



ROLE OF COMPOSTING IN THE FIELD OF AGRICULTURE: REVIEW

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Abstract: Generation of waste is one of the fundamental activities of any industry in this today's world so, is the agriculture. Significantly today there is a rise in the production of the solid organic waste in the field of agriculture and has become a major problem to deal with it now-a-days. So, one of the important and major topics that comes on to the screen is "RECYCLING". This recycling process can be easily achieved by Composting the solid organic waste. Here the solid organic waste is converted into the compost which can be used as a fertilizer for growing the crops by the process of composting. This compost is also useful to improve the soil fertility and the structure of the soil. Composting has been an eternal hope for the present world with its threatening populations and in the hunt of natural/ Eco-friendly degradable process. As well as composting process has become an effective alternative that has the capability to replace the traditional methods of disposing the waste that has a dangerous impact on the environment as well as the humans. (example: dumping and land filling). Here composting is an applicable branch of agriculture where the waste is converted into the value-added substance. It also focuses on the Stabilization, Mass reduction and returning the natural substance of the solid organic waste into the nature cycle. This paper reviews the existing papers on composting and the information on composting for treatment of the waste and also to mention the various environmental pollution concerns.

Keywords: Environmental pollution, Agriculture, Solid organic waste, Composting, Advantages.

1. Introduction: Due the increasing population and the un-planned urbanization these days feeding this large population has become a huge problem and caused a lot of stress on the field of agriculture and dealing with the waste from the agriculture has also become a major concern. Composting has raised as a perfect alternative method to replace the traditional methods of waste disposal methods like dumping and land filling which are posing the serious threats to the environment and the humans. Land filling has led to increased production of the Methane gas which is one of the 6 gases of the green houses. So, globally agreement as made to reduce the land filling of the waste to tackle the climate change Kyoto protocol (UN 1998). Landfills alone contribute to about 30% of methane production globally, (Com 1996). What generally happens in composting is here the waste organic and solid waste gets converted into the dark rich organic matter has is very useful to grow crops also it enriches the soil structure as well as the soil fertility which will be beneficial to farmer as well it will be crucial process to deal with the solid and the organic waste of agriculture. Here the composting process will be done under the presence of the micro-organisms. The performance of the microbes involved in the composting depends on the characteristics of the waste that is used for the composting process. Application of the compost to the field helps to intervene with the water holding capacity, water infiltration rate, water retention capacity and the tilth of that field.

Advantages of composting are in the field of agriculture:

- Reduction of the landfilling waste materials.
- Enrichment of the soil with the nutrients and minerals required for plant growth.
- Emission of the green houses can be controlled.
- Air quality index can be positively improved.
- Enhanced biodiversity is possible.
- Soil erosion can be avoided.
- Helps us to achieve the goals of recycling process.
- Cost-effective process.
- Process is completely practical and convenient.
- Manure will be easily available for the farmers.
- Eco-friendly method to dispose the waste.

- Helps to establish the goals of Sustainable foam of agriculture.

2. Application of compost to soil:

This process will be helpful in the establishment of the Integrated Nutrient Management process where the optimization the nutrients and it will indirectly contribute to combat the loss of organic matter decline and soil erosion (Van Camp et al, 2004). Here the composting plays a crucial in the process of nutrient cycling process where the removed nutrients are again replaced in the circular manner. So, called as the nutrients that are harvested are again replaced (Diner et al, 1993). Maintaining and restoring of the soil quality and increasing of the fertility of the soil is done. Organic matters properties are also increased. Further also helpful in the process of carbon sequestration and used mildly replace the usage of fertilizers (Smith et al, 2001). Sustainable development can be established. Better management and maintenance systems should be developed of the effective process. The important parameter that is used to determine the efficiency are nitrogen availability, In India generally high utilization of nitrogen fertilizers is seen and increase in nitrogen use efficiency of organic fertilizer investigation are required to be carried out (Amlinger et al, 2003).

3. Mechanism of Composting:

Agricultural waste can be converted into the nutrient compost by the process of composting. Composting is considered as an eco-friendly accepted method for the disposal of the waste (Y vette B et.al, 2000). Here the waste materials are converted into the humus like substance naturally by microbes by biological process in the presence of aerobic conditions. Here the pathogens are destroyed, and also the Nitrogen is converted from un-stable ammonia to the stable organic forms, volume and the size of the waste is reduced, and it improves the nutrient quality of that waste materials. Helps in the easy transport and handling of the waste materials. It can also be used in the higher dosages because of its more stable and slow release of Nitrogen as well as other required nutrients (Fauziah et.al, 2009). Composting process is influenced by various factors such as temperature, oxygen supply, aeration, and moisture content. The effectiveness of the compost depends on the factors that influences that process. There are two fundamental types of composting they are: 1. Aerobic, 2. Anaerobic.

