

URBAN AGRICULTURE-RECENT TREND AND FUTURE PROPOSAL IN TIRUCHIRAPPALLI CITY, TAMIL NADU, INDIA

Dr. S.Latha

Guest Lecturer, Department of Geography,
Bharathidasan University, Tiruchirappalli, India

Abstract: Urbanization is one of the key drives of change in the world today. Projections show that urbanization combined with the overall growth of the world's population could add another 2.5 billion people to urban population by 2020, with close to 90 percent of the increase concentrated in Asia and Africa, according to United Nations report.

Rapid and unplanned urbanization, climate change and changing demographics have resulted in increasing urban unemployment and poverty, high food inflation and food insecurity, especially the high nutritional insecurity. However, many countries are making efforts to increase production focusing on new areas and innovation. The Government of India, for instance, is considering promotion of urban agriculture on a national scale to curb the increasing price of food commodities in its cities.

Urban agriculture can be defined shortly as the growing of plants and raising of animals within and around cities. In India, in states like Maharashtra and Kerala, the promotion of urban agriculture is already included in state policies. In Tamil Nadu, the Department of Horticulture had introduced a new scheme, named "DO IT YOURSELF", to promote urban farming in its cities, that was launched in four corporations, where Tiruchirappalli city is one among them. As a recent trend few individuals have developed urban farming in the available empty spaces in and around their residences.

In order to elaborate and extent the urban farming throughout the study area, the related constraints are analyzed and future proposals are framed.

Key Words: Urban agriculture, Land use, Roof top gardening, Community gardening, Solid waste management.

I. INTRODUCTION

The rapid recent urbanization goes together with the rapid increase in urban poverty and urban food insecurity. By 2020, in the developing countries of Africa, Asia and Latin America, nearly 70% of its population would be urban dwellers. Many cities in developing countries face great difficulties due to its increasing population. This rapid and unplanned urbanization have resulted in increasing urban unemployment and poverty, high food inflation and food insecurity especially high nutritional insecurity. However, many countries are making efforts to increase production focusing on new areas and innovation. Urban agriculture is one of the solutions that are perceived globally to meet the demand of food of urban population.

Urban Agriculture is the growing of plants and raising of animals for food and the related processing and marketing activities, in and around the cities and towns (Hempstead, 2007). It also involves animal husbandry, aquaculture, agro forestry and horticulture. These activities also occur in peri-urban areas as well. Urban agriculture can be defined shortly as the growing of plants and raising of animals within and around cities.

The most striking feature of Urban Agriculture is that it integrates an urban ecology and its ecological system. It includes urban residents as laborers, uses urban resources (like organic waste as compost and urban waste water for irrigation), direct links with urban consumers and urban policies and plans. Urban agriculture provides a complementary strategy to reduce urban poverty and food insecurity and enhance urban environmental management.

The Government of India is considering promotion of urban agriculture on a national scale to curb the increasing price of food commodities in its cities. In Indian states like Maharashtra and Kerala, the promotion of urban agriculture is already included in state policies.

In Tamil Nadu, promotion of urban farming has commenced its importance through government launched schemes, that was introduced in four corporations and the study area is one among them. And added to this, few individuals have developed urban farming in the available empty spaces in and around their residences.

In the present study, in order to elaborate and extent the urban farming throughout the study area, the related constraints are analyzed and future proposals are framed.

II. REVIEW OF LITERATURE

Joongsub Kim (2016), has undergone a study on the value of Urban Agriculture in urban design and development of Detroit. He has developed four models namely, industrial district model, open space model, corridor model and residential district model, to enhance to urban farming community in Detroit.

