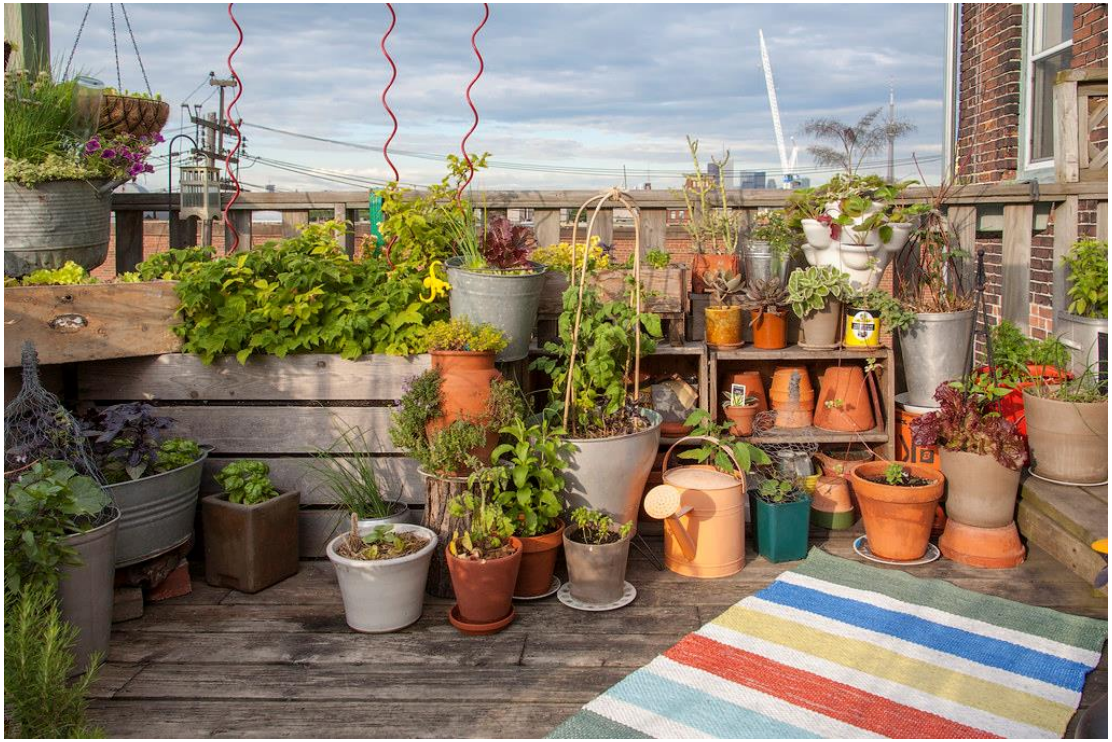
Promoting Non-traditional Fruit Cultivation in Urban and Peri-urban landscape



K. K. Srivastava
Principal Scientist &
Head CPP
Division of Crop Production

E mail:
kanchanpom@gmail.com
Cell: 9452220988

ICAR-Central Institute for Subtropical Horticulture, Rehmankhera, Kakori, Lucknow, UP- 226 101

Container fruit farming in Urban and Semi Urban area

"Container farming is a farm of urban horticulture, helps to cater urban nutrition security and provides multiple services to the urban ecosystem and can be an integral part of urban land use and planning strategies"

Why container farming....

