

RESEARCH SUMMARY

EFFECT OF GEOTECHNICAL AND ENVIRONMENTAL PROPERTIES OF MARYLAND COMPOST AND COMPOST AMENDED TOPSOILS ON VEGETATION ESTABLISHMENT AND GROWTH

WHAT WAS THE NEED?

The State Highway Administration (SHA) and other Maryland agencies are committed to expanding beneficial uses of compost. Due to variability in compost and compost related products, a comprehensive understanding of how individual materials affect the geotechnical and environmental properties of amended soil is necessary to ensure that rapid vegetation establishment is maximized while unwanted impacts to the environment, such as nutrient losses that impact drinking water sources and the Chesapeake Bay, are minimized.

WHAT WAS THE GOAL?

The primary objective of the study was to better understand individual amendment effects on vegetation establishment and the leaching behavior of soils amended with organic materials to improve SHA compost and topsoil specifications. The anticipated outcomes were: 1) to identify the impacts on vegetation establishment associated with individual organic amendments commonly used in Maryland highway topsoil; 2) to compare sediment and nutrient losses via leachate when organic amendments are used to raise the organic matter content of soil; and 3) to identify amendment effects on geotechnical properties.

WHAT DID THE RESEARCH TEAM DO?

The research commenced by interviewing regional topsoil and compost producers to better understand the organic products used in Maryland highway topsoil, and the factors that contribute to product selection. Interview participants donated SHA specified furnished topsoil, including some that were amended with organic products and some that were not, to be characterized based on physical and chemical properties. Donated

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soil was also subjected to repeated flooding via column studies to determine nitrogen and phosphorus losses.

Following the column studies, two greenhouse microcosm studies were conducted. These studies utilized furnished topsoil that was amended with either aged and shredded tree mulch, composted yard waste, or biosolids. Each microcosm was exposed to weekly simulated rain events, including two prior to seeding with SHA spec turf grass and 6-7 after. Amendment effects on soil physical and chemical properties were assessed before and after the studies. Additionally, treatments were evaluated through the lenses of vegetation establishment, water quality, and geotechnical properties. Vegetation establishment was quantified via dry mass measurements and digital analysis of percent cover. Leachate quality was assessed via measurement of pH, total suspended solids, electrical conductivity, organic carbon, and the concentrations of nitrogen and phosphorus (and their chemical species). Geotechnical measurements included shear and saturated hydraulic conductivity properties.

WHAT WAS THE OUTCOME?

The two products most likely to be used in Maryland furnish topsoil are mulch and composted yard waste. Although biosolids are not currently used in large quantities, use is positioned to grow. Concerning impacts to geotechnical parameters, all amendments enhanced hydraulic conductivity - with mulch having the greatest effect. Concerning vegetation establishment, biosolids and composted yard waste had positive effects but the mulch amendment restricted growth. On the other hand, mulch reduced nitrogen and phosphorus

release from topsoil while biosolids increased nitrogen loss and composted yard waste increased phosphorus loss. The column study results highlight the complexity of factors that contribute to nutrient loss and support efforts to consider a wide range of factors when choosing organic amendments. These findings bolster recommendations to expand soil testing for chemical properties including total nitrogen, C:N ratio, and plant available nitrogen. Soil tests should be taken into context of the amendments used in soil. Mulch is not recommended as a source of organic matter unless a supplemental source of N is used. Biosolids can correct a wide range of nutrient deficiencies; however, use should be restricted to plant nitrogen needs to reduce losses to surface and subsurface leachate.

HOW WILL MDOT SHA USE THE RESULTS?

SHA should use the results by establishing methods for soil tests, disclose the source of the organic matter amendment used in their topsoil, matching salvaged topsoils with furnished topsoil standards for pH and soluble salts, consider testing furnished topsoil once it arrives at a construction site, mulch amendments should not be used to raise the concentration of soil organic matter without a supplemental source of nitrogen, Biosolids can be used to provide a wide range of essential plant nutrients to soils with nutrient deficiencies, and SHA usage of biosolids should be restricted to slopes < 25:1 until further studies are conducted. SHA will also use the C:N ratio, total Nitrogen, and plant available Nitrogen when conducting soil tests.

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