aromatic and medicinal herbs, ornamental plants, tree products, etc.) or combinations of these. Often the more perishable and relatively high-valued vegetables and animal products and by-products are favored. Production units in urban agriculture in general tend to be more specialized than rural enterprises, and exchanges are needed across production units. Consumer's acceptance is the key for popularization of any food product within the city domain.

4. Product Market

Urban and peri-urban horticulture includes horticultural production activities as well as related processing and marketing activities as well as inputs (e.g. compost) and services delivery (e.g. animal health services) by specialized micro-enterprises or NGOs, etc. In most cities in developing countries, an

important part of urban agricultural production is for self consumption, with surpluses being traded. However, the importance of the market-oriented urban agriculture, both in volume and economic value, should not be underestimated. Products are sold at the farm gate, by cart in the same or other neighborhoods, in local shops, on local (farmers) markets or to intermediaries and supermarkets. Mainly fresh products are sold but part of it is processed for own use cooked and sold on the streets or processed and packaged for sale to one of the outlets mentioned above.

CONCLUSION

Urban and peri-urban horticulture is an emerging important factor in providing city dwellers with nutritious food along with aesthetic recreation and its socio-economic importance will develop further as the overall advancement of society is progressing at rapid pace. It will also be an increasing driver of growth in the horticultural business entrepreneurship. However, the full potential of urban horticulture as a food and livelihood provider will only be achieved when it is integrated in consonance with urban land use planning and policy making thereby addressing both potential benefits and risks for nutritional benefits and nutritional empowerment. Well-managed urban horticulture will be an important tool to reduce poverty, improve environmental management and further economic development in many cities of developing countries. When these concepts can be transformed into operational standards and actions, urban horticulture can contribute to food security, food safety and livelihoods, while offering considerable potential for innovation. The entire pathway in urban and peri-urban vicinity holds the great potential for inclusion of horticulture under the present scenario. The inclination towards peri-urban horticultural through new vistas like protected cultivation, home gardening, roof top gardening, holds the key to deliver nutritional output and sustainable livelihood and changing food habits as a result of cosmopolitan societies ushering in big and

emerging cities. The ever increasing awareness among urban and peri-urban people about the health benefits of fruits, vegetables and other food items and their availability with regard to their nutritional value inspires the city dwellers towards positive approach in context of horticulture for human health wellness for nutritional security.

REFERENCES

1. Bohn, K., Viljoen, A., The edible city: envisioning the continuous productive urban landscape. *Field J.* **4(1)**: 149–161 (2011).
2. Caplow, T., Building integrated agriculture: philosophy and practice. In: *Urban futures 2030: Urban development and urban lifestyles of the future*, ed. *Heinrich Boll Foundation*, 54–58 (2009).
3. De Neergard, A., Drescher, A. W., Kouame, C., Urban and peri-urban agriculture in African cities. In: Pasquini, C. M., Drescher, M. W., Shackleton, A. W., (eds) *African indigenous vegetables in urban agriculture*. Earthscan, London, pp 35–58 (2009).
4. Dubbeling, M., de Zeeuw, H., van Veenhuizen, R., Cities, poverty and food—multi-stakeholder policy and planning in urban agriculture. *RUAF Foundation*, Rugby, p 173 (2010).
5. Foeken, D., & Uwuour, S., Farming as a livelihood source for the urban poor of Nakuru, Kenya. *Geoforum*, **39**: 1978-1990 (2008).
6. Galhena, D. H., Freed, R., Maredia, K. M., Home gardens: a promising approach to enhance household food security and wellbeing. *Agric Food Secur* **2**: 8 (2013).
7. Hamilton, A. J., Burry, K., Mok, H. F., Barker, F., Grove, J. R., Williamson, V. G., Give peas a chance? Urban agriculture in developing countries. A review. *Agron Sustain Dev* **34**: 45–73 (2013).
8. Kumar, S. S., Land Accounting in India: Issues and concerns. *Central Statistics Office, Ministry of Statistics & Programme Implementation, New Delhi, India* (2012).

9. Lovell, S. T., Multifunctional urban agriculture for Sustainable land use planning in the United States. *Sustainability* **2**: 2499–2522 (2010).
10. Mbaye, A., Moustier, P., Market-oriented urban agricultural production in Dakar. In: Bakker, N., Dubbeling, M., Gündel, S., Sabel- Koschella, U., de Zeeuw, H., (eds) *Growing cities. Growing Food. Dtsch Stift int Entw, Feldafing*, pp 235–256 (2000).
11. Orsini, F., Kahane, R., Nono-Womdim, R., Gianquinto, G., Urban agriculture in the developing world: a review. *Agron Sustain Dev* **33**: 695–720 (2013).
12. Parrot, L., Dongmo, C., Ndoumbé, M., & Poubom, C., Horticulture, livelihoods, and urban transition in Africa: evidence from South-West Cameroon. *Agricultural Economics*, **39(2)**: 245-256 (2008).
13. Tacoli, C., (ed), *The Earthscan Reader in Rural-Urban Linkages*. London / Sterling, VA: Earthscan (2006).
14. Tenkouano, A., The nutritional and economic potential of vegetables. In *The World watch Institute (Ed.), State of the world 2011: Innovations that nourish the planet* (pp. 27-37). New York, London: W.W. Norton & Company (2011).