

# Influence of fertiliser norms and variety on total nitrogen content in reed canary grass dry matter

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Perennial grasses are essential for agricultural production sector in Latvia, since they may be used for the production of biofuel. Nitrogen is an element limiting harvest. This study resulted in finding that total nitrogen content in reed canary grass (RCG) dry matter varied between 0.77% and 2.18%, while the highest indicators are recorded for RCG varieties 'Pedja' (2.27%), 'Bamse' (2.22%) and 'Marathon' (2.18%). Application of higher fertiliser norms resulted in slight changes in total nitrogen content. The research aims at evaluating influence left by fertiliser amounts, norms and types on the total nitrogen content in RCG dry matter. Total nitrogen content was affected by fertiliser norm and variety.

*Reed canary grass (*Phalaris arundinacea L.*), total nitrogen content, fertiliser norms*

## Introduction

Quality of harvested grass is characterised by chemical content thereof that, in turn, is affected by biological features of plants, harvesting regime and growth factors (Būmane et al., 2009). Also content of total nitrogen is one of the grass quality indicators, since nitrogen fertilisers leave notable influence on plant chemical content. Scientific literature states that as higher fertiliser amounts are applied the output from 1 kg of nitrogen spread on grass reduces gradually (Ruža et al., 2012). Optimum nitrogen fertiliser doses increase yield notably, regardless the differences in environmental conditions faced during the research years (Gastal et al., 2002).

Research object: reed canary grass (*Phalaris arundinacea L.*) (RCG), varieties 'Marathon', 'Bamse' and 'Pedja'.

The research aims at evaluating influence left by fertiliser amounts, norms and types on the total nitrogen content in RCG dry matter.

## Materials and methods

Field trials were conducted during the time period from 2011 to 2012 in Latvia University of Agriculture research and study farm "Pēterlauki" (56°53'N, 23°71'E), in calcareous sod soil (pH KCl 6.7), containing P – 52 mg kg<sup>-1</sup>, K – 128 mg kg<sup>-1</sup>; content of organic matter in soil – 21–25 g kg<sup>-1</sup>. Fertiliser norms used in field trials (kg ha<sup>-1</sup>): N<sub>0</sub>P<sub>0</sub>K<sub>0</sub> (control), P<sub>2</sub>O<sub>5</sub> – 80 K<sub>2</sub>O – 120 (F – background), F+N<sub>30</sub>, F+N<sub>60</sub>, F+N<sub>90</sub>, F+N<sub>120</sub> (60+60), F+N<sub>150</sub> (75+75), F+N<sub>180</sub> (90+90) (Table 1). Seed sowing norm – 1000 germinant seeds per 1 m<sup>2</sup>, sowing norm - 15 kg ha<sup>-1</sup>, sowing time - 20 May 2011.

Content of total nitrogen in samples were tested in University of Latvia scientific laboratory for agronomic analysis in compliance with LVS EN ISO 5983 – 2:2009 standard. Data were processed with MS Office Excel (Arhipova et al., 1999).

**Table 1.** Fertiliser norms

No.	Fertiliser norms (kg ha <sup>-1</sup> )
1.	N <sub>0</sub> P <sub>0</sub> K <sub>0</sub> (control)
2.	P <sub>2</sub> O <sub>5</sub> – 80; K <sub>2</sub> O – 120 (F (background))
3.	F+N <sub>30</sub>
4.	F+N <sub>60</sub>
5.	F+N <sub>90</sub>
6.	F+N <sub>120</sub> (60+60)
7.	F+N <sub>150</sub> (75+75)
8.	F+N <sub>180</sub> (90+90)

