



Agricultural Waste Management: Problems and Treatments

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Abstract The rapid growth of population, urbanization and industrialization have accelerated the generation of waste in economy. Agricultural waste is composed of organic wastes (animal excreta in the form of slurries and farmyard manures, spent mushroom compost) which includes natural waste, animal waste and plant waste. If wastes are not properly handled they can pollute surface and groundwater and contribute to air pollution. Waste management helps to maintain a healthy environment as India is one of the richest country in agricultural resources. The prime focus of this paper is to examine the concept of agriculture waste management and to provide various treatment for the agriculture waste generated. The findings of the paper shows that with the technology advancement, agriculture is no longer an environment issue but a resource for energy production. It is also pertinent to develop a sustainable and eco-friendly agricultural practices so that organic resources mainly in the form of crop residues, animal waste, and municipal solid waste are utilized.

Key Words: Agricultural Waste Management, Organic Waste, Sustainable, Solid Waste.

1. INTRODUCTION:

Agricultural Wastes: Agricultural waste is waste produced as a result of various agricultural operations. It includes manure and other wastes from farms, poultry houses and slaughterhouses; harvest waste; fertilizer run-off from fields; pesticides that enter into water, air or soils; and salt and silt drained from fields.

Agricultural Waste Management: An agricultural waste management system (AWMS) is a planned system in which all necessary components are installed and managed to control and use by-products of agricultural production in a manner that sustains or enhances the quality of air, water, soil, plant, animal, and energy resources. Agricultural wastes are defined as the residues from the growing and processing of raw agricultural products such as fruits, vegetables, meat, poultry, dairy products, and crops.

Agriculture is the backbone of many developing nations and is one of the largest contributors to the resource sector. Millions of people practice agriculture as their occupation in the world. With the increase in the population, there is a rise in the demand for food and food products supply, so many people are practicing modern agriculture to meet the demand. Modern agriculture uses the latest farming techniques along with artificial fertilizers. People are also practicing garden farming using modern methods. The demand for animal products such as milk products and meat is also high and producers have found ways to increase productivity and decrease the unit cost of production. Chemicals such as fossil fuels, inorganic fertilizers, and pesticides, improved genetics of production species are enhancing the increase in the production.

Agriculture depends heavily on steady water supplies, different land use, and management practices. Nevertheless, climate change is likely to disrupt those supplies through floods and droughts. Increased warming may also have a greater effect on countries whose climate is already near or at a temperature limit over which yields reduce or crops fail in the tropics or subtropics. One of the most critical questions regarding climate change is how it would affect the food supply for a growing global population particularly for developing countries. For example, India's population has remarkably expanded from 369.88 million (in 1947) to 1173.10 million by 2010 and expected to be more than 1460.74 million by 2030 and 1656.6 million by 2050 with the population growth rate of 1.2% in India.

Agricultural waste is composed of organic wastes (animal excreta in the form of slurries and farmyard manures, spent mushroom compost) which includes natural waste, animal waste and plant waste. If wastes are not properly handled they can pollute surface and groundwater and contribute to air pollution. Waste management helps to maintain a healthy environment.



2. ADVERSE EFFECT OF AGRICULTURE POLLUTION:

Soil Erosion and Sedimentation : Further problems are caused by soil erosion and sedimentation. The soil is comprised of many layers, and it is only the topmost layer that can support farming or grazing. Due to inefficient farming practices, this soil is left open for erosion and leads to declining fertility each year. Whether eroded by water or wind, all this soil has to be deposited somewhere or the other. The resulting sedimentation causes the soil to build up in areas such as rivers, streams, ditches and surrounding fields. And so, the process of agricultural pollution prevents the natural movement of water, aquatic animals and nutrients to other fertile areas.

Pesticides and Fertilizers : Modern-day pesticides & fertilizers have to deal with the local pests that have existed for hundreds of years along with the new invasive species. And so, they are laden with chemicals that are not found in nature. Once they have been sprayed, it does not disappear completely. Some of it mixes with the water and seeps into the ground. The rest is absorbed by the plant itself. As a result, the local streams that are supplied water from the ground become contamination, as do the animals that eat these crops and plants.

