ISSN: 3048-6580

AgroPedia
e - Publication for Agriculture Popular Articles
Volume: 03, Issue: 08 (August, 2026)
Available online at: https://www.agropedia.co.in

Composting for a Greener India: A Neglected Approach to Environmental Conservation

Dr. Sureshkumar M. Bambhaneeya, Dr. N. H. Garaniya and **Dr. Vaishali Surve**
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Navsari Agricultural University, Bharuch Campus
**Corresponding author - sureshsoilscience@nau.in*

Introduction

It is a general notion that Composting is an environmentally safe process. To maintain that good reputation it is essential that the process of composting be done on proper place with proper created facilities to mitigate any adverse environmental impacts. About 500 million tons of agro-wastes are generated in India annually, apart from wastes from agro- industries and animals. There are Organizations and Private companies claiming to have generated new generation beneficial microbial consortia for creating new hope in such waste heap. Marketing and selling of such material have already started. This novel process of composting will not only transform huge waste material into nutrient-rich worth material, but also would save huge exchequer of poor farmers of our country. However, while doing so, we must not be in that hurry as we forget some of basic technological management aspects as are necessary to be followed in relation to environmental protection. Such products are said to have positive effect on produce like fruit, flower and vegetable crops and thus obviously, based on availability of raw material and marketing of produce, suburb areas of cities, villages nearby to urban centers would be the most targeted locations for development of such compost produce on a large scale.

Major factors

Some important physical, chemical and microbial factors which are required to be maintained for good composting as well as for minimum environmental impacts, are hardly maintained under Indian condition till today. Thus, it is high time to give proper attention to that by creating awareness and developing facilities as well, particularly under open field operation. As we know that, the success of composting process depends mainly on temperature. Major factors responsible for good composting and minimum environmental impacts are given as under:

- Physical factors: Moisture content, particle size of the compost ingredients, size and shape of the composting system have large bearing on the rate of composting process. Rate of aeration, retention or dissipation of generated heat within the compost pile mainly depends on size and shape of the system. Major chemical factors: The rate of composting depends on C/N ratio of composite ingredients, oxygen, nutrients balance and pH of the composting medium. Microorganisms play the most significant role in breaking down organic matter during the process of composting.

- An ideal C/N ratio for composting is generally around 30:1(w/w) i.e., 30 parts carbon for each part nitrogen by weight and is based on microbial biomass and energy requirements. At lower ratios, nitrogen will be supplied in excess and will be lost as ammonia gas, causing undesirable odors or nitrate, causing water pollution. At higher ratios, nitrogen supply will be insufficient for optimal growth of the microbial populations, so the compost will remain relatively cool and degradation will proceed at a slow rate.

- Generally, green and moist materials tend to contain high nitrogen, while, those of brown and dry are high in carbon. While planning for composting, ingredients should be so chosen as to maintain C/N ratio little higher than 30:1, which, however, decreases to 10-15:1 in the product. Recommended particle size ranges from 1.3 to 7.6 cm (0.5 to 2 inches).

- 50-60% moisture content is generally considered as optimum for good composting. Less moisture content (<30%) inhibits bacterial activity while, high moisture (>65%) causes slow decomposition, odours production (in anaerobic pockets), and nutrient leaching.

- It is advisable to keep the compost below about 65°C, as the most beneficial microbes die off at temperature above 65°C. For significant reduction of pathogens, fly larvae, and weed seeds etc., composting should continue at a minimum temperature of 40°C consecutively for five days, with temperatures exceeding 55°C for at least four hours of this period. However, the presence of pathogens harmful to human and plant is required to be tested locally. As the temperature rises above about 40°C, thermophilic or heat-loving one replaces the mesophilic microorganisms. As the supply of these high-energy compounds becomes exhausted, the temperature gradually decreases and mesophilic microorganisms again take over for "curing" or maturation of the remaining organic matter.

- Oxygen concentrations > 10 percentage are considered optimal. This is needed for maintaining aerobic composting and to avoid anaerobic process, which produces undesirable odors, including the rotten-egg smell of hydrogen sulfide gas.

