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INFLUENCE OF APPLYING COMPOST FROM MUNICIPAL WASTES ON SOME PHYSICAL PROPERTIES OF THE SOIL*

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A b s t r a c t. Influence of compost from municipal wastes (MSWC), used as a fertilizer, on some physico-chemical and physical properties of the soil such as: pH_{KCl}, total porosity, bulk density, specific density, water retention at pF 2.54 of field water capacity as well as pF range of 1.0 - 2.9, is presented in the paper. The paper is part of a general project analysing the possibility of using compost from municipal wastes in horticulture.

K e y w o r d s: compost from municipal wastes, physical properties of soil

INTRODUCTION

Growing urbanization causes waste increase and the problem of disposal is becoming one of the most serious issues problems for the environment. Most of municipal and agricultural wastes is organic matter (about 40-50%). We can use it as a component in fertilization. All over the world composting of waste is becoming more and more common [1,4]. This is an appropriate way of limiting the amount of waste storage and eliminating the sanitary problems connected with waste removal.

During the composting process, very intense transformation of the organic matter occures. Mineralization of the organic matter leads to a final product which is characterized by various forms of macro- and microelements. On the other side humification processes lead to the formation of humic substances which play a marked role in promoting the fertility value of the compost. Compost contains a lot of organic matter. These are composts produced from municipal wastes which improve soil physical properties. According to many authors compost applied to soil increases total pore volume, facilitates the penetration of water and increases soil water holding capacity [1]. However, due to the heterogenous composition of the composts produced from municipal waste, containing often heavy metals and some other mineral and organic components, the growth and development of plants can be negatively influenced. Therefore, it is necessary to analyze the influence of the composts applied on the soil properties.

The authors present some results of investigations which were carried out at the Agricultural University of Wrocław.

MATERIAL AND METHODS

The study was carried out at the Agricultural Experimental Station Piastów which belongs to the Agricultural University of Wrocław. The field experiment, was conducted on Mollic glay

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soil developed on loam (sand 57%, silt 16% and clay 27%, pH_{KCl} 6.2 and organic matter 1.8%).

In the experiment compost produced according DANO technology [3,4], was used. It came from Katowice - a great agglomeration in Upper Silesia, in the southern part of Poland. Initial material leaving the technological line was composted on a pile and after six months of maturing it was applied to the soil in different doses. The field experiment was arranged in randomized blocks with four replications. Six treatments of fertilization were applied: 1) control - without fertlization, 2) nitrogen 70 kg/ha, 3) compost 30 t/ha, 4) compost 60 t/ha, 5) compost 120 t/ha, 6) compost 30 t/ha and nitrogen 70 kg/ha. The experiment lasted for two years. Samples, from a depth of 0 - 20 cm, were taken twice during the vegetation period: after harvesting both the main crop (lettuce) and second plant (headed cabbage) in the first year, and the following year, after harvesting celery. pH_{KCl} and some physical properties of the soil such as, total porosity, bulk density, specific density, water retention at pF 2.54 of field water capacity as well as pF range of 1.0 - 2.9 were determined. Water retention and pF range of the soil were determined using sand box apparatus with negative pressures 0-98 hPa, and sand-kaolin box apparatus with negative pressures 98 - 333 hPa. Plotting the negative logarithmic value of the force applied against the percentage volume of water (Fig. 1) showed the moisture release curve and its characteristics of the soil. Results were statistically evaluated using test T in programme STATISTICA for WINDOWS.