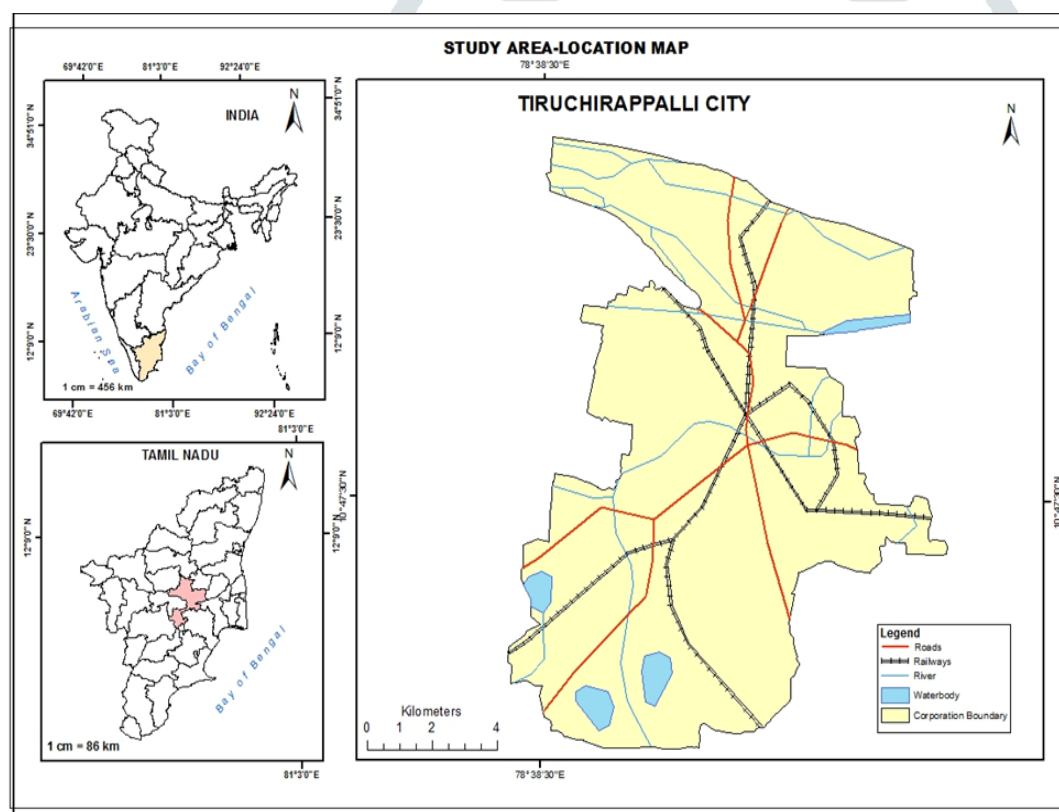
Anuradha et.al (2015), has done a study on the Urban Agriculture in and around greater Hyderabad region. In this study they have analyzed the land use changes in vegetable production, problems in vegetable production and has also assessed the socio-economic conditions of the people involved in vegetable production, in and around the study area.

Pranati Awasthi (2013), has made a study on Urban Agriculture in India and its challenges. She has analyzed the factors involved in Urban Agriculture, like.. location, people, food product and product market. The study also involves the urban agriculture projects and their challenges, those are in practice in various cities of India, New Delhi, Hyderabad and Mumbai.

III. STUDY AREA

Tiruchirappalli city, a fast-growing regional metropolis, is the second largest city in Tamil Nadu state, in a geographical location extending from $10^{\circ}49'N-78^{\circ}42' E$ and $10^{\circ}57' N-70^{\circ}44' E$, at an elevation of 85 meters above msl. The city was upgraded as Corporation in 1994, with an area of 146.90 Sq.Kms. The city experiences tropical climate with an annual precipitation of 835mm. The total population of the city is 8,47,387 persons (2011) and is predicted to reach 9,28,772 persons by 2021(Fig 1).

Figure 1 STUDY AREA



IV. NEED OF THE STUDY

The city urbanization, increase in per capita consumption, and health consciousness demands fresh food every day at their doorway. Always the rapid urbanization goes together with the rapid increase in the urban poverty and urban food insecurity. Hence very recently, the need for the Urban Agriculture has aroused. As a result, the passion for gardening and nurturing plants at rooftops has emerged in the study area. Along with this, raising animals and agro forestry are slowly coming to light. In the study area, currently there is a proliferation of undocumented Urban Agriculture. Hence in the present study, an attempt is made to study the recent trend of Urban Agriculture in the study area. The constraints are also detailed and finally future proposals, to develop the Urban Agriculture in the study area, are framed.

V. OBJECTIVES

1. To study the recent trends-the Government Initiation and Private Involvement in developing the Urban Agriculture in the study area.
2. To analyze the constraints faced in promoting the Urban Agriculture in the study area.

3. To assess the Urban Land use Plan maps of the study area between the periods 2003 and 2011 and to propose sites suitable for introducing the Urban Agriculture in the study area.
4. To suggest future proposals under varied perspectives, for enhancing the Urban Agriculture in the study area.

