The Feasibility of Composting Poultry Litter and Food Residuals

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Agriculture is an essential industry to the state of Delaware. This industry is costly for both the state's land and waters. Replenishing soils of nutrients lost to growing plants is a large part of this problem. Monoculture agriculture, as practiced widely in the state is nearly impossible for the soil to maintain a good nutrient status. In nature nothing is monoculture and at the same time nothing is wasted (Howard 3-4). Often chemical fertilizers or fresh poultry manures are used to replenish nutrients to the soil. Both of these methods have potentially harmful consequences. Run-off occurs when the rate of water infiltration into a soil is less than the amount of precipitation or irrigation (Epstein 360). This is often the case when fertilizers and manures are being applied to soils. Chemical fertilizers cannot maintain soil quality because it does not contribute to physical qualities such as porosity and water-holding capacity (Howard 18). Direct application of poultry manure is problematic due to the high pH of the manure, and high volatilization of nitrogen in the form on ammonia (NRAES 15). Fresh organic matter incorporated into soil also lowers the oxygen content of the soil, causing the plant to compete with the microbes for oxygen (Epstein 108). In 1931, Sir Albert Howard, a British agronomist now known as the father of the modern era of composting, described a method he called the "Indore method" for maintaining soil fertility by the manufacture of humus from vegetable and animal wastes (Howard, ix). It was a process involving the piling of plant and animal wastes in pits or heaps to promote microbial degradation of organic matter. The piles would be turned once over the course of several months and then used as a soil amendment (Howard 39-51). Howard referred to the material "humus" as"soil cement" that leads to "better health of crops and livestock" (24, 166). He emphasized the importance of the balance of nutrients within the agricultural system, and emphasized the maintenance of soil physical quality in order to improve crop yield (39). Knowledge of the details of the composting process has grown significantly since the time Howard did his research, but the same principles are still applicable. Basically it can be examined as a stepwise reduction of complex substances to simpler compounds (Epstein 22). Most definitions of the process require that thermophillic temperatures are reached, pathogens are eliminated, plant seeds are deactivated, and nutrients are mineralized (Haug 1, Zucconi & de Bertoldi, 2.1). Often the finished composting product is mistaken for the humus that Howard discussed. Humus is a semi-finite decompositional state and a result of the long-term decomposition of organic matter in soil (Epstein 22, 102). Although Howard recognized the importance of humus to soil quality, we now know that it returns nutrients to the soil, increases the cation exchange capacity of the soil (the availability of nutrients to the plants) and enhances microbial populations within the soil (Epstein 101-2). Stabilized compost product and humus are sometimes referred to collectively as "humic substances," yellow to black-colored high molecular weight organic based substances comprised mainly of humic acid, fulvic acid and humin (Sparks 57, Epstein 101). These are part of the broader category of "soil organic matter." Because of the functional groups and chemically bonding properties associated with soil organic mater, it is the part of the soil responsible for nutrient retention, porosity and thus aeration, containment of metals and organic contaminants, and water retention (Sparks 53).

Objectives

The objective of these experiments is to determine the efficacy of composting a mixture of food residuals and poultry litter to produce an acceptable soil amendment. The food residuals will be diverted from the municipal solid waste stream and ultimately the landfill. This helps to decrease leaching of acids and organic contaminants from the landfill. The poultry litter will be diverted from direct soil application. This prevents increased nutrient loss due to volatilization and run-off to surface waters due to insufficient infiltration. The ultimate objective of this project would be to combine poultry litter with municipal solid waste organics to produce a composted product for mainly agricultural, but also other applications. The application of stabilized composted product as a soil amendment has several direct implications. Compost decreases erosion when compared to application of chemical fertilizers because of the colloidal-particles formed with the soil. The larger sized particles not only keep water from carrying particles away, but also help to hold the water in the soil (Epstein 360). Stabilized compost also serves to increase nutrient availability to plants and increase aeration to plant roots because of increase porosity.