There two types of composting are:

3.1 Aerobic type of composting:

Here the decomposition of the waste and the organic materials takes place in the presence of the air/ oxygen which also includes the carbon dioxide (CO₂), NH₃, water and heat is called the aerobic process of composting. This method has a broad spectrum of usage in today's world can be applicable to any kind of the organic waste and it's also and very effective process. Right combination of ingredients and conditions are required for the composting process. Which include 60-70% of moisture content and Carbon to Nitrogen (C/N) ratios of (30/1). Incase if can significant variation arises it leads to the inhibition of the degradation process. Dry waste such as wood, paper is a good source for Carbon, sewage sludge and wet waste are good source of Nitrogen which ensures the sufficient supply of oxygen at all the times. Here the ventilation of waste is provided and is also very essential.

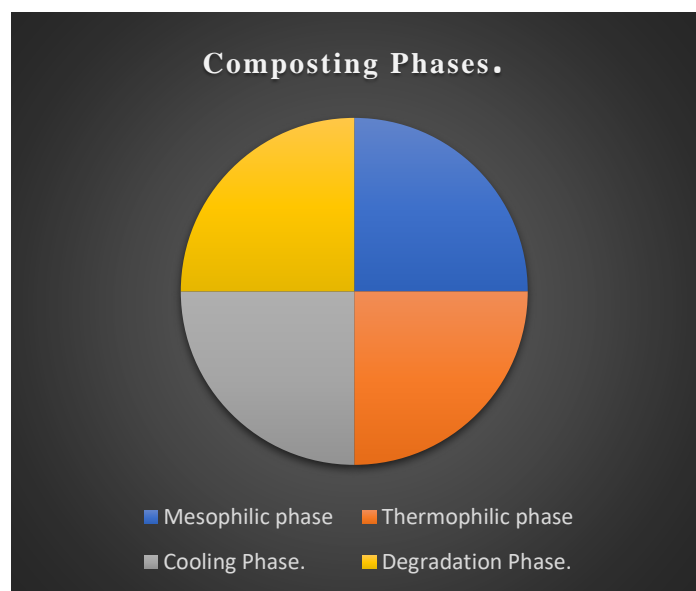
3.2 Anaerobic type of composting:

Here the decomposition of the waste and the organic materials take place in the absence of the oxygen O₂ is called as anaerobic process of composting, where the methane (CH₄), CO₂, NH₃ and trace amounts of other gases as well as organic acids are produced in this process. This type of process is a traditional process of composting which is followed to compost the waste of animals and humans. Recently this process is also used in the management of municipal solid waste as well as the green waste (Y vette B et.al, 2000).

4. Phases involved in the process of composting:

There are four phases involved this composting process:

- Mesophilic phase: occurs at the initial stages where the heat produced is round 20°C – 40°C, break down of cellulose into glucose takes with the help of bacteria. Leads to increase of the temperature at pile phase. Endospore are produced due to heat at pile phase.
- Thermophilic phase: occurs at the second stage where the heat produced is round 40.6°C – 65.6°C, here thermophilic bacteria and fungi take over. Pathogens a destroyed, Proteins are decomposed, and hemicellulose leads to decaying. Microbes tolerant to heat goes into dormant phase.
- Cooling phase: occurs at the third stage where the pile temperature lies below the 40°C (<40°C). Proteins and crab get destroyed and the metabolic activity gets reduced. Temperature in pile is decreased.
- Decomposing phase: This phase is also called curing/ ageing or maturing stage. Very important and crucial phase in the process of compost-making and longer the decomposing phase higher the safety net it adds to the destruction of the pathogens. Immature compost can e very harmful for the plants because it has a higher chance for the presence of the harmful pathogens to the plants health and Immature compost might also produce the Phyto-toxins that can steal the soil nitrogen and oxygen which also leads to the production of the organic acids so, enough time must e given for the compost for complete decomposition/ to mature completely.



5. Factors that influences the process of composting are:

- Water content (Moisture).
- Oxygen required.
- Nutrients present.
- Temperature.
- pH
- Time (Romeele, Mohee, 2005).

6. Substances can be used and substances that are avoided in the process of Composting are:

Substances that are used.	Substances that are avoided.
1.Sewage waste	1. Coal ash
2. Industrial waste products.	2. Plastic and metallic substances.
3. kitchen and garden waste.	3.Meat of fish (due to high rotten smell)
4. Municipal solid waste (70% organic waste).	4. Roots and leaves of persistent weeds
5. Dry leaves, grass cuttings and waste papers.	5. Cooked meat.

(Source: Diener et. al, 1993).

7. Different methods of composting:

- Indore method- developed by A. Howard and Y.D. Wad at the institute of plant industry, Indore, India.
- Bangalore method – was initiated by L.N Acharya at Indian Institute of Science, Bangalore.
- NADEP method- demonstrated at large scale at N. Krishi Vidyalaya, Indore.
- Coimbatore method.
- Vermicomposting.

