

**TECHNIQUES OF CULTIVATION AND METHODS ON BUILDING
BASED INTEGRATED FARMING IN URBAN AGRICULTURE**

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The original research work entitled ‘Techniques of cultivation and methods on building based integrated farming in urban agriculture’ carried out in Bhubaneswar a smart city of India. The study relevant to the plants cultivation on building integrated farming be used group of plants grown as per the use, most categories of containers and the methods of planting in places, planted materials Bio-fertilizer or compost and media, kinds of external soil use in containers and constructed place for cultivation, which help to maintained nutritive value of food as the food security, cultivated propagates like as the seed, seedling and plan parts, eventually the study reflected on the equipment use for water supply (irrigation) methods to the plants. I express my deep sense of gratitude to all the city dwellers, urban farmers, respondents, experts, researchers, for support in every respect throughout the research work. I would like to thanks organizations/institution such as City farmer association/Kitchen garden association/City farmer groups extending help in data collection and immense encourage and support for this study.

ABSTRACT

In recent scenario the urban agriculture in terms of building based integrated farming in cities grow rapidly. Various types of plants has been grown in urban area, now the basically hub of the cultivation in buildings in cities. The building based cultivation carried out in the varieties of methods in terms of perform cultivated place withi8n the buildings, such are known as rooftop farming, rooftop garden, balcony garden, terrace garden and the vertical garden, hanging gardens etc. There is diversity of plants grown in the building as per the used by the cities farmers. Such as the vegetables, Fruits, Spice as food, Flowers as ornamental, medicinal etc. are grown in building based integrated farming in the system. In this study implication of use of containers in this cultivation which has fixed and movable commodity used in the same farming, Combine used as Grow bags, Concrete pots, Polythene bag, Plastic drums, Earthen pots, cement carry bags use in groups as per their dominancy. The containers have been choice according to the characteristic and cultivation methods of the plant species. The present study containers has been fixed on the roofs this type of cultivation in Belayed, Lawns, Beds, Vertical garden settled in a groups in the buildings. The study express planting materials has used on put off in containers, beds or lawns in different farms. Further the soil used in a building based farming. Most of the soil being used Garden soil and crop field soil, again the planted material for cultivation belong to propagates like seeds, seedlings, plants part and Bio-fertilizers and

manures used in the processes. The methods of water supply and tools combinations has been adopted, most of the combination has traditional by mug, Jug, Plastic pipe and in spray form. The combinational study all the materials, technique and the methods used in the building based mixed farming.

KEYWORDS: *Agriculture, Building, Cultivation, Farming, Integrated, Urban, Technique.*

1. INTRODUCTION

Urban agriculture contain of building based farming in cities has been rapidly growing in urban area reported by Choguill, C. L. (1995). Estee, L.Y., Kishnani, N. T. (2010) has been study building-integrated agriculture utilizing rooftops for sustainable food crop cultivation in Singapore The mixed farming means the more no of plant species cultivated in same area and same time with in the building, carried out the integrated farming in cities, Jha, R. K. et al., (2019). This farming grown fresh and organic product surrounding and within the building .The vegetables ,fruits, spices and flowers (ornamental) plants grown on the rooftop, balcony, terrace and vertical places studded by Gajbe, P. U. (2021). The cultivation technique has something different from the field crops. The recent study the urban agriculture provide nutritive organic food in own building, explained by Specht, K., et al., (2021). The technique of cultivation meet to the propagates, planted material, container, organic manure or compost, soil, water management and the structure of building pre-preparation and construction use of materials tools for the calculation proposed by Sanye-Mengual, E., et al., (2015). The data has collected on the basis of dominant materials of following combination has been recorded.

2. REVIEW OF LITERATURE

The study large numbers of reprints are available in the various sources. The rationales of the study have very specific. Rapidly growth of population in urbanities meet to the production of own food in urban agriculture by Torreggiani, D. et al., (2012). Now the urban agriculture plays an important role in food security and urban sustainability. Planning of food production is the main propose of urban agriculture, Feininger, U. B., et al., (2015), urban agriculture in terms of building based farming is most important because of the organic farming to grow fresh nutritive and tasty food near the door steps, Abu, G. A., & Soom, A. (2016). Review of literature this study context of types of plant cultivation on the Rooftop farming, Rooftop gardens, balcony gardens and terrace gardens on the buildings of urban area, Ackerman, et al., (2014). Container used in the garden has control the space, soil, arrangements and water scarcity for cultivation. Variables of containers groups adopted in cultivation methods. Planted materials for urban farming has very unique for cultivation which bio-compost, media, manure etc, that increase of fertility of the soil and the nutritive value of the veggies and fruits. Alaima, K, et al., (2008), Astee, L. & Kishnani, N. (2010). The external soil also use for the process. Further the planted materials like seeds seedlings and the plant parts for propagules were use for cultivation. Equipments of water supply have been studied on the farming systems.

3. RESEARCH VARIABLES

The study presents the variables with methods of cultivation on buildings in various aspects.160 numbers of buildings poses farming included in group and categorize of materials, process and methods has analyzed. The study belong plants, containers, planted materials, methods of farming and the water supply and management.

