ZESZYTY PROBLEMOWE POSTĘPÓW NAUK ROLNICZYCH 2005 z. 504: 551–556

INFLUENCE OF POLYVERSUM ON MACRONUTRITIONAL STATUS OF SELECTED GRASS SPECIES

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Introduction

Intensive exploitation of lawns causes that plants growing for many years are frequently exposed to water stress, threading, infection by diseases. Therefore, methods and agents are looked for which could help to maintain the lawns in good conditions. One of such potential agents can be the biopreparation Polyversum containing *Pythium oligandrum* oospores. It has been proven that this fungus activates the protective mechanism of plants infected by *Fusarium* and *Phythophtora* species and increases plant resistance to fungal diseases [VESELY, HEJDANEK 1984; BENHAMOU et al. 1997; ORLIKOWSKI 2001; SKRZYPCZAK 2001]. KRATKA and VESELY [1988] found that the treatment of cucumber seedlings with Polyversum biopreparation exerts an effect on the metabolism of sugar in plants. Furthermore, the study results of KRATKA et al. [1994] suggest that *Pythium oligandrum* may have an influence of the nutritional status of plants. The objective of the present work was the assessment of the effect of the treatment of selected grass species with the biopreparation Polyversum on the macroelements nutrition of plants.

Material and methods

The experiments were established in the years 2003 and 2004 using the random block design. Four grass species were taken in the studies: Red Fescue *(Festuca rubra* L.) 'Nimba', Sheep's Fescue (*Festuca ovina* L.) 'Noni', Variousleaf fescue *(Festuca heterophylla* LAM.) 'Sawa' and Common Bent-grass *(Agrostis tenuis* SIBTH.) 'Niwa'. The plants were grown in flat containers filled with 2.5 dm^3 of limed raised bog peat enriched with multicomponent fertilizer Azofoska in the dose 1 $g \cdot dm^{-3}$ (N – 13.6; P_2O_5 – 6.4; K_2O – 19.1; MgO – 4.5; B – 0.045; Cu – 0.18; Zn – 0.045; Mn – 0.27; Fe – 0.17; Mo – 0.09%). Results of chemical analysis of substrate before the application of multicomponent fertilizer are shown in the Table 1. Seeds were sown on July 3, 2003 and May 11, 2004. On the same day, one half of the containers was treated with 0.3% of biopreparation Polyversum. The treatment was repeated 7 days later by sprinkling seedlings with

the preparation. Each time, one container with plants was treated with 50 cm^3 of liquid. In order of to decrease the effect of variable substrate moisture on the plant growth, depending on the prevailing temperature, the containers were watered twice a week to a constant weight. During the experiments, the plants were cut twice to the height of 1 cm over the substrate surface; it was done on July 23 and August 5, 2003 and on June 1 and June 12, 2004. Total contents of N, P, K, Ca and Mg were determined in dried plant material after its mineralization in strong acids [NOWOSIELSKI 1974]. Analysis of variance was applied to the results of the analyses and the LSD was calculated at the $p = 0.05$ significance level.

Table 1; Tabela 1

Chemical properties of peat used for the grasses cultivation ($mg \cdot dm^{-3}$)
Właściwości chemiczne torfu użytego do uprawy traw ($mg \cdot dm^{-3}$)

Year Rok	$N\text{-}NO_3$	P	K	Ca	Mg	Na	$S\text{-}SO_4$	pH	Salinity Stężenie soli (g $NaCl \cdot dm^{-3}$)
2003	1	4	20	463	40	25	9	5.85	0.40
2004	27	41	128	378	18	14	7	4.92	0.36

Results and discussion

Results of chemical analyses are shown in Tables 2–3. The application of Polyversum increased of phosphorus content in the plants. The highest content of this element was found in *Festuca rubra* L. 'Nimba'. However, this increase was statistically not confirmed. Also in case of the remaining factors, no interaction was found. An exception was positive interaction of all 3 factors shown in both experiments (A x B x C). The date of sampling for analyses did not exert any effect on the content of plant components.

