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Original Research Paper

Socio-economic outcome of urban horticulture on urban & peri urban communities in South India

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ABSTRACT

Global population will reach around nine billion by 2050, with 70% urbanized. In India, nearly 900 million people are predicted to live in cities by 2050, raising serious concerns about food and nutritional security. Urban horticulture offers a promising solution to improve social and environmental conditions in cities. This study examines urban horticulture practices, socio-economic benefits and constraints encountered by 51 respondents from 5 southern states, guided by ICAR-Indian Institute of Horticultural Research, Bengaluru. Dominant diversified crop models practiced were tomatoes + brinjal + chilli, amaranthus + coriander + spinach + fenugreek + mint, guava + papaya + mango. Respondents typically spent 1–5 hours daily on urban horticulture for chemical-free food (92%) and stress relief (69%). After adopting urban farming, 67% reduced market visits to 1-2 times, while 33% reduced to 3–5 times. Monthly savings varied from Rs.200/- to Rs.1000/- per individual. Adoption rates include Arka Isha and Arka Suguna (90%), Arka Suryamukhi (27%). Technologies like Arka Sasya Poshak Ras and Arka Neem Soap enabled savings of Rs.1000/- to Rs.3000/- while Arka Rakshak, Arka RTF mushroom bags, Arka Meghana, Arka fermented cocopeat, Arka microbial consortium, grow bags etc. yielded savings over Rs. 5000/- annually for few respondents. Major challenges include pest infestation (35.29%), space limitations (27.45%), and knowledge gaps (23.53%), drawing attention towards increased awareness and capacity development.

Keywords: Adoption, capacity development, food security, socio-economic analysis, urban horticulture

INTRODUCTION

Urban horticulture transforms urban spaces into productive areas, growing food within city limits to address global food security (FAO, 2018). Techniques such as hydroponics and rooftop gardening efficiently use urban space, providing health benefits (fresh, nutritious food), economic benefits (reduced food costs), and environmental benefits (lower food miles, waste recycling) (Mok et al., 2014; Alaimo et al., 2008; Goldstein et al., 2016; Orsini et al., 2014). Integrating urban farming into city planning is vital (Mougeot et al., 2000) as it strengthens food security, sustainable land use, and community livelihoods. In India, it tackles food insecurity and empowers women, as shown in Bengaluru, Hyderabad, Thiruvananthapuram and Delhi cities study (Bhati & Dubey, 2023; Kaushik et al., 2023; Deka & Choudhury, 2024; Singh & Rajan, 2022). The objective of the study was to analyse the socio-economic outcome of urban horticulture among practicing trainees of ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru, India for enhancing income and nutritional security.

MATERIALS & METHODS

Socio-economic analysis was conducted on 51 respondents who participated in urban horticulture training at ICAR-IIHR, Bengaluru during 2022 and 2023. Data was collected through structured interviews, online questionnaires and telephonic surveys. The study focused on relationships between socio-economic variables using Karl Pearson's correlation coefficient. A purposive sampling approach involved 51 participants from Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, and Kerala who had received ICAR-IIHR training. While this ensured direct exposure to urban horticulture technologies, it may introduce selection bias. Consequently, findings may not be fully representative of the broader population of urban farmers, and generalization beyond similar training contexts should be undertaken with caution.

Table 1 : Socio-economic analysis of urban horticulture respondents (n=51)