4. RESEARCH METHODOLOGY

The method of study by open survey with the respondents, data has been collected through structured interview by the questioner methods with the respondents to door to door visit and field study. The considered sampling of data have collected from 160 respondents which have the standard integrated farming on own buildings in a mart city Bhubaneswar of India. The primary data has gathered in tabulated form for analysis. The data for analyzed by the used of software ANOVA, SPSS and calculated the value frequency, percent, valid percent and cumulative percentage and interpret in each combination of the process of cultivation in building based integrated urban farming in cities.

5. RESULT AND DISCUSSION

The result of the current study of integrated farming of building carried out data collection, documentation and analysis to different variables in terms of the plant cultivated in the farming system. The study epic the dominant group of cultivar and materials data have been reported and documented in tabulated and interrelated .the research study explore the plants cultivated, container used, bed, lawn, barricade, vertical methods of cultivation been studied in the building. Further study exposed the used of planted materials accompanied Bio-fertilizers and compost also soil in the cultivated system. The study explores the combination of propagules, seeds, seedlings, and plant parts used for cultivation and better production of the crops. The method water and growth materials has supplied to the growing plants. All the data collected for sampling of 160 represented with building integrated farming. The data has analyzed and interpreted in tabulated and the graphic form as follows.

5.1 Study of common category of plants species cultivation in buildings on the basis of uses.

Table 5.1 Majority category of plants cultivation on the basis of uses.

Types of plants cultivation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid Plants	Fl/Fr	15	9.4	9.4	9.4
	Fl/Fr/Or	11	6.9	6.9	16.3
	Fl/Fr/Or/Med	2	1.3	1.3	17.5
	Fl/Fr/Re	1	.6	.6	18.1
	Fl/Fr/Veg	9	5.6	5.6	23.8
	Fl/Fr/Veg/	2	1.3	1.3	25.0
	Fl/Fr/Veg/Or	6	3.8	3.8	28.7
	Fl/Fr/Veg/Or/L-Veg	1	.6	.6	29.4
	Fl/Fr/Veg/Or/Med	3	1.9	1.9	31.3
	Fl/Or	3	1.9	1.9	33.1
	Fl/Or/Fr	1	.6	.6	33.8
	Fl/Or/Med	5	3.1	3.1	36.9
	Fl/Or/Veg	2	1.3	1.3	38.1
	Fl/Or/Veg/Fr/Med	1	.6	.6	38.8
	Fl/Or/Veg/Re	2	1.3	1.3	40.0
	Fl/Sp	1	.6	.6	40.6
	Fl/Sp/Veg	1	.6	.6	41.3

Fl/Veg	15	9.4	9.4	50.6
Fl/Veg/Med	5	3.1	3.1	53.8
Fl/Veg/Or	5	3.1	3.1	56.9
Fl/Veg/Re	3	1.9	1.9	58.8
Fr/Fl	2	1.3	1.3	60.0
Fr/Veg	5	3.1	3.1	63.1
Fr/Veg/Med	2	1.3	1.3	64.4
Or/Fl	4	2.5	2.5	66.9
Or/Fl/Med	1	.6	.6	67.5
Or/Fl/Med/Re	2	1.3	1.3	68.8
Or/Fr/Fl	2	1.3	1.3	70.0
Or/Reg/Fr/Veg/Fl	1	.6	.6	70.6
Or/Reg/Re	2	1.3	1.3	71.9
Or/Sp/Med	1	.6	.6	72.5
Or/Veg/Fl	4	2.5	2.5	75.0
Sp/Fl	4	2.5	2.5	77.5
Sp/Fl/Fr/Med	2	1.3	1.3	78.8
Sp/Fl/Or	2	1.3	1.3	80.0
Sp/Fr/Med	2	1.3	1.3	81.3
Sp/Veg	2	1.3	1.3	82.5
Veg/Fl	12	7.5	7.5	90.0
Veg/Fl/Fr	1	.6	.6	90.6
Veg/Fl/Or	3	1.9	1.9	92.5
Veg/Fl/Or/Med	1	.6	.6	93.1
Veg/Fr	3	1.9	1.9	95.0
Veg/Or	3	1.9	1.9	96.9
Veg/Or/Fl	2	1.3	1.3	98.1
Veg/Sp/Fl	2	1.3	1.3	99.4
Veg/Sp/Re	1	.6	.6	100.0
Total	160	100.0	100.0	

The table 5.1 represents the frequency and percentage distribution of various combinations of plant types cultivated by respondents. Each combination is abbreviated, with "Fl" representing flowers, "Fr" representing fruits, "Or" representing ornamental plants, "Med" representing medicinal plants, "Re" representing religious plants, "Veg" representing vegetables, and "Sp" representing spices(Fig.5.1). The most common cultivation types are "Fl/Fr" and "Fl/Veg," each with 15 instances, comprising 9.4% of the total responses. Less frequent combinations include "Fl/Fr/Re," "Fl/Or/Fr," and "Veg/Fl/Fr," among others, each with only 1 instance (0.6%) (Fig. 5.3). The cumulative percentage column shows the running total percentage, indicating the proportion of respondents accounted for as each new combination is added. The total number of responses is 160, making up 100% of the sample (Fig.5.2).



Fig. 5.1 Vegetables grown on the basis of use in Bhubaneswar. (Source from Author).

