

Productivity and Nutritional Value of Some *Festuca* Species in Moldova

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ABSTRACT

The grass species of genus *Festuca* are quite common in the floristic composition of permanent and temporary grasslands, have an essential role in water conservation, protecting the soil from erosion, and producing phytomass have been used as forages, biofuels, raw materials for the circular economy. The goal of this study was to evaluate the productivity and nutritional value of the green mass, prepared hay and silage from the local ecotype of *Festuca arundinacea*, *Festuca pratensis*, *Festuca rubra* and *Festuca valesiaca*. We found that the forage dry matter productivity at the first cut of the studied *Festuca* species varied from 5.7 t/ha (*Festuca valesiaca*) to 10.4 t/ha (*Festuca pratensis*). The biochemical composition and nutritional value of green fodder were 8.6-12.4% crude protein (CP), 7.5-8.9% ash, 31.5-42.4% crude fibre (CF), 3.0-5.5% acid detergent lignin (ADL), 30.9-39.1% cellulose (Cel), 23.5-29.2% hemicellulose (HC), 4.0-12.2% total soluble sugars (TSS), 492-651 g/kg digestible dry matter (DDM), 443-601 g/kg digestible organic matter (DOM), 527-646 g/kg total digestible nutrients (TDN), relative forage quality RFQ=70-110, 8.90-10.01 MJ/kg metabolizable energy (ME), 4.91-6.13 MJ/kg net energy for lactation (NEL). The quality indices of fescue hays were 7.5-12.2% CP, 8.0-10.5% ash, 35.0-43.0% CF, 3.4-5.8% ADL, 35.1-38.6% Cel, 23.6-31.0% HC, 2.0-10.2% TSS, 462-590 g/kg DDM, 423-541 g/kg DOM, 528-595 g/kg TDN, RFQ=68-93, 10.85-11.68 MJ/kg DE, 8.91-9.59 MJ/kg ME, 4.93-5.61 MJ/kg NEL. The prepared silage from *Festuca arundinacea* and *Festuca pratensis* had pH=4.05-4.11, 28.7-29.6 g/kg lactic acid, 6.7-10.0 g/kg acetic acid, 0-1.3 g/kg butyric acid, 10.6-13.0% CP, 9.1-10.5% ash, 32.0-38.0% CF, 1.9-2.4% ADL, 31.5-38.1% Cel, 22.3-29.0% HC, 650-680 g/kg DDM, 610-614 g/kg DOM, 578-646 g/kg TDN, RFQ=82-112, 11.46-12.32 MJ/kg DE, 9.41-10.12 MJ/kg ME, 5.43-6.13 MJ/kg NEL.

The local *Festuca* ecotypes may serve as material for selecting, breeding and implementing new local grass cultivars for forages production.

Keywords: biochemical composition, *Festuca arundinacea*, *Festuca pratensis*, *Festuca rubra*, *Festuca valesiaca*, green mass, hay, local ecotype, nutritional value, productivity, silage.

INTRODUCTION

The ecosystems with herbaceous perennials play a part in water conservation, protecting the soil from erosion and enriching it with humus. Traditionally, perennial plants of the family *Poaceae* Barnhart are known to provide food and shelter for various species of animals, birds and insects, and are of high socio-economic value, being used to produce building materials and handicrafts, and, in recent years, they have been more commonly used as a source of different types of biofuels, raw material for the circular economy, and as cover crops and ornamental plants in open spaces in vineyards, orchards and recreational land. Today it is an imperative task to carry out a complex of activities to maintain

biodiversity and use rationally the potential of grass species from the local flora.

