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THE EFFECT OF SLUDGE COMPOST ON THE CONTENT OF SELECTED ELEMENTS IN SOIL AND IN *LOLIUM MULTIFLORUM* LAM.

OCENA ZMIAN ZAWARTOŚCI WYBRANYCH PIERWIASTKÓW W *LOLIUM MULTIFLORUM* LAM. I W GLEBIE POD WPŁYWEM STOSOWANIA RÓŻNYCH DAWEK KOMPOSTU

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Streszczenie. Oceniano wpływ różnych dawek kompostu, wytworzonego na bazie komunalnego osadu ściekowego z dodatkiem słomy pszennej, na zawartość wybranych pierwiastków w życicy wielokwiatowej i w glebie. Rośliną testową była życica wielokwiatowa. Eksperyment został założony jesienią w 2012 roku; obejmował następujące obiekty nawozowe: obiekt kontrolny, nawożenie mineralne NPK oraz 3 dawki kompostu (15, 10 i 5 Mg · ha^{-1} św.m.). Materiał roślinny zbierano trzykrotnie po około 30 dniach wegetacji każdego odrostu w latach 2013–2014. Zawartość Fe, Mn, Mo, Cr i Li w roślinie i w glebie oznaczono metodą ICP-AES, po mineralizacji na sucho. Kompost wytworzony z komunalnego osadu ściekowego z dodatkiem słomy pszennej spowodował istotne zwiększenie zawartości Fe, Mn, Mo, Cr i Li w materiale roślinnym i glebowym, w stosunku do obiektu kontrolnego i nawożonego NPK. Największą bioakumulację badanych pierwiastków stwierdzono w życicy wielokwiatowej nawożonej średnią dawką kompostu (10 Mg · ha^{-1}), z wyjątkiem Mn. Najwięcej Fe, Mo i Cr oznaczono w glebie nawożonej największą dawką kompostu (15 Mg · ha^{-1}), a najwięcej Mn i Li – w glebie nawożonej średnią dawką (10 Mg · ha^{-1}).

Key words: sewage sludge, compost, selected chemical elements, *Lolium multiflorum*, soil.
Słowa kluczowe: osad ściekowy, kompost, wybrane pierwiastki, *Lolium multiflorum*, gleba.

INTRODUCTION

Agricultural use of waste is becoming more important now because of the rising prices of inorganic fertilisers and decreasing amount of organic matter in soil (Smith 1996; Jakubus 2005). Municipal sewage sludge is very laborious to dispose of because of the high content of heavy metals and because of microbiological contamination (Deportes et al. 1998; Böhnel and Lube 2000; Scancar et al. 2000; Chipasa 2003). If it complies with environmental standards (the Ministry of Environment Regulation of 2010) sewage sludge can potentially become a widely used fertiliser because of its considerable macro and microelement content (Antolin et al. 2005; De Brouwere and Smolders 2006; Czekała 2012). This way it is possible to use it as compost in agriculture and for land rehabilitation. Such materials, proving

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structure, as saw dust, straw or cocoa husks are most frequently used to add to sewage sludge compost (Chung et al. 2003; Pourcher et al. 2005; Czekała and Sawicka 2006; Balcer and Wołoszyk 2012).

The aim of the paper is to assess the effects of different doses of sewage sludge compost mixed with wheat straw on the content of selected elements in Italian ryegrass and in soil.

