

# Variability of forage quality between and within three maturity groups of *Lolium perenne* L. during the first growth

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## Abstract

A set of 39 different cultivars of *Lolium perenne* (Lp) assigned to early, medium and late maturing types were harvested and analysed at weekly intervals during the first growth. Significant differences between the heading groups were found with a time lag of 6 days for crude protein content resp. up to 11 days for digestibility of organic matter and energy concentration. The early heading cultivars strongly differed from the other two groups, which performed comparably and more resilient for a longer time. Within all three heading groups a strong variation could be noticed, leading to some unexpected overlapping. Our results indicate that the assignment of Lp-cultivars to the heading groups is imprecise and should be improved by advanced recordings resp. analyses during the time of the official variety testing period. This may lead to a more sufficient selection of Lp-cultivars for grassland mixtures and therefore increase the quality of home-grown forage.

**Keywords:** *Lolium perenne*, maturity groups, persistence, variety

## Introduction

To improve the quality of home grown forage from grassland, different strategies have been developed. Among others the establishment and renovation of grassland by over-seeding with high-quality seed mixtures are of great importance. Seed mixtures for grassland are containing well tested cultivars of forage grasses and legumes. *Lolium perenne* L. (Lp) is one of the most common grasses used in seed mixtures for meadows and pastures all over Europe and there is a huge number of cultivars with different quality characteristics available (Krautzer *et al.*, 2013; McDonagh *et al.*, 2015). The selection of cultivars for seed mixtures depends on site conditions, type of grassland management (utilisation frequency, fertilization intensity) and on the intended purpose (e.g. establishment or over-seeding, meadow or pasture). Lp-cultivars are classified into early, medium and late maturity groups (based on heading dates) however early heading cultivars are not necessarily also early maturing. There is still little information available on the variation of quality parameters between and within these groups. Therefore the objectives of our project were: (1) to illustrate the dynamics of quality parameters during the first growth; (2) to identify the variation between and within the maturity groups; and (3) to determine the optimal harvesting time. The findings will both support the selection of suitable Lp-cultivars for seed mixtures under changing environmental conditions and provide grassland farmers with useful information concerning forage quality (Reheul *et al.*, 2013; Blackmore *et al.*, 2015).

## Materials and methods

Following the official variety testing period of three years, we harvested 39 cultivars of Lp assigned to three maturity groups in weekly intervals during the first growth. The field experiment was conducted at the Federal Research and Education Centre Raumberg-Gumpenstein, Austria (47°29' 40'' N and 14°06' 11'' E, 700 m a.s.l.) with an average annual precipitation of 1,015 mm and a long-term mean annual air temperature of 8.4 °C. Yield, forage quality, especially crude protein (CP; VDLUFA, 1976) content, digestibility of organic matter (DOM; Tilley and Terry, 1963) and energy concentration (NEL; calculated according GfE, 2001) were determined to find out the variability between and within the maturity groups. Analyses of

variance (ANOVA) were performed with the software package SPSS version 22.0 (IBM®SPSS®Statistics), followed by a multiple range test (Bonferroni post hoc test) using a significance level of  $P < 0.05$ .

## Results and discussion

The self-supply of energy and protein has become an important issue in European agriculture and therefore there is still an increasing interest to improve forage quality on grassland farms. Our results clearly confirm the decreasing protein concentration with delayed harvest time during the first growth showing a linear mean drop of 15 g CP kg<sup>-1</sup> DM per week for all three maturity groups (Figure 1). On average the late heading Lp-cultivars performed best, followed by the medium heading cultivars and by the early heading group with significantly lower CP-concentrations at most of the sampling dates. A concentration of 150 g CP kg<sup>-1</sup> DM which is at least required for high yielding cows was achieved on 14 May for the early heading group, on 17 May for the medium heading group and again three days later on 20 May for the late heading group. Even though there seems to be a clear differentiation between the three groups, a strong variation within the groups could be noticed with some remarkable overlapping. Two cultivars of the early heading group for example had much higher CP-concentrations that were comparable with those of the late heading group. This finding could also be used to select early heading cultivars providing good winter hardiness and high forage quality as well.