The genus *Festuca* L., is one of the largest genera of the *Poaceae* family and includes 646 species with the greatest diversity in the Holarctic zone of Eurasia and North America. On a global and regional level, the fescue species are quite common in the floristic composition of permanent and temporary grasslands. In Romania, the genus *Festuca* is represented by 32 species and the flora of the Republic of Moldova includes 8 species of the genus *Festuca* (Marușca, 1999; Negru, 2007). The *Festuca* species have been researched in several scientific centers as plants with multiple uses (Niemeläinen et al., 2012; Guo et al., 2013; Berzins et al., 2015; Kuprys-Caruk and Kołodziejwski, 2016; Țiței

et al., 2019, 2021a, 2022; Coblenz et al., 2020; Rotar et al., 2020; Cerempei et al., 2022; Batog et al., 2023; Miron et al., 2023; Holmström et al., 2024).

The goal of this study was to evaluate the productivity and nutritional value of the green mass, prepared hay and silage from the local ecotype of *Festuca* species: tall fescue *Festuca arundinacea* Schreb., meadow fescue *Festuca pratensis* Huds., red fescue *Festuca rubra* L. and wallis fescue *Festuca valesiaca* Schleich. ex Gaudin as feed for livestock.

MATERIAL AND METHODS

The local ecotypes of tall fescue *Festuca arundinacea*, meadow fescue *Festuca pratensis*, red fescue *Festuca rubra*, Wallis fescue *Festuca valesiaca*, originating from seeds collected from the spontaneous flora of the Central Zone of Republic Moldova and grown in mono culture in National Botanical Garden (Institute), served as subjects of the research. The samples were collected in the third growing season, the first cut was done in early flowering stage. The harvested plants were chopped into 1.5-2.0 cm small pieces, with a laboratory forage chopper; the dry matter content was detected by drying the samples to a constant weight, at 105°C. The prepared hay was dried directly in the field. The silage was produced from chopped green mass and compressed in glass containers, the containers were stored for 45 days, and after that, they were opened and the organoleptic assessment and the determination of the organic acid composition of the persevered forage were done in accordance with the Moldavian standard SM 108. The fresh mass and fermented fodder samples were dehydrated in an oven with forced ventilation at a temperature of 60°C. At the end of the fixation, the biological material was finely ground in a laboratory ball mill. For chemical analyses, the plant samples were dried in a forced-air oven at 60 °C, then milled in a beater mill equipped with a sieve with mesh diameter of 1 mm. Some of the main biochemical parameters were assessed: crude protein (CP), crude fibre (CF), ash, acid

detergent fiber (ADF), neutral detergent fiber (NDF) and acid detergent lignin (ADL), total soluble sugars (TSS), digestible dry matter (DDM), digestible organic matter (DOM) were determined by the near infrared spectroscopy (NIRS) technique using the PERTEN DA 7200 NIR analyzer. The concentration of hemicellulose (HC), cellulose (Cel), total digestible nutrients (TDN), Relative Forage Quality (RFQ), digestible energy (DE), metabolizable energy (ME), net energy for lactation (NEL) were calculated according to standard procedures.

RESULTS AND DISCUSSION

Analyzing the biological features of the studied local fescue ecotypes in the third growing season, it was established that the revival of plants was uniform, the generative shoots developed in the second part of April. The local ecotype of tall fescue *Festuca arundinacea* and meadow fescue *Festuca pratensis* were characterized by faster growth and development rates. Some biological peculiarities and the productivity of the studied local ecotypes of *Festuca* species are presented in Table 1. It was found that, in early flowering stage, the fescue plant height differed significantly from 39 cm in *Festuca valesiaca* plants to 109 cm in *Festuca arundinacea* plants. The green mass yield also varied from 16.3 t/ha of *Festuca valesiaca* to 42.5 t/ha of local ecotype of *Festuca arundinacea*. The *Festuca rubra* and *Festuca valesiaca* plants are characterized by a very high content of dry matter as compared with *Festuca arundinacea* and *Festuca pratensis*. The dry matter yield at the first cut varied from 5.7 t/ha in *Festuca valesiaca* to 10.4 t/ha in *Festuca pratensis*.