VI. MATERIALS AND METHODS

Simple Random Sampling method was adopted for collecting primary data related to home gardening, raising animal husbandry, agro forestry by individuals, through questionnaire, interview and observation. Urban Land use plan maps for the study area between the periods 2003 and 2011 are digitized using ARC GIS software.

VII. RESULTS AND DISCUSSION

1. THE GOVERNMENT INITIATION AND PRIVATE INVOLVEMENT IN DEVELOPING THE URBAN AGRICULTURE IN THE STUDY AREA

Government Initiation:

DO IT YOURSELF (DIY) is a scheme introduced by the Department of Horticulture to promote Roof Top Gardening in an individual resident or apartments. Residents are encouraged to grow vegetables to meet their daily requirements. This scheme was launched in 2014 in four Corporations of Tamil Nadu, where the study area is one among them. Under this scheme, the Department of Horticulture distributes Roof Top Gardening Kit (Table 1 and Plate 1) at a cost of Rs.500 each, to the interested individuals. Each kit comprises coco beat compressed bricks and vegetable seeds of brinjal, tomato, chilly, bush beans, cluster beans and types of greens. The kit contains bio fertilizers and bio pesticides with pamphlets and a CD that has guidelines for terrace gardening. The distribution of kits started in February 2016, and the Department of Horticulture has sold 6000 kits till date. The feedbacks from few of those recipients are amazing to note that they have successfully raised terrace garden and grown vegetables fully organic, mostly to meet their daily needs.

Looking onto the response, the department is selling the same kit at a subsidy rate of Rs.200, with the same kit items. The following table 1 shows the Kit items supplied by the Department of Horticulture.

Table 1 ROOF TOP GARDENING KIT ITEMS

Sl.No	Kit Items	Cost (Rs)
1	Seeds	69.40
2	Azospirillum (200g)	3.65
3	Phosphobacteria (200g)	3.65
4	Trichoderma Viridi (100g)	6.00
5	Pseudomonas Fluorescens (100g)	6.00
6	Azadiractin (100ml)	22.00
7	Polythene cover with compressed coco pith 2 Kg bricks-6 bags with each kit	329.40
8	18:18:18 (Urea, Super Phospate with SOP) 1 Kg	74.00
9	Technical Know How folder 1 number	8.00
10	Total Cost	522.11
11	Subsidy Cost	200.00

Plate 1 ROOF TOP GARDENING KIT ITEMS



The highlight of the Government scheme includes:

- Light weighted growing medium
- Hybrid seedlings
- Water soluble fertilizers
- Bio pesticides and fungicides

Private Involvement:

a.Roof Top Gardens

To bring to light the private involvement in developing the Urban Agriculture, these individuals are met in person and their gardens are observed. Vegetables, flowers, fruits, herbs and ornamental plants are grown in pots and bags on terrace, garden and available open spaces around their houses. But it is very discouraging to note that only 200 individuals have successfully developed their private gardens, in and around their residences. Some of their gardens are chosen randomly and are visited personally and the observations made are detailed below.

A female respondent has used her terrace, balcony and walls for her gardening. Her farming technique is purely organic. She says that, big investment or long hours of work is not needed to raise home gardening. She uses sugarcane stalks, composts and garden soil. She has grown mangoes, figs, guavas, bananas, in an area of 1200 Sq.feet. She raises 5 Kg of fruits and vegetables, daily, throughout the year. She has a separate herb garden which has basil, mint, rosemary, thyme, lavender, stevia, chamomile, oregano and feverfew.

A project was conducted in a private school that involves the school kids. The school produces fruits, vegetables and flowers. Their main idea is to spread the methods of raising the gardening, to other schools.

A terrace garden is developed in a private organization in 3000 Sq.feet, which has 150 plants.

Another individual has grown micro greens, planted in shallow pits, which require little water and sun light and the produce are supplied to hotels and super markets.

Another respondent has raised roof top gardening and has grown flowers, fruits and vegetables for her personal use.

There are few people who does roof gardening in a smaller scale, and some have initiated recently.

The selected sites are visited and the evidences for the private involvement in promoting roof top gardens are given as pictures (Plate 2) below.

