Original Scientific paper
10.7251/AGRENG2203063F
UDC 633.2

NUTRITIONAL VALUES ANALYSIS OF SANDY GRASSLANDS ALONG THE DANUBE FROM THE PANNONIAN REGION TO THE ROMANIAN PLAIN

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ABSTRACT

Grazing livestock farming has a long tradition in Hungary. The most valuable feed for grazing animals is provided by plants of grasslands. Supplementation of feed rations with fiber increases the saturation of digestive tract, thus making the animals calmer and improving animal welfare. Grasses can be useful supplements as they contain a lot of digestible fiber. Our aim is to find out about the grassland management values of sandy grasslands dominated by *Festuca* species along the Danube. Cut samples were made along the Danube, beginning in the northwestern part of the Little Hungarian Plain, across the central sandy plains of the Carpathian Basin to the southernmost part of the Basin at Deliblato, Serbia. The last samples were made beyond the Carpathians on the Romanian Great Plain and Bulgaria. Weende analysis of the cut samples was carried out in the laboratory of MATE. Their original dry matter, crude protein, crude fat and crude fiber content were analysed, and fiber fractions (NDF, ADF, ADL) were measured. Based on the results, contents of absolute dry matter, crude fiber and NDF were high in all samples. The five samples of the analysed *Festuca* species showed significant differences between dry matter and crude fiber. *Festuca wagneri* had the highest dry matter content. The highest crude protein contents were found in *Festuca vaginata, Festuca wagnerii* and *Festuca rupicola* samples, the highest crude fiber content in *Festuca tomanii* samples.

Keywords: *feed value, fescue.*

INTRODUCTION

As in Europe, biodiversity is declining in Hungarian Pannonian grasslands, both in agricultural fields and in semi-natural vegetation types (Bakker and Berendse, 1999; Bischoff et al., 2005; Valkó et al., 2011; Tasi et al., 2013, 2014; Halász et al., 2016). Biodiversity loss is caused by anthropogenic impacts, but also by improper use of grassland and lack of land management (Fischer and Stöcklin, 1997; Bischoff et al., 2005). Grazing pressure is important for pastures, but overgrazing or a lack of grazing can cause a decline, resulting in changes of phytomass conditions in many grasslands (Guo 2007; Kelemen et al, 2013; Szentes et al, 2009; Penksza et al, 2013; Antal and Huzsvai, 2007; Antal and Juhász, 2008; Cornwell and Grubb, 2003; Gillman and Wright, 2006; Mittelbach et al, 2001; Précsényi, 1975). Species of the genus *Festuca* are an important group of grassland species for the Pannonian vegetation, and are also the dominant species of the vegetation, because they can survive in habitats where conditions are too extreme for most plant species. In addition to their importance for grassland management, they also have a high natural value. As climate changes, dry habitats are becoming increasingly important. Biomass studies on sandy grasslands following the Danube have been carried out at regional level in several countries (Rácz et al., 2021), and investigations of the nutritional value of grasslands have also become interesting. In the description of the feed materials used for feeding and of the forages made from them, the crude fiber content is the most frequent indicator of the nutritional value. Crude fibre is a chemical composition of residues that are generated after cooking in dilute acid and alkali. Neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL) and the group of non-starch polysaccharides (NSP), which have an important role, and their component polymers can be defined (Orosz, 2015; Halász et al., 2022). Introducing fibre into the feed rations enhances the saturation of the digestive system, which makes the animals calmer and thus increases animal welfare. The addition of grasses can be a convenient supplement as they contain a lot of digestible fibre. One of the biggest challenges of feeding is to maximise the available genetic potential at high production and sustainable costs (Orosz, 2017; Orosz and Mézes, 2007).

The main purpose of the present study is to find out how the nutritional values of grasslands by dominated *Festuca* species along a geographical gradient.

MATERIALS AND METHODS

Sample collection

Cut samples for our studies were collected from 37 sample areas following the Danube from the northwestern part of the Carpathian Basin, starting from the Little Hungarian Plain, through the central Carpathian Basin's extensive sandy ridge, to the southernmost Deliblato, to the Romanian Plain and Bulgaria (Figure 1).

In addition to the separated geographical units, the following *Festuca* species were dominant: *Festuca vaginata, F. pseudovaginata, F. wagneri, F. tomanii* (new to the Hungarian flora), *F. javorkae* and *F. rupicola*, which were combined, because only after the ploid level analysis can it be confirmed which species is concerned.