Variable	Category	%
Age	20-30	7.84
	30-40	8.00
	40-50	19.00
	>50	20.00
Gender	Male	57.00
	Female	43.00
Education	Ph.D.	15.69
	Master degree	19.61
	Bachelor degree	41.18
	Diploma	7.84
	Others	15.69
Occupation	Professor	13.73
	Self employed	11.76
	Engineer	5.88
	Home maker	15.69
	Entrepreneur/Business	21.57
	Govt Employees	11.76
	Private employee/others	19.61
Number of family members	2	13.73
	3	11.76
	4	45.10
	5	9.80
	6	11.76
	7	5.88
	>10	1.96
Experience in urban farming	0 - 3 years	50.98
	3 - 6 years	27.45
	6 - 9 years	5.88
	9 - 12 years	3.92
	>12 years	11.76
Source of information	You tube channels	47.06
	Facebook/instagram	3.92
	Newspapers magazines	0.00
	Fellow farmers/neighbours	7.84
	Trainings	29.41
	Others	11.76
Source of seed/inputs purchase	Online sites/Apps	17.65
	Private enterprises/Companies	23.53
	Nurseries	21.57
	Government institutes (Agri./Horti. departments)	13.73
	Others	23.53
Source of irrigation	Ground water	35.30
	Municipal water	21.60
	Municipal water + ground water	37.30
	Rainwater alone	2.00
	Municipal and rain water	3.90
Participation in urban farming	You alone	52.00
	Complete family labor	38.00
	Labourers from outside	4.00
	Women + Men	6.00

Table 2 : Characteristics determining the adoption of urban horticulture as perceived by respondents (n=51)

Variable	Category	%
Area under urban farming	1-100 sq. ft.	17.65
	100-200 sq. ft.	7.84
	200-300 sq. ft.	9.80
	300-400 sq. ft.	5.88
	400-500 sq. ft.	7.84
	500-600 sq. ft.	5.88
	600-700 sq. ft.	7.84
	700-800 sq. ft.	5.88
	800-900 sq. ft.	1.96
	1000-1500 sq. ft.	17.65
	2000-3000 sq. ft.	5.88
	3000-4000 sq. ft.	1.96
	43560 sq. ft. (1 acre)	3.92
Average time spent	1 h	47.06
	2 h	25.49
	3 h	11.76
	4 h	9.80
	>5 h	5.88
Location of urban farming	Roof-top	15.69
	Backyard	7.84
	Household surrounding	23.53
	Exclusive land area outside of house	9.80
	Balcony	1.96
	Terrace	41.18

Conceptual framework

The study is grounded in the theory of diffusion of innovations, which explains how new technologies in this case, ICAR-IIHR urban horticulture interventions are adopted by a social system.

- Input variables (independent): Socio-economic characteristics (age, education, occupation) and resource allocation (cultivated area, time investment, experience) etc.
- Intervening variables (process): Adoption of ICAR-IIHR technological innovations and Information sources (YouTube, training) etc.
- Outcome variables (dependent): Economic gains (monthly savings, reduced market visits and reduced expenditure).

Research questions

- How do the demographic profiles (age, education, occupation) of urban dwellers influence their engagement with urban horticulture?
- To what degree does the adoption of ICAR-IIHR technologies result in measurable household economic savings and reduced market dependency?
- What is the nature of the relationship between resource allocation (time, area, experience) and the economic outcomes of urban horticulture?

Research hypothesis

- **Null hypothesis (H_0):** Adoption of ICAR-IIHR technologies and diversified crop models has no significant impact on the socio-economic status of urban practitioners.

- **Alternative hypothesis (H_1):** Adoption of ICAR-IIHR technologies and diversified crop models significantly improves socio-economic outcomes of urban practitioners.

The study focused on relationship between different socio-economic variables using Karl Pearson's correlation coefficient. N-Gram analysis using Python's NLTK was employed for crop combinations and descriptive statistics for data trends. Pearson assumptions was used to verified linearity and normality for $p < 0.05$ and $p < 0.01$ levels.

RESULTS & DISCUSSION

Socio-economic analysis of urban horticulture practising respondents

A perusal of socio-economic variables in Table 1 indicates that most respondents belonged to the >50 years age group (20%), followed by 40-50 years (19%), while, younger respondents were fewer in the 30-40 years (8%) and 20-30 years (4%) categories. Gender-wise, males constituted 57% and females 43% of respondents. Regarding education, most were well educated, with 41.18% holding a Bachelor's degree and 19.61% a Master's degree, followed by Ph.D. holders (15.69%), diploma holders (7.84%), and others (15.69%).

