PERGAMON

Soil Biology & Biochemistry 35 (2003) 295–302

Soil Biology & Biochemistry

www.elsevier.com/locate/soilbio

Effects of earthworm casts and compost on soil microbial activity and plant nutrient availability

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Received 9 November 2001; received in revised form 6 September 2002; accepted 26 September 2002

Abstract

Vermicomposting differs from conventional composting because the organic material is processed by the digestive systems of worms. The egested casts can be used to improve the fertility and physical characteristics of soil and potting media. In this study, the effects of earthworm casts (EW), conventional compost (CP) and NPK inorganic fertilizer (FT) amendments on N mineralization rates, microbial respiration, and microbial biomass were investigated in a laboratory incubation study. A bioassay with wheat (*Triticum aestivium* L.) was also conducted to assess the amendment effects on plant growth and nutrient uptake and to validate the nutrient release results from the incubation study. Both microbial respiration and biomass were significantly greater in the CP treatment compared to EW treatment for the initial 35 days of incubation followed by similar respiration rates and biomass to the end of the study at 70 days of incubation. Soil NO_3^- increased rapidly in the EW and CP treatments in the initial 30 days of incubation, attaining 290 and 400 mg N kg^{-1} soil, respectively. Nitrate in the EW treatment then declined to 120 mg N kg^{-1} soil by day 70, while nitrate in the CP treatment remained high. While ammonium levels decreased in the CP treatment as nitrate level increased with increasing incubation time, a low level of ammonium was maintained in the EW treatment throughout the incubation. The wheat bioassay study included two additional cast treatments (EW-N and EW2) to have treatments with higher levels of N input. Plants grown with CP or FT treatment had a lower shoot biomass and higher shoot N content than in EW-N and EW-2 treatments, and also showed symptoms of salinity stress. Ionic strength and other salinity indicators in the earthworm cast treatments were much lower than in the CP treatment, indicating a lower risk of salinity stress in casts than in compost. All cast and compost amendments significantly increased wheat P and K uptake compared to either the non-amended control or the mineral fertilizer treatment. The results show that casts are an efficient source of plant nutrients and that they are less likely to produce salinity stress in container as compared to compost and synthetic fertilizers.
Published by Elsevier Science Ltd.

Keywords: Earthworm casts; N mineralization; Plant nutrient uptake; Microbial respiration; Vermicomposting