Although *Pythium oligandrum* is known as mycoparasitic fungus [WULF et al. 1998], the effects of its action are similar to the action of mycorrhizal fungus. It is well known that the positive influence of mycorrhiza on phosphorus uptake by plants is greatest in phosphorus – deficit soils, and decrease as phosphorus content increase [SCHUBERT, HAYMAN 1986]. Thus, one can suppose that the weaker effect of Polyversum in 2004 was connected with a higher abundance of phosphorus in peat used for grass growing (Tab. 1).

The study of VALENTINE et al. [2001] present that in case of mycorrhizal fungus, any advantages and disadvantages of infection are result of interaction between P supply and the availability of other essential nutrients. In the presented experiments, both in 2003 and 2004, the greatest differences in the initial abundance in the substrate referred to potassium and magnesium. Detailed explanation of these dependence requires further investigation.

There are very few publications indicating the influence of *Pythium oligandrum* on the nutritional status of host plants. KRATKA et al. [1994] reported that *Pythium oligandrum* stimulated the phosphorus uptake by cucumber plants. Results of the experiment of BREŚ and SZTUKA [2004] indicate that fungus has an effect also on the micronutritional status of grasses.

Table 2; Tabela 2

Influence of Polyversum on phosphorus content in plants – year 2003 (% DM)
Wpływ Polyversum na zawartość fosforu w roślinie – rok 2003 (% s.m.)

Cultivar (A) Odmiana (A)		Term of sampling (B) Termin pobierania próbek (B)		Treatment with Polyversum (C) Traktowanie Polyversum (C)	
A1	0.740	B1	0.777	C1	0.746
A2	0.658	B2	0.594	C2	0.624
A3	0.644				
A4	0.699				

A x C			A x B		
	C1	C2		B1	B2
A1	0.808	0.671	A1	0.817	0.662
A2	0.752	0.565	A2	0.737	0.580
A3	0.643	0.644	A3	0.790	0.497
A4	0.782	0.616	A4	0.763	0.635

B x C		
	B1	B2
C1	0.808	0.685
C2	0.745	0.503

A x B x C				
	A1	A2	A3	A4
C1B1	0.851	0.824	0.775	0.782
C1B2	0.764	0.681	0.512	0.782
C2B1	0.782	0.651	0.804	0.744
C2B2	0.560	0.479	0.483	0.489

LSD; $NIR_{0.05}$ A = n.s.; r.n.	LSD; $NIR_{0.05}$ A x B = 0.092	LSD; $NIR_{0.05}$ A x B x C = 0.130
LSD; $NIR_{0.05}$ B = n.s.; r.n.	LSD; $NIR_{0.05}$ A x C = n.s.; r.n.	
LSD; $NIR_{0.05}$ C = n.s.; r.n.	LSD; $NIR_{0.05}$ B x C = n.s.; r.n.	

A1 – *Festuca rubra* L. 'Nimba'
A2 – *Festuca ovina* L. 'Noni'
A3 – *Festuca heterophylla* LAM. 'Sawa'
A4 – *Agrostis tenuis* SIBTH. 'Niwa'
B1 – I term of sampling; I termin pobierania prób
B2 – II term of sampling; II termin pobierania prób
C1 – Treated; Traktowane
C2 – Not treated; Nie traktowane
n.s.; r.n. – differences not significant; różnice nieistotne

Table 3; Tabela 3

Influence of Polyversum on phosphorus content in the plant – year 2004 (% DM)
Wpływ Polyversum na zawartość fosforu w roślinie – rok 2004 (% s.m.)