MATERIAL AND METHODS

The experiment was carried out at the experimental station of the University of Natural Sciences and Humanities in Siedlce (52°17'N, 22°28'E). Loam soil, with neutral pH_{KCl} of 6.75, containing 37.0 g · kg^{-1} of organic carbon and 1.75 g · kg^{-1} of total nitrogen, was taken from the plough layer (0–25 cm). The average concentration of available phosphorus and potassium determined with the Egner- Rhiem method stood at 39.9 mg·kg^{-1} and 128 mg · kg^{-1}, respectively. Before the experiment was set up the total amount of heavy metals in the soil was measured and it was as follows [mg · kg^{-1}]: Pb – 5.03, Cd – 0.550, Cr – 3.09, Cu – 3.20, Zn – 16.56, Ni – 2.96. Those results were lower than the limits for municipal sewage sludge applied to light soil imposed by the Minister of the Environment Regulation of 2010. The concentration of some other chemical elements was as follows [g · kg^{-1}]: P – 1.05, K – 1.00, Ca – 2.40, Mg – 1.25, S – 0.508, Na – 0.312. The Kroto variety of Italian ryegrass was used in the randomised experiment set up in the autumn of 2012 and replicated three times. The experimental area was divided into the following 2.5 m^2 plots: control plot with no fertilisers, a plot with NPK fertilisers applied with the ratio of 1 : 0.3 : 0.8 and plots with three different doses of compost based on sewage sludge: 15, 10 and 5 Mg · ha^{-1} of fresh matter, each containing the amount of nitrogen equivalent to 180, 120 and 60 kg N · ha^{-1}, respectively. Nitrogen fertilisers were applied three times a year: in early spring before the growing season, and after the first and second cut, while phosphorus and potassium fertilisers were used only once, before sowing. With the application of ammonium sulphate the amount of nitrogen applied was supplemented to 180 kg · ha^{-1} on those plots where the rate of nitrogen introduced with the compost was lower than that. We use the following indications: I dose of compost – 15 Mg · ha^{-1} + N_0, II dose of compost – 10 Mg · ha^{-1} + N_{60}, III dose of compost – 5 Mg · ha^{-1} + N_{120}. This way there was the same amount of nitrogen applied to each plot. The same kinds of inorganic fertilisers were used each year. As said above, the compost contained municipal sewage sludge and 15% of wheat straw (in relation to dry mass), with the composting process lasting six months. The compost obtained this way was of neutral pH (Table 1). Like in the case of soil, the total concentration of heavy metals in the compost did not exceed the limits of Fertilisers and Fertilisation Act of 10th July 2007 and Waste Management Act of 2012.

In each growing season of the 2013 and 2014 the grass was cut three times every 30 days, on average. After each cut grass samples were taken and total concentration of Fe, Mn, Mo, Cr and Li was measured with the ICP – AES method, after dry mineralisation in a muffle furnace at the temperature of 450°C. Then, 5 ml of hydrochloric acid solution (1 : 1) was added and the porcelain crucible was put into a sand bath to decompose carbonates and to isolate silica. Next, the contents of the crucible, after adding 10 ml of 10% of hydrochloric acid, were put into a 100 ml conic flask. Additionally, after each year of the experiment soil samples were taken and heavy metal content was determined with the ICP–AES method. Meteorological data for the period of 2012–2014 were taken from the Hydro-Meteorological Station in Siedlce.

Table 1. The total content of selected elements in the compost
Tabela 1. Zawartość wybranych pierwiastków w kompoście

pH	DM Sucha masa	Organic matter Materia organiczna	N_{tot}	C_{org}	Fe	Mn	Mo	Cr	Li
	%	% DM	$g \cdot kg^{-1}$		$mg \cdot kg^{-1}$				
6.8	27	51	45.0	352	6541	311	2.08	24.12	6.51

To determine temporal variation of weather conditions and to assess their impact on plant growth, each month Selianinov's hydrothermal coefficient (K) was calculated (Table 2) as the ratio of monthly precipitation to one tenth of the sum of average daily temperature (Bac et al. 1993). The hydrothermal coefficient values showed that during summer months there were periods of drought and severe drought.

Table 2. Sielianinov's hydrothermal index (K) in each month of growing seasons of 2012–2014
Tabela 2. Wartości miesięczne współczynnika hydrotermicznego Sielianinova (K) w sezonach wegetacyjnych 2012–2014

Months Miesiące	2012	2013	2014
IV	1.12	1.60	1.53
V	1.22	2.20	2.29
VI	1.56	1.80	1.20
VII	0.69	1.50	0.16
VIII	0.94	0.25	1.95
IX	0.27	2.70	0.59
X	1.32	1.22	0.13

$K \leq 0.5$ – severe drought – silna posucha; 0.51–0.69 – drought – posucha; 0.70–0.99 – mild drought – słaba posucha; $K > 1$ – no drought – brak posuchy.

The results were processed statistically to analyse means with the analysis of variance (using the Statistica programme, Version 10.0 StatSoft). Tukey's test was used to calculate the $LSD_{0.05}$ value.

RESULTS AND DISCUSSION

The fertilisers used in the experiment significantly differentiated Fe content in Italian ryegrass (Table 3) with the average concentration of this metal standing at 216.8 mg Fe · kg^{-1}. The most iron was found in plants from the plot with the middle amount of compost (10 Mg · ha^{-1}), and the least from the control and from the NPK-treated plot. The grass from the first cut had the highest concentration of this metal, while in the following cuts the concentration was lower. The average concentration of this metal in the biomass of Italian ryegrass was 4.6% higher in the first year of the experiment than in the second. Wysokiński (2011) found a similar concentration of iron in *Arrhenatherum elatius* grown with sewage sludge compost.