Plate 2 PRIVATE INVOLVEMENT (ROOF TOP GARDENS)





b. Animal Husbandary

A female respondent keeps Nandhanam Turkey and sells 3 Kg meat and eggs after every 15 to 20 weeks. She has 100 turkeys and has initially spent Rs. 60,000.

c. Aquaponics

This involves developing aquaculture and hydroponics at the same time. A male respondent has involved growing vegetables and fishes together. Not only fishes, snails and prawns are also too grown. The wastes of fishes become the fertilizers for the water plants. This needs minimum water supply, no weeding and no fertilizers. He has grown cabbages, greens and tomatoes through this method.

2. CONSTRAINTS

The constraints faced in promoting the Urban Agriculture in the study area are analyzed and listed below.

a. Space

The residents built in the commercial areas have no space for gardening, as they are built on 200 to 500 sq. feet, with double or triple storied and apartment buildings.

b. Readiness and Interest

Houses on the outskirts of the city, though have spaces, readiness and interest of developing lacks among the people, as only countable owners have purchased the kit.

c. Techniques

The study area has to consider implementing techniques like Zoning ordinances, comprehensive plans and urban designs, to promote urban agriculture.

d. Peri Urban Area

The peri urban area should be wisely used for an intensive urban agriculture.

e. Intra Urban Area

The unattended and unused intra urban area should also be utilized for urban agriculture.

f. Water Availability

The underground water availability is gradually decreasing in the study area, is also a constraint in some of the urban areas.

g. Land use Planning

The agricultural dry area and waste land are noticed within the city limit of the study area. Regularizing the urban land use will bring maximum land under the development of urban agriculture.

h. Government Policies

Conducive government policies can easily promote urban agriculture in the study area.

i. People Involvement

Public including school and college goers, teachers, government officials, especially women, jobless individuals should be involved in developing the urban agriculture in the study area.

j. Hot weather

The hot weather in the study area is said to be the major hindrance in making urban agriculture popular.

k. Urban Design

The study area lacks an efficient urban architecture and design projects to promote urban agriculture.

3. URBAN LAND USE PLANNING IN TIRUCHIRAPPALLI CITY

As the space availability is the major constraint in the study area, the urban land use planning is important to mitigate the negative effects of land use, to allocate land uses to meet the needs of people, to safeguard resources and to enhance the efficient use of resources with minimal impact. Hence an attempt was made by the Department of Town and City Planning in Tiruchirappalli city to propose an effective masterplan for the available land use within the corporation limit, for its maximum

utility. For this purpose, the urban land use maps of the study area for the two-year periods, 2003 and 2011 are digitized and shown in figure 2 and 3 respectively. The changes in areas under each class are identified. From the analysis, the propose sites suitable for introducing the Urban Agriculture in the study area are suggested.

