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Review Article

Assessment of Human and Ecosystem Risk Due to Agricultural Waste Compost Application on Soils: A Review

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Agricultural wastes (AW) are often characterized by varying pH and substantial contamination potential, which are mainly related to their high organic load, thus affecting—when improperly disposed of—soils, living organisms, and water bodies. Composting of AW is the most commonly used management option and results in the production of soil improver that enhances crop growth and contributes to agricultural sustainability. This study aims to present the framework for assessing human and ecosystem risk when compost produced from AW is applied on soil. In order to develop this framework, issues such as origin, composition and pretreatment of AW, application rates on soils, bioavailability and mobility of contaminants present in compost, exposure routes and rates as well as determination of the fate of contaminants in soil, air, and water, should be taken into consideration.

Keywords: agricultural waste, compost, human and ecosystem risk

The interpretation of the term *resource efficiency* includes mainly raw materials, energy sources, biomass, waste, land and soil, water, and biodiversity. Resource efficiency is a key priority for policymakers across Europe and many other developed countries. The European Union (EU) has designated resource efficiency as one of seven flagship initiatives in its Europe 2020 strategy for smart, sustainable, and inclusive growth. The most common priority resources are energy carriers and waste, followed by minerals, raw materials, and water (European Environment Agency [EEA], 2011). In a similar manner, United Nations Environment Programme (UNEP) defines resource efficiency from a life cycle and value chain perspective. This definition means reducing the total environmental impact of the production and consumption of goods and services, from raw material extraction to final use and disposal (UNEP, 2011).

According to the Directive 2008/98/EC (European Commission [EC] 2008), the term *waste* means any substance or object that the holder discards or intends or is required to discard; whereas a *byproduct* is a substance or object resulting from a production process, the primary aim of which is not the production of that item. A byproduct may be regarded as not being waste but can be used if several conditions are met, including fulfillment of all relevant product, environmental, and health protection requirements for the specific use and not leading to overall adverse environmental or human health impacts (EC, 2008). A*gricultural waste* (AW) is waste that is produced as a result of various agricultural operations. AW includes manure and other wastes from farms, poultry houses and slaughterhouses, harvest waste, fertilizer runoff from fields, pesticides that enter into water, air or soils, and salt and silt drained from fields (OECD, 1997).

AWs are mainly characterized by seasonal production, exhibit often a substantial contamination potential and may cause various adverse effects when disposed of untreated on soil or in water bodies. Their production route and composition vary in different geographical regions. Some of the most important AW used today for the production of compost include animal waste, olive oil mill and winery wastewater, and rice and wheat straw waste, as well as wastes from fruit and vegetable processing (Sarmah, 2009; Altieri and Esposito, 2010).

Animal wastes, which are produced in huge quantities, include mostly manure, poultry, and slaughterhouse waste. Application of manure on crop land can result in decreased soil permeability and affect adversely crop growth due to the addition of inhibitory amounts of nitrogen, phosphorus and salts and also cause eutrophication of water bodies or contamination of drinking water sources. Animal waste can also affect surface water and groundwater quality in case of generation of leakage from waste storage facilities and runoff in fields where an excessive amount of waste has been applied as fertilizer. Other potential impacts include dust generation during unloading of poultry waste as well as offensive odors from slurries,

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