

INTEGRATED APPROACHES FOR DISEASES MANAGEMENT IN ROOFTOP GARDENING

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Introduction

Rooftop gardening : Rooftop gardening is an art of utilizing the urban spaces in a smart way that bring greenery to life maintain the piece, reducing the air pollution, obtaining the fresh green herbs, vegetables, and fruits for better health as well as save the money.

The green herbs, vegetables, and fruits are selected for rooftop gardening are dependent on the basis of season, plant heights, and daily need basis of family. The following medicinal herbs are suitable for grow on roof top gardening are Basil, mint (Pudina), Aloe, Mandukaparni, Brahmi, etc. The following vegetable of choice

are suitable for this are tomatoes (cherry tomato), green chilli, brinjal, lady finger, Roots vegetable (Radish, carrot, sugar beets), bulb vegetables (onion & garlic), Cole crops (cabbage, cauliflowers, broccoli), leguminous vegetables (garden pea, cowpea, beans), cucurbits vegetables (bottle gourd, pumpkin, ridge gourd, squash gourd and snake gourd), leafy vegetables (corianders, spinach, lettuce) and suitable fruits crops are strawberries, blueberries, citrus tree, fig, bonsai guava, mango etc. and ornamental plants of choice.



Fig. 1. Rooftop Gardening

Diseases of vegetables and fruits in rooftop gardening

In rooftop gardening growers generally planted the seed and seedling of vegetable crops and sampling of fruits crops in large grow poly bag, or earthen Pots or cemented pots or thermo coal open boxes. Source of irrigation is generally applied by drip or manually watering using plastic pipes. The rooftop garden top part is sometimes open or may be cover with shed net to

avoid high temperatures. More watering or rainfall, relative humidity, low nutrient status of soil and other micro climate are responsible for attack of pathogens which causes the diseases in plants. Many common diseases incited on herbs, vegetables and fruit crops are caused by fungi, bacteria, and viruses that reduces the quality and production of produce are listed below;-

A. Common fungal diseases on rooftop gardening

Diseases	Symptoms	Crops infected (Host)
Powdery mildew	White powdery patches appears on the leaves	Cucumbers, cowpea, pea, chilli, grapes, mango
Downy mildew	Downy growth of fungal propagules on leaf or yellow to brown patches	Onion, cucurbits, cauliflowers, lettuce, cabbage, grapes
Anthraco nose	Brown or black sunken lesion appears on leaf or stems	Chilli, tomato, brinjal, grapes, Mango, guava
Alternaria Leaf spot	Brown or black spots appear on the leaf surface	Potato, tomato, chilli, brinjal, onion, radish, cauliflowers, cabbage, broccoli etc.
Phytophthora Leaf rot, fruit rots	Brown or black rotting on leaf from marginal of leaf or any portion of leaf and fruits	Tomato, potato, brinjal, citrus fruits, guava, papaya
Rhizoctonia Root Rot	Yellowing of leaf and softening of stems	Chilli, radish, cabbage, potato, brinjal
Fusarium Wilt	A plant became yellowish and withers. Brown coloration is appear in xylem pith portion when on splitting the stem in two parts	Onion, okra and cucurbits, guava
Botrytis Leaf blight	Browning, spotting, and wilting of leaf, flowers and stems	Cucurbits, cabbage, tomato, beet root, onion

B. Common bacterial diseases of rooftop gardening crops



Diseases	Symptoms	Examples
Bacterial blight	Water-soaked lesion on leaf or stem or fruits	Tomato, Pepper and cucurbits, pomegranates,
Bacterial leaf scorch	Brown or yellow leaf	Tomato, Pepper and cucumbers affected by bacterial leaf scorch
Bacterial Canker	Outgrowth rough dark brown lesions appears on leaves, stems and fruits	Most of citrus fruits affected by this diseases, tomato, guava
Bacterial wilt	Plant bacteria block the water conducting tissue leading to rapid wilting and death	Tomato, brinjal

C. Viral diseases of rooftop gardening crops

Diseases	Symptoms	Plants affected
Cucumber mosaic virus	Mottled or distorted leaves, yellowing or stunting of plants	Cucumbers, squash, melons
Tomato Mosaic Virus	A mosaic pattern of light and dark green or yellow and green on leaves, which may also become crinkled or distorted. Plant look like stunting and yellowing.	Tomato

Pepper mosaic virus	Mosaic or mottled pattern on pepper plants leaves along with symptom likes stunted growth, leaf distortion and reduction in fruits.	Pepper
Okra Yellow Vein Mosaic virus	Yellow vein and mosaic pattern on leaves, leading stunting and reduced deformed fruits.	Okra
Bean common mosaic virus	Common mosaic pattern-light and dark green mosaic or mottling pattern on leaves. Dark green area often appears as raised, blister like (puckered) tissue along vein. Plant appears stunted growth of plant and deformity pod	Bean

Vectors in virus transmission are living organisms that carry and transmit an infectious virus between hosts. Mosaic Virus is generally transmitted by insect vectors like Aphids, Whiteflies and by infected seeds