Figure 2 URBAN LAND USE MAP -2003

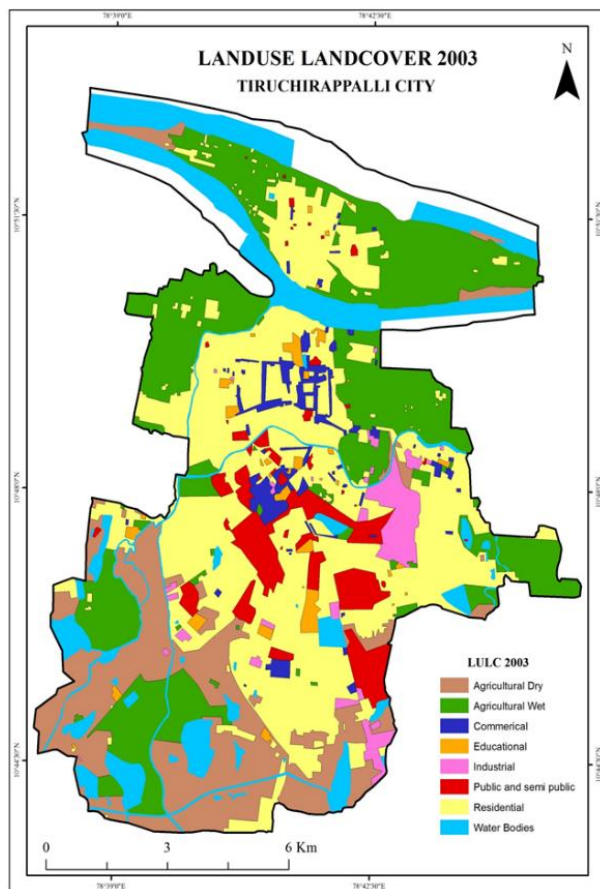
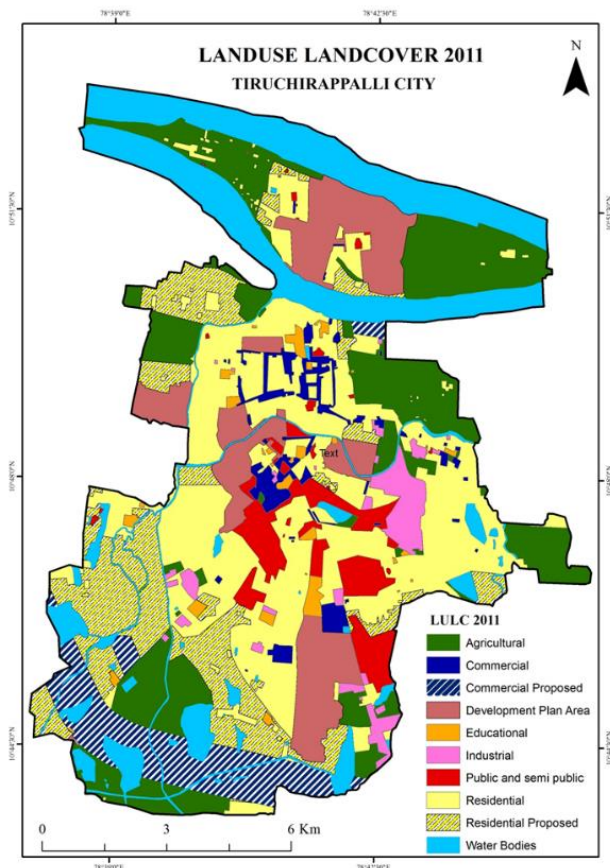


Figure 3 URBAN LAND USE MAP -2011



The urban land use changes between these year periods are identified and the areas under each class are tabulated (Table 2).

Table 2 URBAN LAND USE CHANGES BETWEEN 2003 AND 2011

S.No	Urban Land use 2003	Area (%)	Urban Land use 2011	Area (%)
1	Agricultural Dry	20.85	Commercial Proposed	7.75
			Development Plan Area	13.80
			Residential Proposed	17.25
2	Agricultural Wet	32.65	Agricultural	24.34
3	Commercial	3.05	Commercial	3.2586
4	Educational	1.66	Educational	1.59
5	Industrial	3.25	Industrial	3.42
6	Public and Semi public	6.83	Public and Semi public	5.95
7	Residential	43.04	Residential	34.27
8	Water Bodies	17.00	Water Bodies	16.70

From the table, the following inferences are made. A significant change in the urban land use is noticed between 2003 and 2011.

Land use those remained as the same between 2003 and 2011:

The land under industrial and commercial activities has increased to 0.17 and 0.20 % respectively between 2003 and 2011. The area under educational, water bodies, public and semi-public activities had decreased to 0.17, 0.30 and 0.88 respectively. But the changes under these land use categories are found meagre and of a negligible change.

Land use those have been modified into another type of land use between 2003 and 2011:

A considerable change has been noticed in agricultural wet land which has shown a decrease of 8.31% and residential area, which has shown a decrease of 8.77%, between these year periods, both totally accounting for 17.08%.

The area under agricultural dry has undergone the maximum change, with an increase of 17.95%, between 2003 and 2011. It could be observed that the decrease in the area of agricultural wet and residential area has been modified into agricultural dry area.

The reasons for the above discussed urban land use changes in the study area, could be due to the following major reasons.

1. Increasing population structure

The population structure has increased in the study area, that is, in 2011 it is 847387 persons, and is predicted to increase to 1033107 persons in 2021 and to 1314148 in 2131.

2. Development of built up lands due to expansion of city

The study of the spatial growth of the city over the years has revealed that the built-up area has spread along the five main transportation corridors in a radial pattern viz. Tanjore, Madurai, Pudukottai, Dindigul and Perambalur, in the process devouring agricultural lands and water bodies. The decrease in agricultural area is due to conversion of urban land use or discontinuation of agricultural lands and water bodies is more apparent to urban uses. The loss of these agricultural lands and water bodies is more apparent towards the east, south and south-west of Tiruchirappalli city, where the town growth is more.