Table 3. Total content of iron [mg · kg^{-1} DM] in Italian ryegrass
Tabela 3. Zawartość ogólna żelaza [mg · kg^{-1} s.m.] w życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Cuts – Means of 2 years Pokosy – Średnia z 2 lat			Years – Means of 3 cuts Lata – Średnia z 3 pokosów		Mean for years Średnia z lat
	I	II	III	2013	2014	
Control object Obiekt kontrolny	110.5	96.8	106.5	107.9	101.3	104.6
NPK	122.1	109.9	101.9	112.8	109.8	111.3
I dose I dawka + N_0	279.4	254.0	265.2	289.3	243.1	266.2
II dose II dawka + N_{60}	395.1	300.1	235.4	302.1	318.2	310.2
III dose III dawka + N_{120}	285.2	274.0	316.5	296.3	287.4	291.9
Mean – Średnia	238.5	206.9	205.1	221.7	211.9	216.8

$LSD_{0.05}$ – $NIR_{0.05}$: fertilization – nawożenie (F) – 26.80; cuts – pokosy (C) – 10.5; years – lata (Y) – n.s./n.i.

I dose of compost – I dawka kompostu – 15 Mg · ha^{-1} + N_0, II dose of compost – II dawka kompostu – 10 Mg · ha^{-1} + N_{60}, III dose of compost – III dawka kompostu – 5 Mg · ha^{-1} + N_{120}, n.s./n.i. – not significant difference – różnica nieistotna.

The average manganese concentration in the dry matter of Italian ryegrass was 59.70 mg · kg^{-1} (Table 4). Statistical analysis shows significant differences between the content of this metal in Italian ryegrass from different plots, different cuts and different years of the experiment. Out of all experimental units the least manganese was found in the dry mass of the grass from the control and from the plot with NPK while the biggest amounts of this metal were in Italian ryegrass grown with the highest dose of compost. Compared to the first year, there was a 9% fall in manganese content in the second year of the experiment. For most plants the toxic concentration of manganese is about 500 mg · kg^{-1} DM (Kucharzewski and Dębowski 2001) but the amount found in the present experiment was a few times lower than that. Wysokiński (2011) growing plants on sewage sludge compost obtained results ranging from 10.0 to 156.2 mg Mn · kg^{-1}. Similarly, Kalembasa and Wiśniewska (2004) reported comparable concentration of manganese in Italian ryegrass grown with mushroom substrate.

Calculating the Fe : Mn ratio it is possible to determine the surplus or shortage of those chemical elements in plants. The ratio should range from 1.5 : 1 to 2.5 : 1 but if it is smaller than 1.5 : 1, then the amounts of manganese can be toxic to plants while iron is in short supply, If the ratio is higher than 2.5 : 1 then the excess of iron might be toxic and plants may show symptoms of manganese deficiency (Motowicka-Terelak 1978; Mazur 1990). In the present experiment the average value of the Fe : Mn ratio in Italian ryegrass, from all units with fertiliser, standing at 3.77, indicates that there is an excess of iron (Table 5). The narrowest Fe : Mn ratio, being close to normal level, was found in Italian ryegrass grown with the highest dose of sewage sludge compost. According to Błaziak (2007) pH change in soil can lower the toxicity of some microelements to plants, in particular manganese.

Table 4. Total content of manganese [mg · kg^{-1} DM] in Italian ryegrass
Tabela 4. Zawartość ogólna manganu [mg · kg^{-1} s.m.] w życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Cuts – Means of 2 years Pokosy – Średnia z 2 lat			Years – Means of 3 cuts Lata – Średnia z 3 pokosów		Mean for years Średnia z lat
	I	II	III	2013	2014	
Control object Obiekt kontrolny	26.09	22.01	25.28	25.98	22.94	24.46
NPK	30.54	33.28	30.56	30.41	32.56	31.49
I dose I dawka + N_0	90.41	85.21	93.36	91.20	88.12	89.66
II dose II dawka + N_{60}	75.05	68.09	62.84	77.19	60.13	68.66
III dose III dawka + N_{120}	86.01	90.40	76.25	86.98	81.45	84.22
Mean – Średnia	62.35	57.04	59.70	62.35	57.04	59.70
$LSD_{0.05}$ – $NIR_{0.05}$: fertilization – nawożenie (F) – 2.26; cuts – pokosy (C) – 1.24; years – lata (Y) – 0.997						

Legend as in Table 2 – Objaśnienia jak w tab. 2.