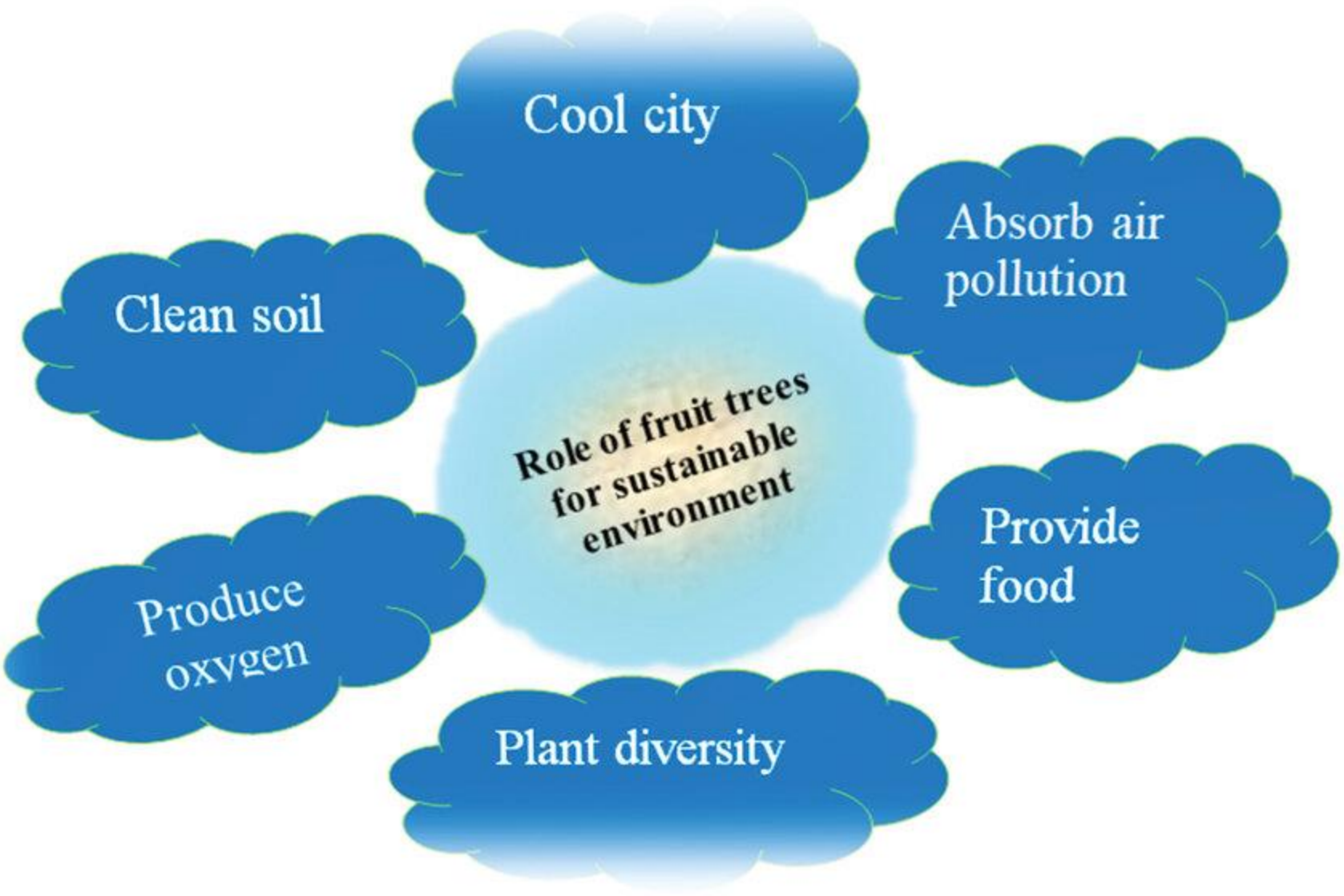
i. **Global population is expected, 9 billion with approx 70 percent in urban areas by 2050.**
ii. **India urban population has gone up 27.7- 36.4% over the past 20 years and projected to reach 52.8 percent by 2050.**
iii. **According to NFHS, 27.3 % children (<5 years), 30.1 % stunted in urban area.**
iv. **Approx 13%, urban men and women aged 15-49 have a low BMI (<18.5 kg/m²), while 33.2 % women and 29.8 % men obsessed.**
v. Toxic residue in fruits and vegetables due to excessive spray and marketing lures.

Conti……

- India's urban areas face grave challenges like- **food security, rapid population growth & densities and limited access to fresh fruit and vegetables.**
- By turning rooftops, balconies and available vacant areas into productive green spaces, urban dwellers can have access to fresh and residue free fruits and vegetables.

The above facts compelled to an urgent need to explore alternative farming practices (Container farming or urban horticulture).

