Agro-ecological effects of sewage sludge application to orchard grass (Dactylis glomerata) fields

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Introduction Municipal sewage sludge can have a great fertilisation effect. However, its application is limited by high amounts of heavy metals, which have adverse effects on soil biota and plants (Ladonin *et al*., 2002). Our work was aimed at investigating the sludge effect on a soil-plant system.

Materials and methods The investigation was carried out as a micro-field experiment with two kinds of heat-digested sewage sludge of Moscow: 1 from filter-presses and 2 from sludge fields with a storage life exceeding 10 years. Two sludge doses were studied (10 and 35 t/ha of dry matter DM). The experiment was carried out in the field in small plastic cylinders without bases (size 0,5x0,5 m depth 0,4 m) filled with soil. In 1999 orchard grass was sown under the cover of barley for green forage. Peat-podzol clay loam was used in the experiment. The top layer contained 0.6% of organic carbon, 3.5 mg/100 g P_2O_5, 7.8 mg/100 g K_2O, pH $_{KCl}$ 4.0. The soil micro-flora was studied using the methods described by Alef & Nannipieri (1998).

Results Sludge application had a great agro-chemical effect (Table 1). Average DM yield in comparison with the control increased during the experimental period (1999 - 2003) with the increase of the sludge dose. Sludge from filter-presses in the amount of 35 t/ha gave the maximum increase.

Table 1 Average production of perennial grasses over 5 years

Experiment versions	DM g/m^2	Increase	
		g/m^2	%
Without fertiliser (control)	277	-	-
Sewage sludge 1, 10 t/ha	365	88	32
Sewage sludge 1, 35 t/ha	569	292	105
Sewage sludge 2, 10 t/ha	372	95	34
Sewage sludge 2, 35 t/ha	460	183	66
$N_{180}P_{60}K_{100}$ fertiliser	661	384	139

For all doses of both kinds of sludge there were no differences between the sludge treated and control plots in DM content of cadmium (0,40-0.42 mg/kg), nickel (0,4-0,6 mg/kg) and copper (3-5 mg/kg). At the same time the content of phosphorus in grass forage increased up to 0,43% in comparison with the control (0,33%) as well as with mineral fertiliser application (0,35%). With both types of sewage sludge the total amount of micro-organisms was slightly higher (10%) in comparison with the control. The same applied for ammonifying, ammilolythic micro-flora and oligonitrophyls. The amount of fungi was slightly lower (7%), which is a positive factor.

Conclusions Sewage sludge application of 10 and 35 t/ha DM increased production of orchard grass by 32-105%, with increasing phosphorus content in the plants. Content of Cd, Ni, Cu in plants with sludge application was the same as in the control plants. Sludge application increased microbiological soil activity stimulating growth of aerobic bacterial micro-flora.

References

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