Table 5. The Fe : Mn in Italian ryegrass
Tabela 5. Stosunek ilościowy Fe : Mn w życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	2013 year – rok	2014 year – rok	Mean Średnia
Control object Obiekt kontrolny	4.15	4.42	4.29
NPK	3.71	3.37	3.54
I dose – I dawka + N_0	3.17	2.76	2.97
II dose – II dawka + N_{60}	3.91	5.29	4.60
III dose – III dawka + N_{120}	3.41	3.53	3.47
Mean – Średnia	3.67	3.87	3.77

Legend as in Table 2 – Objaśnienia jak w tab. 2.

The characteristic feature of the effect of sewage sludge application in agriculture is accumulation of iron and other elements, including metals. In the research on the concentration of trace elements carried out in 43 waste water processing plants, Siebielec and Stuczyński (2008) found that the coefficient of variance for iron and manganese was considerably high, standing at 60 and 68%, respectively.

Czekała and Sawicka (2006) and Pourcher et al. (2005) point out that nutritional value of sewage sludge compost with cereal straw is high. Applying waste to grow plants can meet their demand for microelements and make up for their deficit, common when typical mineral fertilisers are used (Balcer and Wołoszyk 2012; Czekała 2012).

In Italian ryegrass the average concentration of molybdenum was 3.03 mg · kg^{-1} DM (Table 6). Fertilisation significantly diversified accumulation of this element in the plants. On average the most molybdenum (3.99 mg · kg^{-1} DM) was in the biomass of Italian ryegrass grown with the middle dose of compost and the least in plants from the control object. Comparing the cuts it turns out that the grass from the second harvest had the most molybdenum.

The average concentration of chromium in Italian ryegrass was 0.338 mg · kg^{-1} DM (Table 7) and was similar to the results obtained by Kalembasa and Wiśniewska (2004). The highest chromium concentration was found in the grass from the third cut. In the second year the grass contained significantly more chromium than in the first year. There was also a significant diversity between the concentration of this metal in grass from all plots were fertilisers were applied. In the grass grown with the middle dose of compost (10 Mg · ha^{-1}) there was twice as much chromium as in the grass from the plot without fertiliser and as from that with NPK.

Table 6. Total content of molybdenum [mg · kg^{-1} DM] in Italian ryegrass
Tabela 6. Zawartość ogólna molibdenu [mg · kg^{-1} s.m.] w życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Cuts – Means of 2 years Pokosy – Średnia z 2 lat			Years – Means of 3 cuts Lata – Średnia z 3 pokosów		Mean for years Średnia z lat
	I	II	III	2013	2014	
Control object Obiekt kontrolny	2.56	2.01	1.55	2.09	1.98	2.04
NPK	2.63	2.69	3.02	2.87	2.69	2.78
I dose I dawka + N_0	3.88	2.14	3.76	3.06	3.45	3.26
II dose II dawka + N_{60}	4.09	3.57	4.31	4.11	3.87	3.99
III dose III dawka + N_{120}	3.10	3.19	3.04	3.09	3.12	3.11
Mean – Średnia	3.25	3.72	3.14	3.04	3.02	3.03
$LSD_{0.05}$ – $NIR_{0,05}$: fertilization – nawożenie (F) – 0.676; cuts – pokosy (C) – n.s./n.i.; years – lata (Y) – n.s./n.i.						

Legend as in Table 2 – Objaśnienia jak w tab. 2.

Table 7. Total content of chromium [mg · kg^{-1} DM] in Italian ryegrass
Tabela 7. Zawartość ogólna chromu [mg · kg^{-1} s.m.] w życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Cuts – Means of 2 years Pokosy – Średnia z 2 lat			Years – Means of 3 cuts Lata – Średnia z 3 pokosów		Mean for years Średnia z lat
	I	II	III	2013	2014	
Control object Obiekt kontrolny	0.232	0.189	0.212	0.211	0.209	0.210
NPK	0.211	0.198	0.278	0.209	0.248	0.229
I dose I dawka + N_0	0.356	0.399	0.520	0.348	0.501	0.425
II dose II dawka + N_{60}	0.501	0.459	0.462	0.489	0.458	0.474
III dose III dawka + N_{120}	0.340	0.359	0.362	0.320	0.386	0.353
Mean – Średnia	0.328	0.321	0.367	0.315	0.360	0.338
$LSD_{0.05}$ – $NIR_{0,05}$: fertilization – nawożenie (F) – 0.023; cuts – pokosy (C) – 0.011; years – lata (Y) – 0.010						

Legend as in Table 2 – Objaśnienia jak w tab. 2.