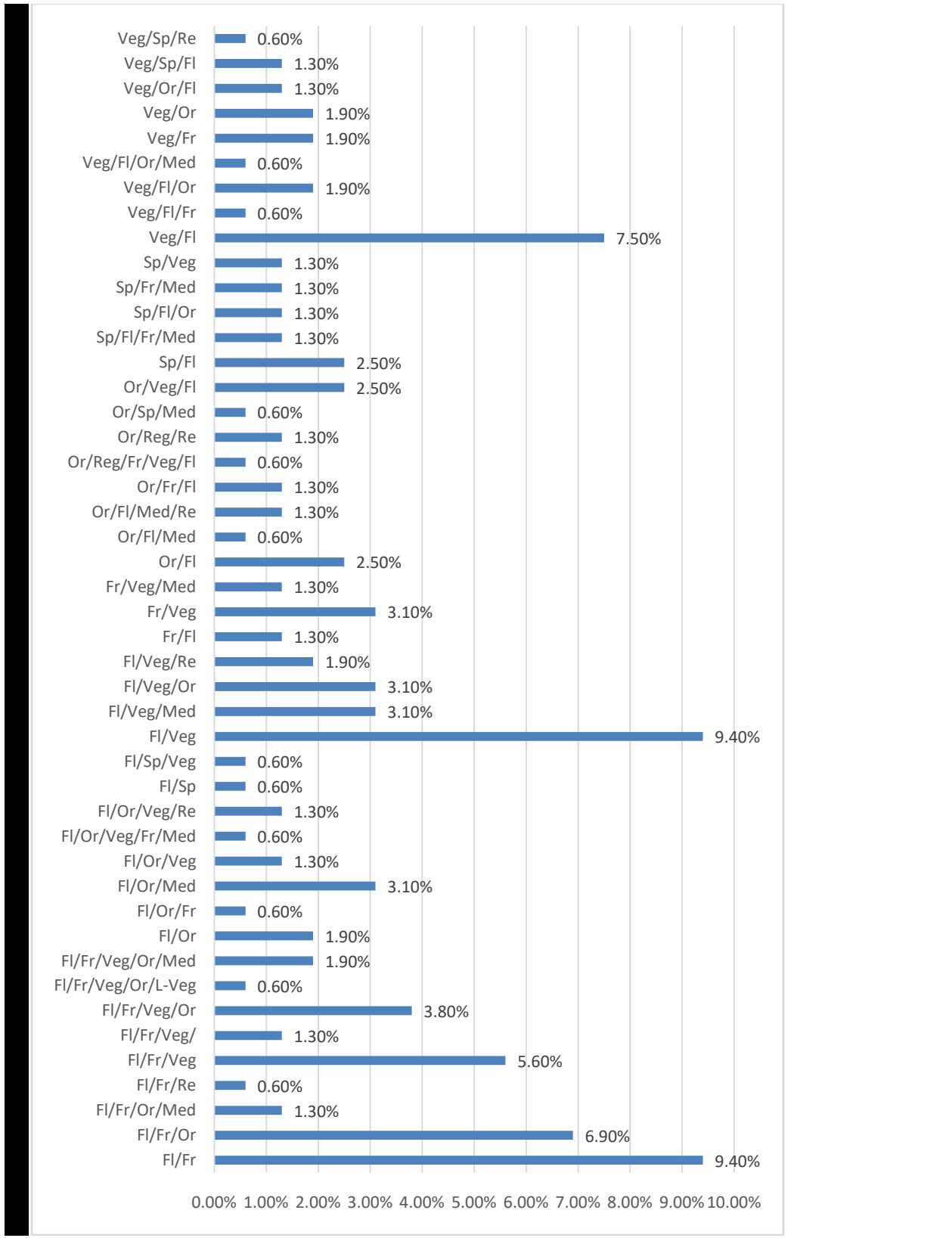


Fig. 5. 2 Majority combination groups integrated of plants cultivation.



Fig. 5. 3 Flowers grown in building based integrated farming in Bhubaneswar. (Source from Author).

5.2 Combination groups of containers in building integrated farming.

Table 5.2 Combination groups of containers.

Containers used.

	Frequency	Percent	Valid Percent	Cumulative Percent
C-pot	3	1.9	1.9	1.9
C-pot/GB	4	2.5	2.5	4.4
C-pot/Pl-drum	2	1.3	1.3	5.6
C-pot/pl-pot	1	.6	.6	6.3
C-pot/Pl-pot	5	3.1	3.1	9.4
CB/C-pot	2	1.3	1.3	10.6
CB/E-pot	2	1.3	1.3	11.9
CB/GB/JR	2	1.3	1.3	13.1
CB/JR	3	1.9	1.9	15.0
CB/Pl-drum	1	.6	.6	15.6
CB/Pl-pot	6	3.8	3.8	19.4
CB/Ply-B	3	1.9	1.9	21.3
E-pot	2	1.3	1.3	22.5
E-pot/C-pot	1	.6	.6	23.1
E-pot/CB	16	10.0	10.0	33.1
E-pot/GB	6	3.8	3.8	36.9
E-pot/Ply-B	4	2.5	2.5	39.4
GB/C-pot	1	.6	.6	40.0
GB/CB	14	8.8	8.8	48.8
GB/CB/C-pot	1	.6	.6	49.4
GB/CB/E-pot	1	.6	.6	50.0
GB/CB/JR	1	.6	.6	50.6
GB/CB/Ply-B	1	.6	.6	51.2
GB/E-pot	4	2.5	2.5	53.8
GB/E-pot/Ply-B	2	1.3	1.3	55.0
GB/JR/CB	2	1.3	1.3	56.3
GB/Ply-B	14	8.8	8.8	65.0
GB/Ply-B/E-pot/	4	2.5	2.5	67.5
GB/Ply-B/E-pot/CB	9	5.6	5.6	73.1

