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The nitrogen efficiency of MSW composts as measured by triticale uptake in a 3-year field experiment

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This paper presents results of three year field experiment, where two different composts produced from municipal solid wastes were applied to sandy soil. The experiment was established on soil developed from loam sand, according to U.S.D.A. textural classes (81% of sand, 12% of silt, and 7% of clay), of a slightly acidic reaction (pH KCl 6.05 – 6.44). The plough layer (0 - 25 cm) contained about 5.0 g/kg of organic carbon.
Both composts were alkaline in reaction and contained high amounts of plant available forms of phosphorus, potassium and magnesium. Composts were used non-recurrently in rates of 18, 36, and 72 t/ha, calculated on dry matter basis. Control objects (0 and NPK) were plots without fertilization, as well as plots fertilized each year with mineral forms of NPK. Field experiment was conducted in 15 m2 plots, using five replications in a randomized block design. Spring triticale (x Triticosecale Wittm.) cultivated in a 3-year monoculture was used as the experiment plant. Soil samples were collected each year after harvesting. Changes in triticale yield were considered in relation to soil properties and nitrogen content in triticale straw and grain.
Application of composts caused beneficial changes in soil fertility, connected mainly with an increase of soil organic matter and content of available forms of P, K, and Mg. These effects were observed throughout three years of the experiment. However, significantly higher values of organic carbon - as compared to control (0 and NPK) - were observed only in plots with medium and highest compost doses. This effect was very clear in the first year, while significant differences in soil carbon content were still observed in next two years.
The yield of triticale straw and grain depended significantly on fertilization with composts, but beneficial effect of compost was observed only in the first year. Yield similar to NPK control was found only on plots where the highest dose of compost was applied. Next two years, all compost amended plots indicated distinctly lower yield than that on NPK control. Decrease of yield was accompanied by decreased level of nitrogen in triticale straw and grain, although soil of compost amended and NPK fertilized plots indicated the same level of total nitrogen. In the third year dramatic decrease of soil total nitrogen was observed in (0) control, as result of exhausting available nitrogen, while soil amended with composts still contained nitrogen present in non-mineralized organic matter.
The yield of triticale grown on soil amended with compost produced from municipal solid wastes was limited by not sufficient amount of plant available nitrogen. Nitrogen efficiency measured as amount of N taken up by triticale grain and straw - after depriving N uptake by triticale grown on control (0) - was very low, around 3 % in the first year and around 1% in the third year. Application of MSW composts is a good alternative for mineral fertilization, however supplementary fertilization with mineral nitrogen is necessary, depending on compost dose and quality.