On average, from all cuts and both years, lithium concentration in the biomass of Italian ryegrass was 22.76 mg · kg^{-1} DM (Table 8). In the first year of the experiment this concentration was 14.8% higher than in the second year. Like in the case of chromium, the most lithium was in the grass of the third cut. The compost doses of 10 and 15 Mg · ha^{-1} increased lithium concentration in Italian ryegrass most.

Compared to the control and the NPK plot, compost made with sewage sludge and straw increased the amount of all the above elements in Italian ryegrass (Fig. 1). As an effect of this organic fertiliser, out of all elements, iron and manganese concentration rose most, more than 100% when compared to the control plot. In turn the content of lit and molybdenum increased the least.

Table 8. Total content of lithium [mg · kg^{-1} DM] in Italian ryegrass
Tabela 8. Zawartość ogólna litu [mg · kg^{-1} s.m.] w życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Cuts – Means of 2 years Pokosy – Średnia z 2 lat			Years – Means of 3 cuts Lata – Średnia z 3 pokosów		Mean for years Średnia z lat
	I	II	III	2013	2014	
Control object Obiekt kontrolny	18.51	14.28	19.59	19.69	15.23	17.46
NPK	18.06	17.10	18.12	18.56	16.95	17.76
I dose I dawka + N_0	27.45	25.14	25.77	28.14	24.10	26.12
II dose II dawka + N_{60}	30.11	24.03	33,82	30.11	28.53	29.32
III dose III dawka + N_{120}	24.40	23.01	22.04	25.18	21.12	23.15
Mean – Średnia	23.71	20.71	23.87	24.34	21.19	22.76
$LSD_{0.05}$ for: $NIR_{0,05}$ dla: fertilization – nawożenie (F) – 1.84; cuts – pokosy (C) – 1.05; years – lata (Y) – 0.809						

Legend as in Table 2 – Objaśnienia jak w tab. 2.

a) b)

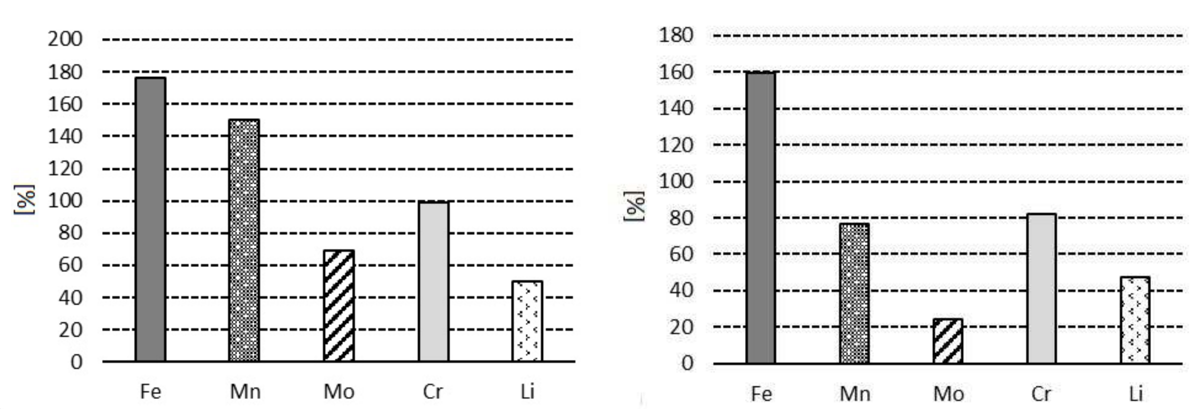

Fig. 1. Increase of the content of selected elements in Italian ryegrass caused by the use of compost in relation to: a) the control object b) NPK object
Ryc. 1. Zwyżki zawartości poszczególnych pierwiastków w biomasie życicy wielokwiatowej wywołane stosowaniem kompostu w stosunku do: a) obiektu kontrolnego, b) obiektu nawożonego NPK

The average content of iron and manganese in soil was significantly differentiated under the influence of the experimental factors, while molybdenum, lithium, chromium content differentiated only under the influence of fertilization (Table 9 and 10). The higher doses of compost (15 and 10 Mg · ha^{-1}) significantly increased concentration of the studied elements in soil. The highest concentration of iron, molybdenum and chromium was found in the soil with the highest dose of compost while manganese and lithium when the middle dose was applied.