Valid Containers

GB/Ply-B/P-pot	1	.6	.6	73.8
JR/GB	2	1.3	1.3	75.0
JR/GB/CB	3	1.9	1.9	76.9
Pl-drum	2	1.3	1.3	78.1
Pl-drum/GB	4	2.5	2.5	80.6
Pl-drum/JR	5	3.1	3.1	83.8
Pl-pot/CB	6	3.8	3.8	87.5
Pl-pot/GB	2	1.3	1.3	88.8
Pl-tray	5	3.1	3.1	91.9
Pl-tray/E-pot	1	.6	.6	92.5
Ply-B/CB	2	1.3	1.3	93.8
Ply-B/GB	9	5.6	5.6	99.4
Ply-B/GB/E-pot	1	.6	.6	100.0
Total	160	100.0	100.0	

Abbreviation used in the table 5.2: C-Pot=Concrete pot/GB=Grow bag/Pl-drum=Plastic drum/Pl-pot=Plastic pot/CB=Cement carry bag/JR=Jar (plastic Jar)/E-Pot=Earthen pot/Ply-B=Plythene bag.

The table 5. 2 show the frequency and percentage distribution of various container combinations used in a study, with a total of 160 responses. Each container combination is listed under the "Valid" category, with specific combinations such as "C-pot," "CB/C-pot," and "GB/CB/E-pot." (Fig. 5.4). The "Frequency" column indicates the number of times each combination was used, while the "Percent" column shows the percentage of the total 160 responses. The "Valid Percent" column repeats these percentages, as all responses are valid. The "Cumulative Percent" column adds these percentages sequentially to indicate the running total. The most frequently used container combination is "E-pot/CB," accounting for 10% of the responses, followed by "GB/CB" and "GB/Ply-B," each with 8.8%. Less common combinations, such as "C-pot/Pl-pot" and "GB/CB/C-pot," appear at the lower end of the frequency distribution, each representing 0.6% of the total. The cumulative percentages help understand the incremental addition of each combination's frequency to the overall distribution, culminating in 100%.



Fig. 5. 4 Plants grown by the use of containers on building based integrated farming by urban farmers in Bhubaneswar. (Source from Author).

5.3 Combination categories of dominant methods used in cultivation.

Table 3.3 Distribution of different combination categories of dominant methods used in cultivation.

Types of dominant methods of cultivation

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid Gardens	Bed/Blr	5	3.1	3.1	3.1
	Bed/Blr/VrG	1	.6	.6	3.8
	Bed/Con	26	16.3	16.3	20.0
	Bed/Con/VrG	5	3.1	3.1	23.1
	Bed/Lw	13	8.1	8.1	31.3
	Bed/Lw/Blr	1	.6	.6	31.9
	Bed/Lw/VrG	2	1.3	1.3	33.1
	Blr/Bed	7	4.4	4.4	37.5
	Blr/Bed/VrG	5	3.1	3.1	40.6
	Blr/Con	2	1.3	1.3	41.9
	Blr/Lw	1	.6	.6	42.5
	Con/Bed	34	21.3	21.3	63.7
	Con/Bed/Lw	1	.6	.6	64.4
	Con/Bed/VrG	1	.6	.6	65.0
	Con/Blr	8	5.0	5.0	70.0
	Con/Blr/VrG	2	1.3	1.3	71.3
	Con/Lw	5	3.1	3.1	74.4
	Con/Lw/ Blr/Bed	1	.6	.6	75.0
	Con/Lw/Bed	2	1.3	1.3	76.3
	Con/Lw/Blr/ Bed/VrG	1	.6	.6	76.9
	Con/Lw/Blr/Bed	10	6.3	6.3	83.1
	Con/Lw/Blr/Bed/VrG	1	.6	.6	83.8
	Con/Lw/VrG	2	1.3	1.3	85.0
	Lw/Bed	1	.6	.6	85.6
	Lw/Bed/Blr	1	.6	.6	86.3
	Lw/Bed/Con	5	3.1	3.1	89.4
	Lw/Bed/Con/Blr	2	1.3	1.3	90.6
	Lw/Bed/VrG	4	2.5	2.5	93.1
	Lw/Blr	5	3.1	3.1	96.3
	Lw/Blr/Bed	1	.6	.6	96.9
Lw/Blr/VrG	1	.6	.6	97.5	
Lw/Con	4	2.5	2.5	100.0	
Total	160	100.0	100.0		

The table 5.3 reflected the distribution of different types of dominant cultivation methods among a sample of 160 respondents. Each method is identified by a combination of abbreviations: Bed (Bedding plants), Blr (Bleyer plants), (Fig.5.7) VrG (Vertical Gardening), Con (Containers), and Lw (Lawns) (Fig.5.5). The most common method is "Con/Bed" (Container and Bedding plants), used by 34 respondents, representing 21.3% of the total sample. Other notable combinations include "Bed/Con" (Bedding plants and Containers) and "Bed/Lw" (Bedding plants and Lawns),

each accounting for 16.3% and 8.1% respectively. Less common methods such as "Lw/Blr" (Lawns and Belyer plants) and "Blr/Lw" (Bleyer plants and Lawns) are each used by 5 respondents (3.1%). The table shows that some combinations, like "Con/Lw/Blr/Bed" and "Con/Lw/Blr/Bed/VrG", are extremely rare, each occurring only once (0.6%) (Fig. 3.2). Overall, the data indicates a diverse range of cultivation methods with varying levels of adoption among the respondents, with cumulative percentages illustrating the incremental addition of each method's frequency to the total process present in graph (Fig.5.6).