Some authors have mentioned various findings about the productivity of *Festuca* plants. Kanapeckas et al. (2005) mentioned that dry matter yield of the studied meadow fescue cultivars and wild populations at the first cut varied from 4.75 to 6.53 t/ha. Cristea et al. (2010) found that the dry matter yield of *Festuca rubra* grown as monoculture varied from 2.82 t/ha in the untreated control up to 4.31 t/ha in the variant with nitrogen

fertilization. Samuil et al. (2010) revealed that the dry matter yield of *Festuca valesiaca* grown in a permanent grassland varied from 1.5 to 6.2 t/ha. Grais et al. (2011) reported that the dry matter productivity of *Festuca rubra* cultivars was 12.3-13.6 t/ha, *Festuca pratensis* - 11.6-13.1 t/ha and *Festuca arundinacea* - 11.6-13.2 t/ha. According to Marușca et al. (2016), the annual yield of the Romanian varieties of *Festuca arundinacea* reached 55-60 t/ha green mass or 12-13 t/ha dry matter, varieties of *Festuca pratensis* - 50-55 t/ha green mass or 11-12 t/ha dry matter, respectively, but *Festuca rubra* varieties produced 40-50 t/ha green mass or 8-10 t/ha dry matter. Akdeniz et al. (2019) reported that the hay yield from *Festuca arundinacea* was 10.23 t/ha, while from *Festuca*

rubra - 4.34 t/ha. Coblenz et al. (2020) revealed that the dry matter yield of *Festuca arundinacea* was 5.76 t/ha and *Festuca pratensis* - 5.58 t/ha. Babić et al. (2023) found that the dry matter yield of meadow fescue progenies at the first cut varied from 8.12 to 9.45 t/ha and at the second cut - from 3.19 to 4.75 t/ha. Batog et al. (2023) reported that the dry matter productivity of *Festuca arundinacea* reached 6.24 t/ha at the first cut, 4.29 t/ha at the second and 4.24 t/ha at the third cut. Georgieva et al. (2023) mentioned that during the 9-year experimental period, the highest yield was demonstrated by *Festuca rubra* (5.75 t/ha), followed by *Festuca arundinacea* (5.54 t/ha) and *Arrhenatherum elatius* (5.43 t/ha).

Table 1. Some biological peculiarities and the productivity of the studied *Festuca* species

Species	Plant height (cm)	Yield (t/ha)		Content of leaves and inflorescence in fodder (%)
		fresh mass	dry matter	
<i>Festuca arundinacea</i>	109	42.5	10.2	62.2
<i>Festuca pratensis</i>	89	38.9	10.4	67.0
<i>Festuca rubra</i>	63	20.6	7.0	53.0
<i>Festuca valesiaca</i>	39	16.3	5.7	56.4

The biochemical composition and the nutritional value of the green mass from the studied *Festuca* species are presented in Table 2. We found that the dry matter nutrient content varied depending on the fescue species: 8.6-12.4% CP, 7.5-8.9% ash, 31.5-42.4% CF, 33.9-44.6% ADF, 57.4-73.8% NDF, 3.0-5.5% ADL, 30.9-39.1% Cel, 23.5-29.2% HC, 4.0-12.2% TSS, with fodder value 492-651 g/kg DDM, 443-601 g/kg DOM, 527-646 g/kg TDN, RFQ=70-110, 10.84-12.20 MJ/kg DE, 8.90-10.01 MJ/kg ME, 4.91-6.13 MJ/kg NEL. The harvested

mass from *Festuca pratensis* was characterized by high concentration of crude protein, optimal total soluble sugars and mineral content and low amount of structural carbohydrates and acid detergent lignin, which had a positive effect on the digestibility, nutritional value and energy supply of the feed. The lowest level of crude protein, total soluble sugars and the highest concentration of cellulose, hemicellulose and acid detergent lignin were found in the harvested mass from *Festuca valesiaca*.

