Effects of compost on soil chemical, physical and biological properties in field nursery crop production.

Narrative

We amended field soils with composts to evaluate their effects on soil physical properties and field-grown ornamental shrubs. Duck manure-sawdust (DM), potato cull-sawdust-dairy manure (PC) and paper mill sludge-bark (PMB) composts were applied to a Plano silt loam soil using two application methods, (i) 2.5 cm of compost incorporated into the top 15 cm of soil (incorporated-only) or (ii) 2.5 cm of compost incorporated + 2.5 cm of compost applied over the soil surface (mulched). We grew three shrub species from seedlings for two seasons: *Spirea japonicum* 'Gumball', *Juniper chinensis* 'Pfitzeriana', and *Berberis thunbergia* 'Atropurpurea'.

Total soil organic carbon contents (TC), bulk density, aggregate stability, soil moisture retention capacity (MRC), volumetric moisture content, and saturated hydraulic conductivity were measured over three years (1998 to 2000). Soil chemical parameters included total P, N, S, Al, Cu, NO3-N, NH4-N, Exchangeable Ca, Mg, K, Na, available P, DTPA-Zn, pH and EC. Aboveground and belowground dry matter production (biomass) of all plant species was measured at the end on the 1st and 2nd growing seasons.

Mulched treatments produced 15%-21% more TC than the incorporated-only and no-amendment control treatments. Bulk density decreased with increasing TC contents. Greater aggregate stability and the formation of larger aggregates were related to increased TC. Field moisture retention capacity tended to be higher in the incorporated treatments than in mulched treatments and the control. Saturated hydraulic conductivity in the control was 85% lower than Ksat in compost-amended treatments. Among the soil physical properties measured in this study the best predictors of plant growth were saturated hydraulic conductivity, bulk density and field moisture content.

During the second growing season the mulched treatment of PMB compost produced significantly higher Exch. Ca than the other compost treatments and the control. The mulched treatment of DM compost produced significantly higher DTPA-Zn relative to the other treatments throughout the course of the study. Among the soil chemical properties measured, the best predictors of plant growth during the second growing season were TC, TS, available P, ExCa, ExK, and DTPA-Zn.

Shrub biomass did not increase significantly until the second year after compost application, and only Barberry plants were significantly affected by compost. Total plant biomass production in the mulched treatment of DM compost was 39-42% higher the other treatments. The mulched treatment of DM compost improved soil physical and chemical properties which resulted in greater growth of Barberry shrubs.

Impact Findings from this research suggest that compost effects on field nursery production are crop (shrub) specific. Shrubs with intermediate growth rates (e.g. Barberry) respond most to compost, whereas fast-growing (Spirea) and slow-growing (Juniper) species are less sensitive to compost effects. In all cases,

composts improved soil physical properties; these findings suggest use of composts could ameliorate some of the degradative effects of field nursery production on soil quality.

Publications:

R.F. Gonzalez and L.R. Cooperband. 2002. Compost Effects on Soil Physical Properties and Field Nursery Production. Compost Sci. Utiliz. 10: 226-237.

R.F. Gonzalez and L.R. Cooperband. 2003. Compost effects on soil chemical properties and field nursery production. J. Environ. Hortic. 21: 38-44.