Role of Fruit plants urban landscape



Environmental benefits

Greening the concrete jungle

- Rooftop gardens and vertical farming enhance the urban microclimate, lowering energy consumption for cooling and improving air quality. Urban horticulture also mitigate the “heat island” effect, reducing ambient temperatures,
- **Chennai case study- Densely vegetated areas experience 20-30 per cent lower particulate matter (PM) levels compared to less green zones.**

Carbon sequestering unit

Fruit trees use photosynthesis to absorb CO2 from the atmosphere and assimilate it into their cellulose, lowering atmospheric builup. High CO2 exposure, boost photosynthesis in tropics/subtropics region and increase tree biomass, thus reducing load of atmosphric carbon dioxide.

Mango plants sequester CO2 ranging from 47.66 – 62.33 tones/ ha or 0.21 tones/tree

guava 0.012 tones/tree

Jackfruits-26.7 tones/ ha

Effect on climate

- Rooftop covered with fruit and vegetable plants not only increase aesthetic value but also reduce energy demands for the cooling, absorb dust etc.
- To maximize benefits from urban landscape, future initiatives must prioritize eco-friendly materials and energy-efficient practices, insuring that urban horticulture remains a positive for the environment.

System of Urban Horticulture

- **Home gardening and Kitchen gardening:** It provides fresh, residue free fruits and vegetables and saves the home income spent on food.

- **Community Gardens:** People collaborate with each other and share the facilities

- **Terrace gardening: G**rowing plants on a terrace, balcony, or rooftop, typically in pots/raised beds/ containers

• **Landscape Gardening:** It includes growing and utilization of garden flowers, Turf grass, bedding plants, potted plants, hedges, edges, water garden, rock garden etc.

• **Window garden:** Choosing a container and a location is a fine start for window box gardening.

• **Container gardening :** Growing of fruit, vegetables, medicinal and flowering plants it is easy to maintain.

- **Herbal Garden: Gr**owing of herbs having functional and ornamental value mainly flavoring food in cooking and discouraging pest and providing pleasant scent .

- **Meditation garden:** It provide beautiful and therapeutic for relaxation, rejuvenation and meditation. Scented flowering, herbal, tropical or desert plants.

Indore Growing System (Z farming) or Zero Acreage: This includes roof of school, shopping malls, hotels, super market etc. Z farming includes indoor farms, vertical green house rooftop green house, rooftop gardens, edible green walls.

- **Vertical Gardening:** It is helpful in maintaining the urban ecological environment (Van Renterghem, 2014). Edible plants used in vertical gardening can provide abundant fruits and vegetables throughout the year. **It is also helpful in noise reduction and air purification.**

Approx. roof top available for container gardening (RTG)

Name of city	Area (Sq km)	Roof top available (Sq km) (Estimated)
Delhi	1484	296
Mumbai	600	120
Lucknow	340	68
Varanasi	112	22.5

Case study of RTG in Metro Cities

- RTG in Bengaluru is popular due to moderate temperatures and humidity allow gardens to grow all year long.
- Sapota, guava, custard apple, Barbados cherry, ramphal (Bullock's Heart), orange, sweet lime, star fruit, soursop, Indian gooseberry (dwarf amla), bananas, purple jamun, dragon fruits, mango, litchi, ber (Indian jujube), rambutan, cashew and passion fruit. "Fruit trees like moringa, breadfruit and coconut palm are doing well"
- Today, the rooftop garden in five-storeyed apartment is thriving: grows figs, grapes, papayas, pineapples, pomegranates, seasonal vegetables such as okra and sweet potatoes and a variety of leafy greens.

The daily harvest is shared with the building's residents.

Requirement of Container farming
(Pot/Container)

1- UV stabilized, 400 gauge thickness, light weight, different size, low cost plastic bags lost long.

2- Rs 150-250 for large size (100 Lit capacity.

3- Flexible, easy to handle, Easily available.

