

Strategy for crop and kitchen wastes management for organic production of vegetables at rooftop

Urban India produces about 42.0 million tons of municipal solid waste annually, i.e. 1.15 lakh metric tons per day (TPD), out of which 83,378 TPD is generated in 423 Class-I cities. Waste generated in 423 Class-I cities works out to 72.5% of the total waste generated each day and this needs to be tackled on priority.

MUNICIPAL solid waste comprises 30 to 55% of bio-degradable (organic) matter, 40 to 55% inert matter and 5 to 15% recyclables. Composition of waste varies with size of city, season and income group.

Per capita waste generation varies between 0.2 to 0.6 kg per day in cities with population ranging from 1.0 to 50 lakhs. An assessment has been made that because of increasing per capita waste generation of about 1.3% per year, and growth of urban population between 3 and 3.5% per annum, yearly increase in the overall quantity of solid waste in the cities is about 5%. Waste collection efficiency ranges from 50% to 90%. Urban Local Bodies (ULBs) spend between ₹ 500/- to ₹ 1500/- per ton on solid waste management, of which 60 to 70% is spent on collection alone, 20 to 30% on transportation and less than 5% on treatment and disposal which is very essential to prevent environmental pollution. Crude dumping is normally resorted to by ULBs without adopting scientific and hygienic approach of sanitary land filling (MSW/MSW_AnnualReport_2020-21).

Crop residues are natural resources with tremendous value to farmers. These residues are used as animal feed, in composting, thatching for rural homes and fuel for domestic and industrial use. About 25% of nitrogen and phosphorus each, 50% of sulphur and 75% of potassium uptake by cereal crops are retained in residues, making them valuable sources of nutrients. However, a large portion of the residues is burned in field primarily to clear the field from straw and stubble after the harvest of the preceding crop. The problem is severe in irrigated agriculture, particularly in the mechanized rice-wheat system. The main reasons for burning crop residues in field include unavailability of labour, high cost in removing the residues and use of combines in rice-wheat cropping system especially in the Indo-Gangetic plains.

According to the Ministry of New and Renewable Energy (MNRE), India generates on an average 500 Million Tonnes (MT) of crop residue per year. Majority of this crop residue is used as fodder and fuel for other domestic and industrial purposes. However, there is still a surplus of 140 MT out of which 92 MT is burned each

year. The two crops rice and wheat produce a large amount of residues in India. Crop waste burning is popular in NW India (Punjab, Haryana, Uttarakhand and western Uttar Pradesh) where rice wheat crops are harvested and threshed mechanically. Nowadays crop wastes burning is spreading throughout country with popularization of use of combine in rice wheat cropping system. Around 30-40 years back, animals were integral part of farmer's family and all crop wastes were used as feed to animal. Every household had one compost pit in which farmers used to decompose organic wastes along with cow dung but with mechanization in agriculture activities, viz. ploughing, harvesting, sowing, etc. compost pits have disappeared in past few years. Population of animals decreased significantly in the villages. Therefore, use of crop wastes as feed of animals decreased significantly. Recently, during Swachh Bharat Abhiyan people are burning organic wastes throughout India for cleaning of the places.

According to a conservative estimation, around 34 million tonnes of crop wastes are produced in Haryana, Punjab, Uttarakhand and western Uttar Pradesh. 23 million tonnes crop wastes are burnt annually. Punjab burns 80% of crop wastes produced. This huge quantity of wastes can be converted into nutrient rich compost for sustainable land restoration practices. Estimation showed that 30-35% of applied N & P and 70-80% for K remained in the residues of crops. Such nutrient rich crop residues are required to be converted into compost.

Importance of organic matter

The term "organic matter" is used to describe the dead and decomposing remains of living things, such as plant debris, animal remains, and manure. These are crucial part of the soil, providing food for soil living creatures; for plants in particular, it is a major source of nitrogen. Without it, soil would be just sterile rock dust. Organic matter is continually being broken down by soil creatures and by natural oxidation. In nature, it is replenished in the natural cycles of life and death. Humus is the final product in the breakdown of organic matter. It acts as a valuable reservoir of water and plant nutrients, and helps soil structure.

Viable solution

ICAR-CISH, Lucknow has developed model for crop and kitchen wastes management. These crop residues can be utilized in compost production with any one of following methods.

Biodynamic compost: Biodynamic compost is an effective method of composting and is an immediate source of nutrient for crops. Biodynamic compost heap can be prepared by using green (nitrogenous material) and dry leaves (carbonaceous material). The enriched compost is ready in 75-100 days in normal period depending upon the prevailing temperature and moisture.

Vermicompost: Organic and crop wastes can be converted into compost along with dung with use of earthworms. Earthworms are easily available in every part of country for production of compost.



Vermi-compost production

NADEP compost: It is a method of aerobic composting because of aerobic respiration, composting is fast and nutritional status of the compost is better than the ordinary compost. In this method of composting, farm wastes (Cow dung, green/dry grasses, wheat/paddy straw and weeds) along with good quality farm soils are used.



NADEP compost

Microbe mediated compost: An effective micro-organism consortium is used for fast decomposition of organic wastes, contains lactic acid and photosynthetic bacteria, yeast, filamentous fungi and actinomycetes, etc. These are aerobic and anaerobic in nature and can exist in acidic and saline soil both. Farm wastes (Cow dung, green/dry grasses, wheat/paddy straw and weeds) can be used for production of microbe mediated compost.

Use of crop/organic wastes as mulch

Crop residues and organic wastes can effectively be used as mulch in fruit trees as well as line sown crops. Mulching is helpful in weed management, reduces water evaporation, minimizes soil erosion, maintains soil temperature and improves physical, chemical and biological property of the soil.