Fig. 5. 5 Plants grown in lawn farming of rooftop farming in Bhubaneswar. (Source from Author).

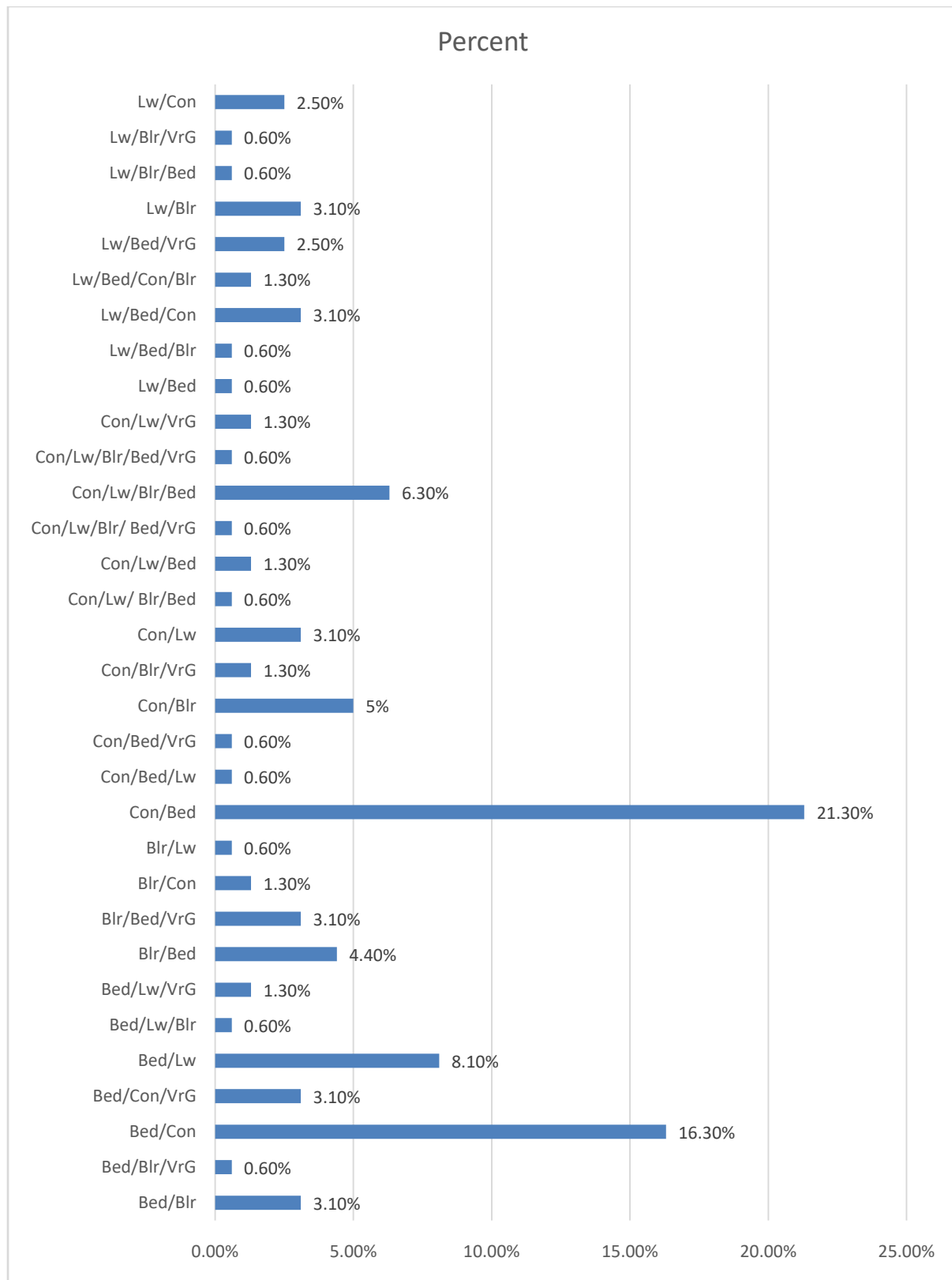


Fig. 5.6 Distribution of different types of dominant cultivation.



Fig. 5. 7 Vegetable grown by the help of belayed on rooftop farming in Bhubaneswar. (Source from Author).

5.4 Preparation and use of planted material.

Table 5.4 Preparation and use of planted material in building based integrated farming. Preparation and use of planted material.