Table 2. The biochemical composition and the nutritional value of the green mass from studied *Festuca* species

Indices	<i>Festuca arundinacea</i>	<i>Festuca pratensis</i>	<i>Festuca rubra</i>	<i>Festuca valesiaca</i>
Crude protein, g/kg DM	107	124	86	92
Crude fibre, g/kg DM	354	315	397	424
Minerals, g/kg DM	89	83	75	86
Acid detergent fibre, g/kg DM	388	339	414	446
Neutral detergent fibre, g/kg DM	666	574	664	738
Acid detergent lignin, g/kg DM	34	30	45	55
Total soluble sugars, g/kg DM	122	108	118	40
Cellulose, g/kg DM	354	309	369	391
Hemicellulose, g/kg DM	278	235	250	292
Digestible dry matter, g/kg DM	607	651	513	492
Digestible organic matter, g/kg DM	555	601	468	443
Total digestible nutrients, g/kg DM	591	646	562	527
Relative Forage Quality	87	110	83	70
Digestible energy, MJ/ kg	11.64	12.20	11.27	10.84
Metabolizable energy, MJ/ kg	9.56	10.01	9.25	8.90
Net energy for lactation, MJ/ kg	5.57	6.13	5.27	4.91

Different results regarding the biochemical composition and the nutritive value of the harvested mass from *Festuca* species are given in the specialized literature. Babić et al. (2012) reported that the chemical composition of the dry matter of meadow fescue genotypes at the first cut was 7.81-11.01% CP, 1.24-2.58% EE, 31.56-36.80% CF, 7.61-9.14% ash, the second cut 10.09-14.85% CP, 2.98-4.63% EE, 23.37-35.71% CF, 11.53-14.89% ash, while at the third cut: 11.23-17.52% CP, 2.30-4.38% EE, 18.05-25.95% CF, 10.50-14.66% ash. Kanapeckas et al. (2005) revealed that the chemical composition and nutritive value of meadow fescue cultivars and wild populations were 10.26-13.62% CP, 26.38-31.43% CF and 61.13-70.11% digestibility. Samuil et al. (2010) revealed that the dry matter of *Festuca valesiaca* from permanent grassland contained 117 g/kg CP, 343 g/kg CF, and 78 g/kg ash. Grais et al. (2011) reported that *in vitro* digestibility of organic matter of *Festuca rubra* fodder was 53-65%, *Festuca pratensis* 61-69% and *Festuca arundinacea* - 58-66%. Niemeläinen et al. (2012) mentioned that the quality characteristics of dry matter from meadow fescue at the first cut were 13.5% CP, 58.3% NDF, 33.9% ADF, 3.35% ADL, 69.9% DOM, while the dry matter from tall fescue - 13.9% CP, 56.8% NDF, 33.0% ADF, 3.23% ADL, 69.2% DOM. Berzins et al. (2015) remarked that the nutritive value of

first-cut green mass from *Festuca pratensis* cultivars was characterized by 10.66-12.50% CP, 5.46-6.79% ash with RFV=89.49-104.53. Maruşca et al. (2016) mentioned that depending on the growth phase of harvesting the chemical composition and nutritive value of meadow fescue varieties were 11-15% CP and 63-67% digestibility, while of red fescue varieties - 9-11% CP, 28-30% CF and 60-65% digestibility. Staniak (2016) found that the tested *Festuca pratensis* cultivars contained 146-156 g/kg CP, 286-296 g/kg CF with 73.4-75.2% DDM, 86.6-94.5% PDIE, 32.9-38.1% PDIF, 0.90-0.91 UFL, 0.84-0.86 UFV. Czyż et al. (2017) reported that the quality of organic content of fodder obtained from *Festuca arundinacea* cultivars at the first cut was 14.3-15.2% CP, 29.3-30.2% CF, 2.0-2.3% EE, 5.2-6.9% soluble sugars. Bozhanska (2019) reported that the fodder from *Festuca rubra* grassland contained 59.0% NDF, 36.8% ADF, 9.1% ADL 21.4% HC, 27.7% Cel, 566 g/kg DOM, 18.10 MJ/kg GE, 8.8 MJ/kg ME, 0.75 FUM/kg and 0.69 FUG/kg. In our previous works (Țiței et al., 2019; 2021a; 2021b; 2022) we assessed that nutritive value of green mass from Romanian cultivars of *Festuca arundinacea* and obtained the following indices: 65.6-141.0 g/kg CP, 22.4-35.8 g/kg EE, 316.6-386.0 g/kg CF, 363.5-430.5 g/kg NFE, 62.0-85.0 g/kg soluble sugars, 15.4-22.4 g/kg starch, 74-130.9 g/kg ash, 582-593 g/kg NDF, 392-396 g/kg ADF,