3. Changes in water resources

River Cauvery passes through the study area. The depletion in the surface water resources in this river and its tanks has been identified and it is caused by the growth of urban lands, land erosion, siltation, etc. Developing of building lands necessitates the filling up to tank beds and river portions. Negatively, it changed the surface water resource. Hence, the decreasing of annual rainfall and increasing city population is also cause such changes.

4. GOVERNMENT PROPOSAL

The Department of Town and City Planning has planned and proposed the area of increased agricultural dry land, and brought them under three major categories, for effective utilization, namely –

Residential proposed (17.25%)-urban land use in which houses predominates, including single and multi-family residential buildings.

Development plan area (13.80%)-sets out a strategy for the proper planning and sustainable development of a specific area by the local authority for a time scale.

Commercial proposed area (7.75%)-urban land use intended for the use of commercial business like.. office complexes, shopping malls, service stations and restaurants.

Added to this, Tiruchirappalli city has been chosen as one among the smart Cities of Tamil Nadu, and its developmental strategies include- Solid waste management, Pedestrian ways, Multilevel parking, Innovative use of open space, integrated bus stand, clean and green ways etc..

In all the above-mentioned proposed areas, the Department of City Planning has taken steps to promote the urban agriculture, in all the possible ways.

To improve the green cover in the city, Tiruchirappalli city corporation has decided to directly involve locals for its effective implementation. Planting five saplings in each of the 65 wards, residents in localities were given the responsibility of raising the saplings till they take the shape of a tree. Named 'Project 65', the drive was mooted by a forum of city based voluntary organization supported by the city corporation. Native species were identified for the purpose and planted based on the requirement and availability in the areas. The mission was to plant 350 saplings, 5 in each ward on public spaces. Each sapling will be taken care by residents in the area. A team has also been formed to monitor the growth of saplings every month. Volunteers who took up the responsibility to raise the sapling will share a picture of the sapling on the social media platform.

5. SUGGESTED FUTURE PROPOSAL

In the light of the above observations, it is obvious that there is a wide scope for developing Urban Agriculture in the study area. Hence future proposals are suggested under varied perspectives, for enhancing the Urban Agriculture in the study area.

1) Social Perspectives - Subsistence Oriented Urban Agriculture

-This includes the Urban Agriculture followed as Home gardening, Community gardening, Institutional gardening in school, colleges, offices and hospitals.

-It will form a part of livelihood strategies of urban low-income households with a focus on producing food and medical plants for home consumption.

-Food crops like root vegetables, mushrooms, fruits and non-food crops like aromatic and medical herbs and ornamental plants can be grown in home gardens.

-The garden supplies are mostly used for self-consumption and the surplus can be marketed.

-The households seek out multiple additional income sources for their survival.

-It will enhance Food security, Social inclusion, Poverty alleviation and Community development.

-An individual, Family, Group or Cooperative farms could be developed, to enhance its social benefits.

-Women participation should be encouraged, since Urban Agriculture can easily be combined with their other tasks in their households.

-Urban Agriculture may improve food intake of urban poor, in terms of quality and quantity.

- It may involve disadvantaged groups such as orphans, disabled people, destitute women, recent jobless immigrants and elderly people.
- The low-income urban poor get benefited.
- Urban Agriculture is a very effective tool to fight against hunger and mal nutrition as it facilitates access to food.
- It has positive impact on social health.
- It facilitates positive social interaction and networks within the communities.
- For neighborhoods, home gardening provides a “Symbolic Focus”, which leads to neighborhood pride.
- Urban Agriculture may advance food justice by reducing racial and class disparities in access to healthy food.
- Trichy City Corporation can assist the Community Gardening groups with basic infrastructure like fence, tool shed, tank, hose pipes, quality seeds, natural fertilizers and bio pesticides etc.
- Under Community gardening, trees like pungam, illupai and neer maruthu, can be planted close to the open drainage ways.

