BIOSOLIDS RECYCLING research notes

NORTHWEST BIOSOLIDS MANAGEMENT ASSOCIATION

Improving Degraded Urban Soils Using Organic Amendments

Researchers and Collaborators

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Background

Urban and suburban development degrades the soil environment, resulting in loss of soil organic matter, loss of structure and permeability, increased compaction, decreased macroporosity and aeration, increased runoff, and an overall decline in the environment for plant growth. Organic amendments can ameliorate these negative effects. Increasing concern about the effects of development on soil and water quality, and increasing volumes of locally produced biosolids and composts provides opportunities for high value use of local organic materials to improve urban soils.

Objectives

The scientific literature on organic soil amendments was evaluated to provide a basis for guidelines for biosolids and compost use in urban soils. We reviewed the refereed scientific literature from the 1970s until the present, along with selected recent non-refereed articles available from universities and other research institutions. We also include some unpublished information from our own research and demonstration projects at WSU Puyallup. This review addresses the following questions:

- Is there a good scientific basis for the expected benefits of organic amendments in urban soils?
- Do biosolids composts and other biosolids products offer any specific advantages or disadvantages?
- How long are the organic amendments effective?
- How much organic matter should be added to achieve these benefits?

Discussion

Most of the research on the effects of organic amendments on soil physical properties has been done in agricultural soils, with application rates ranging from about 5 to 200 dry tons/acre/year. Results of this research have consistently shown significant positive effects of organic amendments. The stability of soil aggregates increases, bulk density declines, macroporosity and infiltration rates increase, and total water holding capacity increases, leading to a better environment for plant growth. Higher rates of amendments led to greater improvement in soil properties. Although few studies have assessed the effects of organic amendments on runoff and erosion, the improved physical properties of these soils would be expected to reduce runoff and erosion. Organic amendments with C:N ratio < 20:1 also supply significant amounts of nutrients to plants.

Organic amendments increased plant available water in some studies, but not in others. This is because not all soil water is available to plants, and in some cases the amendments increased the amount of unavailable water, held tightly in the small pores of the soil. Increased organic matter had the greatest effect on available water in coarse-textured soils.

Data on the longevity of amendment benefits are limited, but suggest that levels of organic matter are still greater and bulk density and compaction still lower in amended soils more than five years after application in a humid, temperate environment.

Most of the biosolids literature focused on biosolids composts. Biosolids composts are effective soil amendments, and the research data shows that biosolids composts are equivalent to other types of composts in their effects on soils and plants. The rate of compost is more important than the source of compost, as long as composts are of suitable quality for amendment to soil.

Non-composted Class A biosolids (including dried biosolids products and many biosolids blends) have low C:N ratios and supply much larger amounts of nitrogen than composts. Application rates of these materials are limited to the nitrogen needs of the plants, and their primary benefit is as slow-release fertilizers. Organic matter benefits of these materials are secondary, because total application rates are smaller than for composts.

Little direct research has been published on amending soils disturbed by urban development. Amendment guidelines for establishing lawns or landscape beds in these soils have largely been based on agricultural research. Adaptation of agricultural results suggest that compost amendment rates of about one-third by volume should be suitable for establishing landscape beds in humid, temperate environments in soils degraded by development, provided that the entire bed is amended, and not just planting holes. Suggested rates for lawn establishment in degraded soils are 15 to 25% amendment by volume.

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