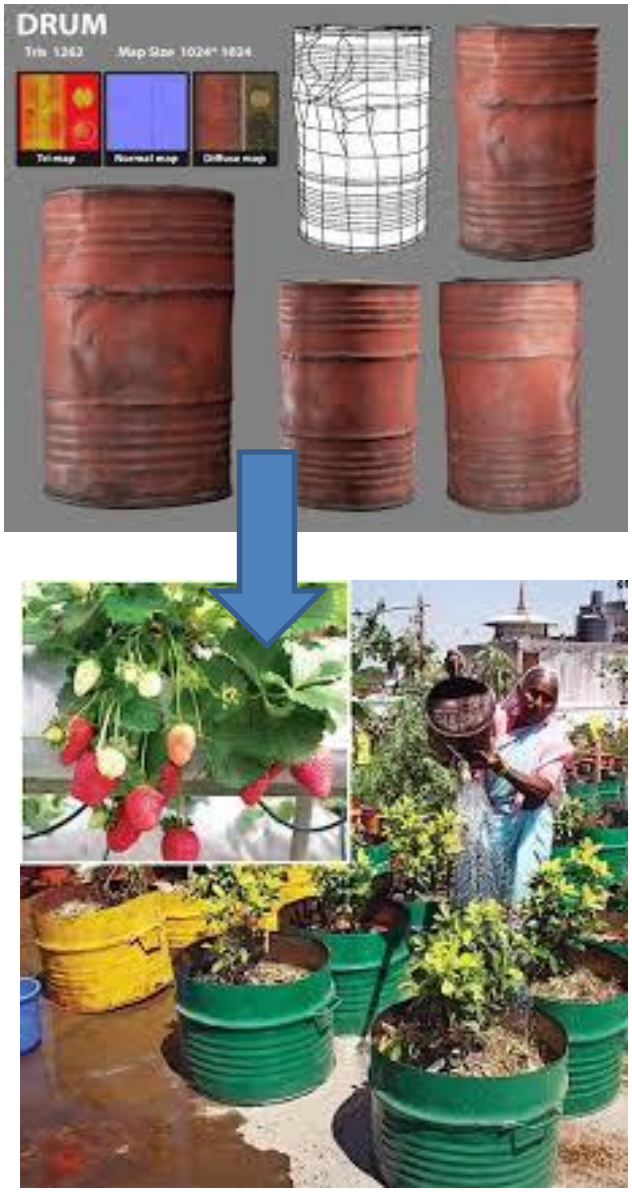
Constraints:

1- Difficult to move,

****HDPE bags are also available for containerized**

Requirements for RTG

1.Containers / pots for growing fruit crops need Large containers, flexible, easy to move etc.



Constraints with tin containers or plastic pots:

1- Costly each containers are Rs 300-400/ 100 lit capacity

2- Tough to handle

3- Difficult to move

4- Bottom starts leaking in contact of media.

5- Poor life, require lot of care etc.

CISH-Easy-Grow

A container pre mix fruit growing media for terrace gardening

CISH-Easy-Grow properties

- Light in weight
- Especially suitable for fruit plant growing
- Fair water holding capacity
- Odour free
- Free from parasitic nematode and pathogenic fungi
- Nutrient rich, growing plants do not require exogenous application of nutrient supplements for 2-3 years
- Firmly holds the fruit plants

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Growing media

Growing media/substrate

CISH-Easy-Grow (under patent)-

It comprised garden soil 25%, FYM 25% , cocopeat 25%, vermicompost 10%, sand 8%, neem cake 4%, leaf moulds 2% and bone meal 1% and other

Growing media

Containers size (cm)	CISH-Easy Grow (kg)	Traditional media Media (Soil-FYM-Vermi-Sand)
60*60	55-60	115-130 kg
45*60	40-45	85-90
45*45	25-30	55-60
30*45	12-18	25-30
30*30	10-15	15-20

Fruit varieties suitable for container culture

- Mango (Amrapali, Arunika, Ambika)
- Guava- (CISH-Shweta, CISH-Lalit, CISH-lalima and Ald Safeda)
- Citrus sp. (Lime- Shriganganagar lime-1, Kagazilime, lemon, Musambi, Jaffa, Washington, Malta Blood Red), Kinnow, Daisy etc
- Pomegranate (Arakta, Mridula, Super Bhagwa)
- Ber (Apple ber)
- Karonda (Red and White type)
- Fig (Poona, Deanna)
- Sapota (Cricket Ball, Kallipatti)
- Custard apple (Balanagar)
- Tamarind (PKM series)
- Wood apple (Kaintha)
- Strawberry (most of the varieties)
- Many berries (Raspberry and other berries)