34-41 g/kg ADL, 60.3-63.8% DDM, 17.34-18.17 MJ/kg GE, 8.55-9.62 MJ/kg ME, 4.71-5.86 MJ/kg NEI; *Festuca pratensis* cultivars - 112-120 g/kg CP, 361-394 g/kg CF, 78-79 g/kg ash, 374-381 g/kg ADF, 622-630 g/kg NDF, 34-38 g/kg ADL, 59.0-61.5% DMD, 9.63-9.71 MJ/kg ME, 5.65-5.73 MJ/kg NEI and *Festuca rubra* cultivars - 104-154 g/kg CP, 71-113 g/kg ash, 550-713 g/kg NDF, 335-445 g/kg ADF, 31-52 g/kg ADL, 54.2-62.8% DDM, RFV=71-102, 10.84-12.38 MJ/kg DE, 8.91-10.16 MJ/kg ME, 4.92-6.18 MJ/kg NEI. Zaiț et al. (2023) reported that the quality of the fodder produced by the species *Festuca arundinacea* in pure stand was 11.74% CP, 64.53% NDF, 39.73% ADF with RFQ=87.8. Kurgak and Karbivska (2022) remarked that the chemical composition and nutritive value of *Festuca rubra* was 10.4% CP, 2.9% EE, 29.4% CF, 49.9% NFE, 56% digestibility, 8.1 MJ/kg ME and 104 g DP/nutritive units. Babić et al. (2023) revealed that the chemical composition of meadow fescue progenies at the first cut were 11.9-13.0% CP, 33.5-38.1% ADF, 56.1-59.6% NDF, and the second cut 14.4-15.9% CP, 31.434.8% ADF, 56.4-62.0% NDF, respectively.

Grass hay is usually used as livestock fodder, a rich source of nutrients, vitamins and minerals, especially during the winter period. The quality indices of the prepared

hay can vary widely depending largely on soil fertility, plant species and stage of maturity when they are harvested. The biochemical composition and the nutritional value of the hay from the studied *Festuca* species are shown in Table 3. We would like to mention that the prepared hays from fescue species had 7.5-12.2% CP, 8.0-10.5% ash, 35.0-43.0% CF, 38.5-44.4% ADF, 62.1-75.4% NDF, 3.4-5.8% ADL, 35.1-38.6% Cel, 23.6-31.0% HC, 2.0-10.2% TSS, with nutritive value 462-590 g/kg DDM, 423-541 g/kg DOM, 528-595 g/kg TDN, RFQ=68-93, 10.85-11.68 MJ/kg DE, 8.91-9.59 MJ/kg ME, 4.93-5.61 MJ/kg NEI. It has been determined that during the haymaking process, cell wall constituents and minerals increase and the concentration of crude protein and total soluble sugars decrease. The digestibility, relative forage quality and energy concentration in fescue hays are lower as compared with the harvested green mass. The *Festuca pratensis* hay is characterized by low amount of cellulose, hemicellulose and acid detergent lignin, high level of crude protein, total soluble sugars, digestibility, nutritional value and energy supply of the feed as compared with the other fescue hays. The hay prepared from *Festuca valesiaca* did not differ significantly in the concentration of nutrients and energy in comparison with the initial green mass.