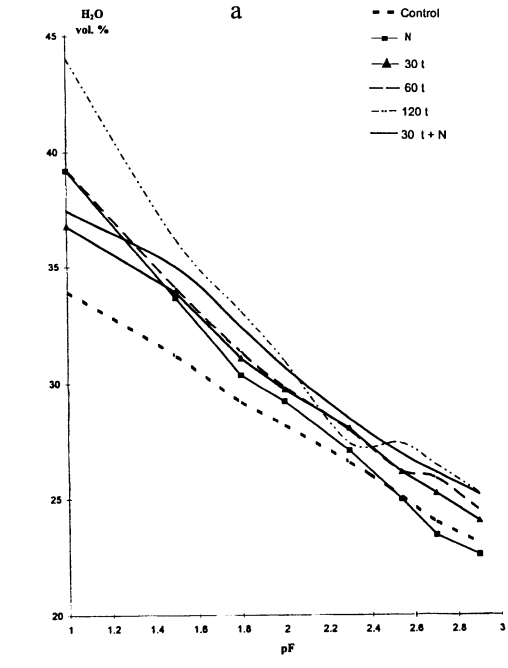
RESULTS

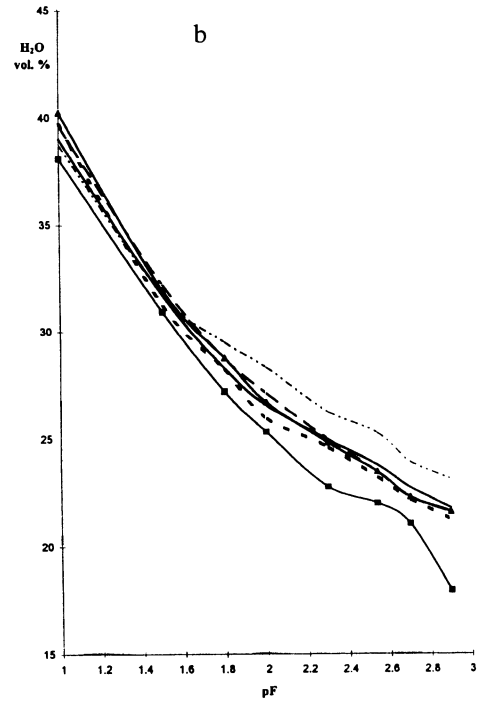
One, among many reasons, why we should be interested in using compost in agriculture is the fact that composting reduces the amount of municipal solid waste and at the same time provide a nutrient-rich soil amendment. Compost added to soil improves structure, texture, aeration and water retention as well. Compost promotes the soil water retention capacity [5].

Matured compost from municipal wastes used in the experiment had no negative influence on most of the measured physical properties. Only 120t/ha significantly influenced the decrease of the bulk density (Table 1). Total porosity increased according to the rate of the compost doses in comparison to the control. The highest increase was noticed after harvesting the first and the second testing plant (first year of compost application) (Table 1). Maximum changes of water retention at pF 1.0 - 2.9 were

Table 1. Influence of various doses of compost MSW on some physical properties of soil - layer 0-20 cm and on pH_{KCl}

Object	Lettuce	Cabbage	Celery
Total porosity (vol. %)			
Control	42.19	42.88	42.73
Nmin	42.12	41.17	44.00
MSWC 30t	41.84	43.06	39.61
MSWC 60t	43.45	42.42	42.51
MSWC 120t	46.40	47.56	42.70
MSWC 30t+N	44.17	41.16	45.50
Bulk density (g cm^{-3})			
Control	1.55	1.39	1.56
Nmin	1.53	1.39	1.47
MSWC 30t	1.54	1.35	1.59
MSWC 60t	1.47	1.33	1.62
MSWC 120t	1.38	1.26	1.53
MSWC 30t+N	1.44	1.37	1.53
LSD $\alpha = 0.05$		0.12*	
Specific density (g cm^{-3})			
Control	2.65	2.66	2.51
Nmin	2.50	2.63	2.52
30t MSWC	2.55	2.55	2.47
60t MSWC	2.57	2.52	2.51
120t MSWC	2.59	2.51	2.50
30t MSWC+N	2.65	2.59	2.47
Retention at pF 2.54 of field water capacity (vol. %)			
Control	25.07	23.23	26.39
Nmin	24.97	22.01	25.98
30t MSWC	26.15	23.51	26.69
60t MSWC	26.18	23.5	27.02
120t MSWC	27.42	25.3	26.46
30t MSWC+N	26.96	23.82	25.93
pH_{KCl}			
Control	6.69	6.66	6.06
Nmin	6.66	6.68	6.40
30t MSWC	6.74	6.68	6.52
60t MSWC	6.75	6.70	6.54
120t MSWC	6.79	6.70	6.65
30t MSWC+N	6.70	6.64	6.58





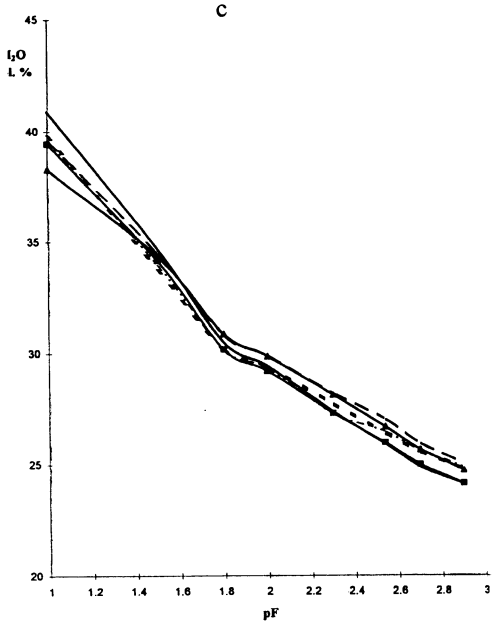


Fig. 1. Infuence of various doses of compost from MSW on changes of water retention at pF 1-2.9 after harvesting the first testing plant-lettuce (a), second testing plant-cabbage (b) and third testing plant-celery (c).

observed after harvesting the first testing plant - lettuce (Fig. 1), smaller changes, although noticeable were observed after harvesting the second testing plant - cabbage, especially at pF 1.5 - 2.9. The most visible influence was observed for a dose of 120 t in comparison to the nitrogen fertilization. The second year of compost application, did not show a significant influence of different doses of compost on changes of soil properties. Neither the first or second year of compost application indicated any changes of the soil pH measured in KCl.

CONCLUSIONS

1. Higher doses of matured compost promotes water content in soil, and the most positive effect was found for a dose 30 t ha^{-1}+ Nmin.

2. The influence of compost from municipal wastes on some physical properties of the soil was observed from the first year of application.

3. The changes did not indicate negative influence, of the application of matured compost from municipal wastes when studying the physical properties of soil.

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