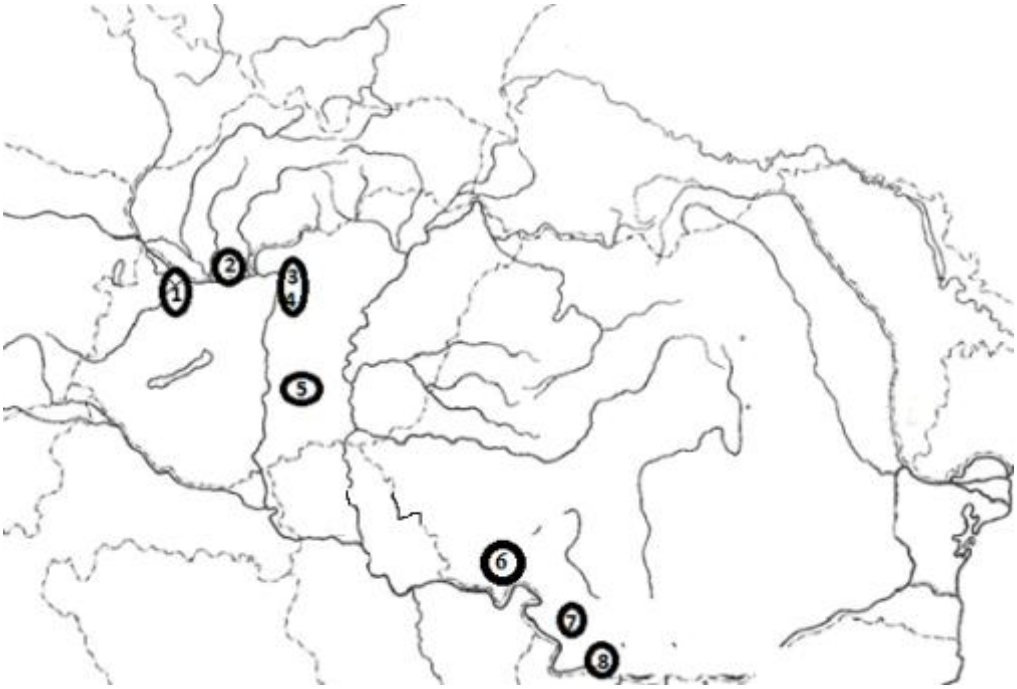

Figure 1. Sampling areas along the Danube River (1: Gönyű, 2: Cenkov, 3: Szigetmonostor, 4: Homoktövis TT, 5: Bugac, 6: Deliblato,7: Balta Verde, 8: Vidin)

Nutritional values analysis

The nutritional values of the cut samples were defined by Weende analysis, including the original dry matter content, crude protein, crude fat and crude fibre content according to MSZ EN ISO 6865, Harris et al. (1972), and NRC (1989), plus the fibre fractions (NDF, ADF, ADL). Samples were classified according to the dominant *Festuca* species, within this, mixed samples with co-occurring *Festuca* species (Schmidt, 1993; Schmidt et al., 2000; Orosz, 2015).

RESULTS AND DISCUSSION

Differences were observed for the nutritional values.

The mixed *Festuca vaginata* values were high in all areas with high absolute dry matter content, but there was a slight increase towards the southern area, the highest values being observed in the sample from Balta Verde (BvFv), which was 897.54 mg/kg. Crude protein values were low, never reaching the 100 mg/kg value. Crude fat ranged only between 18 and 25 mg/kg. The highest values of the fibre fraction were found in the NDF data, around 500 mg/kg. The amount of ADF fibre did not change a lot, the ADL sample from Deliblato (DFv) had the lowest value with 298.22 mg/kg.

The values of mixed *Festuca pseudovaginata* were characterised by high absolute dry matter content in all samples, increasing towards the south. Crude protein values showed minimal variation, not reaching the 100 mg/kg value in any case. Crude fat ranged between 22 and 24 mg/kg. The highest crude fibre content was measured in Bugac (BFp), which was 366,68 mg/kg. There were differences in the ratios of the fibre fraction. The highest values of the fibre fraction were in NDF, around 500 mg/kg. The amount of ADF fibre decreased towards the southern area. The amount of ADL showed a smaller increase in the sample from Bugac (BFp).

The absolute dry matter content was high for the mixed *Festuca tomanii* samples. Crude protein was low with 72.20 mg/kg for the sample from Újpest Homoktövis Természetvédelmi Terület/Újpest Sea-buckthorn Nature Reserve (HFt) but 57.13 mg/kg for the sample from Szigetmonostor. Crude fat ranged from 22 to 23 mg/kg. There was no significant difference in the amount of crude fibre. Fibre fraction ratios: highest values of fibre fraction were found in NDF above 500 mg/kg, ADF showed higher value in the sample from Szigetmonostor (SFtX), while ADL showed lower value for fibre.

Based on the measurements of mixed *Festuca wagneri* values, the absolute dry matter content was high in all samples, but showed an increase towards the southern area: the highest values were observed in the sample from Vidin (VFw), which was 882.37 mg/kg. Crude protein values were low, not reaching 100 mg/kg in any case. Crude fat ranged from 20 to 32 mg/kg. There were no significant differences in the crude fibre content, which was around 320 mg/kg. The highest values of the fibre fraction were found in the NDF data, above 500 mg/kg, while the amount of ADF fibre did not show significant differences. ADL showed an increasing value towards the south.