2) **Economic Perspectives – Market Oriented Urban Agriculture**

- Under this, the Urban Agriculture involves small scale or large-scale enterprises.
- It includes -Food products-vegetable and dairy production and Nonfood products-medical and aromatic herbs, flowers and ornamental plants, Sale of inputs like seeds, compost, fodder and agro chemicals and Processing and marketing the agricultural products.
- Proper training regarding food hygiene should be given for the food processors, vendors, inspectors and consumers.
- City Corporation can assist special credit and finance to the women producers.
- Corporation can support with “Green Labels” for the safe grown urban food.
- The Market facilities should be made accessible to the poor urban farmers.
- A weekly Organic Farmers Market for organically grown products can be opened for the public use, within the city limit.
- The City Corporation can prioritize the buying of agricultural products from Urban Farmer groups and supply them to schools, hospitals community kitchens and other service organizations.
- Corporation can promote the development of small-scale enterprises like- supplying enterprises of compost, earthworms, seeds, plants, bio pesticides etc, and processing enterprises like food preservation, food storage, packaging, street vending, transporting etc.
- Urban Farmers are mostly in an informal way, thus lacking channels and power to voice their needs. This limits their representation in urban policy making and planning.
- Government Agricultural Cooperatives can closely link with urban farmers to facilitate Joint Marketing.
- As an enterprise, animals like poultry, rabbit, goat, sheep, cattle, pig, guinea pig and fishes can be tamed.
- Livestock is fed on the leftovers from the restaurants or chop bars. Later the skeletal wastes from the livestock are processed into powder for feed and paints.
- The main concern is the city should not avoid free roaming cattle and in the central districts, as it may result in traffic and bad odor.
- The adoption of animal waste management, regular cleaning, following disinfection methods, proper handling of animal feed will help to prevent health risks related to animal raising.
- The cow dung and chicken droppings are sold back to farmers as fertilizers or as a cooking fuel.
- Aquaculture can be promoted in peri urban lakes and ponds combined with recreational activities like boating, restaurants etc.
- The produce can be sold at the farm gate, other neighborhoods, local shops, markets, super markets or to a mediator.

3) **Ecological Perspectives - Multi Functional Character**

- Urban Designing in the study area is very important. For this, the existing urban land use characteristics should be studied. Under the Zoning Ordinances, the acts, rules and laws should be framed. The physical characteristics like ground studies, land ownership, traffic volume, environmental contamination, challenges and opportunities at the proposed site have to be analyzed.
- The unused open space within the city limit should be mapped using GIS and its suitability for agriculture can be analyzed. For this purpose, urban planning authorities, officials, field experts and NGO should be involved.
- The degraded open spaces within the city limit are often used as informal waste dumpsites and are the sources of crime and health issues. Such areas should be bought under Urban Agriculture.
- Public lands along roads, streams, conservation areas, railway lines and parks can be used.
- Semi public lands like grounds of schools, colleges and hospitals can be bought under farming.
- The lands away from the residences- off plots can be utilized.

- Temporal lease of vacant corporation lands can be given to an individual for gardening.
- The derelict lands like former industrial and mining areas can be identified and given to unemployed workers for developing Urban Agriculture.
- The Roof top gardens are a means of Pollution abatement. A roof top containing 2000m² of grass has the potential to remove up to 4000 Kg of particulate matter. Also, 1m² of green roof could offset the annual particulate emissions of a car.
- These will certainly improve the Urban Greening, which in turn results in Urban climate improvement.
- This involves in environmental management like composting, reusing of organic wastes, and waste water.
- Within the city limit, buffer zones, free from construction should be marked for urban farming.
- Also, while zoning the city for Urban Agriculture, factors like population density, ecological sensitivity, closeness to pollution industry and closeness to sources of water should be taken into account.
- Proper location of urban gardening in relation to sources of contamination is important in order to reduce the effects of air pollution.
- Urban Agriculture contributes to reduce the net discharge of CO₂.
- Urban Agriculture improves the physical climate because, vegetation can help to increase humidity, lowers the temperature, capture dust and gases and conserve soil.
- Within 50-75 meters from a main road, growing leafy vegetables should be avoided. Also, production of food crops near industries that emit toxic elements should be discouraged.
- Effective irrigation system like drip irrigation should be used to reduce the demand for potable water.
- Treated waste water can be used for food crops for growing trees and shrubs and not for edible crops.
- Tiruchirappalli City Corporation can provide the treated waste water to poor urban farmers those who are a part of the community gardening and in return can get their assistance to maintain public green areas.
- Peri Urban areas can developed as a multi-functional land use. For example, parks can be made which will provide recreational services to urban citizens. The youth can act as a co-manager for those parks. They can also provide ecological education for the people.
- Urban Agriculture may reduce the cost of food mile and transport related emissions.
- Filao (belong to banyan family) can be planted along the road sides of the city to stabilize the soil.
- Urban Agriculture will decrease the Noise pollution, especially in the city centre.
- New technologies like Non Soil Production, safe and economic practices for the reuse of water, Phytoremediation method, that absorbs the soil toxins etc.. can be adopted.
- Urban Agriculture also have a greater capacity to absorb run off and rain water, thereby reducing the waste water flow and also relieves the over flowing sewage systems in the city.