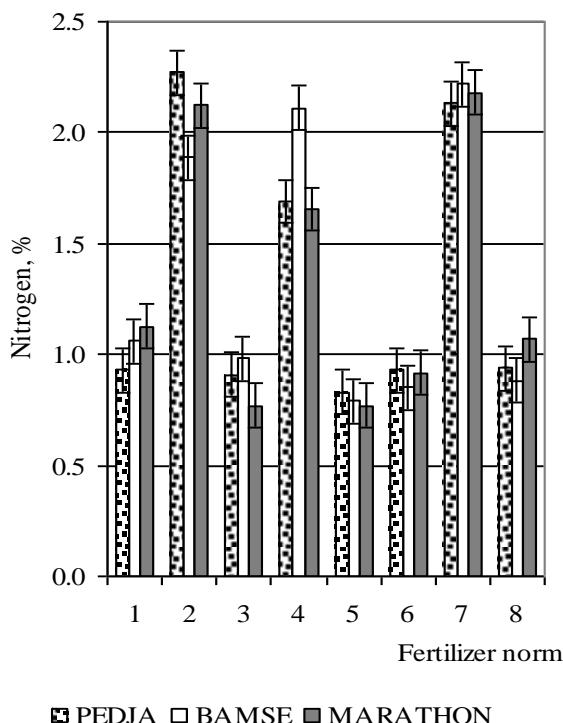
## Results and discussion

When cultivating grass, it is of a great significance to choose suitable fertiliser dose, because it will influence productivity and quality of grass variety. Figure 1 depicts that content of total nitrogen is approximately 20% higher when using fertiliser doses K<sub>2</sub>O - 120 kg ha<sup>-1</sup> + P<sub>2</sub>O<sub>5</sub> – 80 kg ha<sup>-1</sup>, F+N<sub>60</sub>, F+N<sub>150</sub> (75+75). Total nitrogen content, depending on RCG variety, varied between 0.77% and 2.22%. The highest total nitrogen amount was observed for varieties 'Pedja' (2.27%) and 'Bamse' (2.22%) with fertiliser norm P<sub>2</sub>O<sub>5</sub> – 80 K<sub>2</sub>O – 120 (F – background), and for variety 'Marathon' (2.18%) with F +N<sub>150</sub> (75+75). The highest mean content of total nitrogen was observed for RCG variety 'Marathon' – 1.35%, whereas 'Pedja' and 'Bamse' indicated 1.33.

If fertiliser amount is increased, changes in the content of total nitrogen are insignificant. Along with synthesis of protein in plants, changes in protein content in dry matter may be minimal (Gill et al., 1989). This research did not indicate notable changes in total nitrogen content depending on fertiliser amounts and types applied. In well-cultivated soils, the best results not always may be observed with higher fertiliser amounts; therefore it is advisable to evaluate efficiency of nitrogen fertiliser norms (Poiša et al., 2010).

This research showed that influence left by fertiliser norm and type is significant (Table 1). Nitrogen, as a part of protein, controls uptake of nutrients in plant. Availability of nitrogen in plants partly regulates

production of chlorophyll that is the dominating functional protein in plants (Demoranvila, n.y.).



**Fig. 1.** Content of total nitrogen content in dry matter of different RCG varieties, where 1 -  $N_0P_0K_0$  (control), 2 -  $P_2O_5 - 80 \text{ kg ha}^{-1}$ ,  $K_2O - 120 \text{ kg ha}^{-1}$  (F), 3 -  $F+N_{30}$ , 4 -  $F+N_{60}$ , 5 -  $F+N_{90}$ , 6 -  $F+N_{(60+60)}$ , 7 -  $F+N_{150 (75+75)}$ , 8 -  $F+N_{180 (90+90)}$

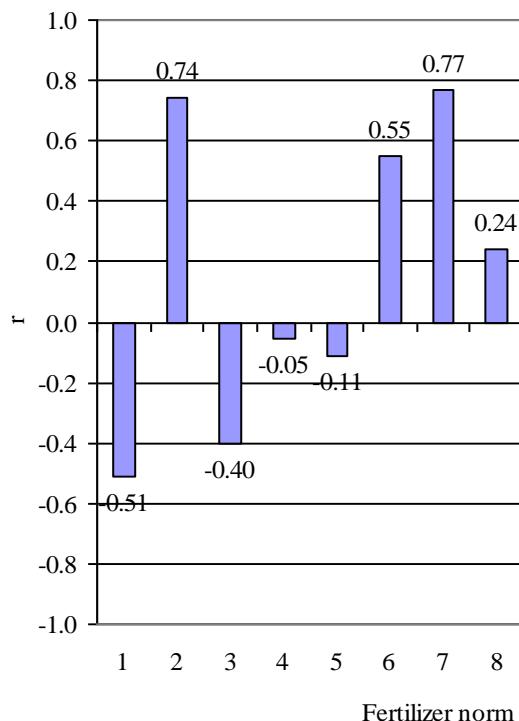
Fertiliser norm has the greatest influence on the nitrogen content in RCG dry matter; while research allowed observing that both fertiliser norm and type have significant effect. Nitrogen, as part of protein, controls uptake of nutrients in plant.