Compared to the control and to the plot with NPK fertilisers the increase in the amount of the elements in soil caused by organic fertilisers was diversified (Fig. 2). The highest increase was in the case lithium, and stood at 161% when compared to the control and 151% when compared to the NPK plot. For the other elements the increase caused by organic fertiliser was not so high, with the lowest rise, less than 30%, for manganese and molybdenum.

Table 9. The average content [mg · kg^{-1} DM] of Fe, Mn and Mo in the soil where Italian ryegrass has been cultivated
Tabela 9. Średnia zawartość Fe, Mn i Mo w glebie [mg · kg^{-1} s.m.] po uprawie życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Fe			Mn			Mo		
	2013	2014	mean średnia	2013	2014	mean średnia	2013	2014	mean średnia
Control object Obiekt kontrolny	1692.9	1523.0	1608.0	73.02	70.11	71.57	0.120	0.119	0.120
NPK	1523.0	1698.4	1610.7	72.39	78.12	75.26	0.110	0.103	0.107
I dose I dawka + N_0	2897.8	3561.0	3229.4	84.59	98.12	91.36	0.147	0.159	0.153
II dose II dawka + N_{60}	3008.7	2961.2	2985.0	90.23	97.56	93.90	0.125	0.139	0.132
III dose III dawka + N_{120}	2630.1	2847.0	2738.6	83.69	80.12	81.91	0.109	0.140	0.125
Mean – Średnia	2350.5	2518.1	2434.3	80.78	84.81	82.80	0.122	0.132	0.127
$LSD_{0.05}$ – $NIR_{0,05}$ fertilization nawożenie (F)	F = 75.62		F/Y = 106.9	F = 1.77		F/Y = 2.51	F = 0.038		F/Y = n.s./n.i.
years – lata (Y)	Y = 33.34		Y/F = 74.55	Y = 0.781		Y/F = 1.75	Y = n.s./n.i.		Y/F = n.s./n.i

Legend as in Table 2 – Objaśnienia jak w tab. 2.

Table 10. The average content [mg · kg^{-1} DM] of Cr and Li in the soil where Italian ryegrass has been cultivated
Tabela 10. Średnia zawartość Cr i Li w glebie [mg · kg^{-1} s.m.] po uprawie życicy wielokwiatowej

Fertilization variants Obiekty nawozowe	Cr			Li		
	2013	2014	mean średnia	2013	2014	mean średnia
Control object Obiekt kontrolny	2.10	2.32	2.21	0.859	0.802	0.831
NPK	2.19	2.21	2.20	0.911	0.816	0.864
I dose I dawka+N_0	4.40	4.03	4.22	1.98	1.29	1.64
II dose II dawka+N_{60}	4.09	4.12	4.11	2.23	3.39	2.81
III dose III dawka+ N_{120}	3.11	3.56	3.34	2.10	2.02	2.06
Mean – Średnia	3.18	3.25	3.21	1.62	1.66	1.64
$LSD_{0.05}$ – $NIR_{0,05}$ fertilization nawożenie (F)	F = 0.725	F/Y = n.s./n.i		F = 0.302	F/Y = 0.428	
years – lata (Y)	Y = n.s./n.i	Y/F = n.s./n.i.		Y = n.s./n.i.	Y/F = 0.298	

Legend as in Table 2 – Objaśnienia jak w tab. 2.

Czekała (2012) found that there is no strong correlation between a year-long sewage sludge application and a substantial increase of minerals in plants, with Kuziemska and Kalembasa (1997) and Akdeniz et al. (2006) confirming that. However, Roszyk et al. (1988) and Baran et al. (2002) in their research found that sewage sludge application increased the amount of nutrients in plants and their accumulation. The differences can be explained by the fact that there are other factors determining different results, like organic matter content in soil, chemical properties of the metals, fertiliser doses, plants used in the experiment and other experimental conditions (Kumar et al. 1995).