	Frequency	Percent	Valid Percent	Cumulative Percent
Amrut arka	1	.6	.6	.6
Amrut sanjebani	1	.6	.6	1.3
Bin-Compost	24	15.0	15.0	16.3
Bin-Compost/Kitchen compost	1	.6	.6	16.9
Bin-Compost/Liquid media	1	.6	.6	17.5
Bin-compost/Mulch	1	.6	.6	18.1
Cocopeat/Liquid media	2	1.3	1.3	19.4
Compost	8	5.0	5.0	24.4
Compost media	2	1.3	1.3	25.6
Compost/Amrit Jal	2	1.3	1.3	26.9
Compost/Cocopeat	4	2.5	2.5	29.4
Compost/Liquid enzyme	2	1.3	1.3	30.6
Compost/Liquid fertilizer	1	.6	.6	31.3
Compost/Mulch	2	1.3	1.3	32.5
Enzyme Compost	1	.6	.6	33.1
Forest Com/Mulch	1	.6	.6	33.8
Forest Compost	1	.6	.6	34.4
Forest Compost/Kitchen compost	3	1.9	1.9	36.3
Forest Compost/Liquid media	2	1.3	1.3	37.5
Kitchen Compost	7	4.4	4.4	41.9
Kitchen compost/Cocopeat	2	1.3	1.3	43.1
Kitchen-Compost	6	3.8	3.8	46.9
Leaf Compost	4	2.5	2.5	49.4
Liquid Compost	8	5.0	5.0	54.4
Liquid fertilizer	2	1.3	1.3	55.6
Liquid media	3	1.9	1.9	57.5
Liquid media/Cocopeat	1	.6	.6	58.1

Valid Materials

Micro-bacterial	1	.6	.6	58.8
Open Compost	53	33.1	33.1	91.9
Open Compost/Amrut jal	1	.6	.6	92.5
Open Compost/Cocopeat	3	1.9	1.9	94.4
Open Compost/Enzyme	2	1.3	1.3	95.6
Open Compost/liquid arka	1	.6	.6	96.3
Open Compost/Liquid arka	1	.6	.6	96.9
Potted Compost/Mulch	2	1.3	1.3	98.1
Potted Compost/Cocopeat	2	1.3	1.3	99.4
Potted-Compost/Liquid arka	1	.6	.6	100.0
Total	160	100.0	100.0	

The table 5.4 explores the frequency and percentages of different types of planted material preparations and their usage. Among the 160 total responses, "Open Compost" is the most commonly used method, accounting for 33.1% of the total, followed by "Bin-Compost" and "Liquid Compost," each representing 15.0% and 5.0% respectively. Other combinations such as "Kitchen Compost," "Compost," and various mixed methods, including combinations with cocopeat, liquid media, and mulch, show lower frequencies, mostly around 0.6% to 4.4%. The cumulative percentage column shows the running total of the valid percentages, culminating at 100%. This indicates a diverse range of materials and combinations used in preparation, with a notable preference for open composting methods among respondents.

5.5 Used of soil in farming.

Table 5. 5 Different types of soils use.

Soil use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid Soil	Alluvial Soil	24	15.0	15.0	15.0
	Crop Field Soil	41	25.6	25.6	40.6
	Field Soil	3	1.9	1.9	42.5
	Garden Soil	53	33.1	33.1	75.6
	Loam Soil	37	23.1	23.1	98.8
	Sandy Soil	2	1.3	1.3	100.0
	Total	160	100.0	100.0	

The table 5.5 presents data on the frequency and distribution of different types of soil used. The soil types and their respective frequencies are as follows. Alluvial soil (24 occurrences, 15.0%), crop field soil (41 occurrences, 25.6%), Field Soil (3 occurrences, 1.9%), Garden Soil (53 occurrences, 33.1%), loam soil (37 occurrences, 23.1%), and sandy soil (2 occurrences, 1.3%). Each type's valid percent is equal to its frequency percent, indicating no missing data. The cumulative percent shows a running total of the percentages, reaching 100% with sandy soil. Garden soil is the most commonly used type at 33.1%, followed by crop field soil and loam Soil and while field soil and sandy soil are the least used (Fig.5.8). The total number of cases is 160, ensuring that all soil use categories sum up to 100% of the sample.

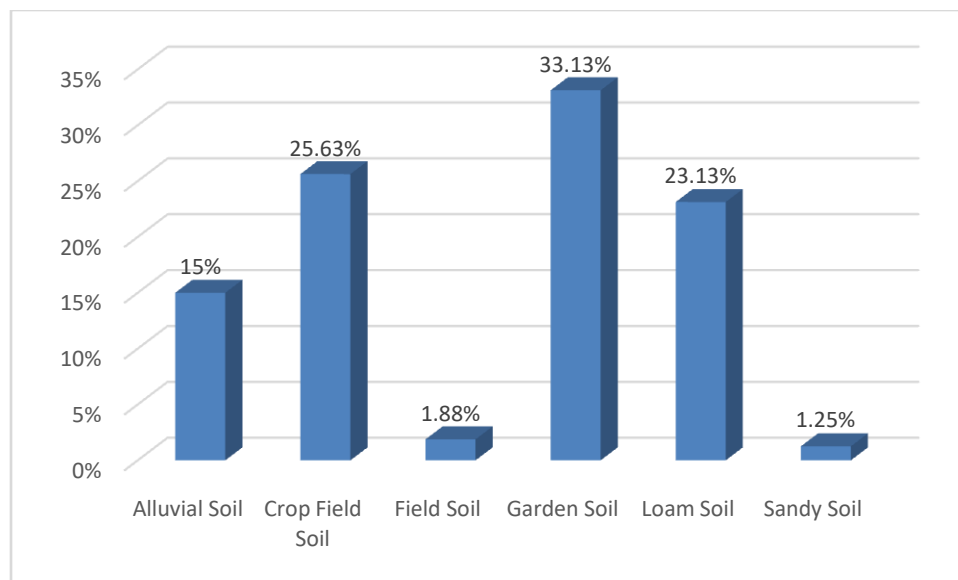


Fig.5.8 Different types of soils use.