Harvest quality mostly is changed by nitrogen fertilisers: under the influence of fertiliser norms  $N_{60}$  and  $N_{120}$  (background  $P_{60}K_{80}$ ) content of total nitrogen in grass dry matter rose by 0.14% and 2.66%, total nitrogen yielded from 1ha went up by 98% and 226% (Būmane et al., 2009).

**Table 2.** Rate of factor influence on total nitrogen content

Factor	Factor influence rate	p-value
Fertiliser norm ( $F_A$ )	96.00	p<0.000
Variety ( $F_B$ )	0.03	p=0.441
Interaction between factors ( $F_A, F_B$ )	3.57	p<0.000

Correct and suitable fertilisation is one of the ways to improve productivity and quality of grass frontispieces. Evaluation of total nitrogen content and dry matter productivity in RCG dry matter was based on correlation coefficient (Fig. 2).



**Fig. 2.** Correlations between total nitrogen content and RCG dry matter yield, where 1 -  $N_0P_0K_0$  (control), 2 -  $P_2O_5 - 80 \text{ kg ha}^{-1}$ ,  $K_2O - 120 \text{ kg ha}^{-1}$  (F), 3 -  $F+N_{30}$ , 4 -  $F+N_{60}$ , 5 -  $F+N_{90}$ , 6 -  $F+N_{(60+60)}$ , 7 -  $F+N_{150 (75+75)}$ , 8 -  $F+N_{180 (90+90)}$

Second ( $P_2O_5 - 80 \text{ kg ha}^{-1}$  and  $K_2O - 120 \text{ kg ha}^{-1}$ ) and seventh  $F+N_{150 (75+75)}$  fertiliser norms indicated very close positive correlation, while first  $N_0P_0K_0$  (control) and sixth  $F+N_{120 (60+60)}$  showed medium close correlation between total nitrogen content and dry matter yield. Nitrogen is significant component of protein, moreover they are closely related. Nitrogen content in leaves positively correlates with quality of photosynthesis, because photosynthesis is assisted by proteins containing nitrogen (Otronen et al., 2001). Fertiliser norms have the greatest influence on total nitrogen content in RCG dry matter.

Yield of total protein depends on harvest, while production of bioenergy needs varieties with lower total protein content to ensure that residues have as few gases containing nitrogen as possible.

## Conclusions

- With application of fertiliser norms  $P_2O_5 - 80 \text{ kg ha}^{-1}$  and  $K_2O - 120 \text{ kg ha}^{-1}$ ,  $F+N_{60}$ ,  $F+N_{150 (75+75)}$  the content of total nitrogen in RCG dry matter increases by 20%.
- Total nitrogen content was affected by fertiliser norm (p<0.001) and variety (p<0.05).
- Application of fertiliser norm  $P_2O_5 - 80 \text{ kg ha}^{-1}$  and  $K_2O - 120 \text{ kg ha}^{-1}$  and  $F+N_{150 (75+75)}$  resulted in close positive correlation, while use of fertiliser norms  $N_0P_0K_0$  (control) and  $F+N_{(60+60)}$  led to medium close correlation between total nitrogen content and dry matter yield.

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Расма Платаче, Александр Адамович, Лиена Пойша

**Влияние удобрений норм и сортов на общее количество азота в двукисточнике сухого вещества**

Summary

Исследование направлено на оценку общего содержание азота в сухом веществе двукисточника (*Phalaris arundinacea L.*) в зависимости от норм удобрений и сортов двукисточника. Азот является элементом, который увеличивает урожай. Многолетние травы имеют важное значение для сектора сельскохозяйственного производства в Латвии, так как они могут быть использованы для производства биотоплива. Это исследование привело к выводу, что общее содержание азота в сухом веществе двукисточника варьируется среднем от 0,77% до 2,18%, самые высокие показатели зарегистрированы для сортов *Phalaris arundinacea L.* – ‘Pedja’ (2,27%), ‘Bamse’ (2,22%) и ‘Marathon’ (2,18%). Применение более высоких норм удобрений привело всего лишь к небольшим изменениям общего содержания азота.

*Phalaris arundinacea L., общее содержание азота, нормы удобрений*

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