Enhancement of Soil and Soil Management Practices

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Objectives:

1. The purpose of this research is to develop improved soils and or soil management practices for turfgrass.

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Project Duration: three years
Total Funding: $35,000

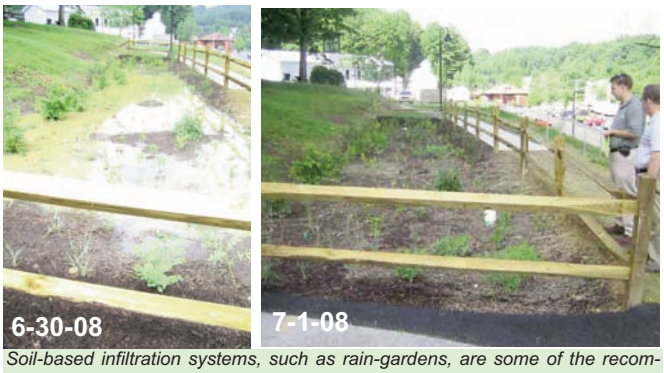
Topsoil is often unavailable in sufficient amounts during urban soil constructions or restoration of degraded soils. Therefore, there is an increasing use of mineral and organic by-products from agricultural and manufacturing industries as topsoil replacements, or as amendments in constructed soils.

A selected suite of municipal and agricultural organic by-products (anaerobically digested poultry litter, poultry litter compost, yard waste compost, and turkey litter compost), and quarry industry products were evaluated as topsoil replacements in a growth chamber experiment. The objective was to determine which by-product mix(es) provided the most desirable soil properties for turfgrass growth compared to a reference commercial topsoil mix.

Plant biomass was similar in most treatments, however it was consistently and statistically significantly lower in treatments where yard waste compost was used. Microbial activity varied among treatments. We found that the substrates present in the constructed soils promoted bacterial dominance compared to the fungal dominance in the reference commercial mix. It is also likely that the higher pH of the quarry mixes promoted the observed bacterial dominance in those treatments.

Similarly, soil enzyme activities also varied among treatments. Organic amendments increased soil ß-glucosidase activity in all treatments over their non-organic amended controls. A strong correlation was found between ß-glucosidase and available phosporus. Results of this study suggest that selected waste streams can be effectively used in constructed topsoil.

The growing residential and commercial development of urban and rural areas results in an increased demand for borrowed topsoil for landscaping purposes. Yet, topsoil definition itself varies among authoritative sources and include the A horizon surface layer, the A master horizon (A_m), or a mixture of A and E master horizons. This study was aimed at evaluating how different topsoil definitions affect these properties of the borrowed topsoil. The hypothesis was that a mixture of A and E horizons will result in larger salvaged soil volume while having minor, if any, adverse effects on the borrowed topsoil characteristics.



Soil-based infiltration systems, such as rain-gardens, are some of the recommended practices for reduction and on-site treatment of storm water.

Of the over 100,000 entries of the USDA-NRCS National Soil Survey Center (NSSC) database, 59,300 entries of different soil orders (excluding histosols, oxisols, and andisols) from the 48 contiguous states were used. AE-mix topsoil resulted in an average reduction of 38% in organic carbon and negligible changes in average sand, silt, and clay content compare to its respective A_m topsoil (i.e. among A_m and AE-mix constructed from the same pedon). Yet, average thickness of AE-mix topsoil was over 2.5 times that of its respective A_m topsoil.

The study provides average topsoil characteristics on a soil order basis that can serve as a reference in developing and/or refining guidelines for topsoil characteristics and specifications for borrowed topsoil.

Recent implementation of phase II of USEPA National Pollutant Discharge Elimination System (NPDES) requires the participation of urban municipalities of less than 100,000 people in the program. This means that most municipalities in urbanized areas will be required to capture and treat storm water. Soil-based infiltration systems, such as rain-gardens, are some of the recommended practices for reduction and for on-site treatment of storm water. Hence, at minimum, rain garden soil needs high infiltration rates and the ability to promote and sustain cover vegetation.

Research was conducted to identify local materials, and mixes thereof, in developing recipes for rain garden planting soil from locally available materials. Local topsoil, three quarry sands (<1/4" sandstone, washed <1/4" limestone, and non washed <1/4" limestone), USGA sand, and two commercially available composts (coarse and fine texture) were evaluated.

The mixture of sandstone:topsoil: yard waste (55:25:20) with saturated hydraulic conductivity of 2.5 inches/hour and pH of 7.5 (6.8 in 10mM $CaCl_2$) was selected for further use. The above mix recipe was used in a large-scale operation to create a planting soil for the construction of a rain garden at a nearby municipality (Beckley, WV).

The vegetation development and soil chemical and physical properties are monitored and evaluated at different times from inception. In addition, a water quality monitoring system is expected to be installed in the near future for further performances evaluations.

Summary Points

- Good turfgrass growth can result from soil constructed from organic wastes and quarry industry by-products
- Mixing A and E horizon soil profiles from a construction site can create a "topsoil" that performs much like a natural topsoil
- Several soil mixes are being evaluated for use in rain gardens (ie., on-site treatment of storm water).