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How does the city grow farms? The resource utilisation and diversity pattern in urban farming

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Abstract

Increased population density and urbanisation pushed the city dwellers to adopt an eco- innovative way for food system which could provide nutritional security to them. The concept of urban farming emerged as an economically feasible solution which ensures food justice to urban population. Cities are always complex and considered as poor in the case of resource availability for farming. And the major constraints include, space, labour, time and water. These diminishing factors could decide the structure and components in the farm. The analysis on the resource utilisation and system diversity could help to formulate a sustainable city development plan. The study conducted in two major corporations of Kerala, i.e. Kochi and Calicut. And the results showed that, even though the farmers had resource constraints, they could include different components like horticulture crops, cereals and livestock rearing.

Keywords: urban farming, resource utilisation, components in urban farming, challenges in city

1. Introduction

When there is a need existed for quality food access to all categories of people, urban agriculture could act as a solution. It will assure provision of healthy food to all categories of people without any gender disparity and socio economic differences. The concept of urban agriculture includes both food and non-food production such as cultivating crops and doing animal husbandry activities within the urban areas or in peri urban areas not only as a healthy food system source but also as a profitable income oriented employment for urban citizens. Ruel., *et al.* (2017) ^[13], Kontothanasis (2017) ^[8].

Hence it could reduce the dependence of cities on rural areas and thereby it can reduce the food mile between the producer and consumer distance. Bannor *et al.* (2020) ^[2].

The scope of urban farming extends from ensuring quality food to stabilising the urban environment. Growing crops in their spaces improved the individual fresh food availability, food accessibility and also the daily nutritional intake as per the diet recommendation and in turn the household food security. Kennard & Bamford (2020) ^[7] Palar, *et al.* (2019) ^[12] and Salleh *et al.* (2020) ^[14]. On the other side, urban agriculture had a greater role in maintaining the environmental dimension for the sustainable city development. Sylla, *et al.* (2020) ^[15], Gasparatos (2020) ^[5].

Cities are always considered as vulnerable and urban farming is considered as a complex with the environment because of the need for its survival with minimum resources. The reduced per head land availability made the urban dwellers to take decisions based on the economic benefits. Hence the priority turned towards matters other than farming.

Since urban residents have challenges in assembling the resources, the investment found to be more for urban farming. Converting this informal farming system to formal practices can make it affordable and economically profitable.

The sources of labour can be different as per their size and components of the urban farms. The factors like seasonality of agricultural works, high cost labour, low self-esteem feeling and participation in MGNREGA programme contributed to less availability of skilled labours for farming in cities. In this scenario, compared to full dependence on hired labours, the urban farmers may prefer family labour or combination of both for agricultural activities. Mugisa *et al.* (2018) ^[11], Chandra & Diehl (2019) ^[3], Al-Mayahi *et al.* (2019) ^[1].

Irrigation is considered as the major challenging task in farming, since it involved the willingness of payment for water in cities. Less ground water table in cities made the residents to depend water on payment for household purposes. An efficient use of available water resources is needed for the sustainable urban environment. Hence, the use of treated waste water and grey water for irrigation in urban farming could be considered.

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Miller-Robbie *et al.* (2017) [11].

The access and management of inputs such as seeds, manures & fertilizers is found to be a cumbersome process in cities. Hence there is difference in adoption of cultivation practices. Based on the easiness in input availability and attitude of the farmer, the cultivation methods could be organic or conventional methods. And it can make impacts on the merits they get from doing agriculture.

Time could be the basis for all activities. In urban farming also time utilisation pattern is different for each respondent. And this over dependence on markets for all resources made farming preparation more time consuming and less cost effective.

Within these constraints, the farming is found to be very challenging for community. But there are many improved cropping systems and cultural practices which can challenge this constraint. And a diversity in cropping pattern with various components like apiculture, pisciculture etc., can improve the nutritional security and ecological balance. Hussain, *et al.* (2019) [6], Gasparatos (2020) [5] and Feldmann & Vogler (2021) [4].