The dynamic of dOM during the first growth was following a polynomial function with a clear shift between the three maturity groups. In the early heading group the maximal dOM was achieved on 18 May with a decrease of 3% per week afterwards, whereas the highest dOM of both other groups was obtained 7 resp. 11 days later, remaining at a high level for another week. Again some early heading cultivars performed very similar to the medium and late heading group. The energy concentration (expressed in MJ NEL kg<sup>-1</sup> DM) was strongly linked with dOM and therefore the dynamic during the observation period but also between the three maturity groups was very similar (Table 1).

For farmers, not only high forage quality but also sufficient yield is of great importance. Our results indicate that there is a relatively small time span to achieve high forage quality with early heading Lp-cultivars in combination with high yield in the first growth. In contrast medium and late heading Lp-

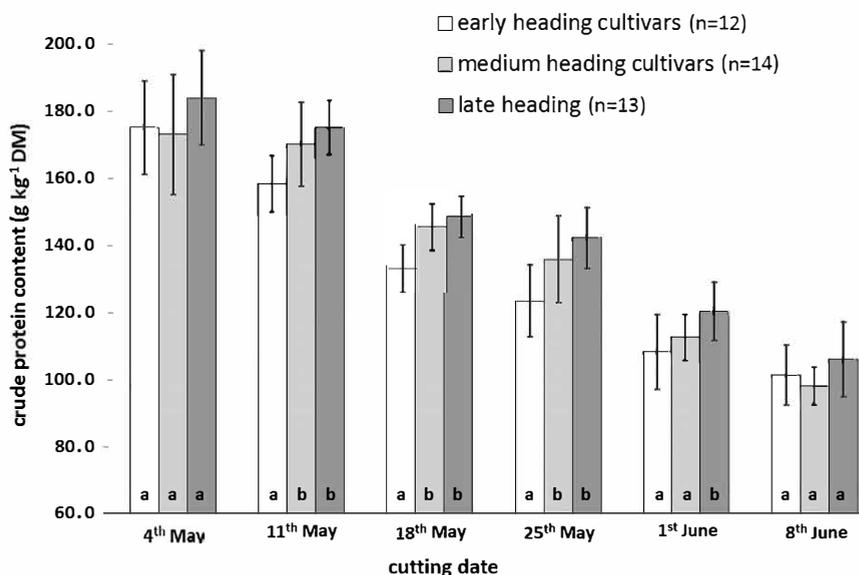


Figure 1. Crude protein content of *Lolium perenne* cultivars in the course of the first growth.

Table 1. ANOVA for selected parameters of forage quality assigned to heading groups (early, medium, late) and six weekly harvest intervals (from 4 May to 8 June) in Austria.

	Dependent variable <sup>1</sup>		
	CP (g kg <sup>-1</sup> DM)	dOM (%)	NEL (MJ kg <sup>-1</sup> DM)
Heading group (Hg)	sign.	n.s.	n.s.
Harvest date (Hd)	sign.	sign.	sign.
Hg × Hd	n.s.	sign.	sign.
R <sup>2</sup>	0.88	0.46	0.37

<sup>1</sup> Significance level  $P < 0.05$ .

cultivars performed much more resilient and provide a later and extended time slot of about 10-12 days for high forage quality and sufficient yield.

## Conclusions

It has become very common to use a set of differently heading Lp-cultivars for grassland seed mixtures to provide a larger harvest window and to reduce the risk of unfavourable weather conditions, which in mountainous regions very often occur during the harvest time of the first growth. As there is a strong variability of forage quality between and within the maturity groups of Lp-cultivars more specific information about these characteristics are desirable.

There is an ongoing discussion in Austria to implement more detailed recordings and analyses during the official, three years lasting variety testing period which should provide more reliability in the selection of Lp-cultivars for grassland seed mixtures.

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