Container size Vs Plant growth pomegranate cv Mridula

Container size	Plant height	Plant spread (E-W)	Plant Spread (N-S)	Trunk girth (cm)
30x30 cm	85.00	49.30	46.66	1.53
30x40 cm	107.67	48.35	41.76	1.83
45x45 cm	**140.71**	**65.72**	**46.74**	**2.10**
45x60 cm	**153.66**	**70.85**	**60.51**	**2.56**
60x60 cm	157.73	73.90	68.85	2.60

Container size on plant growth citrus

Container size	Plant height	Plant spread (E-W)	Plant Spread (N-S)	Trunk girth (cm)
30x30 cm	48.00	52.30	61.76	3.54
30x40 cm	59.67	69.33	64.66	4.83
45x45 cm	**62.71**	**73.66**	**71.66**	**5.33**
45x60 cm	**69.70**	**75.33**	**66.22**	**4.81**
60x60 cm	57.73	89.53	71.62	4.71

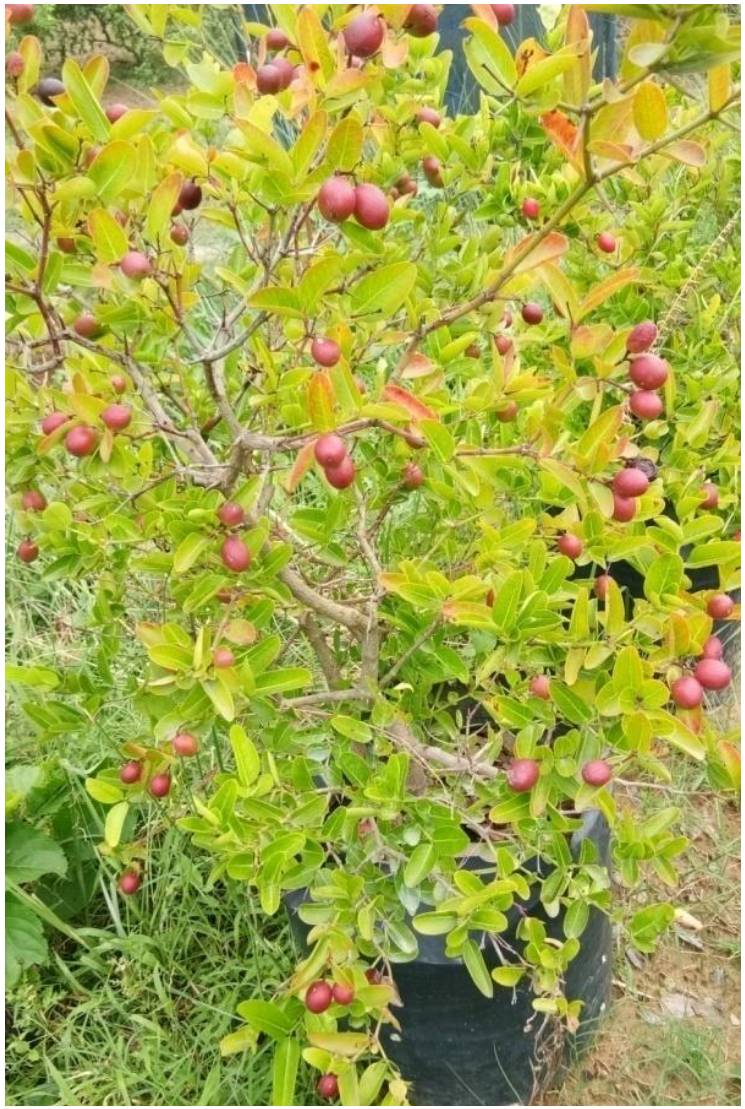
Yield in different container size (3-4 years)

Container size	No of fruits Pomegranate (2 years old)	No of fruits Lime	No of fruits Guava
30x30 cm	15.33	19.30	15.33
30x40 cm	17.45	22.45	17.45
45x45 cm	**25.52**	**156.33**	**27.52**
45x60 cm	**34.77**	**186.67**	**25.77**
60x60 cm	29.67	65.67	29.67