The above mentioned constraints are different for each urban community. Based on the degree of constraints, farming practices could be specific to each urban micro location. This clearly identifies the need for analysis on different resource utilisation pattern and the resulted diversity in the urban farming practices. Hence the study is focussed on the analysis of nature of cultivation practices, labour utilisation pattern, time utilisation pattern and water source for farming. Also it analyses that, within these challenges, what are the different components included in their farming spaces.

2. Methods

According to the 2011 census report, nearly half (47.72 per cent) of the population in Kerala residing in cities. The state consists of 6 corporations and 87 municipalities. There are many schemes and projects initiated by Government and 'Promotion of micro irrigation and fertigation-Wick Irrigation' was a major among them. Hence based on the active participation of urban people, two corporations, Kochi and Calicut were selected for the study. The scheme will support the urban agriculture by providing assistance for the implementation of micro irrigation units for farming through Krishi Bhavans (Agricultural Offices).

From each corporation, three prominent Krishi Bhavans with highest number of beneficiaries of the scheme were considered for the respondents' selection. One third (33.33 per cent) of the total active participants were considered as the sample for the study and accordingly the sample size was fixed as 189 respondents. The sample respondents were selected from the above two corporations by employing proportionate random sampling technique.

Based on the research, Ex post facto research design was selected for the study. And the data were collected using a pre tested interview schedule. The collected data were tabulated and analysed using MS Excel and IBM SPSS 21.0 statistical analytical tools.

3. Results and Discussion

3.1 Nature of cultivation practices

From the Table 1, it is evident that, little more than half (55.60 per cent) of the respondents were following organic practices for cultivation. Nearly one fourth (23.80 per cent) of the respondents were using a mix of organic and inorganic

cultural activities. One fifth (20.60 per cent) of the urban farmer respondents were commercial cultivators i.e. they were following inorganic practices in their field.

Table 1: Distribution of respondents based on Nature of cultivation practices

| S. No. | Category | No. of respondent | Per cent |
|--------|-----------------------|-------------------|----------|
| 1. | Organic practices | 105 | 55.60 |
| 2. | Commercial practices | 39 | 20.60 |
| 3. | Traditional practices | 45 | 23.80 |
| Total | | 189 | 100 |

The urban community mainly aims for self-consumption and sharing the surplus products to friends and relatives. The efforts for profit oriented farming are very low. Hence, half of the respondents belongs to organic nature. Due to the improper knowledge on organic practices and lack of guidance, most of the traditional farmers who were using more of inorganic inputs they think themselves as organic farmers. The poor market facility for organic products, low soil quality in urban areas and poor access and management of organic manures made the traditional farmers to follow inorganic methods or combination of organic and inorganic methods.

Some of the respondents opinioned that, products through scientifically recommended cultivation are safe for consumption. They further opinioned that, considering the population and demand for food, it is not possible to depend on organic farming completely. Hence it is acceptable. In most of the cases, the crops like paddy and banana were found to be cultivated by commercial practices. But there are paddy cultivators following fully organic methods in group farming but not market driven agriculture. In the case of terrace farming and courtyard farming of vegetables, it was organic methods mostly done by the farmers. And they stated that, adaptability of hybrid seeds towards organic methods is very poor.

3.2 Labour utilisation pattern

From the Table 2, it is revealed that, nearly half (47.60 per cent) of the respondents were using both family labour and hired labours for farm activities. Also it is understood that little more than one third (35.40 per cent) of the respondents were doing activities by their own family labours without help of others.

Table 2: Distribution of respondents according to Labour utilisation pattern

| S. No. | Labour utilisation pattern | No. of respondents | Percent |
|--------|-------------------------------------|--------------------|---------|
| 1. | Family labour only | 67 | 35.40 |
| 2. | Both family labour and hired labour | 90 | 47.60 |
| 3. | Hired labour only | 32 | 17.00 |
| Total | | 189 | 100 |

Followed by that, 17.00 per cent of them were doing cultivation with the help of hired labours only.