Contamination Water: Contaminated water used for irrigation is one further source of pollution. Much of the water we use comes from groundwater reservoirs, canals and through the rains. While plenty of it is clean and pure water, other sources are polluted with organic compounds and heavy metals. This happens due to the disposal of industrial and agricultural waste in local bodies of water.

Pests and Weeds: Growing exotic crops and reducing the natural species in a certain area has become the norm for agriculture. However, it is simply adding to the process of agricultural pollution. With the arrival of new crops, the native population has to deal with new diseases, pests, and weeds that it is not capable of fighting. As a result, the invasive species destroy the local vegetation and wildlife, altering the ecosystem permanently. This is especially the case with Genetically Modified Foods(GMO), which create plant and animal species that can wipe out the existing species in a matter of years.

Organic Contaminants: Manures and Bio-solids frequently contain nutrients, including nitrogen, carbon, and phosphorus. Furthermore, because they are industrially processed, they may also have within them contaminants such as personal care products (PPCPs) and pharmaceuticals. These products have been found in human and animal bodies and are believed to have negative health impacts on wildlife, animals, and humans.

Figure: 1



Sources: Metropolitan Transfer Station, 2021

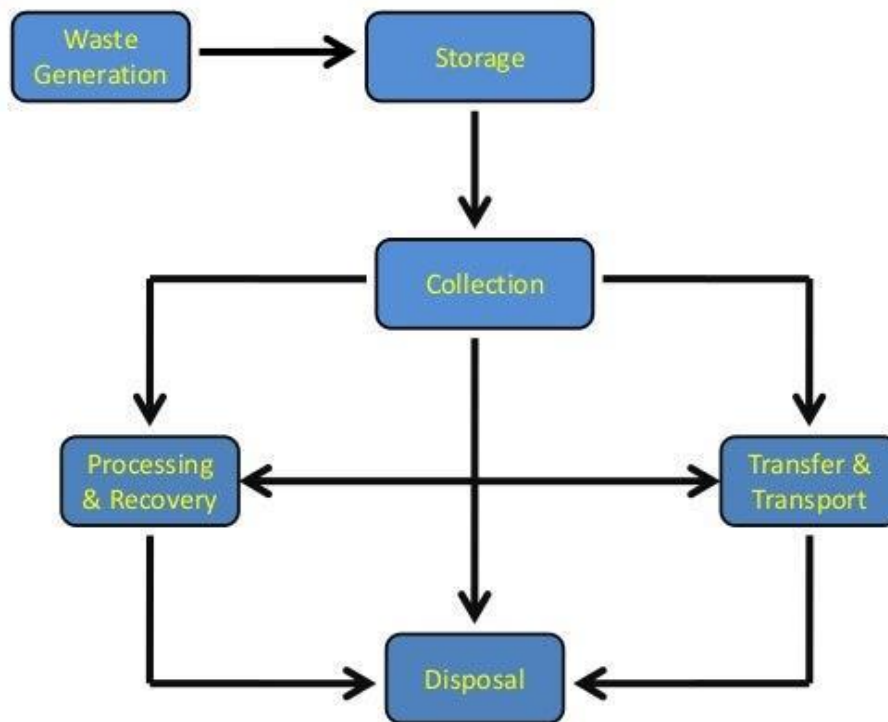
3. FUNCTIONAL ELEMENTS OF AGRICULTURAL WASTE MANAGEMENT SYSTEM

The activities connected with the management of agricultural wastes from the purpose of generation of ultimate disposal can be clustered into the six functional elements:



1. Waste generation
2. Waste handling, storage and processing
3. Waste collection
4. Transfer and transport
5. Processing and Recovery
6. Disposal Waste

Figure: 2
INTERRELATIONSHIP OF FUNCTIONAL ELEMENTS IN WASTE MANAGEMENT SYSTEM



Source: Environmental Engineering Peavy & Rowe

4. AGRICULTURAL WASTE MANAGEMENT – TREATMENTS :

How is agricultural waste disposed of? Methods of getting rid of agricultural waste:

Pyrolysis: Pyrolysis is one of the technologies available to convert biomass to an intermediate liquid product that can be refined to drop-in hydrocarbon biofuels, oxygenated fuel additives and petrochemical replacements. Pyrolysis is the heating of an organic material, such as biomass, in the absence of oxygen. Biomass pyrolysis is usually conducted at or above 500 °C, providing enough heat to deconstruct the strong bio-polymers mentioned above. Because no oxygen is present combustion does not occur, rather the biomass thermally decomposes into combustible gases and bio-char. Pyrolysis is most commonly used in the treatment of organic materials. Most of these combustible gases can be condensed into a combustible liquid, called pyrolysis oil (bio-oil), though there are some permanent gases (CO₂, CO, H₂, light hydrocarbons), some of which can be combusted to provide the heat for the process.