The occupational profile showed a higher proportion of entrepreneurs or business owners (21.57%), followed by private employees and others (19.61%), homemakers (15.69%), professors (13.73%), self-employed individuals and government employees (11.76% each), and engineers (5.88%). Most households had four family members (45.10%). In terms of urban farming experience, 50.98% were beginners (0-3 years), followed by 27.45% with 3-6 years and 11.76% with more than 12 years. YouTube channels were the main information source (47.06%), and seeds and inputs were procured mainly from private enterprises (23.53%) and nurseries (21.57%). Irrigation was primarily through municipal water and groundwater (37.30%). More than half (52%) practiced urban farming individually, while 38% involved complete family labour.

Characteristics determining the adoption of urban horticulture as perceived by respondents

Equal proportions (17.65% each) practiced urban horticulture in 1–100 sq. ft. and 1000–1500 sq. ft., while fewer used 2000–3000 sq. ft. (5.88%) or one acre (3.92%) (Table 2). Most devoted one hour per day (47.06%), followed by two hours (25.49%) and three hours (11.76%). Terraces were the most commonly used space (41.18%), followed by household surroundings (23.53%), rooftops, exclusive land areas, backyards, and balconies, indicating diverse spatial settings under varying constraints.

Reasons for practicing urban horticulture as perceived by respondents

Most respondents (92.15%) grew food for chemical-free produce, indicating health as the primary motivation. Enjoyment (82.35%) and stress relief (68.62%) further highlight lifestyle benefits (Table 3). Environmental considerations motivated 50.98%, while better flavour (58.82%) and emotional well-being (45.09%) were secondary drivers.

Table 3 : Reasons for practicing urban horticulture as perceived by respondents (n=51)

Reasons for practicing urban farming as perceived by respondents	%
I want a chemical free food	92.15
I enjoy the activity	82.35
It relieves stress	68.62
I enjoy the flavour of home-grown food	58.82
It is good for the environment	50.98
For emotional well being	45.09

Economic analysis of urban horticulture

Impact of urban horticulture on reducing market visits per month

The reduction in market visits associated with urban horticulture (Fig. 1), with 36.5% of respondents limiting visits to once per month and 30.8% to 1-2 visits. Another 23.1% reduced visits to 2-3 times, while only 9.6% reported 4-5 visits per month. This distribution suggests that access to home-grown produce lowers dependence on markets, resulting in savings in food expenditure, time, and effort required for routine purchases.

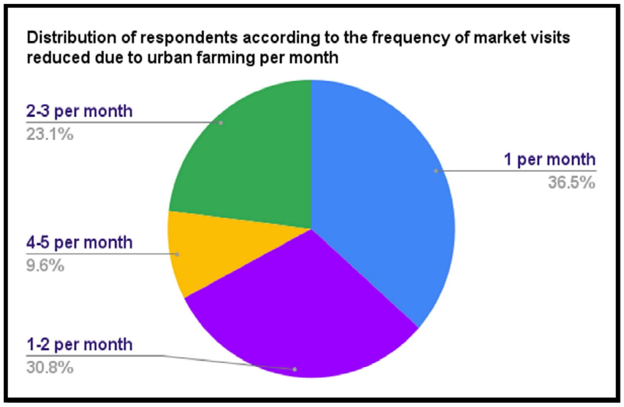

Fig. 1 : Distribution of respondents according to the frequency of market visits reduction

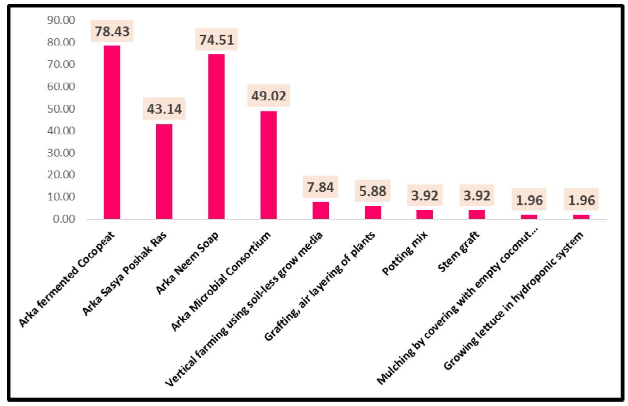

Fig. 2 : Distribution of respondents according to the innovations/better practices used in urban horticulture

