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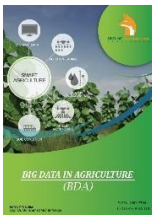

RESEARCH ARTICLE

URBAN GARDENING IN BHARATPUR METROPOLITAN, NEPAL

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ABSTRACT

Urban gardening consists of various organic productions, environmental protection, and medicinal supply as well, in a limited space. This study was done to know the status of production from such gardening in Bharatpur Metropolitan-10, Nepal. First-hand data from 101 respondents using random sampling was piloted to recognize the strengths and weaknesses of various aspects related to urban gardening. It is observed that a large number of urban householders have created small gardens for ornamental, medicinal, fruits, and vegetables in their households. Maximum householders have 155 to 190 m^2 areas for their home gardens, where the presence of seasonal flowers as outdoor flowers, aloe vera as an indoor plant, lime as a fruit, and holy basil as a medicinal plant are found at their maximum. Farmyard manure as fertilizer and inorganic pesticides are used most often where people invest NRs. 2000 to 3000 for fertilizer and less than NRs. 1000 for pesticides per year. The majorities of people buy or use old home seeds and use clay pots for cultivation. It was identified that most people grow 40 to 60% of the required vegetables in their own home gardens, where most of them spend about 1 hour per day on garden work.

KEYWORDS

Organic Production, Ornamental Gardening, Medicinal Plants, Fertilizer, Home Garden.

1. INTRODUCTION

The growing of plants in a limited enclosed space within a house or open area is common these days in metropolitan cities like Bharatpur. Maintenance of greenery maintained by such small garden plants has many benefits that include a supply of fresh kitchen ingredients; providing beauty; a healthier lifestyle; improvement in air quality within the house; food security; and removing stress for the family (Galhena et al., 2013). Garden plants have medicinal and aromatic importance as well. Free land in Nepal's Bharatpur Metropolitan has been decreasing as urbanization has increased over the last two decades. These days, it is common for people to use their limited free space in the house for ornamental gardening (indoor and outdoor), organic farming (fruits and vegetables), and medicinal plant cultivation (basil, mint, neem, aloe vera, and more).

The indoor plants also work to purify the air within the house. Contamination of indoor air by gaseous materials such as volatile organic compounds (VOCs) is reduced by such plants. The reduction of different VOCs due to such indoor plants was found significantly to be 9% in benzene, 36% in acetaldehyde, 35% in acrolein with acetone, 50% in formaldehyde, 72% in xylene, 75% in ethyl-benzene, 75% in styrene, and 85% in toluene (Hong et al., 2017). Likewise, outdoor ornamental plants in urban home gardens are generally used for aesthetic, medicinal, social, and various other purposes. Similarly, regularly cultivated soil does not usually have sufficient amounts of nutrients required for plants to have constant and high product yield parameters (Quansah et al., 2010), due to soil acidification, soil degradation, organic matter reduction, and a decline in combined stability in soil (Meyer et al., 2011). So, the application of various types of fertilizer is an important factor in the soil to increase productivity, which is essential for proper plant growth and development. Quality seed is also an essential component like fertilizer, which helps to ensure good crop stand to give high genetic and physiological properties. Therefore, the selection of quality seeds is also an important part of gardening.

Home gardening has various benefits. It helps to supply organic fresh vegetables, save family expenditure on food items, reduce disease prevalence, improve health and provide surplus food (Bellows et al., 2003). Home gardening also helps to boost up the fruit and vegetables quality and quantity, for communities as well (Khan et al., 2020). This is predominantly significant in developing countries, where the maximum amount of income is spent on food commodities. Home gardening, therefore, has an important contribution to food security and the welfare of the community (Shrestha et al., 2004).

The increasing trends of urbanization and food security are the key factor of the present era (FAO, 2011). The urbanization rate of Nepal in 2019 was 20.15%, and in Bharatpur Metropolitan, this rate is as high as 7% per annum, according to the government of Nepal. An urban gardening study from Bharatpur-10 has not been carried out yet. This study identifies the status of the indoor garden and recognizes different plants grown on the premises; finds out the type of pesticides and fertilizers used; and also determines the practice of house gardening. It is hoped that the results from the analysis of primary data will provide an exact picture of urban home gardening in the considered area.