5.6 Combinations of seeds, seedlings, and plants Parts (Propagules) used for building based integrated cultivation.

Table 5.6 Different combinations of seeds, seedlings, and plants cultivation.

Seed / Seedling/ Plants Cultivation

	Frequency	Percent	Valid Percent	Cumulative Percent
Rh/Sd	1	.6	.6	.6
Rh/Sdl	5	3.1	3.1	3.8
Rh/Tr	2	1.3	1.3	5.0
Rh/Tr/Sd	5	3.1	3.1	8.1
Rh/Tr/Sd/Sdl	3	1.9	1.9	10.0
Rh/Tr/Sdl/Sd	2	1.3	1.3	11.3
Sd/Rh	1	.6	.6	11.9
Sd/Rh/Tr	2	1.3	1.3	13.1
Sd/Rh/Tr/Sdl	1	.6	.6	13.8
Sd/Sdl	45	28.1	28.1	41.9
Sd/Sdl/Rh	4	2.5	2.5	44.4
Sd/Sdl/Rh/Tr	1	.6	.6	45.0
Sd/Sdl/St-cut	3	1.9	1.9	46.9
Sd/Sdl/Tr	2	1.3	1.3	48.1
Sd/St-cut	15	9.4	9.4	57.5
Sd/St-cut/Sdl/Rh	2	1.3	1.3	58.8
Sd/Tr	2	1.3	1.3	60.0
Sd/Tr/Rh	1	.6	.6	60.6
Sdl/Rh	3	1.9	1.9	62.5
Sdl/Sd	18	11.3	11.3	73.8
Sdl/Sd/Rh	2	1.3	1.3	75.0
Sdl/Sd/St-cut	1	.6	.6	75.6
Sdl/St-cut	5	3.1	3.1	78.8

Valid Propagule

Sdl/Tr	1	.6	.6	79.4
St-cut/Rh	2	1.3	1.3	80.6
St-cut/Rh/Tr	2	1.3	1.3	81.9
St-cut/Sd	15	9.4	9.4	91.3
St-cut/Sdl	5	3.1	3.1	94.4
St-cut/Sdl/Sd	1	.6	.6	95.0
Tr/Sd	2	1.3	1.3	96.3
Tr/Sd/Sdl	2	1.3	1.3	97.5
Tr/Sdl	1	.6	.6	98.1
Tr/St-cut	3	1.9	1.9	100.0
Total	160	100.0	100.0	

Abbreviation used in the table 5.6: Rh=Rhizome/Sd=Seed/Sdl-Seedling/Tr=Tuber/St-cut=Stem cutting (stomp).

The table 5.6 presents a detailed breakdown of different combinations of seed, seedling, and plant types used in cultivation, along with their frequencies and percentages. The total number of observations is 160. Each combination is listed with the frequency of occurrences, percentage of total responses, valid percentage, and cumulative percentage. For example, the combination "Sd/Sdl" appears most frequently, accounting for 28.1% of the responses. Other notable entries include "Sdl/Sd" (11.3%) and "Sd/St-cut" (9.4%). Combinations with lower frequencies, such as "Rh/Sdl" (3.1%) and "Tr/Sdl" (0.6%), are also included, showing the variety in cultivation

Practices. The cumulative percentage column indicates the cumulative total of each combination up to that point, providing an overall view of the distribution of cultivation practices across the dataset.

5.7 Water managements in building based integrated farming.

Table 5.7 Equipments and method of water supply.

Method of water supply.

	Frequency	Percent	Valid Percent	Cumulative Percent
Btl/ Spy	2	1.3	1.3	1.3
Btl/M/J	3	1.9	1.9	3.1
Btl/PP	15	9.4	9.4	12.5
Btl/Spy	15	9.4	9.4	21.9
M/J/Bol	1	.6	.6	22.5
M/J/Btl	12	7.5	7.5	30.0
M/J/Btl/Spy/PP	2	1.3	1.3	31.3
M/J/PP	18	11.3	11.3	42.5
M/J/PP/Spy/Bol	1	.6	.6	43.1
M/J/PP/Spy/Btl	7	4.4	4.4	47.5
M/J/Spy	15	9.4	9.4	56.9
Mug/Jar/Btl	2	1.3	1.3	58.1
Mug/Jar/PP/Spy	1	.6	.6	58.8
Mug/Jar/PP/Spy/Btl	4	2.5	2.5	61.3
Mug/PP	2	1.3	1.3	62.5
Mug/Spy	1	.6	.6	63.1

PP/Btl	10	6.3	6.3	69.4
PP/M/J	6	3.8	3.8	73.1
PP/Spy	10	6.3	6.3	79.4
Spy/Btl	12	7.5	7.5	86.9
Spy/M/J	8	5.0	5.0	91.9
Spy/PP	13	8.1	8.1	100.0
Total	160	100.0	100.0	

Abbreviation used in the table 5.7: Btl=Balty/Spy= spey/M=Electric motor by pipe/J=Jar /Bot= Bottle /PP=Plasic pipe/Mug=Mug(plstic).