Impact of training for adoption of innovation or better practice in urban horticulture

Arka fermented cocopeat recorded the highest adoption (78.43%), followed by Arka Neem Soap (74.51%), Arka Microbial Consortium (49.02%), and Arka Sasya Poshak Ras (43.14%) (Fig. 2). Cocoponics, being a relatively new practice, showed moderate adoption (14%), reflecting emerging interest among trainees. Other practices, including vertical farming, grafting, mulching, potting mix, and hydroponic lettuce cultivation, showed limited adoption (d ≤ 84%), indicating scope for targeted extension interventions.

Diversified crop farming models practiced under urban horticulture

The diversified cropping patterns under urban horticulture (Fig. 3) and illustrated through a respondents N-gram in Fig. 4, representing the frequency of crops grown based on respondent numbers. Tomato was the most commonly cultivated vegetable (38 respondents), followed by chilli (30), beans (27), ridge gourd (25), brinjal (17), and pumpkin (14), along with bitter gourd, bottle gourd, drumstick, and radish. Less common vegetables like broccoli, carrot, and cowpea were reported by 2-6 respondents. Among leafy vegetables, coriander and amaranthus were most popular (46 each), followed by spinach (36), fenugreek (24), mint (12) and mesta (10). In fruit cultivation, mango dominated (9), followed by guava, fig, banana (5-6), and water apple, mulberry, sapota (4 each). The N-gram visually represents crop diversification by scaling crop names according to respondent numbers.

