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Strategies for Eco-Friendly Agricultural Waste Management

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INTRODUCTION

Agricultural waste is a byproduct of agricultural production that results from a variety of post-harvesting processes. Manure, crop residues and other waste from farms, slaughterhouses, poultry houses, as well as harvest waste, salt and silt drained from the field, fertiliser run-off from fields and pesticides that enter the water, air, or soils are all examples. Waste has been a problem since the introduction of technology in agricultural processes because of its capacity to harm and pollute the environment. Agricultural trash, sewage, and municipal solid waste are the three most pressing issues in rural communities today. Every year, India produces more than 300 million tonnes (MT) of agricultural waste.Farmers cultivate the most profitable crops appropriate to their fields and apply cost-effective agricultural procedures, therefore the type and quantity of agricultural waste produced in the country varies from region to region. Many farmers today see residue utilisation as an added cost with little or no profit potential, and the best way to get rid of the residues is to dump them off, burn them openly, and so on. The burning of paddy and wheat straw, for example, produces a variety of dangerous gases that not only contribute to global warming but also endanger human health. Such methods' environmental risks can no longer be overlooked. Though attempts have been made to the utilization of agricultural waste for composting and animal fodder, none of them has been implemented in a sustainable form. Several factors have aggravated the problem including the absence of environmental awareness and low level of knowledge and skills affecting the approach of farmers in handling agricultural waste. Attitudes must change to create wealth from agricultural waste and foster the idea of considering agricultural residue and its utilization as an integral part of agricultural production.

Composting, animal fodder, and energy production are just a few of the novel ideas and ways for utilising crop waste that have become appealing and profitable. Several biomass research and development activities are now conducted in India and other nations. Many efforts are being made at the national level, particularly by the Ministries of Agriculture and Farmers Welfare and Environment, Forestry, and Climate Change. The Indian government must develop solutions to the problem and prevent environmental damage caused by inappropriate crop residue management. Those initiatives need to be bolstered, scaled up, and implemented on a large scale.

The need of the hour is to raise awareness among farmers so that they recognise the importance of crop leftovers in conservation agriculture for the long-term sustainable management of Indian agriculture.

Recycle Agricultural Waste to Wealth

Agricultural wastes are a result of the production and processing of agricultural goods that may contain material that is useful to humans but whose economic value is less than the cost of collecting, transportation, and processing for beneficial use. They might be in the form of liquids, slurries, or solids, and their composition will vary based on the system and kind of agricultural activity. These agricultural wastes contain a lot of minerals that can be recycled and used as a nutrition source for subsequent crops.

Composting is the most effective way to recycle agricultural waste since it mobilises nutrients, decreases harmful pollutants, and kills microorganisms that cause illness in agricultural crops. Composting provides a number of other benefits, including improving soil health, lowering the environmental risks of agricultural residues, and reducing pollution of land, water, and air, as well as providing nutrients to the following crop.

Different methods for Agri-waste Management

A. Biomass Pellet

Using a biomass pellet mill to convert agricultural wastes such as crop straw, rice husk, peanut shell, corncob, and giant grass into pellets is one of the most profitable methods.

Application of agricultural waste pellets

1. Pellets can be used for both residential heating and industrial manufacturing as a fuel.
2. Animal bedding: Compared to straw and cheap bedding, pellet animal bedding has a higher absorbency, is more convenient, and is a better value.
3. Animal feed: Agricultural waste pellets can be utilised as animal feed in addition to the previous uses such as fuel and animal bedding.

B. Agricultural wastes for Production of Biogas and Biofuels

This is a very significant emerging subject, particularly in light of the ever-increasing costs of energy and garbage disposal, as well as the growing public concern about environmental deterioration. As a result, these crop residues can be transformed into sustainable, carbon-neutral solid, liquid, and gaseous biofuels as a source of alternative energy. Waste products from different plants can also be used to fuel boilers in these plants. A good example may be found in rice processing factories, where raw rice is first dehusked, with the husks being a severe environmental hazard because they are difficult to dispose of. These husks, on the other hand, can be harvested and utilised to fire boilers throughout paddy parboiling. This will save a great deal of money for such a business, which can then be invested in other areas of the business. Another example is a groundnut processing facility. During the manufacturing of groundnut oil, dried groundnut shells are commonly employed as an alternative energy source. Husks, hulls, chaff, and stalks from different grains and pulse processing factories, as well as spice and

condiment manufacturing plants, are utilised as fuel.

C. Production of Biodiesel from Agricultural Wastes

Vegetable oils or animal fats are commonly used to make biodiesel. Palm oil, soybean oil, sunflower oil, rice bran oil, rapeseed oil, and other oils are used. The type of vegetable oil used is determined by how readily available it is in the country where biodiesel is made. Bioethanol made from wastes, on the other hand, can be used to transesterify vegetable oils to form monoethyl esters of fatty acids, which can then be used to make biodiesel. Biotechnological systems for biofuels production from agro-industrial wastes and residues have the potential to reduce harmful pollutants and greenhouse gas emissions, save the environment, and help to solve the global fuel issue in part.One can reasonably hope to enable the'second industrial revolution' that our society currently requires by focusing the revolutionary force of biotechnology on issues in biofuel production while addressing sustainability in all of its dimensions. Life cycle analyses, which provide the conceptual framework for a comprehensive review of energy supply alternatives with regard to their resource needs as well as the health and environmental impact, are needed in order to make the rational and balanced judgments that are so important in this matter concerning the sustainable development of energy supply chains and energy systems as significant factors to consider.

D. Agro-Food wastes as Substrates for Production of Oxytetracycline and Other Antibiotics

The broad-spectrum antibiotic oxytetracycline is a bacteriostatic antibiotic that suppresses protein binds reversibly to the microorganism's 30S ribosomal subunit. As a result, it is a very significant antibiotic class that is utilised in human and veterinary medicine, as well as as a supplement in poultry and swine production, as well as the preservation of fish, meat, and poultry. It's also used in non-therapeutics for plant disease control, amino acid fermentation stimulation, and material biodeterioration inhibition. Various ways had been used to manufacture oxytetracycline and other antibiotics. Some can be derived from a semi-solid culture with a low water content and high aeration at the surface, which favours antibiotic synthesis. Oxytetracyclines were made from a variety of organic compounds by different strains of streptomyces bacteria, which were mostly found in soil and decaying vegetation. Sweet potato residue, sawdust, rice hulls, corn cob, cassava peel, maize pomace, corncob, groundnut shell, and cocoyam peels have all been used as effective substrates for the synthesis of antibiotics by solid-state fermentation. The process of microbial growth and product generation on the surfaces of solid substrates in the presence or absence of water is known as solid-state fermentation. The biggest genus of actinobacteria, Streptomyces, is a group of Gram-positive bacteria with a high guanine-cytosine concentration. They're mostly found in soil and decaying plants, and they have a unique earthy odour due to the synthesis of the volatile metabolite geosmin. For energy and growth, they use a wide spectrum of organic substances as their sole supply of carbon. The ideal temperature range is 25 to 35°C, but certain species can grow in the thermophilic and psychrophilic ranges. ThepH range for optimal growth is 6.5 to 8.8.