2. METHODOLOGY

The increasing trend of urban gardening is achieving popularity rapidly in metropolitan cities like Bharatpur. This study aims to identify the status of current trends in indoor and outdoor gardening, including the growing of vegetables, fruits, medicinal plants, and the use of seeds, fertilizer, and pesticides in the considered households, and the investment and efficacy required for it (Bharatpur Meteropolitan, 2022). Moreover, we also investigate the total land used for these practices, the source of motivation, the time spent on such activities, etc.

2.1 Study Area

Bharatpur is a metropolitan city and district headquarters located in

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Chitwan district in the central-southern part of Nepal. Chitwan occupies 2,218 km² of the area, which is about 1.5% of the total area of Nepal. It is one of the fastest-growing cities in Nepal. The total area covered by Bharatpur metropolitan is 433 km² with an average elevation of 208 m. The study is based on survey data from Bharatpur-10, which has residential buildings with a dense population.

2.2 Sample Selection and Selection of Tools

A random sampling survey was conducted at Bharatpur -10, Chitwan. Active participation of urban householder's in situ study was observed. For this purpose, a survey questionnaire (both open-ended and close-ended) was developed, containing 25 questions addressing the objective of this study. A survey was conducted at 101 households in Bharatpur within the selected area in June 2021. Due to the pandemic situation, some difficulties were faced, but the survey was conducted effectively. Respondents were interviewed personally by visiting their individual homes and gardens during the morning and evening.

2.3 Analysis of Data

The data collected from the questionnaire survey were analyzed using the statistical software SPSS.

3. Data Analysis, Results and Discussion

Concern related to urban agriculture has increased in recent days due to increasing awareness regarding healthy living, impregnable food requirements, climate change, the importance of organic food, and air quality along with their importance. The outbreak of novel coronavirus (covid-19) changed people's lifestyles, as people all over the world were locked inside their homes during the lockdown period. That causes a drop in income along with job insecurities. Such a new situation makes people emphasize the importance of home gardening, which provides self-reliance to people and also provides peace, therapy, nourishment, and a relaxing, healthy environment.

The data obtained from the field survey provides the following outputs.

3.1 Sex of the Respondents

It is found that among the respondents, nearly one-third were male (31.7%) and nearly two-third (68.3%) were female, involved in this study.

3.2 Family Size and type of Respondents

The data shows that the majority of the families were nuclear in type. Only 27.7% of families have more than 5 members, and 72.3% of families have less than 5 family members.

3.3 Total Area of Householder

The majority of householders (57.4%) have a 338-507 m² land area (≥1 Gatta) whereas 3% of householders have a maximum area greater than 676 m². The lowest area (<169 m²) was owned by 11.9% of householders, as depicted in Tab.1. This total area of householders includes their house and any open space therein.

Table 1: Total Area of Householders

Total own area (meter sq.)	Frequency	Percentage
Less than 169meter sq.	12	11.9%
169-338 meter sq.	20	19.8%
338-507 meter sq.	58	57.4%
507-676 meter sq.	8	7.9%
Greater than 676 meter sq.	3	3.0%
Total	**101**	**100%**

3.4 Area used for Gardening

The home garden is a farming system that includes different physical, social, and economic activities on the land around the house for the supply of fresh food at the household level (Lal R., 2020). The remaining area after the construction of the house was used for gardening. It is found that some of the total household areas were used for gardening. As shown in Tab.2, the majority (45%) of householders has 155-190 m² of gardening space, only 8% have more than 190 m², and 8% use less than 50 m². In such home gardens, they cultivate various crops.

Table 2: Area used for Gardening

Total own area (meter sq.)	Frequency	Percentage
Less than 50 meter sq.	17	16.8%
50-85 meter sq.	8	7.9%
85-120 meter sq.	10	9.9%
120-155 meter sq.	10	9.9%
155-190 meter sq.	47	46.5%
Greater than 190 meter sq.	9	8.9%
Total	**101**	**100%**

3.5 Types of Ornamental Gardening

An increasing trend of ornamental gardening has been found in Bharatpur metropolitan in recent times. It is seen that 49.5% of respondents have outdoor gardening, 27.7% have indoor gardening, and 18.8% have both. Very few (only 4%) of the respondents were not involved in such gardening.

