Rooftop Nutritional Garden for Food security and Sustainability Prospect

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ABSTRACT

The establishment of terrace garden is a sustainable way of approach for people in urban areas for gardening. The rooftop gardening is a new idea of gardening in urban areas where the availability of land is curtailed and leads to crop production in containers, planters, grow bags and even in plastic drums. The developing urban horticulture can reduce burden to a certain extent, strengthen food security and improve income generation. Even though, villages occupy major share in agriculture, the urban horticulture can minimize burden to a certain extent and brings urban population closer to natural scenery. The current stat also shows that, urban farms supply food to the quarter of world's urban population. The key aspect of urban horticulture is to plan the calendar of crops for year and choosing optimum nutrition source like kitchen waste for successful urban horticulture. The various proportions of nutrients from organic and inorganic sources should be calculated to provide optimum nutrition to the plants according to plant growth stage and external environment. To achieve the malnutrition free India by 2022, govt. of India has launched the National Nutrition Mission or POSHAN Abhiyan. To surplus the food as per demand, rooftop vegetable farming can help by supplying fresh and hygienic vegetables and curtails the household expense for vegetables.

INTRODUCTION

The expanding population and shrinking area for gardening within cities has led the idea of rooftop gardening in towns. New ways were introduced to grow a series of crops in different types of containers or structures. It should be started with a few plants like fresh vegetables, perennial fruit trees and leafy greens as these thrive in planters, grow bags and even plastic drums. Although the importance of rural agriculture can never be replaced, the globally developing urban horticulture can reduce burden to a certain extent and bring urban people to nature (Kumar *et al*., 2019). However, both urban and rural agriculture must be considered in order to achieve global food security. Around 15 % of world food is now grown in urban areas. According to UN food and agricultural organization, urban farms supply food about the quarter of the world's urban population.

There is a substantial prevalence of undernourishment and deficiency of calories intake is increasing even in India's urban areas. Indeed, India ranks 102nd out of 117 countries in the 2019 Global Hunger Index (GHI) and suffers from a serious level of hunger. Availability of limited space is the main reason for evolving the concept of rooftop gardens in the metropolitan cities. It is possible to gain cultivation space in volume, improving family's capacities to self-produce healthy food and balance their diets even in the lower strata of population (Patel *et al*., 2019). The vegetables grown in nutritional garden will supply nutrients which are essential for balanced diet since they supply vitamins, minerals, dietary fiber and phyto-chemicals. In the daily diet vegetables have been strongly associated with improvement of gastrointestinal health, good vision, and reduced risk of heart disease and stroke. All the vegetables may offer protection against free radical damage, detoxification of carcinogens, chronic diseases such as diabetes, and more forms of cancer.

IMPORTANCE OF ROOFTOP GARDENING

- It facilitates easy access to fresh fruits and vegetables, helps to provide a balanced diet and to reduce malnutrition.
- The vegetable grown in terrace garden, contributes to supply variety of nutrients, which help to meet the requirement for healthy diet and contribute to the food and nutritional security of the increasing urban population (Dash and Deole, 2020).
- It has the potential to improve a variety of ecosystem services, increase urban biodiversity and reduce food scarcity.
- It helps to combat malnutrition and supply Recommended Dietary Allowance of food to family members.
- It is promoted to reduce environmental footprint of the city, resilience to climate change

SELECTION CRITERIA OF VEGETABLES FOR ROOFTOP GARDENING:

- Crops should be sturdy, and able to resist wind and other climatic situation.
- The plants having brittle stem should be avoided.
- The vegetables having small height like root vegetables (Carrot, radish and turnip) will be most suitable for growing on terrace.

- Short statured leafy greens like lettuce and spinach are suitable crops under rooftop gardening

- More precisely, rooftop vegetables should be started in containers under nets to prevent soil from drying out.

- Immediately after transplanting plants should mulch with growing medium having the good water holding capacity and rich in organic constituents.

TYPES OF ROOFTOP GARDEN:

There are three primary types of roof top garden for vegetables production-

1. **Direct producing green roofs**: The plants are grown on shallow beds prepared in a soil based growing medium placed on top of a water proof membrane or additional layers such as root barrier, drainage layer and an irrigation system.

2. **Rooftop Container gardens:** It involves growing of vegetables, herbs, flowers in pots, buckets, containers, bottles or raised beds which contain soil based growing medium. The mixture can be made of mixture of soil, compost or wood chips. Rooftop containers can range from simple pots to more elaborate systems. As much as possible locally available and recycled material could be used (Dash and Deole, 2020).

3. **Rooftop hydroponic systems:** Growing of plants in a liquid nutrient solution to enhance output and extend growing seasons. The hydroponics can be used under protected or open cultivation. The nutrient solution is prepared by mixing the various proportions of nutrient elements.

COMPONENTS OF TERRACE GARDENING: The successful roof garden must have easy access to planting material, plant growing structures, plant nutrition and tools & equipment along with better management practices.