Most of the respondents were retired or employed farmers. Thus, to manage their available time and their physical constraints, they might have engaged hired labours along with their own family labours. The farmers with crops like Banana, Paddy and Cassava were found to be depending more on hired labour. The area holding and cultivation in fields were found to be more in Calicut district and hence the dependents on

hired labours were also high there. During the discussion the paddy farmers have expressed their difficulties about the labour scarcity

The farmers with grow bag cultivation, terrace farming were able to manage their work with their family labours. And the study already showed that more than half of the respondents were practicing organic methods and hence led to less dependence on hired labours. Also, difficulty in getting skilled labours and high labour cost encouraged the farmers to do farming activities mostly by family labours. Usually the practices such as irrigation, harvesting etc. are done by the respondents themselves.

3.3 Time utilisation pattern

From the Figure 1, it is understood that, almost an equal proportions of respondents were utilizing their time in a similar pattern. i.e., nearly one third of them were utilizing 1-2 hours/daily and 2-3hours/daily for farming activities (34.90 per cent and 32.80 per cent) respectively. Only four respondents had time utilisation pattern on weekly basis and

they were found 4-5 hours and more than 5 hours categories. Time is found to be a major constraint for the respondents. The activities like, vegetable cultivation, paddy cultivation, dairy unit, poultry unit, mushroom culture and fish farming needs daily routine examinations like irrigation, feeding, waste management, cleaning etc. Hence these components need much time compared to others. Anyhow, in the case of paddy and vegetables, most of the farmers have engaged hired labours. In this case, their present time engagement could be reduced. The farmers with other components need to utilize their time more for farming activities.

The respondents who were using 1 to 3 hours per day were engaged with activities like irrigation and regular pest attack checking. One to two hours each during morning and evening is enough for a farmer with a small grow bag cultivation. The salaried employees could spend only 1-2 hour either morning or evening. In the case of retired respondents, their physical situation might not allow them to work more than 2-3 hours per day.

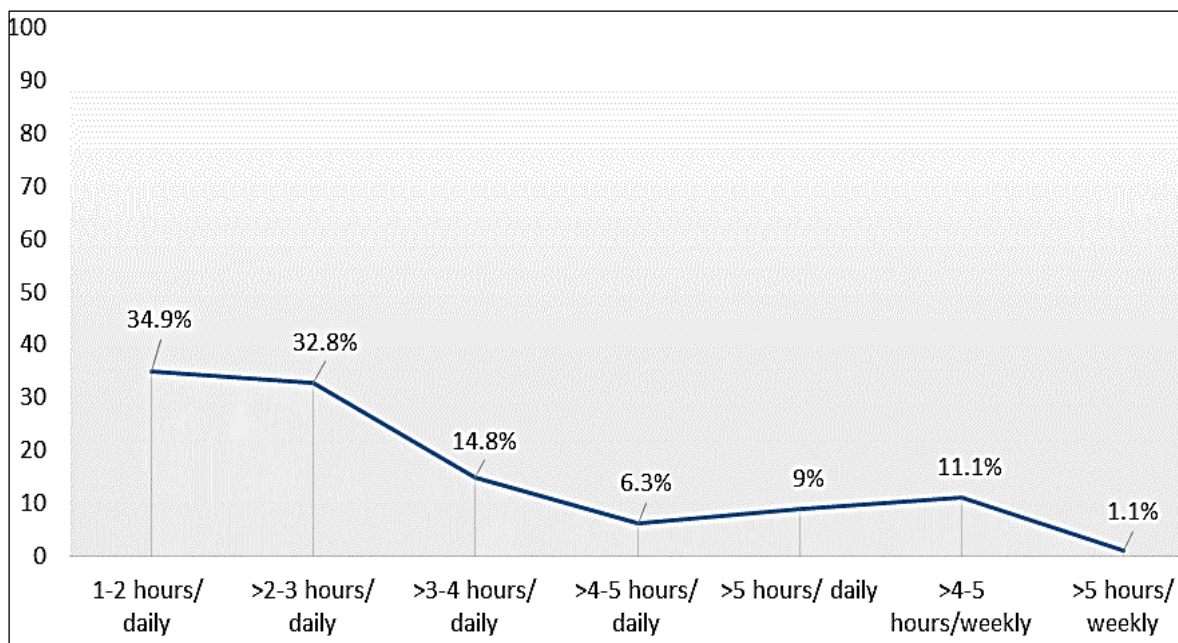


Fig 1: Distribution of the respondents according to their time utilisation pattern

When the size of area and number of components increase, the time utilisation also increased and it is true with the livestock farmers. Accordingly, they have spent 3 to 5 hours or more than that on daily basis. Fixed time table in group farming found to be very much useful for the farmers with other occupations and it is followed in community gardens and terrace cultivation in flats also.

