

Root system development of *Lolium perenne* under different management of landscape lawns



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Introduction

The objective of this study was to compare the weight of roots and their stratification under 2-mow and 5-mow management of landscape lawns of *Lolium perenne*. The trials were carried out at Rousínov in the Czech Republic from 2007 to 2009. Nitrogen (N) was applied as fertilizers differing in forms and actions and at different levels of N rate (0, 50 and 100 kg ha⁻¹ y⁻¹). In the third year of the experiment the root weight of *Lolium perenne* was the highest. High doses of nitrogen (100 kg ha⁻¹ y⁻¹) increased the weight of the root biomass in the 0–20 mm layer.

Methods

A multi-factorial small-plot experiment was established in a randomized block design with three replications in September 2006 on the site of Rousínov, Czech Republic (phytogeographical region - termophyticum; soil class - loamy; altitude 229 m above sea level). Temperature and precipitation data at the experimental site are reported in Table 1. A cylindrical soil probe (50 mm in diameter) was used to take samples of grass turf monolith to a soil depth of 200 mm at the end of the vegetation season. The soil monolith was divided into the layers of 0–20 mm and 21–200 mm.

Table 1. Climatic characteristics of the Rousínov site

| | Long-term averages | 2006 | 2007 | 2008 | 2009 |
|-------------------------------------|--------------------|-------|-------|-------|-------|
| Average annual day temperature (°C) | 9.0 | 9.1 | 10.6 | 10.7 | 10.2 |
| Total annual precipitation (mm) | 511 | 590.7 | 627.8 | 426.0 | 612.5 |

Experimental factors:

Factor 1 – year: a) 2007, b) 2008, c) 2009

Factor 2 – frequency of mowing: a) 5M - five per year, b) 2M - two per year

Factor 3 – the applied form of nitrogen in fertilizer:

a) RN – N in a fast-soluble form, ratio of nutrients 15N-5P-20K + micro-elements ME; b) SN – with N stabilizer (nitrification inhibitor DMPP – Dimethylpyrazole phosphate), ratio of nutrients 14N-7P-17K+ME; c) DN – N in a long-term form (IBDU-condensate of urea), ratio of nutrients 16N-7P-15K+ME; d) C – control (without fertilizing)

Factor 4 – nitrogen dose: a) 0 kg ha⁻¹ y⁻¹; b) 50 kg ha⁻¹ y⁻¹; c) 100 kg ha⁻¹ y⁻¹ applied in two doses

Results

In the third year of the experiment the root weight of *Lolium perenne* was the highest. High doses of nitrogen (100 kg ha⁻¹ y⁻¹) increased the weight of the root biomass in the 0–20 mm layer.

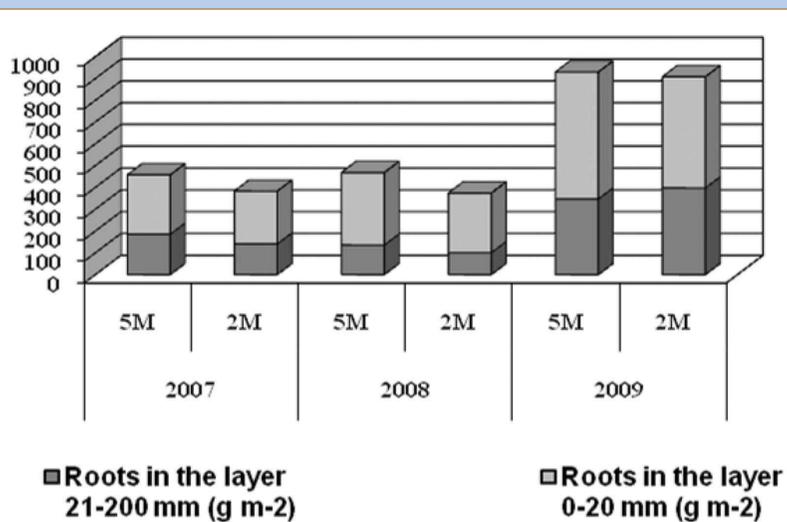


Figure 1. Comparison of the root biomass weight and stratification in individual variant of mowing of *Lolium perenne*



Table 2. Impact of the factors on the root biomass weight and stratification in *Lolium perenne*

| Factor | Roots in the layer 0-20 mm (g m ⁻²) | Roots in the layer 21-200 mm (g m ⁻²) | Roots 0-200 mm (g m ⁻²) | |
|-------------------|---|---|-------------------------------------|--------|
| Year | 2007 | 256.8a | 163.1a | 419.9a |
| | 2008 | 302.8a | 118.1a | 420.9a |
| | 2009 | 546.4b | 372.1b | 918.5b |
| Number of mowings | 2M | 341.9a | 212.9a | 554.8a |
| | 5M | 395.5a | 222.7a | 618.2a |
| Nitrogen form | C – without fertilization | 305.4a | 209.9a | 515.3a |
| | RN – quick-acting | 352.5a | 222.2a | 574.7a |
| | SN – with N stabilizer | 391.9a | 218.3a | 610.2a |
| | DN – slow-acting | 393.3a | 216.7a | 610.0a |
| Nitrogen dose | 0 kg ha ⁻¹ y ⁻¹ | 305.4ab | 209.9a | 515.3a |
| | 50 kg ha ⁻¹ y ⁻¹ | 320.6a | 212.2a | 532.8a |
| | 100 kg ha ⁻¹ y ⁻¹ | 437.8b | 225.9a | 663.7a |

a, b - means followed by the same letter within a column and one factor are not significantly different ($P < 0,05$)

Conclusions

This multifactorial study of the *Lolium perenne* root system within a three year period provides information about the root system's response in two soil layers (0–20 mm and 21–200 mm) to different methods of extensive management of landscape lawns. Root biomass stagnated in the dry year 2008 and increased markedly in the wet year 2009. The only management factor which produced significant differences was nitrogen dosage.

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