Table 3. The biochemical composition and the nutritional value of the hay from studied *Festuca* species

Indices	<i>Festuca arundinacea</i>	<i>Festuca pratensis</i>	<i>Festuca rubra</i>	<i>Festuca valesiaca</i>
Crude protein, g/kg DM	100	122	75	85
Crude fibre, g/kg DM	393	350	414	430
Minerals, g/kg DM	89	80	105	95
Acid detergent fibre, g/kg DM	427	385	434	444
Neutral detergent fibre, g/kg DM	720	621	739	754
Acid detergent lignin, g/kg DM	35	34	56	58
Total soluble sugars, g/kg DM	55	102	94	26
Cellulose, g/kg DM	372	351	378	386
Hemicellulose, g/kg DM	292	236	305	310
Digestible dry matter, g/kg DM	544	590	484	462
Digestible organic matter, g/kg DM	471	541	442	423
Total digestible nutrients, g/kg DM	548	595	540	528
Relative Forage Quality	74	93	71	68
Digestible energy, MJ/ kg	11.09	11.68	11.00	10.85
Metabolizable energy, MJ/ kg	9.10	9.59	9.02	8.91
Net energy for lactation, MJ/ kg	5.13	5.61	5.04	4.93

In the specialized literature, there are results regarding the quality of hays from fescue species. According to Burlacu et al. (2002) the *Festuca pratensis* hay had 8.5-11.5% ash, 10.0-18.2% CP, 2.8-4.1% fats, 22.5-32.0% CF, 43.7-46.7% NFE, 18.1-18.2 MJ/kg GE, but *Festuca arundinacea* hay - 6.9-9.0% ash, 11.5-16.7% CP, 4.7-5.9% EE, 26.9-31.2% CF, 41.5-45.7% NFE, 35.0-39.0% ADF, 30.8-31.1% ADF, 4.3-5.2% lignin and 18.9-19.0 MJ/kg GE, respectively. Kaplan et al. (2017) mentioned that tall fescue hay dry matter contained 5.56% CP, 64.94% NDF, 41.01% ADF, 1.61% EE, 12.03% ash with 48.54% OMD, 7.00 MJ/kg ME and 3.75 MJ/kg NEL. Akdeniz et al. (2019) found that the quality indices of the hay from *Festuca arundinacea* was 10.23 t/ha, 9.54% ash, 9.86% CP, 1.15% EE, 44.85% CF, 64.05% NDF, 47.64% ADF with RFV=75.22, while *Festuca rubra* hay 8.94% ash, 8.85% CP, 1.44% fats, 43.61% CF, 69.25% NDF, 44.26% ADF with RFV=71.11. Yazici and Tan (2021) revealed that the chemical composition and nutritive value of the hay from tall fescue cultivars was 13.47-18.67% CP, 42.48-50.05% NDF, 20.20-30.97% ADF with RFV=127.1-144.4, while the hay from red fescue cultivars - 12.60-18.33% CP, 43.83-50.23% NDF, 22.00-31.60% ADF with RFV=125.9-139.7. Țiței et al. (2021a) reported that the hay

prepared from *Festuca pratensis* 'Tâmpa' contained 113-125 g/kg CP, 378-386 g/kg CF, 88-91 g/kg ash, 407-418 g/kg ADF, 651-673 g/kg NDF, 41-43 g/kg ADL, 366-375 g/kg Cel and 244-255 g/kg HC, 59.0-61.5% DMD, 54.2-58.1% DOM, RFV=88-89, 9.63-9.71 MJ/kg ME and 5.65-5.73 MJ/kg NEL. Coșman et al. (2023) mentioned that the nutrient content of hay from *Festuca arundinacea* was 5.88-12.31% CP, 0.83-2.60% EE, 31.07-37.20% CF, 31.50-44.95% NFE, 8.51-12.31% ash, 8.90-64.67 mg/kg carotene; from *Festuca pratensis* 6.88-10.81% CP, 1.79-2.82% EE, 29.60-36.03% CF, 36.20-44.37% NFE, 7.35-12.14% ash, 8.70-49.80 mg/kg carotene; from *Festuca rubra* 6.18-6.31% CP, 1.64-2.17% EE, 36.47-36.75% CF, 41.43-42.67% NFE, 6.62-8.39% ash, 18.45-18.50 mg/kg carotene, while from *Festuca valesiaca* 8.06-10.0% CP, 2.51-3.04% EE, 29.38-35.71% CF, 40.64-47.33% NFE, 6.74-8.15% ash, 9.70-49.80 mg/kg carotene. Miron et al. (2023) reported that the quality indices of the hay from grasslands with *Festuca valesiaca* were 7.85-12.20% CP, 1.99-3.15% EE, 29.92-40.78% CF, 40.42-49.03% NFE, 2.41-5.37% sugars, 1.78-2.93% starch, 6.79-8.44% ash, 0.31-0.48% Ca, 0.13-0.20% P, 3.45-29.00 mg/kg carotene, 18.17-18.41 MJ/kg GE, 7.93-9.48 MJ/kg ME and 4.28-5.33 MJ/kg.