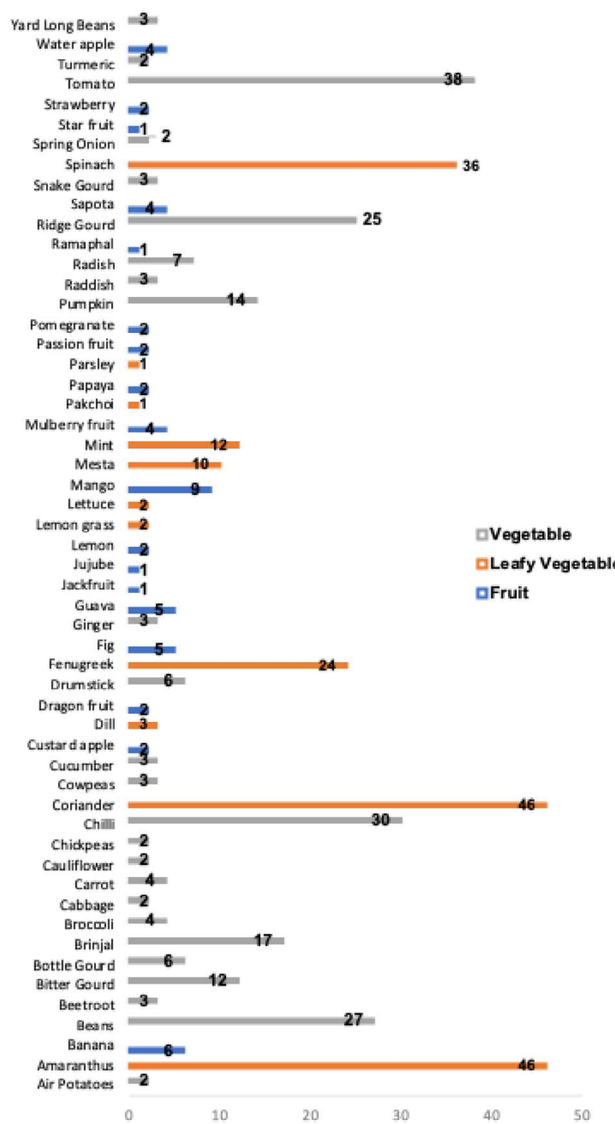

Fig. 3 : Diversified crop farming practiced under urban horticulture

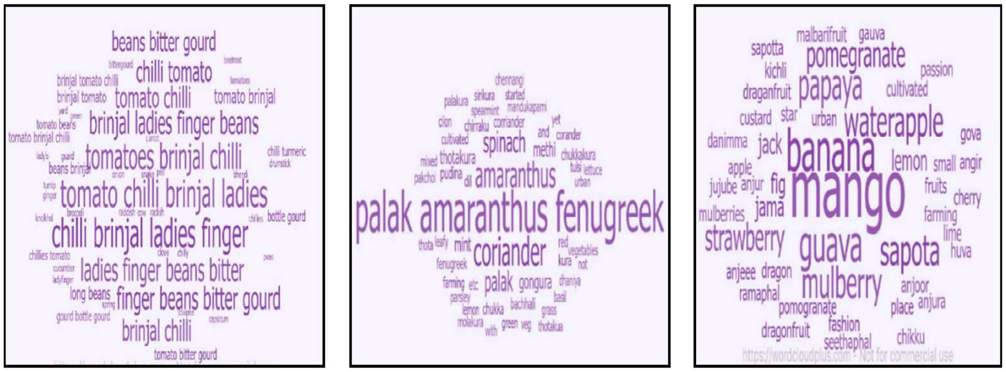

Fig. 4 : Respondents N gram on list of vegetables, green leafy vegetables and fruits farming models grown under urban farming

Impact on range of monetary savings from vegetables & green leafy vegetable cultivation per month

In vegetable cultivation, 16% saved Rs.100/month, followed by Rs.200 (15%), Rs.300 (13%), Rs.400 (10%), Rs.600 (11%), and Rs.1,000 (12%) (Fig. 5). For green leafy vegetables, 41% saved Rs.100/month, 20% Rs.200, with additional savings of Rs.400–Rs.1,000 reported by 6–8% of respondents. These findings indicate that urban horticulture contributes to tangible household-level cost savings.

Impact of the adoption rate & the monetary savings of ICAR-IIHR technologies

Arka Isha (coriander) and Arka Suguna (amaranthus) recorded highest adoption (90% each), with 21% and 17% reporting annual savings of Rs.1,000–2,000, respectively (Fig. 6). Arka Rakshak (tomato) and Arka Neem Soap showed 74% adoption; 26% of Arka Rakshak adopters saved > Rs.5,000 annually. Arka Fermented Cocopeat (78% adoption) resulted in annual savings of Rs.2,000–5,000 for 25% of users, while 12% reported savings exceeding Rs.5,000. Arka Microbial Consortium (49% adoption) yielded savings of more than Rs.5,000 for 8% of users and Rs.1,000–2,000 for 24%. Arka Sasya Poshak Ras (43% adoption) generated savings of Rs.1,000–2,000 and Rs.2,000–3,000 for 23% and 22% of adopters, respectively. Grow bags (49.00% adoption) resulted in annual savings of Rs.1,000–2,000 for 40% of users, while, 20% saved more than Rs.5,000. Adoption of Arka Mushroom RTF bags (39) and Arka Suryamukhi (27%) also generated measurable savings. These savings reflect reduced dependence on costlier private inputs through ICAR–IIHR technology adoption.

Relationship between the socio-economic variables

Age exhibited positive correlations with gardening hours (r=0.313*) and farming experience (r=0.274*) (Table 4; $p < 0.05$; $p < 0.01$). Gender showed moderate association for selling produce with positive correlation for males r=0.365*, negative correlation for females r=-0.325* indicating market participation differences. Education correlated strongly with occupation (r=0.513**). Gardening hours and experience were strongly correlated (r=0.523**), suggesting continued engagement enhances skills; hours showed weak negative correlation with occupation (r=0.293*), indicating occupational demands may constrain time. Area under urban farming was moderately correlated with selling produce (r=0.389**) and monthly savings (r=0.502**), implying larger spaces facilitate surplus

