

GRASS STRAW AS FEED

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ABSTRACT

Grass straw is produced as a byproduct when growing grasses for seed. Its yields vary and, depending on the grass species, the intensity of inputs into the stand, and weather conditions, range from 2.0 to 12.1 t·ha⁻¹. Grass straw has a wide range of uses, including as a source of thermal energy, a raw material for compost production, a substrate for growing edible mushrooms, shredded and spread over the field, and, finally, as an animal feed. When straw is utilized appropriately, it increases the revenue and profitability of grass seed growers. In terms of nutrient composition, it is a higher-quality feed than cereal straw. Compared to meadow hay, it has a higher fiber content (usually more than 650 g·kg⁻¹ NDF) and a lower crude protein content (26–92 g·kg⁻¹ DM).

Keywords: mineral contents, feed value, perennial ryegrass, italian ryegrass, dry mater content

INTRODUCTION

The growing emphasis on sustainable agriculture and the efficient use of byproducts from crop production is leading to increased interest in alternative roughage feeds for livestock. One such feed is grass straw, which is produced as a byproduct of grass seed production. Although a significant amount of grass straw is produced annually in areas with intensive seed production, its potential in livestock nutrition is not fully utilized (Bohnert et al., 2012).

In terms of nutritional value, grass straw represents a middle ground between high-quality meadow hay and cereal straw. Hay harvested at the optimal stage of growth contains a higher concentration of crude protein (CP), a lower proportion of lignified fiber, and a higher content of metabolisable energy, which is reflected in higher digestibility. In contrast, cereal straw is characterized by a low CP content, a high proportion of lignin, and therefore exhibits lower feed value (Van Soest, 1994). Grass straw typically contains more crude protein and has higher



digestibility than wheat or barley straw; however, its nutritional value is generally lower than that of high-quality hay (Bohnert et al., 2012).

The chemical composition of grass straw is significantly influenced by the grass species, variety, growth stage, seed harvest date, and conditions during crop maturation. Differences between individual species can be substantial, particularly in the content of crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and lignin, which decisively influence nutrient utilization by ruminants and horses (Hejduk, Macháč, 2019; Moore, Jung, 2001). For this reason, grass straw cannot be considered a homogeneous feed, and its nutritional value should be assessed individually based on species and production conditions, considering the proportion of sterile tillers and leaves.

When appropriately supplemented with energy, CP, and mineral nutrients, grass straw can be an economically attractive component of ruminant diets, particularly for beef cattle, dry cows, or sheep with lower nutrient concentration requirements. Compared to cereal straw, it is generally more readily accepted by animals and provides a higher content of digestible nutrients. On the other hand, attention must be paid to the possible presence of endophytic alkaloids in certain grass species, particularly tall fescue and perennial ryegrass, which can negatively affect the health and productivity of animals (Cheeke, 1995; Bohnert et al., 2012).

The aim of this study is to assess the production potential and chemical composition of grass straw from selected grass species grown for seed and to evaluate its potential use in ruminant nutrition. The results are discussed in relation to the quality of hay and cereal straw, which are commonly used roughage feeds.

MATERIAL AND METHODS

This study evaluates the available knowledge on grass straw production and its quality characteristics in relation to its use in livestock feed. There is relatively little published information on this topic, and most of it comes from regions where grass seed production has long been concentrated.

This study primarily draws on the results of the authors' previously unpublished experiments conducted in the Czech Republic. The greatest attention was devoted to Italian and perennial ryegrass, which are among the most important grass species cultivated for seed production not only in Europe but in all temperate regions of the world. Experimental data were collected at the Forage Research Station of Mendel University in Valtín (49.52° N, 15.97° E) and at the Research Station of the Oseva PRO Grass Seed Company in Zubří (49.47° N, 18.07° E) (Hejduk, Macháč, 2019; unpublished data). The experiments were conducted on 10 m² plots, which were harvested using a small plot combine harvester. Additional results were obtained from commercial stands, where samples were collected from a 1 m² area in three replicates.

Grass straw samples were collected immediately after harvest to determine dry matter (DM) content and dry matter yield. For laboratory analysis, the dried

samples were ground and homogenized in a laboratory grinder equipped with a 1.0-mm sieve. Three samples were analysed from each combination of species, location, and year. Chemical analyses included the determination of CP, NDF, and ADF content. Ash content was determined by ignition at 550 °C for six hours. NDF and ADF values were determined using the ANKOM method (2017a, 2017 b). Total nitrogen content was determined by the Kjeldahl method according to AOAC (1984), and crude protein content was subsequently calculated by multiplying the nitrogen content by a factor of 6.25.

RESULTS AND DISCUSSION

The results of the chemical composition of grass straw from individual species are presented in Table 1. Significant differences were found among the evaluated species in crude protein, neutral detergent fibre, acid detergent fibre, and ash content, confirming that the nutritional value of grass straw is significantly influenced by botanical species.