- A pH between 5.5 and 8.5 compost microorganisms operate best and are considered optimal. Mature compost should have pH between 6 and 8.

- If the system becomes anaerobic, acid accumulation occurs which can lower the pH as low as to 4.5, severely limiting microbial activity. Sufficient aeration is necessary to get back the compost pH to acceptable ranges.

Specific Environmental problems and necessary steps to mitigate

Many a times we abandon compost pit or pile half-through or due to some reason or other we are not in a position to maintain all the points as above and as a result environmental problems arise in the form of water and air pollution. Because proper site selection, ingredient mixtures, and compost pile management are major concerns in this line.

- Development of buffer between the site and surface or groundwater resources is the prime defense against water pollution.

- The primary concerns of leaf composting are Biochemical Oxygen Demand (BOD) and phenol concentrations found in water runoff and percolation. The concentrated levels of these generated by large-scale composting, should not be discharged into surface water supplies.

- Another potential concerns are nitrate, ammonia and in some cases phosphorus, where nutrient rich materials such as grass, manure, or sewage sludge including other nitrogenous compounds, are used. With manure or sewage sludge, there may also be pathogen concerns. As per reports, mixtures with low C/ N ratio can generate nitrate levels above the groundwater standard. Much of this nitrate in runoff water and leachate will infiltrate into the ground. Nitrate can be controlled by maintaining C: N ratio as above in the composting mixture, while proper selection, mixing, and management of materials can minimize the overall runoff, BOD, pathogen and nutrient movement.

- In a system with limited N, microorganisms efficiently assimilate nitrate, ammonia and other nitrogen compounds efficiently from the aqueous phase, thereby reducing the pollution threat.

- The moisture content as above is a balance between water and air filled pore space which allowing adequate moisture for decomposition and control flow of air for supply of oxygen.

- Some important issues are soil type, slope, and the nature of the buffer between the site and surface or groundwater resources from an environmental management perspective. In impermeable soils, groundwater is protected from nitrate pollution, but runoff is maximized which increases the BOD, phosphorus, and pathogen threat to surface water. Highly permeable soils reduce the runoff potential but may allow excessive nitrate infiltration to groundwater. Intermediate soil types may be best for sites if working on the native soil. Those handling challenging waste materials, a working surface made of gravel, compacted sand, oiled stone or concrete would be appropriate. However, in this case the question of surface or groundwater quality issues still remains.

References

Cole, M.A. 1994. Assessing the impact of composting yard trimmings. *Bio Cycle* 35(4):92-96.

Gray, K. R., and K. Sherman, 1970. Public Cleansing 60(7):343-354.

Gray, K.R., K. Sherman, and A.J. Biddlestone. *Process Biochemistry* 6(10):22-28.

Haug, R.T., 1993. Practical Handbook of Compost Eng'g. Lewis Publishers, Boca Ratan, FL. p.411.

Loehr, R. C., W. J. Jewell, J. D. Novak, W. W. Clarkson, G. S. Friedman. 1979. *Land Application of Wastes, Vol. II*. Van Nostrand Reinhold Co. New York, NY.

Richard, T.L. and M. Chadsey. 1994. Environmental Impact Assessment. In: *Composting Source Separated Organics.* Edited by BioCycle staff. J.G. Press, Inc. Emmaus, PA. pp 232-237. Also published in 1990 as: Environmental monitoring at a yard waste composting facility. *BioCycle.* 31(4):42-46.

Rymshaw, E., M.F. Walter, and T.L. Richard. 1992. Agricultural Composting: Environmental Monitoring and Management Practices. Dept. of Ag. & Bio. Eng., Cornell University, Ithaca, NY.

Rynk, R., M. van de Kamp, G.B. Willson, M.E. Singley, T.L. Richard, J.J. Kolega, F.R. Gouin, L. Laliberty, Jr., K. Day, D.W. Murphy, H.A.J. Hoitink, and W.F. Brinton. 1992. on farm composting handbook, NRAES, Cornell University, Ithaca, NY. 186 pp.