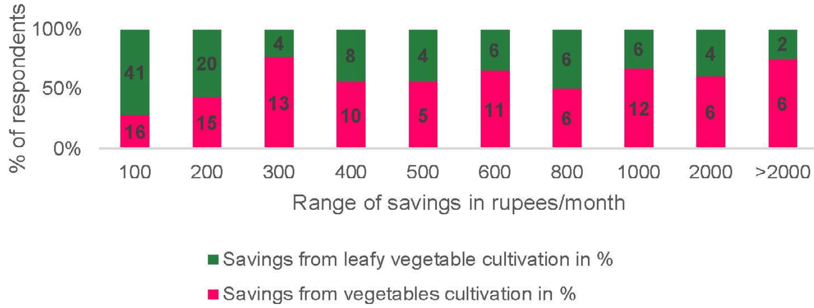

Fig. 5 : Distribution of respondents according to monetary savings of vegetables cultivation/ month

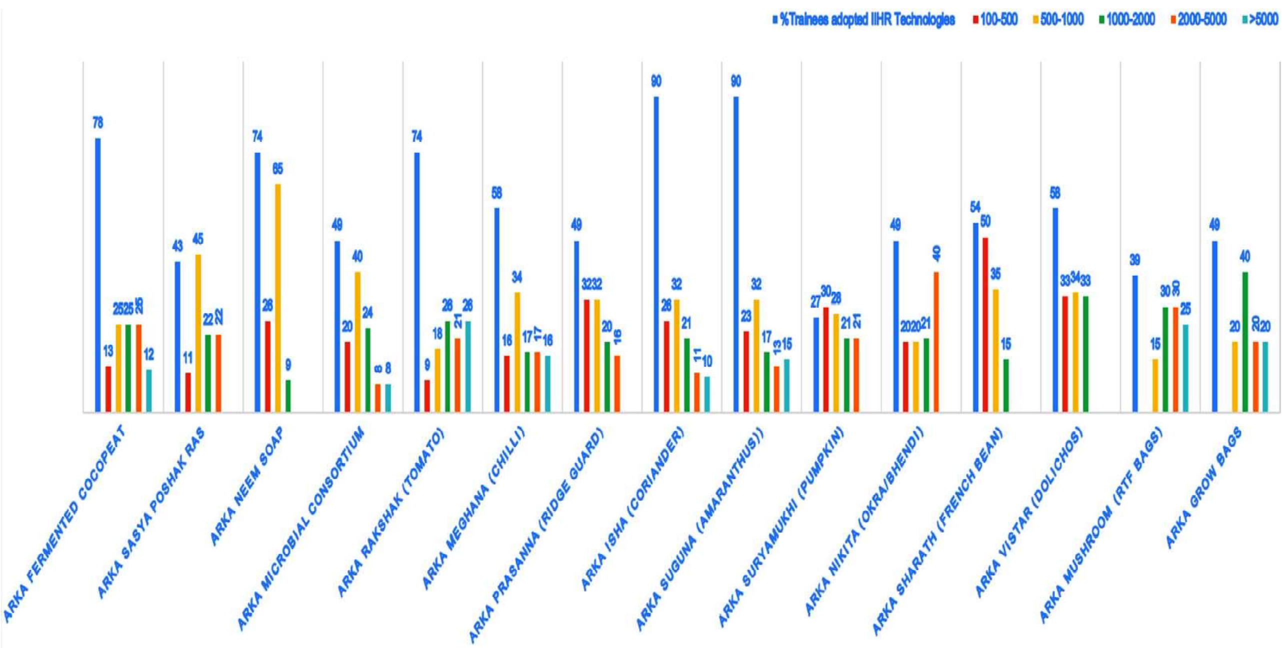

Fig. 6 : Distribution of respondents according to the adoption & monetary savings of ICAR-IIHR technologies

production. Selling produce showed strong correlation with monthly savings (r=0.667**).