Crude protein content ranged from 26 g·kg⁻¹ DM in red fescue (*Festuca rubra*) and meadow fescue (*Festuca pratensis*) to 92 g·kg⁻¹ DM in Kentucky bluegrass (*Poa pratensis*). A relatively high crude protein content was also found in timothy grass (*Phleum pratense*); 81 g·kg⁻¹ DM, while both ryegrass species reached intermediate values (64–74 g·kg⁻¹ DM). These results are consistent with the findings of Youngberg and Yough (1977), who reported considerable variability in CP content among individual grass species grown for seed. Compared to high-quality hay, which typically contains 120–180 g CP·kg⁻¹ DM (Van Soest, 1994), the crude protein concentration in grass straw was significantly lower. On the other hand, for most of the evaluated species, it was higher than the values typically reported for cereal straw, which range approximately between 20 and 45 g CP·kg⁻¹ DM. These results confirm that grass straw can represent a nutritionally more valuable alternative to cereal straw, especially for species with higher CP content.

The NDF content ranged from 629 to 762 g·kg⁻¹ DM. The lowest concentration was found in meadow foxtail, while red fescue had the highest NDF content. Higher NDF concentrations are generally associated with lower feed intake in ruminants, as they reduce the rate of rumen passage (Mertens, 1997). The values observed for ryegrasses (656–680 g·kg⁻¹ DM) correspond to the data published by Bohnert et al. (2012) for grass straw produced in Oregon. Although the NDF values are higher than those of high-quality hay, they generally remain lower than those of most cereal straws, where the NDF content often exceeds 750 g·kg⁻¹ DM (Van Soest, 1994).

A similar trend was also observed for ADF, with concentrations ranging from 410 g·kg⁻¹ DM in meadow grass to 523 g·kg⁻¹ DM in red fescue. Higher ADF content is associated with a higher proportion of cellulose and lignin, which leads to reduced digestibility of organic matter (Jung, Allen, 1995). The lowest ADF values were found in meadow grass and meadow fescue, suggesting their higher

potential digestibility compared to fescues. In contrast, red fescue exhibited the highest NDF and ADF contents, indicating a high degree of lignification of the tissues following seed harvest and lower nutrient availability.

Tab. 1: *Nutritional composition of grass species (g·kg⁻¹ DM) (trial Czech Republic)*

Species	Crude protein	NDF	ADF	Ash
Timothy	81	629	412	71
Peren ryegrass	64	656	442	68
Italian ryegrass	74	680	442	68
Red Fescue	26	762	523	41
Meadow Fescue	26	671	452	37
Kentucky Bluegrass	92	672	410	60

Ash content ranged from 37 to 71 g·kg⁻¹ DM. The highest concentration was found in timothy, while the lowest content was recorded in meadow fescue. Differences in mineral content may be due not only to the genetic characteristics of individual species but also to variations in the intensity of nutrient uptake from the soil, fertilization levels, rainfall prior to straw harvest, and contamination of the harvested material with soil particles during harvest (Moore, Jung, 2001).

An overall assessment of the chemical composition suggests that there are significant differences in the potential feed value of grass straw among the species studied. From the perspective of ruminant nutrition, based on the above analyses, meadow fescue and ryegrass appear to be the most promising, as they combine a higher crude protein content with a lower ADF concentration. Both species can therefore be considered a more suitable alternative to cereal straw, particularly as a structural component of feed rations. In contrast, red fescue exhibited the lowest CP content and, at the same time, the highest concentration of structural fiber, which limits its usefulness in ruminant nutrition.

Tab. 2: *Grass straw yields by species (trials 2016–2017, Hejduk, Vlček, 2026)*

Species	Range of yield (t·ha ⁻¹)
Timothy	8.1 – 12.1
Perennial Ryegrass	3.3 – 11.4
Italian Ryegrass	3.3 – 11.3
Red Fescue	2.0 – 7.8
Meadow Fescue	5.3 – 9.1
Kentucky Bluegrass	6.9 – 7.8

The results of this study are consistent with the findings of Bohnert et al. (2012) and Niemeläinen et al. (2001), who reported that, in terms of nutritional value, grass straw represents a middle level between high-quality hay and cereal straw. Although it does not reach the quality of a meadow hay, in most cases it provides a higher concentration of crude protein (CP) and better digestibility than cereal straw, making it an interesting byproduct suitable for use in rations for ruminants with lower nutrient concentration requirements.

CONCLUSION

The results of this study confirmed that the chemical composition of grass straw varies significantly among different grass species, which significantly affects its potential use in ruminant nutrition. The highest crude protein (CP) content was found in Kentucky bluegrass and meadow fescue, while the lowest values were observed in red fescue. At the same time, significant differences were found among species in NDF and ADF content, which are key indicators of digestibility.

Compared to high-quality hay, grass straw exhibited a lower concentration of crude protein and a higher content of structural carbohydrates, which is a result of the physiological aging of the plants. Nevertheless, most of the evaluated species were found to have a higher nutritional value than commonly used cereal straw, primarily due to their higher CP content. Grass straw thus represents a promising alternative roughage, particularly for categories of ruminants with lower nutrient concentration requirements, such as beef cattle, dry cows, or sheep.

Greater use of grass straw in livestock nutrition can contribute to increased sustainability and efficiency in agricultural production, while making better use of byproducts from seed production. Supplementing the feed base during dry years when forage is scarce can be particularly important.

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