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Amending soils of different texture with six compost types: impact on soil nutrient availability, plant growth and nutrient uptake

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Abstract

Background Composts with different feedstocks may have differential effects on soil properties and plant growth which, may be further modulated by soil texture.

Materials and methods In a 77-day pot experiment in the glasshouse, we investigated the effect of a single application as mulch of six types of composts derived from different starting feedstocks in two soils (13% and 46% clay, referred to as S13 and S46) on soil physical, chemical and biological properties, plant growth and nutrient uptake. Composts were placed as 2.5 cm thick mulch layer on the soil surface and wheat plants were grown and harvested at 42 days and at 77 days (grain filling).

Results Composts differed in total and available N and P and particle size with C1, C3, C4 and C5 being fine-textured, whereas C2 and C6 were coarse-textured. Compost addition as mulch increased soil total organic

C and EC, but had no effect on pH. In all treatments, cumulative soil respiration was higher in S13 than in S46 and was increased by compost addition with the greatest increase with C2 and C6. Compared to the unamended soil, most compost mulches (except C2) increased macroaggregate stability. Compost mulches significantly increased available P and N in both soils, except for C2. Compost mulches increased available N up to 6-fold in both soils with the strongest increase by C5. Most composts also increased wheat growth and shoot P and N concentrations with the greatest effect on plant N concentration by C5 and on plant P concentration by C4. However, C2 decreased shoot N and P concentrations compared to the unamended soil. Most compost mulches (except C2) increased mycorrhizal colonization by up to 50% compared to the unamended soil.

Conclusions Fine-textured compost mulches generally had a greater effect on soil properties and plant growth than coarse-textured composts. Despite distinct differences between the soils with respect to clay content, TOC and available P, the effect of the compost mulches on soil and plant properties was quite similar.

Keywords Dissolved organic C · Microbial respiration · Mycorrhizal colonization · Nutrient mobilization

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Introduction

Soil organic matter plays a crucial role in retaining nutrients, maintaining soil structure, and plant water