Landfills: A landfill is an engineered pit, in which layers of solid waste are filled, compacted and covered for final disposal. It is lined at the bottom to prevent groundwater pollution. Landfills need expert design as well as skilled operators and a proper management to guarantee their functionality. It is a carefully designed structure built into or on top of the ground in which trash is isolated from the surrounding environment (groundwater, air, rain). This isolation is accomplished with a bottom liner and daily covering of soil. The purpose of a landfill is to bury the trash in such a way that it will be isolated from groundwater, will be kept dry and will not be in contact with air. Unlike a compost pile, a landfill is designed to keep the trash away from people, but does not allow it to decompose quickly.

Sanitary Landfills: A method of disposing of solid waste on land without creating hazards to public health or safety, by utilizing the principles of engineering to confine the solid waste to the smallest practical area, to reduce it to the



smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation or at more frequent intervals as may be necessary.

Compost: Composting is a process by which organic wastes are broken down by microorganisms, generally bacteria and fungi, into simpler forms. The microorganisms use the carbon in the waste as an energy source. The degradation of the nitrogen-containing materials results in the breakdown of the original materials into a much more uniform product which can be used as a soil amendment. Composting is the natural process of 'rotting' or decomposition of organic matter by microorganisms under controlled conditions. The compost made from farm waste like sugarcane trash, paddy straw, weeds and other plants and other waste is called farm compost.

Incineration : Incineration is a waste treatment process that involves the combustion of substances contained in waste materials. Industrial plants for waste incineration are commonly referred to as waste-to-energy facilities. Incineration and other high-temperature waste treatment systems are described as "thermal treatment". Incineration is a method of treating waste which involves the combustion of the organic substances found in waste materials. The solid mass of the original waste is reduced by around 80 to 85%, while the volume is reduced by between 95 and 96%. While incineration does not totally replace the process of landfilling, it does reduce the amount of waste to be disposed of considerably.

The 3R Approach

Reduce-Reuse-Recycle, is a concept of how to manage waste properly. The top priority is to reduce the waste generation, and then reuse, and recycle the waste generated to give waste disposal a chance before disposing them into landfill.

Figure: 3



Reduce means to minimize the amount of waste we create.

Reuse refers to using items more than once.

Recycle means putting a product to a new use instead of throwing it away.

Concerns about Agriculture Waste Management

- If not managed properly, agricultural waste can pollute the environment.
- The degradation of water quantity can impact adjacent waterways and groundwater both onsite and offsite.
- This degradation reduces the ability of these resources to support aquatic life and water for human and animal consumption.
- Nitrates can be found in fertilizers and agricultural runoff, can seep into groundwater.
- Water contamination with nitrates is hazardous to humans as it results in oxygen depletion in the blood.

5. CONCLUSION :

India generates about 350 millions of tons of agriculture waste every year. As per the estimates given by the Ministry of new and renewable energy, this waste can generate more than 18,000MW of power every year apart from generating green fertilizer for use in agriculture. Agriculture waste management is an important issue that needs governmental action quickly. At present, there is very little awareness exists regarding this issue in our society. The practices of bringing forth waste are too risky not only for today but they could be dangerous for our future generation.



It is very important to educate people and tell them to adopt practices for Recycle, Reuse and Reduce rather than generating waste. Municipalities and Governments should pay importance to disposal of waste in agriculture. The reuse of agriculture waste in farming operations can reduce the quantity and hauling costs of commercial fertilizers. The contribution of agriculture waste increase the organic matter contents of soil, which increases nutrient availability of crops and improves the water holding capacity. Good agriculture waste management reduces the instances of water contamination and minimizes surface water pollution.

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