Cultivar (A) Odmiana (A)		Term of sampling (B) Termin pobierania próbek (B)		Treatment with Polyversum (C) Traktowanie Polyversum (C)	
1	2	3	4	5	6
A1	0.908	B1	0.769	C1	0.913
A2	0.892	B2	0.994	C2	0.850
A3	0.871				
A4	0.856				

1	2	3	4	5	6
A x C			**A x B**		
	C1	C2		B1	B2
A1	0.955	0.860	A1	0.783	1.032
A2	0.894	0.889	A2	0.799	0.984
A3	0.910	0.832	A3	0.765	0.977
A4	0.894	0.818	A4	0.728	0.984
B x C					
	B1		B2		
C1	0.785		1.041		
C2	0.752		0.947		
A x B x C					
	A1	A2	A3	A4	
C1B1	0.854	0.808	0.803	0.676	
C1B2	1.056	0.981	1.017	1.111	
C2B1	0.712	0.791	0.726	0.779	
C2B2	1.008	0.986	0.937	0.857	
LSD; $NIR_{0.05}$ A = n.s.; r.n. LSD; $NIR_{0.05}$ B = 0.066 LSD; $NIR_{0.05}$ C = n.s.; r.n.	LSD; $NIR_{0.05}$ A x B = n.s.; r.n. LSD; $NIR_{0.05}$ A x C = n.s.; r.n. LSD; $NIR_{0.05}$ B x C =n.s.; r.n.		LSD; $NIR_{0.05}$ A x B x C = 0.188		

explanations see Table 2; objaśnienia jak w tabeli 2

The treatment of seeds and seedlings with Polyversum biopreparation did not increase the uptake, and in consequence, the concentration of nitrogen, potassium, calcium and magnesium in the plants (Tab. 4).

Table 4; Tabela 4

Effect of grass species, term of leaf sampling and treatment with Polyversum on N, K, Ca and Mg content in plants – summary of statistical calculations

Wpływ gatunku traw, terminu pobierania prób oraz traktowania Polyversum na zawartość N, K, Ca i Mg w roślinie – podsumowanie obliczeń statystycznych

Effect of Wpływ	N		K		Ca		Mg	
	2003	2004	2003	2004	2003	2004	2003	2004
Cultivar Odmiany	n.s.; r.n.	*	n.s.; r.n.	n.s.; r.n.	n.s.; r.n.	*	n.s.; r.n.	*
Term of sampling Terminu pobierania prób	n.s.; r.n.	*	*	n.s.; r.n.	n.s.; r.n.	*	n.s.; r.n.	n.s.; r.n.
Treatment with Polyversum Traktowania Polyversum	n.s.; r.n.	n.s.; r.n.	n.s.; r.n.	n.s.; r.n.	n.s.; r.n.	n.s.; r.n.	n.s.; r.n.	*

* – significant differences p = 0.05; różnice istotne α = 0,05

n.s.; r.n. – differences not significant; różnice nieistotne

Conclusions

1. Inoculation of seeds and sprouting seeds of grass by *Pythium oligandrum* oospores only slightly increased the content of phosphorus in the plants.
2. Treatment of seeds and sprouting seeds of grass by *Pythium oligandrum* has no influence on nitrogen, potassium, calcium and magnesium concentration in grass tissue.
3. Further studies referring to the effect of *Pythium oligandrum* on nutritional status of plants are necessary.

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Key words: grass, *Pythium oligandrum*, macroelements, phosphorus

Summary

In greenhouse experiment the influence of Polyversum on macronutritional status of selected grass species was examined. Inoculation of seeds and sprouting seeds by *Pythium oligandrum* oospores slightly increased the content of phosphorus. No influence on nitrogen, potassium, calcium and magnesium concentrations in plants was found. In the presented experiments the highest phosphorus content was found in the overground parts of *Festuca rubra* L. 'Nimba'.

WPŁYW POLYVERSUM NA ODŻYWIENIE MAKROELEMENTAMI WYBRANYCH GATUNKÓW TRAW

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Słowa kluczowe: trawa, *Pythium oligandrum*, makroskładniki, fosfor

Streszczenie

Wpływ Polyversum na stan odżywienia wybranych traw makroelementami badano w doświadczeniach szklarniowych. Inokulacja nasion i siewek traw oosporami *Pythium oligandrum* spowodowała tylko nieznaczny wzrost zawartości fosforu w roślinach. Nie stwierdzono wpływu zastosowanego preparatu na zawartość azotu, potasu, wapnia, magnezu w roślinach. W prezentowanych doświadczeniach największą zawartość fosforu stwierdzono w części nadziemnej trawy *Festuca rubra* L. 'Nimba'.

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