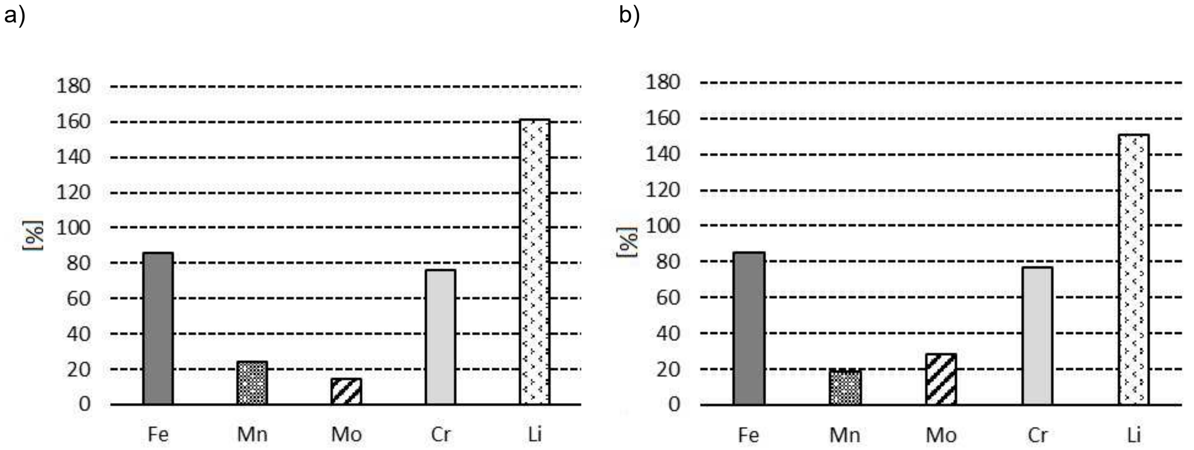

Fig. 2. Increase of the content of selected elements in the soil caused by the use of compost in relation to: (a) the control object b) NPK object
Ryc. 2. Zwyżki zawartości poszczególnych pierwiastków w glebie wywołane stosowaniem kompostu w stosunku do: a) obiektu kontrolnego, b) obiektu nawożonego NPK

CONCLUSIONS

1. Compared to the control and to the NPK plot compost made with municipal sewage sludge and wheat straw significantly increased the content of Fe, Mn, Mo, Cr and Li in the biomass of Italian ryegrass and in the soil.
2. With the exception of Mn, the middle dose of compost (10 Mg · ha^{-1}) increased accumulation of studied elements in Italian ryegrass most.
3. The Fe : Mn ratio in the biomass of Italian ryegrass from all experimental units shows that the accumulation of iron is high. The narrowest Fe : Mn ratio, close to normal, was found in the grass grown with the highest dose of compost (15 Mg · ha^{-1}).
4. The content of the studied elements in the soil was significantly diversified as a result of fertiliser application while in the case of Fe and Mn it was also diversified in the years of the experiment. The highest amount of Fe, Mo and Cr was found in the soil with the highest dose of compost (15 Mg · ha^{-1}), while Mn and Li in the soil with the middle dose (10 Mg · ha^{-1}).
5. Compost produced from municipal sewage sludge with the addition of straw can be used for fertilizing of *Lolium multiflorum*, because it covers the need for most of the plant nutrients.

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Abstract. The aim of the paper, based on a two-year experiment set up in autumn 2012, is to assess the effects of different doses of municipal sewage sludge compost mixed with wheat straw on the content of selected chemical elements in *Lolium multiflorum* Lam. and in soil. The experimental design consisted of a control plot, a plot with NPK fertiliser and three plots with three different doses of municipal sewage sludge compost (5, 10 and 15 Mg of fresh matter · ha^{-1}). During 2013 and 2014 seasons the grass was cut three times a year, after about a 30-day growing period. The content of Fe, Mn, Mo, Cr and Li in the soil and in the plant material, after dry mineralisation, was measured with the ICP-AES method. Compared to the control and to the plot treated with NPK fertilizer, compost made with sewage sludge and wheat straw significantly increased Fe, Mn, Mo, Cr and Li content in plants and in soil. The biggest amounts of those elements, with the exception of Mn, were found in Italian ryegrass with the mid dose of compost (10 Mg · ha^{-1}). In the soil the highest dose of compost (15 Mg · ha^{-1}) increased the content of Fe, Mo and Cr most, while the greatest amounts of Mn and Li were in the soil with the mid dose (10 Mg · ha^{-1}).