3.6 Types of Indoor Plants Cultivated

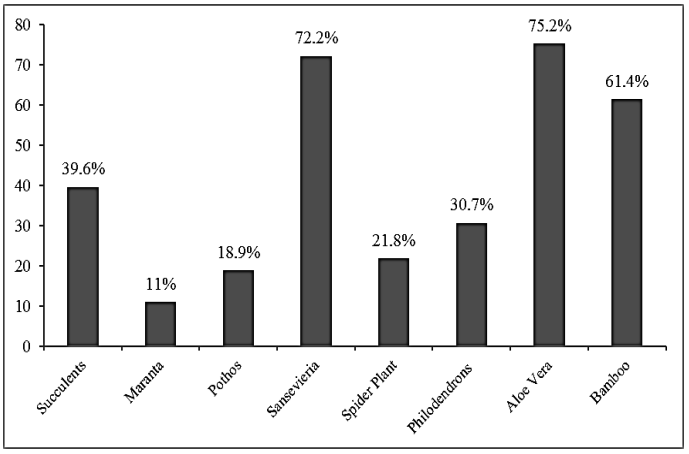

Figure 1: Types of indoor plants cultivated

Indoor gardening is one of the emerging themes for urban people to maintain a healthy environment, which is grown in yards, balconies, inside rooms in pots, containers, etc. The most common indoor plants found in households were Aloe Vera (75.2%) followed by Sansevieria plant (72.2%), Bamboo (61.4%), Succulents (39.6%), Philodendrons (30.7%), Spider plants (21.8%), Pothos (18.9%), and Maranta (11%).

3.7 Types of Outdoor Ornamental Plants Cultivated

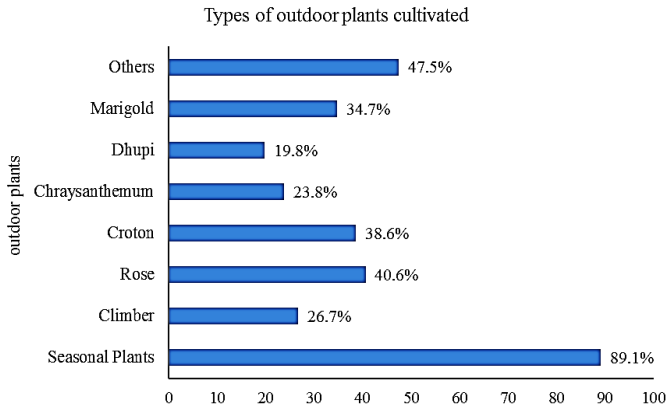

Figure 2: Types of outdoor plants cultivated

Outdoor gardening is the practice of flower gardening outside the house; whether in a small, limited open space or hanging baskets and containers. The majority of householders have such a type of gardening, even in limited space for enjoyment and fresh nature. 89.1% of householders had seasonal plants, followed by 40.6 householders had roses, croton 38.6%, marigold 34.7%, climber 26.7%, chrysanthemum 23.8%, dhupi (black Juniper) 19.8%, and 47.5% had various other types of outdoor ornamental plants.

3.8 Types of Pots Used

The study shows that the maximum number of people using clay pots is 86.1%; cement pots (32.7%), polythene pots (29.7%), where polythene pots include waste bags, poly bags, etc.; plastic bags (28.7%) which include fish crates, ceramic pots (21.8%), and metallic pots (8.9%).

3.9 Types of Fruits Cultivated

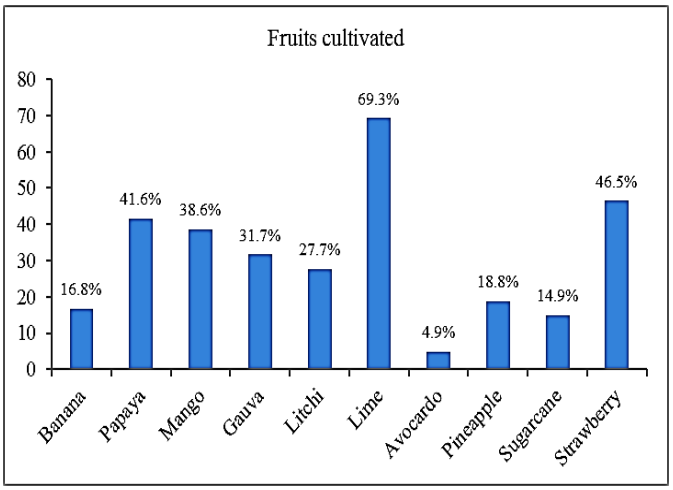

Figure 3: Types of fruits cultivated in urban garden

Bharatpur lies in the tropical region at an elevation of 208 m (682 feet) where various types of tropical fruits can be cultivated. From the survey analysis, as shown in the graph below, these are the fruits cultivated in this region. Where, maximum 69.3% of householders had lime, followed by (46.5%) had strawberry, (41.6%) had papaya, (38.6%) had mango, (31.7%) had guava, (27.7%) had litchi, (18.8%) had pineapple,(16.8%) had banana, (14.9%) had sugarcane, and only 4.9% had avocado.