7.1 Indore method: Here the organic waste materials are laid in the cattle shed which acts as a bedding. Urine-soaked substance is removed everyday about 15 cm thick at suitable sites. Water is sprinkled over these layers twice / thrice a day. Till fortnight layering process continues. Old compost acts as Inoculum and the heap is left undisturbed for about a month then it is moistened by turning finally after a month compost is ready for application. Size of pit is – Breath = 6-8 feet, Depth = 2-3 feet, Length = 10 feet.

7.2 Bangalore method: Here the dry waste of 25 cm thick is spread in a pit and thick suspension of cow dung is sprinkled for the moistening again a thin layer of dry waste is again laid on the moistened layer in a such a way pit is filled alternately. Till cow dung suspension rises to 0.5m above ground level and up to 15 days this pit is left uncovered later turning is done and plastered with wet mud and left undisturbed for about 5 months. Cost effective method as well as reduction in the usage of the labours as there is no need for regular turning and sprinkling of water. Size of the pit is 30'x6'x3' or in pits of 20'x6'x3'.

7.3 NADEP method: Here this type of method is used for composting a large amount of waste materials by the minimum use of the cattle dung. Here the process takes place aerobically. This involves the steps of 1. Selection of site for compost making, 2. Materials required, 3. Method of filling the tank, 4. Second filling. Size of the pit is 10' x 6' x 3' size and are prepared with 9' inch thick wall.

7.4 Coimbatore method: Composting is done in different sized pits depending on the waste materials used generally first layer laid is waste materials and suspension of 5-10 kg cow dung in 2.5 to 5.0 L of water is used to moistened and 0.5 to 1.0 kg fine bone meal is spreaded uniformly. Similar layer is made till it raises to 0.75 m above ground then plastering with wet mud is done and left undisturbed for 8-10 weeks. Later, plaster is removed and moistened with water and turning is given and made into rectangular heap under shady region and left undisturbed till it is used.

7.5 Vermicomposting: It's a process depends on the earthworms and micro-organisms helps to stabilize active organic materials and helps to convert them into the useful and valuable substance to plant growth. Earthworms consumes a wide range of waste products. Waste materials are recycled traditionally in this process. When vermicompost is added to soil this boosts the nutrient availability in the soil and enhances its structure. This compost has also shown the effective growth of plant and suppress the plant diseases and insect pest attacks. Nutrient value in vermicompost is Nitrogen= 0.5- 1.50%, Phosphorous= 0.1- 0.30%, Potassium= 0.15- 0.56%. Suitable earthworm species are: Eisenia foetida, Eudrilus eugine, Perionyx excavates, Bimastos parvus. Required conditions are a container of 2.23 x 2.23 m, about 10 kg of earthworms, lower mot layer should be feed materials such as coir pith, banana stem and banana stem, Moisture content should be around 30 – 40% and temperature requirement is 20° – 30° C is optimum

8. Areas where the compost can be utilized:

1. For the purpose land dressing, 2. Kitchen gardening, 3. Flower garden.
4. For soil dressing/ soil Conditioning, 5. Trees and plants, 6. House plants (kashmanian, 1995).

9. The criteria used for the measurement / determination of the compost quality:

1. Content of moisture in the compost, 2. Nutrient content present in compost, 3. Mass and particle size determination, 4. Level of Stability, 5. level of Pathogens, 6. Metallic content, 7. Consistency of product over the period (James, 2008).

10. Sales and Marketing strategy:

Sales and the marketing of the compost leads to generate the additional economic source and also its generate the employment for people thus leading to the betterment of the livelihood of the people living in the society. To get good sales the compost should be of high quality, should be able to be easily accessible to the end users and even the planning of the composting plant should be well planned, and economically beneficial method should adopted. Few important factors that influence the compost users are:

- Cost (cost should based on the quality of the compost).
- Quality of the product (should have good nutrient content, free from pest, weeds and harmful pathogens and odour and consistency of the substance).
- Appearance (good texture, dry in foam and earthy colour).
- Related source of information (benefits, nutrient content present, P^H analysis, Application rates and procedures of application).
- Adequate supply (Romeela, Mohee , 2005).

11. Conclusion:

Composting is very useful and beneficial process and eco-friendly process of decomposition of waste and here the waste and solid organic waste is converted into the useful substance for the growth of the plants. Composting can be an perfect alternative for the replacement of landfilling and open area dumping and also leads to the contamination of the ground water and composting also leads to reduced release of methane gases and also leads to the easy handling and management of the waste. Also, helpful to avoid the burning of waste. Helpful for establishment of goals of recycling process. Operation cost of the waste materials can be reduced. Composting will be an additional source of income and also helps in the employment generation in the rural areas and government and NGOs should also encourage the new ideas and innovation in the foam of start-ups in the field of composting.

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