3.4 Water sources for the urban agricultural activities From the Figure 2 it is visible that, nearly three fourth (70.40 per cent) of the respondents were using ground water as their major water source. Only a fewer of them didn't consider it for farming activities. Little more than half (59.60 per cent) of the respondents didn't want to use paid corporation water/tap water for agricultural purposes. In the case of rain water harvest, nearly half (48.70 per cent) were using it as a water source. The proportion of the grey water users was very low.

Even though water is considered to be a diminishing and undersupplied resource, the urban respondents had diverse sources of the same. The general trend among the city dwellers was seen that, only the water resource secured

people were following urban farming activities. No one found with a risk of water availability. And the respondents who are willing to pay for water were able to manage it with their income without taking any risk. Among the resources, ground water was considered to be the predominant resource. Geographically, Calicut corporation belongs to low land area. Hence, they didn't have the problem of water scarcity, but they are facing issue of water overflow. As it is a low land, even small rise in rain, could results into water overflow.

Presence of river, pond and other surface water runoffs near to their fields improved their ground water level also. These contribute to the highest proportion of urban farmers using groundwater for agricultural activities. The respondents who use tap water for agricultural activities were predominantly found in Kochi Corporation. Most of the tap water users' family size was having only three members and hence they could able to manage the farm with the available corporation water. During the discussion it is found that they were willing to pay for the water for farming uses.

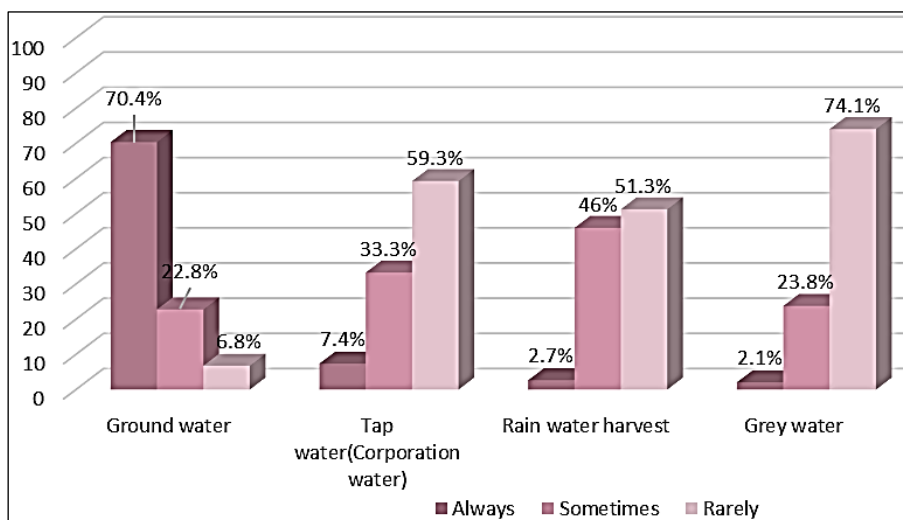


Fig 2: Distribution of respondents based on Water sources for the urban agricultural activities

As water is not considered as undersupplied resource, half of the respondents didn't want to spend for rain water harvesting structures. The occasional users do collect during summer showers in large rain barrels and using it in their farms. Unfamiliarity and lack of proper knowledge made the farmers, not to use grey water in farming purposes. And, since they were not getting adequate profit from the farm it's not economically feasible to go for grey water system.