3.10 Types of Medicinal Plant Cultivated

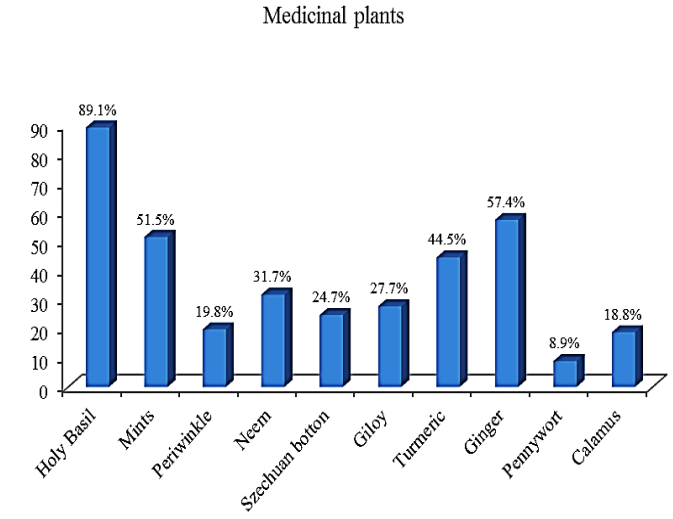

Figure 4: Types of medicinal plants

A survey of medicinal plants had shown that the majority of people have holy basil (89.1%) which is also due to Nepalese culture where it is used for religious purpose. 57.4% had ginger, 51.5% had mint, 44.5% had turmeric, 31.7% had neem, 27.7% had giloy, 25% had Szechuan botton, 19.8% had periwinkle, 18.8% had calamus and only 8.9% had pennywort

3.11 Types of Fertilizer used in Urban Gardening

For proper growth & development of plants, light, moisture & fertilizer are the three major pillars. So, fertilizer is the substance used to make soil fertile & to increase the productivity of the plants. Data obtained from the survey reveals that the majority (64.4%) householders were using farmyard manure, 63.3% used inorganic manure, 55.4% used homemade compost, 43.6% used poultry litter, 26.7% used vermicompost, 15.8% used mustard cake and only 6.9% used goat manure.

Table 3: Types of Fertilizer Used in Urban Gardening

Types of Fertilizer used	Percentage
Farm yard manure	64.4%
Poultry	43.6%
Homemade compost	55.4%
Vermicompost	26.7%
Goat manure	6.9%
Mustard cake	15.8%
Inorganic manure	63.3%

3.12 Amount of Expenditure on Fertilizer per Year (Rupees)

The survey result shows that, the majority of people (24.8%) don't buy fertilizer because they had homemade compost & some people have animals (cow, buffalo, goat, poultry, etc.) whose excreta are used as fertilizer. So, 16.8% people spend 2000-3000rs/yr., 14.9% spend 3000-4000rs/yr., 13.8% spend 4000-5000rs/yr., 12.9% spend 1000-2000rs/yr., 11.9% spend 5000-6000rs/yr. and only 4.9% people spend more than 6000rs/yr. for fertilizer.

3.13 M. Amount (%) of Vegetable Produced in own Field

From the survey, it is identified that, (20%) of daily intake vegetable was produced by 20.8% of the householder, (20-40%) of daily intake vegetables by 16.8% of the householder, (40-60%) by 44.6% of the householder, (60-80%) by 9.9% of people & (80-100%) by 7.9% householder i.e. 7.9% of householder doesn't need to buy any vegetables or only required to buy 10-20%.

Table 4: Percentage (%) of Vegetable Produced in Own Field

Vegetable produced at own field (%)	Percentage
0 – 20	20.8%
20 – 40	16.8%
40 – 60	44.6%
60 – 80	9.9%
80 – 100	7.9%

3.14 N. Source of Seed

High-quality seeds play a vital role in the farming system to increase agriculture production (Elias et al., 2018). The output of crops mainly depends on seeds and seedlings. So seed selection is a major part of agriculture. The survey reveals that; 48.5% of householders buy seed from a shop, 41.6% of people use old homemade seeds, 8.9% get seed from friends and relatives, and only 1% gets free seed from government organizations.