The table 5.7 present data on various methods of water supply among 160 respondents. The different combinations of water supply methods are listed in the first column, with their corresponding frequencies and percentages provided in subsequent columns. The most common methods include "M/J/PP" (11.3%), "Spy/PP" (8.1%), and "PP/Btl" (6.3%). Less common methods, with only 0.6% each, include "M/J/Bol," "M/J/PP/Spy/Bol," "Mug/Jar/PP/Spy," and "Mug/Spy." The "Valid Percent" column mirrors the "Percent" column, as there are no missing values. The "Cumulative Percent" column indicates the running total percentage, showing the accumulation of each method's percentage as we move down the list. The cumulative percent reaches 100% at the end, indicating that all methods of water supply have been accounted for.

CONCLUSION

A method of urban agriculture that is both practical and forward-thinking to the issue of urban food security is the growth of crops on urban agriculture, which has emerged as a potential opportunity. This method, which involves the growing of food and flowers (ornamental) plants on building rooftops, offers a myriad of benefits, including improved air quality, enhanced building insulation, and the availability of fresh, locally grown veggies. In addition to making the most efficient use of vacant urban spaces, this practice also offers a multitude of other advantages. Techniques like as hydroponics, aquaponics, soil-based systems, and vertical gardens are examples of methods that can be utilized to the fullest extent possible in order to maximize the utilization of space and resources. Effective waste management solutions, such as composting and recycling, contribute to the further enhancement of sustainability by reducing the environmental imprint and enhancing resource efficiency. This is accomplished through the reduction of their environmental impact. The practice of urban agriculture is associated with containers gardens, use of manure, water supply and the production of local fresh organic food on buildings of the cities.

CONFLICT OF INTEREST

The research carried out in own interest of author and it has partial work of the Ph D. thesis of the Author. Further the own funding has been spent in research work by author. No, any funding from other sources spend towards the research, the research work have not any conflict of interest as per my faith and believe.

REFERENCES

1. Abu, G. A., & Soom, A., (2016). *Analysis of factors affecting food security in rural and urban farming affecting household food security status among rural and urban farming households of Benue State, Nigeria.*

2. Ackerman, K., Conard, M., Culligan, P., Plunz, R., Sutto, M. P., & Whittinghill, L., (2014). *Sustainable food systems for future cities: The potential of urban agriculture*. The economic and social review, 45(2, Summer), 189-206.
3. Alaima, K., Packntt, E., Miles, R. A., Kruger, D. J.. (2008). Fruits and vegetable intake among urban community gardeners. *NutrEduct Behav* 40:94-101.doi:10.1016/j.jneb.2006.12.003
4. Choguill, C. L. (1995). Urban Agriculture and Cities in the Developing World, *Habitat International*, Vol. 19, No. 2 pp.149-235.
5. Estee, L.Y., Kishnani, N. T., (2010). Building-Integrated Agriculture: Utilizing Rooftops for Sustainable Food Crop Cultivation in Singapore. *J. Green Build.*, 5, 105–113. doi.org/10.3992/jgb.5.2.105 [Google Scholar] [Cross Ref.]
6. Feininger, U.B., Specht, K, Swaicks, M. (2015). There’ something’s growing on the roof, Rooftops greenhouses .idea, planning, implementation .Leibniz Center for Agricultural Landscape Research (ZALF), Munch berg.
7. Gajbe, P. U., (2021). *Urban rooftop farming Model for sustainable vegetable production and environmental well being*. *Agricultural Science Digest A Research Journal*, 41(spl), 211-214.
8. Jha, R. K., Bhattarai, N., Suraj, K. C., Shrestha, A. K., Manahar, K., (2019). *Rooftop Farming: An Alternative to Conventional Farming for Urban Sustainability*. *Malaysian Journal of Sustainable Agriculture (MJSA)*, Doi.Org/10.26480/Mjsa.01.2019.39.43
9. SanyéMengual, E., Anguelovski, I., Oliver Solà, J., Montero, J. I., & Rieradevall, J., (2016). *Resolving differing stakeholder perceptions of urban rooftop farming in Mediterranean cities: promoting food production as a driver for innovative forms of urban agriculture*. *Agriculture and human values*, 33, 101-120.
10. Sanye-Mengual, E., Orsini, F., Oliver-Sola, J., Rieradevall, J., Montero, J.I., Gianquinto, G., (2015). *Techniques and Crops for Efficient Rooftop Gardens in Bologna*, Italy. *Agron. Sustain. Dev.*, 35, 1477–1488. doi org/10.1007/s13593-015-0331-0 [Google Scholar] [Cross Ref.] [Green Version]
11. Specht, K., Schimichowski, J., Fox-Kämper, R. Weith, T., Barkmann, T., Gaasch, N., Rogga, S., Strauß, C., Zscheischler, J., (2021). *Multifunctional Urban Landscapes: The Potential Role of Urban Agriculture as an Element of Sustainable Land Management*. In *Sustainable Land Management in a European Context. Human-Environment Interactions*, Eds., Springer: Basel, Switzerland, Volume 8, pp. 291–303. doi.org/10.1007/978-3-030-50841-8_15 [Google Scholar]
12. Torreggiani, D, Dall, Are E, Taissenari, P., (2012). The urban nature of agriculture: bidirectional trends between city and countries .*cities* 29:412-416.doi.10.1016/J.cities.20001.012.0006.