6.SOLID WASTE MANAGEMENT IN THE STUDY AREA

- Tiruchirappalli city is one of the few civic bodies that has extensively implemented the decentralization of waste collection, segregation and recycling in the state.
- The city corporation has been awarded for effective Solid Waste Management.
- The city had bagged merit awards for decentralized solid waste management and the Platinum award for overall performance at the 49th Skoch Summit at New Delhi.
- The city collects garbage waste from households and organic wastes from the markets. The city generates 430 tonnes of garbage daily. The city uses an advanced Monitoring Technology, RFID (Radio Frequency Identification System), that monitors the garbage collection from various sources.
- RFID attached dumpsters in 17 wards are monitored with a help of software called, Chitragupta. The system includes segregation of wastes into degradable and bio degradable wastes. 4 zones, each of 400 areas, each with 400 houses are identified for the source segregation of solid waste.
- Four Dry Resource Centers are organized, one in each zone to collect and store the dry waste such as paper, plastics and wood. These dry wastes are collected from the households of the city by women self-help groups. Here the plastic shredding machines are installed and its produce is used in laying roads.
- A total of 23 Micro Compost Shredding Units are also effectively practiced in the study area. They are 20 in number. Every center includes 2 wards, 47 streets, 11177 houses and 647 commercial centers.
- Vermi compost Units are launched. They produce bio fertilizers out of the organic waste in 45 days. The non-bio degradable items are recycled.
- The excess waste water is dispatched to the methanation plant and gasifier run by the city corporation.
- The corporation begun sale of bio manure manufactured from the city solid waste.
- The corporation sells the compost for Rs.2000-2300 per tonne. Further the civic body has generated a total of Rs.95.28 lakhs by selling the recycled non-bio degradable to scrap dealers.

- Locally available willing unemployed personnel are involved in compost making. It adds income for urban poor.
- The proposed sites for developing Urban Agriculture within the city corporation has been suggested earlier in this study. The compost fertilizers that the city corporation produces can be used to grow trees within the city.

Tiruchirappalli City Corporation has recently commenced selling bio manures, produced from recycling the city solid wastes, at lower cost. Added to this, the recycled city waste water is also planned to supply to public to enhance the Urban Agriculture.

The effective solid waste management and recycling of waste water in the study area is shown the following pictures (Plate 3).

Plate 3 SOLID WASTE MANAGEMENT AND RECYCLING OF WASTE WATER



VIII CONCLUSION

Tiruchirappalli Corporation should create the proper frame work for optimal development of social, economic and ecological benefits of Urban Agriculture. Our key lesson is that a successful Urban Agriculture in the study area requires a systematic incorporation of the suggested future proposals. Because the study area has unserved population and underutilized land that requires creative attention.

IX ACKNOWLEDGMENT

Department of Town and City Planning in Tiruchirappalli city.
Mr.Prabhakaran, Assistant Commissioner, Tiruchirappalli Corporation.

X REFERENCES

- [1] Joongsub (2016), The Value of Urban Agriculture in Urban Design and Development: Case study in Detroit, Director, The Detroit Studio/Community Based Program and Master of Urban Design Program, Lawrence Technological University, Southfield, Michigan, USA, email:jkim@ltu.edu.
- [2] Anuradha,T, Sudhakar Goud,R, and Nirmala Babu Rao (2015), Urban Agriculture in and around Greater Hyderabad region, Scientia research Library, Journal of Applied Science and Research, 2015, 3(4):pp24-30.
- [3] Pranati Awasthi (2013), Urban Agriculture in India and its challenges, International Journal of Environmental Science: Development and monitoring (IJESDM), ISSN No.2231-1289, Vol4, No2.
- [4] Hempstead, H (2007), Cities farming for the future-Urban agriculture for green and productive cities, Review of urban agriculture for green and productive cities, Appropriate Technology, 34(4/5),pg40.

