Available online at www.sciencedirect.com
ScienceDirect
Waste Management 26 (2006) 1253–1258
wasteWmanagement
www.elsevier.com/locate/wasman

Effects of composted sewage sludge on microbial biomass, activity and pine seedlings in nursery forest

S.Yu. Selivanovskaya *, V.Z. Latypova

Department of Applied Ecology, Ecological Faculty, Kazan State University, Kremlyevskaya, 18, Kazan 420008, Russia

Accepted 6 September 2005
Available online 22 November 2005

Abstract

The investigation was carried out in a 2 year experiment to evaluate the benefits and hazards of the use of composted sewage sludge as a restoration agent for the soil of the nursery forest intended for growing *Pinus sylvestris* seedlings. The grey forest soil (Haplic Greyzem) was amended with compost at the 25, 50, 75, 100, 150 and 175 t ha^{-1} application rates on a dry matter basis. The organic matter content increased with the increase in sludge amendment as well as the metal content. However, the concentrations of individual metals were below the current limits established for Russia and European countries. Sludge amendments enhanced the germination and decreased the mortality of the seedlings. The effects were more obvious for the soil with the highest sludge treatment. The beneficial effects on the biomass of seedlings and the height of the shoots as well as on the length of the roots of the pine seedlings were greater in plots with the highest rates of composted sludge. The application of composted sludge to soil was followed by an increase in microbial biomass and to a lesser extent in basal respiration. In the absence of any detrimental effect on microorganisms, this study lends support to using composted sewage sludge as the organo-mineral fertilizer for the soil of nursery forest.

1. Introduction

Large amounts of sewage sludge have been accumulated and expected to be generated in Russia due to the increasing volume of wastewater treated. Current trends in European waste policy aim at reducing biodegradable wastes in landfill sites (Debosz et al., 2002). Another disposal option, i.e. land application, is commonly used in most municipalities. Land application of sewage sludge provides not only a means for sludge disposal but can also improve soil fertility and the physical properties of the soils, causing increase in crop yield (Peles et al., 1996; Ramachandran and D'Soura, 1998; Gardiner et al., 1995; Jorba and Andres, 2000). The agricultural use of sewage sludge is mandated by Russian law (SanPiN No 2.1.7.573-96, 1997). However, only 1% of the sewage sludge generated is used in agriculture. Unfortunately, the effects of sewage sludge on soil quality are dual. On the one hand, sludge applications to soil increases the content of organic matter and plant nutrients; on the other hand, the presence of pathogens and heavy metals limits the general use of sewage sludge in agriculture, especially that derived from both industrial and domestic sources. The safe utilization of the sewage sludge has to be ensured by its preliminary treatment. Composting might be a possible and practical means for reducing metal contents and the amount of pathogens in the sewage sludge (Page, 1996; Selivanovskaya et al., 2001; Sanchez-Monedero et al., 2004). Furthermore, as previously shown the composted sewage sludge causes the minimal alteration of the pre-existing equilibrium of soil microbial communities and a prolonged positive effect on soil properties in comparison with the anaerobically digested or untreated sludge (Selivanovskaya et al., 2001; Ros et al., 2003).

Whereas most of the works have focused on the effect of the sewage sludge on soil fertility and crop quality in agriculture, the effect of the composted sewage sludge used as a fertilizer in forestry, namely in the nursery forest is less known. Meanwhile, the experience of the sewage sludge

* Corresponding author. Tel.: +7 8432 930782; fax: +7 8432 920554.
E-mail address: Svetlana.Selivanovskaya@ksu.ru (S.Yu. Selivanovskaya).

0956-053X/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.wasman.2005.09.018