		
Alternaria leaf spot of cabbage	Alternaria leaf spot of radish	Alternaria leaf spot of tomato
		
Anthracnose fruit rot of Capsicum	Anthracnose fruit rot of bean	Anthracnose fruit rot chilli
		
Phytophthora blight of potato	Phytophthora blight of tomato	Bacterial wilt of tomato







		
Powdery mildew of garden pea	Powdery mildew of bean	Powdery mildew of okra
		
Okra yellow vein mosaic virus	Cowpea yellow mosaic virus	Cucumber mosaic virus

Fig. 2. symptoms of diseases on few vegetable crops in rooftop gardening







	
Bacterial canker of lemon on leaf and fruits	
	
Rust on guava fruits	Bacterial blight of pomegranate
	
Anthracnose of guava	Powdery mildew of mango

Fig. 3 symptoms of diseases on few fruits crops in rooftop gardening

Integrated disease management in rooftop gardening fruits and vegetables crops

Integrated Disease Management (IDM) is a holistic and sustainable approach to controlling and preventing diseases by combining multiple strategies rather than relying on a single method, such as chemical use.

A. Preventive measures: Preventive measures for plant diseases include maintaining good sanitation by cleaning tools and removing debris, practicing crop rotation, and using disease-resistant plant varieties. The following preventive measure should be applied to make unfavorable condition for pathogen attack on the vegetable and fruits crops under rooftop gardening;

1. Good air circulation: Kept the poly bag or planted pots at proper space as per plant canopy to make sure plants have enough space to breathe. Also arrange the bags to monitor wind direction to ensure good air circulation.
2. Prune the fruit tree regularly to promote air circulation, sunlight, avoid infected leaf e.g. for fruit crops like guava, citrus, mango etc.
3. Removed the infected plants and plant parts regularly interval to reduce inoculum load and spread of diseases like fungi, bacterial and virus.
4. Avoid overwatering in pot or poly bag because proper aeration in root is required and avoid physiological wilting of plants
5. Use of healthy and certified seed to grow plants
6. Seed treatments are required to prevent early seed infection by seed born fungi and bacterial diseases. Generally, use any one fungicide like Thiram, Captan, Carbedazim, or Combination of two ingredients like caebendazim + mancozeb, 2 gram/kg of for small seed and 3 gram/kg of seed for large seeds and antibiotics like streptomycin 1 gram/kg of seeds.
7. Other than chemicals alternative bioagents like *Trichoderma harzenium*, *Trichoderma viridi* @ 10 gram per kg of

seed can be used for fungal diseases and *Bacillus subtilis* or *Pseudomonas fluorescens* @ 5 gram/kg of seed can be used for bacterial diseases.

8. Judicious use of fertilizers is necessary for proper growth of plants. Avoid excess nitrogenous fertilizer to it creates succulence in foliage which promotes many mould, fungi and bacterial infections.
9. Use of Resistant Varieties: Manly for viral diseases.
10. Use agricultural tools for hoeing and harvesting should be hygiene by disinfecting tools
11. Avoid injury to plant
12. Remove the weeds in polybags at regular interval to avoid the pathogen reservoir

B. Curative measures: Curative measures for plant diseases involve chemical or biological treatments, physical methods, and early removal of infected parts to manage diseases after they have occurred. Common methods include applying specific chemicals like fungicides, bactericides, or nematicides to kill pathogens, and using bio fungicides for a more natural approach. Other curative strategies include the physical removal of infected plant parts, disinfecting tools, and using heat to treat soil. Following curative measure should be taken in management of diseases;-

1. Use foliar spray of Neem oils (1500 ppm Azadiractin) – 2-3 ml/liter of water or Acephate @ 0.1% or imidachloropid @ 0.03 % at 10 days interval for vectors control of viral disease.
2. Use of plant botanicals like garlic bulb, neem leaf paste use to making 20% solution for foliar spray
3. Use copper-based fungicide for pasting on pruned area of fruit stems like Bordeaux paste (A fresh mixture prepare of copper sulphate, Chuna and water) or spray 0.5% concentration, or copper oxychloride 50% WP or spraying @

- 0.25% concentration. Use these chemicals can be used for foliar spray for bacterial blight, bacterial canker and fungal leaf spot.
4. Amend the soil with *Trichoderma viridi* or *T. harzanium* alongwith vermicopost/ oil cake/ FYM at (1:100 ratio) for management of Fusarium wilt and Rhizoctonia root rot and *Bacillus subtilis* for bacterial wilt of vegetables and fruit crops.
 5. For powdery mildew disease of both fruits and vegetable crop: foliar spray of sulphur 80% @ 3 ml/liter or Tridemorph @ 1 ml/liter of water solution.
 6. For Downy mildew and Phytophthora leaf blight diseases: foliar spray of fungicides like metalaxy + mancozeb ingredients or copper oxychlorode 50%WP @ 2 gram/liter of water at 15 days interval
 7. For Alternaria leaf spot: spray the fungicides like mancozeb or carbendazim + mancozeb or chlorothalonil 75% WP @ 2 gram/liter of water at 15 days intervals