The absolute dry matter content was high in the mixed *Festuca javorkae/rupicola* samples, 384.54 mg/kg in the samples from Gönyű (GFjrX) and 666.02 mg/kg in the samples from Cenkov (CFjrX). Crude protein values were low, not exceeding 100 mg/kg in either case. The crude fat content did not show significant differences, ranging from 24 to 26 mg/kg. There was no significant difference in the amount of crude fibre, which was around 350 mg/kg. The highest values of the fibre fraction were found in the NDF data, 535.71 mg/kg at Gönyű (GFjr) and 498.13 mg/kg at Cenkov. The ADF fibre showed higher values than Cenkov (CFrjX) and ADL than Gönyű (GFrjX) (Table 1).

Table 1. Data of content values of the mixed samples according to sampling areas

	Absolute dry matter	Crude protein	Crude fat	Crude fibre	Crude ash	NDF	ADF	ADL
	g/kg tak.	g/kg sz.a.						
mixed *Festuca vaginata*								
Gönyű (GFvX)	460,13	96,28	25,75	334,69	58,03	541,68	397,52	36,12
Szigetmonostor (SzFvX)	511,58	96,36	23,02	355,45	49,37	551,30	403,31	36,03
Homoktövis TT (HFvX)	487,34	85,33	21,28	342,95	47,96	524,09	370,49	37,37
Bugac (BFvX)	554,50	93,30	21,57	287,11	73,84	543,09	386,78	33,36
Deliblato (DFvX)	631,28	69,91	18,71	371,25	39,55	512,67	400,86	29,82
Balta Verde (BvFvX)	897,54	73,13	21,29	321,47	60,23	515,06	402,24	31,51
mixed *Festuca pseudovaginata*								
Szigetmonostor (SzFpX)	457,45	79,28	23,52	360,43	62,79	533,68	391,61	32,88
Homoktövis TT (HFpX)	532,57	87,33	22,75	352,02	58,44	506,95	376,28	32,45
Bugac (BFpX)	530,57	77,15	23,00	366,68	87,20	519,47	355,23	28,68
mixed *Festuca tomanii*								
Szigetmonostor (SzFtX)	677,71	57,13	22,51	370,75	29,25	528,77	400,84	35,88
Homoktövis TT (HFtX)	619,18	72,20	22,46	365,60	48,45	537,06	364,85	29,74
mixed *Festuca wagneri*								
Bugac (BFwX)	482,01	97,08	31,90	320,67	69,04	533,88	394,95	30,29
Deliblato (DFwX)	767,37	93,97	25,63	318,95	54,78	566,15	386,01	34,06
Balta Verde (BvFwX)	615,45	86,03	20,17	325,54	60,41	500,05	361,83	31,49
Vidin (VFwX)	882,37	91,85	20,05	324,99	60,99	528,96	380,78	32,78
mixed *Festuca javorkae/rupicola*								
Gönyű (GFjrX)	384,54	87,66	25,66	340,92	75,26	535,71	376,31	33,03
Cenkov (CFjrX)	666,02	92,31	24,07	354,48	54,34	498,13	393,62	30,70

CONCLUSION

The analysed grassland samples have typically high crude fibres and NDF values, as well as high dry matter content. However, the crude protein values seem to be low.

It can be concluded that the amount of crude protein in the samples decreases with increasing dry matter ($r=-0.29$; $P<0.10$; $r=-0.24$; $P<0.10$).

The amount of crude protein decreases with increasing crude fibre content in the dominant *Festuca* species ($r=-0.46$; $P<0.05$).

Festuca wagneri has the highest dry matter value according to the research, and these samples are typically from Great Hungarian Plain, Kiskunság and Balkan regions. The lowest dry matter value was found in *Festuca rupicola* samples, which were derived from Little Hungarian Plain and Slovakia. *Festuca tomanii*

samples had the lowest crude protein value. These samples were mostly from Kiskunság. The samples with the highest crude protein value were *Festuca vaginata, Festuca wagneri* and *Festuca rupicola*. For crude fibre, the highest value was found in *Festuca tomanii* and the lowest in *Festuca vaginata*.

We could not detect any differences between the samples for cell wall components, but available values compared with literature (Schmidt et al., 2000) show medium quality.

In total, *Festuca vaginata* and *Festuca rupicola* samples had the highest nutritional value, while *Festuca tomanii* samples were considered to have the lowest nutritional value.

From the studied vegetation types, low quality hay from meadows can be expected. Based on the presented results, it could be a potential feed source for the small ruminant livestock sector. The most suitable application of the investigated grasslands is mainly for sheep production (Schmidt, 1993).

ACKNOWLEDGMENTS

This research was supported by the OTKA K-125423.

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