Guava variety CISH-Shweta in 30X45 cm containers (4-5 years)

Fruiting in container grown pomegranate varieties

Karonda in bearing (4-5 years age)



Kagazi lime in container 3 years

Kagazilime and Sweet orange in bearing(age- 04 years

Kagazi lime var Sriganganagar and Sweet orange varieties

Fig and dragon fruit suitable for container farming on the roof top

Phenological, variation in containerized as per BBCH scale

Growth stages	Citrus spp. in container	Field
Inflorescence bud swelling: bud closed	30-31/08	1-3/9
Bud burst: scale separated	6-8/09	10-12/09
Flower visible, still closed	9-11/09	16-22/09
Full bloom	24-26/09	25-28/09
End of bloom	3-5/10	8-10/10
Fruit development	4-6/10	10-12/10
40% Fruit growth	8-30/10	12-15/10
90% fruit growth	25-29/11	27-30/11
Color break(Fruit maturity)	27-30/11-05/12	30/11-10/12

Fruiting management in container plants

- Rational watering is important.
- With holding the irrigation 2-3 months before expected flowering time.
- 15-23 % root ball pruning in Dec- Jan after 4 years.
- Replacing with 20-30% fresh growing media.
- Excessive fertilization be avoided.

Planting care

Dipping of roots in COC solution before placing in the containers.

Root pruning and filling fresh media after 4 years in Fig for maintaing the plant growth

After root pruning again dipping in COC and replacing in fresh media…

After pruning of roots dipping in COC solution to prevent from fungal infections.

Repotting ……..

Feeding root intensity at different depth of container

Fruits	Container size	Percent feeding roots (root thickness 0.05-2mm)	Depth (cm)
Guava	30x45 cm	45 %	0-15 cm
Citrus	30x45 cm	65%	0-15 cm
Mango	30x45 cm	38%	0-20 cm
Bael	30x45 cm	35%	0-20 cm
Aonla	30x45 cm	35%	0-15 cm
Pomegranate	30x45 cm	28%	0-15 cm

Rooting pattern in 30x45 cm container of pomegranate

Kagazi lime root pattern (age 5-6 yr) 45x45 cm

Rooting behaviour of guava

Economics of growing potted fruit plants for sale

S No	Particular	Unit cost (Rs)	For 1000 plants	Total cost (Rs)
1	Container cost (35x40 cm)	45/bag	50x1000	50,000.00
2	Vermicompost	5/kg	4x1000.00	20,000.00
3	FYM	2/kg	5x1000.00	10,000.00
4	Sand	15/sq feet	0.5x1000.00	7500.00
5	Soil	2-3 /kg	6x1000.00	6000.00
6	Plant cost (Guava, Citrus)	50/ plant	50x1000.00	50,000.00
7	Labour cost (filling)	5/ bag	5x1000.00	5,000.00
8	Irrigation and maintenance for one year	150/plant/ year	150x1000	1,50000.00
9	Chemical and other inputs and other miscellaneous charges	-	-	15,000.00
10	Total			3,13500.00
11	Total per unit cost for one containerized plants (Rs)			313.50
12	Sale of 1000 plants on bearing (Rs 800/ plants)			8-10 lakhs
13	**Benefit Cost ratio**			**3.05:1**

Constraints in RTG (Fruits)

- Require big containers due to larger root system.
- Due to perennial nature crop require special attention.
- Need support to stand in containers.
- Requires soil media for strength
- Need understanding for reproductive and morphological balance.
- Need to apply nutrition judiciously.
- Soil media become heavy to move.

RTG, Fruits

Papaya and fig gives high yield on roof top. Excessive watering in papaya be avoided as plants get infected with collar rot

Summary

- **Container gardening have scope to practice in urban and semi-urban areas.**
- **Light weight and long lasting containers are suitable.**
- **Fruited containerized plants are high in demand such plants can be sold at premium price (Rs 600-1000/ container plants), with least investment Rs 230-320/ plants.**
- **Can helps to reduce down the building temperature 3-4 degree as compared to barren terrace.**
- **Have aesthetic value, income generation and availability of nutrition for house hold dwellers.**

THANKYOU