3.5 Urban farming system components

From Table 3 of area under cultivation, it is noticed that, nearly two third (62.40 per cent) respondents had only less than 1 acres under cultivation. The percentage of farmers with more than 3 acres was just 15.90 per cent. The small areas holders usually use grow bag method of cultivation and it starts mainly from terrace. The higher area land holders had crops like paddy, vegetables, livestock and most of them were full time farmers.

From Figure 3 of farming components, it is evident that, most (82.00 per cent) of the respondents had vegetables as a major component in their farm. About the cultivation of fresh fruits, nearly one fourth (22.80 per cent) of the respondents had it as a major component and didn't include in their field (39.70 per cent).

In the case of paddy crop, little more than two third (69.80 per cent) of the respondents didn't include this as a component in their field. Nearly two fifth (38.10 per cent) didn't cultivate

tuber crops.

Coming to the rearing of livestock, little more than half (57.70 per cent) of the respondents didn't include the meat and poultry section in their farm. Considering the rearing of milch and dairy animals, most (82.00 per cent) of them didn't have this component in their farm. When three respondents taken fish farming as a major component in their farm, nearly one fourth of them (23.30 per cent) had it as a minor element. During the data collection, it could be noticed that, the period of COVID-19 lockdown, a large number of respondents started urban farming and many of them upgraded their activities by including more components. The Government has also started schemes and subsidies for agricultural production activities in urban areas. Scheme will provide subsidy for diversification in the urban farm. Here they have to include 5 different components like vegetables, fish farming, poultry unit etc. And this diversification could contribute to the environmental stability of the urban ecological system.

Table 3: Distribution of the respondents according to their size of operation of farming

| S. No. | Area under cultivation | No. of respondents | Per cent |
|--------|------------------------|--------------------|----------|
| 1 | Less than 1 acre | 118 | 62.40 |
| 2 | One to three acres | 41 | 21.70 |
| 3 | More than 3 acres | 30 | 15.90 |
| Total | | 189 | 100 |

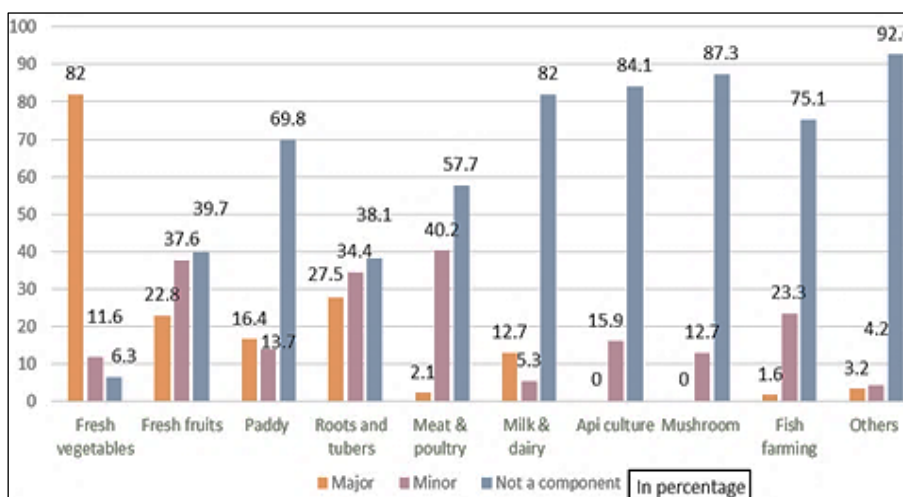


Fig 3: Distribution of respondents according to urban farming system components

When the idea of farming comes to micro level, the component which comes always first is vegetables. They started this idea mainly because of the worry over the quality of food as explained earlier. When their demand for the quality couldn't meet with the accessible supply, there existed a gap in production. And this gap made the city dwellers to think about agriculture. Common vegetables found in urban farmers were, Tomato, Curry leaf, Chilly, Brinjal, Ivy guard, Ladies finger, Long beans/Cowpea, Spinach, Yellow cucumber and cool season vegetables like, Cabbage, Cauliflower etc. And during the study it is surprised to see that, along with the above mentioned common vegetables, the respondents from Kochi Corporation cultivated many new vegetables cultivation in their field such as Carrot, Onion, Celery, Peppermint, Bell pepper, Palak leaves etc. High price of these vegetables, less availability in small stores and its nutritional quality made the respondents to cultivate these crops in their houses.