Constraints faced in urban horticulture by respondents

The constraints are illustrated in Fig. 7, sucking pests and insect infestations (35.29%), space limitations (27.45%) and lack of technical knowledge (23.53%) were the main challenges. High input costs (13.73%), heavy rainfall (11.76%), monkey-related problems (9.80%) and water seepage on terraces (7.84%) were also reported. These findings highlight the need for improved pest management, space-efficient technologies, and targeted training to enhance urban farming sustainability.

Table 4 : Correlation matrix with r values depicting the relationship between the Socio-economic variables

Particular	Age	Male	Female	Education	Occupation	Family member	Gardening (hours/day)	Experi-ence	Approximate area urban farming	Share with neighbours	Sell Produce	Savings/ month
Age	1	0.222	-0.221	-0.174	-0.263	-0.043	0.313*	0.308*	0.092	-0.141	0.081	0.071
Male	0.283*	1	-1	-0.080	0.041	0.072	0.124	-0.164	0.081	-0.047	0.365*	0.212
Female	-0.283*	-1	1	0.080	-0.041	-0.072	-0.124	0.164	-0.081	0.047	-0.325*	-0.213
Education	-0.171	-0.080	0.083	1	0.513**	0.018	0.018	0.175	-0.026	0.144	0.024	0.090
Occupation	-0.294*	0.041	-0.045	0.513**	1	0.057	-0.246	0	0.087	-0.053	-0.054	-0.033
Family members	-0.040	0.071	-0.076	0.015	0.056	1	-0.033	-0.134	-0.118	0.092	-0.037	-0.074
Gardening h/day	0.313*	0.124	-0.128	0.011	-0.293*	-0.035	1	0.523**	0.144	0.274*	0.189	0.297*
Experience	0.274*	-0.165	0.163	0.172	0	-0.136	0.523**	1	-0.117	-0.223	0.191	0.183
Approximate area of your urban farming	0.092	0.080	-0.081	-0.022	0.083	-0.114	0.144	-0.113	1	0.091	0.389**	0.502**
Share with neighbours	-0.146	-0.043	0.044	0.146	-0.056	0.093	0.285*	-0.042	0.098	1	0.112	0.284*
Sell Produce	0.085	0.365*	-0.325*	0.025	-0.054	-0.031	0.183	0.194	0.389**	0.132	1	0.667**
Savings per month	0.071	0.212	-0.213	0.090	-0.033	-0.074	0.297*	0.183	0.502**	0.284*	0.667**	1

R: correlation co-efficient, **: Significant at 1% level, *: significant at 5% level

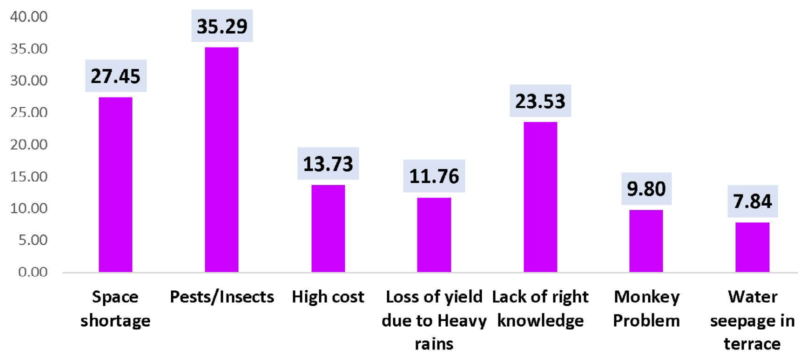

Fig. 7 : Distribution of respondents according to the constraints faced in urban horticulture

CONCLUSION

In this study, urban horticulture yielded measurable household benefits, including reduced market visits, monetary savings, and improved access to chemical-free vegetables and leafy greens. High adoption of selected ICAR–IIHR technologies reduced reliance on costlier private inputs, improving economic efficiency. Correlation analysis showed that experience, time invested, cultivated area, and market participation were positively associated with economic outcomes. However, respondents reported constraints such as pest incidence, space limitations, high input costs, and knowledge gaps. These findings highlight the need for targeted capacity-building, improved pest management, and promotion of space-efficient technologies to enhance productivity and sustainability of urban horticulture systems in urban & peri urban Communities.

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