Use of rotavator in rice wheat cropping system

After harvesting of paddy as well as wheat, ploughing of field with rotavator breaks crop residues in small pieces and further irrigation of field with Jeevamrita/Amritpani/



Mulching of organic wastes in capsicum and lettuce at rooftop

Cow pat pit/waste decomposer helps in fast decomposition of organic wastes. Jeevamrit/Amritpani/cow pat pit are the bio-enhancers which can easily be prepared at the farm and used in crop production. It contains fast fermenting and beneficial microbes. *In situ* decomposition of organic waste improves the soil fertility as well as crop health.



Rotavator

Solid waste management (Kitchen waste) for ensuring nutritional security

World generates 2.01 billion tonnes of municipal solid waste annually and India contributes to 1.6 million metric tonnes daily. By 2050, 1750 acres land will be required for dumping of this municipal waste. Delhi, Mumbai, Chennai, Hyderabad and Kolkata are top five cities which generate maximum wastes in India.

Dumping and burning of municipal organic wastes at the outskirts of any city, generate CO₂, N₂O, polycyclic hydrocarbons and mercury which pollute air, water and cause several respiratory problems to animals and human beings.

Viable solutions

Rooftop/Terrace gardening: Kitchen and other bio-wastes generated in every household can be used for growing vegetables, few selected herbs, ornamental plants including few fruits at the roof top and terrace without agrochemicals. For this, dry and wet bio-wastes which are available in routine should be utilized. Dry waste may include dry leaves, lawn clippings, saw dust, coconut husk, cardboard pieces, etc. and wet includes vegetable and fruits peels and other bio-materials. Two containers of appropriate size may be earthen, plastic or cement could be used as bio digester for regular decomposition of these



Containers for decomposition of kitchen and organic wastes

materials. These should be placed at the top of terrace for routine decomposition of bio-waste to convert as rich manure. Daily wastes which are generated should be filled in one container after filling (say up to 3/4th), should be drenched with any bio-enhancer such as Jeevamrita / Cow pat pit/ vermi-wash as per convenience for enhancing decomposition of materials. Normally it takes few days for decomposition. The other container should be used for filling. This should be a routine process for regular cleaning of household and availability of enriched compost. Ready compost along with some garden soil from nearby area should be used as filling mixture in any structure or container or structure which can be used for production of daily requirements. One should try to procure seeds or seedlings on their own or try to procure from nearby genuine source for growing as per season. Regular collection and use of crop waste, generated in routine, or those which can be obtained from dropping of foliage from nearby trees and lawns should be placed in gaps as mulching material. Mulching and its drenching with bio-enhancer will help in quality production. If possible, after thorough filtrations, these can be used as foliar spray. In general, there is minimum possibility of insect pest occurrence, but in case of incidence, simple practices such as use of light trap/ pheromone trap/ cow urine, cow butter milk or neem oil is beneficial.



Permanent structures for gardening at rooftop

Precautions

- Conservation of kitchen waste and other organic waste should be a regular practice rather than throwing in the garbage,
- Decomposition of these materials in container or as mulch should be inculcated as hobby,
- Mulching is integral part of rooftop garden,
- If possible, structure may be made for climbing vegetables plants,
- Regular use of bio-enhancers (Jeevamrita/Amritpani/ Cow Pat Pit) for quick decomposition of materials filled in bio-digester or those mulched in gaps of the crop will enhance quality production.



Sponge gourd (*Luffa acutangula*) and Satputia production



Knowl khol and cherry tomato production



Capsicum, lettuce and coriander production

In fact rooftop/terrace production of vegetables crops is a source of physical exercise, management of kitchen wastes and pesticide free food for family members.

It appears to be simple but has many implications such as regular supply of quality produce, high esteem of family members particularly children and old persons in the family. By this gesture one can help in cleaning the home, nearby area and help in minimizing air pollution. Besides these efforts, there are some climbing plants such as gourds, pole beans and grape, passion fruit, etc can be trained to grow along the height of building, spread at the top of it.

The other alternative is to grow them in suitable structures in balconies, grow there or train downward for bearing. It is important to mention that there is regular dropping of older leaves, this needs to be collected and utilized as mulch materials.

Crops like chilies, coriander, basil, few cucurbits and some vegetable which have tendency of bearing over longer duration are preferred. It is customary to have a small structure at rooftop made with local material for climbing vegetable such as sponge gourd, snake gourd, bottle gourd, bitter gourd, pointed gourd, climbing beans, etc. which can be trained on these structures to get some home grown vegetables.

Advantage of rooftop/terrace gardening

- Rooftop/terrace gardening is a pleasant hobby to every person, particularly aged people and growing children.

- Just like senior citizens, it provides equal opportunity to children to gain self-confidence of creating some positive contribution.
- It gives inner joy to keep watch on different stages in plant growth right from germination to growth, flowering, fruiting and harvesting.
- It provides ample opportunity for fruitful utilization of time.
- Harvesting of fresh produce for daily consumption provides immense satisfaction which cannot be measured in financial terms.

CONCLUSION

From the above enumeration, it can be concluded that use of kitchen/organic wastes at rooftop is a cheap source of nutrition and provides pesticide free food for the family. Regular exercise near rooftop garden also provides happiness and sound health to practitioners. Use of kitchen/organic wastes at rooftop gardening can reduce municipal solid wastes by 50 to 60%. This practice reduces stress on urban infrastructure services and reduces lot of expenditure in municipal solid waste management system.

For further interaction, please write to:

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