Along with these factors they had high anxiety of growing these new vegetables and it made them to feel prestigious. Most of the respondents had used grow bags for vegetable cultivation both in terrace and courtyard areas. Vegetables which need pandal support found very less with farmers because of the space centered constraints. The farmers who cultivate vegetables in fields and growing crops after paddy harvesting used to grow crops like, Yellow cucumber, Ash guard, Cowpea, Bitter guard etc. And this is the market oriented and better price getting idea because they can harvest it in April at the time of Vishu.

As space is a major constraint for city dwellers, the people interested in agriculture first started to grow vegetables which need less space. And in most of the Govt. schemes, the seeds and other inputs for vegetable cultivation were given to them. Moreover they can cultivate vegetables in small spaces and hence, they found vegetable cultivation as the most needed and easily accessible component for their farm.

In the case of fresh fruits cultivation, which mainly include the crop Banana followed by Mango and Papaya. As a minor component, they could grow crops like, Jackfruit, Sapota, Lemon, Champa hybrid, Soursop (Annona), Rambutan and Passion fruit. They found to be very much interested in growing bush type budded or grafted varieties of Mango, Jackfruit which comes to harvest within 5 to 6 years. And they had a positive attitude and interest towards cultivating different and new fruit crops in their limited areas.

These similar minded farmers wanted to bring back the local heritage of environment, and it leads them to paddy cultivation without any profit orientation. Another motive behind the paddy cultivation is social cohesion and platform for communication among themselves. Because paddy is the crop which needs a collective labour and time. All the farmers were found to be the members of different '*Padasekhara samithi*' (Paddy cultivation group) and this made them the easy access towards inputs, information sharing, use of implements and machines and marketing.

The cost of eggs in market and subsidy from Govt. for poultry unit motivated the farmers to think about including poultry unit in their field. The cost for country egg and duck egg is Rs. 10 to 12 per egg, which they found as not affordable for a family with children. The mini poultry cage is available in market, and which is suitable for urban farming system with which farmers can keep the chicken in the cage itself. Many country chicks are available through subsidy also.

Rearing livestock/cattle is very difficult in urban condition

because it needs more space and time. As the majority of the respondents belongs to old age group and retired or employed, the proportion of cattle rearing found to be less in urban system. All the rice field holders had cattle also. The difficulty in waste management and complaints from the neighbours were the main discouraging factors for many small land holding respondents.

Apiculture and mushroom were not considered as a major component by any respondents. They started it out of interest and now they are getting the honey for their own purposes. The mushroom management is very difficult as its getting fungus attack soon and hence the discontinuing tendency is high among them and hence low participation was found.

The emergence of fish farming is very recent and started in COVID 19 lockdown period. When the availability of sea food was very difficult, the Government of Kerala has announced a subsidy on fish farming in a land area not less than 2 cents in the backyard. Along with this, the issue of poor quality items in the market has also compelled them to start fish farming at micro level. And it could be noticed that, the structure for fish farming starting from useless refrigerator to well aerated biofloc fish tank. The number of fishes per tank varies from 50 to 1000 generally. And the major types were Tilapia, Red-bellied Natter and Boal fish. Many urban farmers were reluctant to do fish farming because of the taste difference compared to sea fishes. And also high priced fish feed pellets was also a discouraging factor for them.

As they have a very small area for cultivation, they need small quantities of inputs for each components. Especially for better quality seeds, fertilizers, etc. and hence by making a common input purchasing coordination system will make them convenient for the same. Same way, scheduling vegetable planting for continuous harvest will help them to include different components according to the needs.

4. Conclusion

Each urban community is different its resource strength and urban households design their farm according to their resources. And hence, assessment of resource constraints will help the urban authority to develop a plan according to its availability and management. The resources like land, labour, time and capital were found to be limited in urban farming and hence the best solution to manage these issues is pooling of these resources. And this could be possible through various ways such as the creation of clean green working spaces in city, common places city wide systems of composting the wastes.

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