I. PLANTING MATERIAL:

As per the family preference, minimum amount and number of planting material should be procured locally from genuine source. Some of the most commonly preferred and highly nutritive vegetables grown were listed below

A. LEAFY VEGETABLES: Leaves of these plants are consumed directly as vegetable. Among all vegetables, highly nutritious and contains major amount of minerals along with vitamins and dietary fibre. Eg- Palak, Amaranthus, Basella, Coriander, Mint, Fenugreek, Roselle.

B. FRUIT TYPE: In this group, immature fruit is cooked as vegetable. When they attain right stage for harvest, shows coloring pigments (lycopene in tomato, anthocyanin in purple brinjal, chlorophyll in pods of legumes and fruits of cucurbits). Cole crops are highly recommended as anti-carcinogenic & nervous stimulant due to presence of Sulpher compounds (Sulphoraphanes). Bhendi recommends mainly to cure mental illness in children due to presence of high iodine content. Legumes supplement proteins in our diet. Cucurbits supply major electrolytes and antioxidants to the body, cucumber used as salad, bottle gourd makes soothing effect to our body and bitter gourd prevents formation of free radicals, recommends for diabetic patients and slowdowns HIV virus infection.

- Solanaceous crops- Tomato, Brinjal, Chilli

- Cucurbits- Bitter gourd, Ridge gourd, Bottle gourd, Cucumber

- Legumes- Dolichus bean, Cluster bean, Cow pea, French bean
- Cole crops- Cabbage, Cauliflower
- Bhendi

C. UNDER GROUND VEGETABLES: These are biennial crops; first season stores food material and second season produces flowering. for vegetable purpose grown as annuals Onion and garlic both are consumed for its pungent flavor, the Sulpher compounds like allyl propyl di sulphide in onion and di allyl di sulphide in garlic contains anti-fungal, anti-bacterial properties. Root crops like carrot beetroot contains Carotenoids pigments (β carotene, anthocyanin, delphinidin, β-Nine) improves our body activity. Similarly, tuber crops are staple food in many countries due to presence of starch and used in preparation of processed products.

- Root crops- Carrot, Radish
- Bulb crops- Onion, Garlic
- Tuber crops- Potato, Colocassia, Yams

D. PERENNIALS: Leaves of both curry leaf and drumstick used as vegetable. Fruits of drumstick and Coccinia used as vegetable.

E. FRUITS: Some nutritive cultivars of banana, papaya, guava and pomegranate.

F. FLOWERS: Rose, marigold and jasmine can also include.

II. GROWING STRUCTURES:

Various types of growing structures are available for growing on vacant place of terrace based on nature of growth and duration of crop, for instance grow bags, containers, vertical towers and ceramic pots are famous structures used for vegetable crops

III. PLANT NUTRITION:

The seedlings were raised in portrays using properly sterilized media containing 2:1:1 ratio of Cocopeat, perlite and vermiculite. Various proportions of growing media containing essential nutrients has to be taken from organic or inorganic sources to supply growing plants as and when needed according to the growth stage and external appearance of plant. FYM, Neem cake, poultry manure, urban compost, kitchen waste and biofertilizer are utilized as organic source, whereas DAP, MOP, SSP and Urea are mostly used inorganic nutrient sources. Micro nutrients are applied in the form of foliar spray during flowering and fruiting along with growth regulators (Auxins, GA3, Cycocel and Ethrel)

- Organic nutrients- FYM, Neem cake, Poultry manure, Urban compost, kitchen waste and Biofertilizers (Azospirillum, Azotobacter, Vascular Arboscular Mycorhiza, Arboscular Mycorhiza and Rhizobium).
- Inorganic Nutrients- Urea, Muriate of potash, Super Phosphate (Single & Double) and DAP.
- Micronutrients- Micro mix at flowering and fruiting stage.
- Growth regulators- Auxins, GA_3, Cytokinins, Cycocel, Malic hydrazide.

IV. TOOLS AND EQUIPMENTS:

Protrays, Rose Can, Khurpi, Hose pipe, Hand sprayer, green shade net are some of the tools and equipment utilized for successful production of vegetable crops on terrace.

CONCLUSION:

Nutrition gardens as a sustainable practice to improve nutrition and food security by contributing significantly to dietary diversity. Kitchen gardens can help strengthen food security and improve income generation and livelihoods.

- The Government of India launched the National Nutrition Mission or POSHAN Abhiyaan with the objective of a Mult ministerial convergence mission to ensure attainment of a malnutrition-free India by 2022.
- Mizoram has begun developing school spaces for kitchen gardens called 'Kan Sikul, Kan Huan' or My School, My Farm.
- Government schools in Chandigarh are developing mini farms to provide mid-day meals.
- The Ministry of Human Resource Development has developed guidelines for school nutrition (kitchen) gardens in government and aided schools under the midday meal scheme.
- The Village Health and Nutrition Day, a Government of India has taken initiative to improve access to health and nutrition services, can be utilized to raise awareness on nutrition gardens, and also demonstrate how the food grown can be introduced in the daily diet.
- **Capacity**-building on kitchen gardens can be incorporated as part of training curriculum of community health workers/anganwadi workers under the Ministry of Women and Child Development's flagship programme of ICDS. This will enhance their knowledge on benefits of nutrition gardens and raise awareness in the community.

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