3.15 Amount of Expenditure on Seed per Year (rupees)

A certain amount of investment is required for proper outcomes. So, a certain investment in the seed is required for effective results. According to the survey, 53.5% of householders invested 1000 NRs/year, 24.8% invested 1000 to 2000 NRs/year, 10.9% invested 2000 to 3000 NRs/year, 6.9% invested 3000 to 4000 NRs/year, and 3.9% invested more than 4000 NRs/year in the seed.

3.16 Types of Pesticide Used

Consumption of pesticides is increasing by about 10% to 20% per year in Nepal (Joshi et al., 2003). Various kinds of human health hazards include cancer, reproductive problems, tumors, birth defects, and damage to the liver, kidney, and neural organs as a result of the increasing rate of pesticide application (Sharma et al., 2012). Also, inappropriate handling and use of pesticides by inadequately trained farm workers causes adverse effects on human health and the environment (Naidoo et al., 2010). In this survey, out of 101 respondents, 13.9% had not used any kind of pesticide because of very limited space for gardening. 17.8% had used both organic & inorganic types of pesticides, where organic pesticides include (neem leaf, oil spray, cow urine, onion and garlic spray, *Artemisia vulgaris,* etc.), 37.6% used only inorganic pesticides and 30.7% had used only organic pesticides.

3.17 Amount of expenditure on Pesticides per year (rupees)

From the survey information, 13.9% had not used any kind of pesticide, which means they didn't invest any money in pesticides. Of the remaining 87 respondents, 70.1% had invested less than 1000 NRs/year, 23% had invested 1000-2000 NRs/year and only 6.9% had invested more than 2000 NRs/year for pesticides.

3.18 Time Expenditure in Garden Work per Day

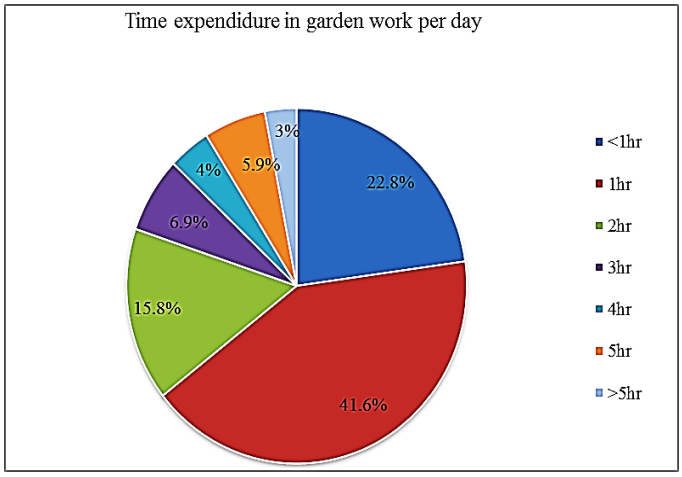

Figure 5: Time expenditure in garden work per day

Garden plants require constant inspection. Some for the fresh environment, some for the organic food, some due to interest, spend their time in garden work. Data show that the majority of respondents (41.6%) spend one hour per day on gardening work, with only 3% spending more than five hours

4. CONCLUSION

Home gardening promotes a viable and convenient environment. The strategic intention behind such gardening is to detriment society by improving air quality, maintaining a healthy environment, reducing carbon content present in the atmosphere; and health security. Urban householders have cultivated different varieties of ornamental plants, vegetables, and fruits using different applications of fertilizer, pest management techniques, pots, seeds, and seedlings within their very limited areas. The majority of respondents had less than 5 members in the house and had a 155-190m^2 area for gardening, where 40 to 50% of the food requirements are fulfilled for the majority of householders. Urban householders mostly buy or use old homemade seeds for cultivation, whereas the majority of them invest NRs. 2000 to 3000 for fertilizer and less than NRs. 1000 for pesticides and seeds.

Furthermore, from the survey, it was identified that the majority use farm yard manure and inorganic pesticides for their purposes, and the majority of them spend about 1 hour a day doing garden work. Also, the kind of pleasure and satisfaction a person gets while working in the garden. Moreover, from the survey, we get to know that training, awareness education regarding pesticides and insecticides, free seeds through the governmental sector, equipment, and new technologies such as hydroponics, rooftop gardening, etc., should be provided among the urban householders for comprehensive growth and development of the urban gardening sector.

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