Table 4. The biochemical composition and nutritional value of the silage from studied *Festuca* species

Indices	<i>Festuca arundinacea</i>	<i>Festuca pratensis</i>
pH index	4.05	4.11
Organic acids, g/kg DM	36.7	39.6
Total acetic acid, g/kg DM	6.7	10.0
Total butyric acid, g/kg DM	1.3	0
Total lactic acid, g/kg DM	28.7	29.6
Acetic acid, % of organic acids	18.3	25.3
Butyric acid, % of organic acids	3.5	0
Lactic acid, % of organic acids	78.2	74.7
Crude protein, g/kg DM	106	130
Crude fibre, g/kg DM	380	320
Minerals, g/kg DM	105	91
Acid detergent fibre, g/kg DM	400	339
Neutral detergent fibre, g/kg DM	690	562
Acid detergent lignin, g/kg DM	19	24
Total soluble sugars, g/kg DM	74	84
Cellulose, g/kg DM	381	315
Hemicellulose, g/kg DM	290	223
Digestible dry matter, g/kg DM	680	650
Digestible organic matter, g/kg DM	614	610
Total digestible nutrients, g/kg DM	578	646
Relative Forage Quality	82	112
Digestible energy, MJ/ kg	11.46	12.32
Metabolizable energy, MJ/ kg	9.41	10.12
Net energy for lactation, MJ/ kg	5.43	6.13

In recent years, grass silage has become an important component of the diet of livestock, being an excellent source of nutrients, particularly in the late autumn - middle spring period, also under year-round uniform feeding diets. The results regarding the biochemical composition and nutritional value of silage from local ecotypes of *Festuca arundinacea* and *Festuca pratensis* are shown in Table 4. The fermentation profiles of fescue silages were: pH=4.05-4.11, 28.7-29.6 g/kg lactic acid, 6.7-10.0 g/kg acetic acid, 0-1.3 g/kg butyric acid. The *Festuca pratensis* silage contained high level of high level of acetic acid, but butyric acid was not detected. The nutrient and feed energy value of fescue silage dry matter were: 10.6-13.0% CP, 9.1-10.5% ash, 32.0-38.0% CF, 33.9-40.0% ADF, 56.2-69.0% NDF, 1.9-2.4% ADL, 31.5-38.1% Cel, 22.3-29.0% HC, 650-680 g/kg DDM, 610-614 g/kg DOM, 578-646 g/kg TDN, RFQ=82-112, 11.46-12.32 MJ/kg DE, 9.41-10.12 MJ/kg ME, 5.43-6.13 MJ/kg NEI. It has been determined that, in the ensiled mass, cell wall constituents modified, the mineral content increased and acid detergent lignin decreased

significantly as compared with the initial green mass, which had a positive impact on digestibility and energy value of the fermented fodder. The concentration of crude protein, digestibility, relative forage quality and energy supply in *Festuca pratensis* silage are higher as compared with *Festuca arundinacea* silage.

Several publications have documented the biochemical composition and the nutritive value of the ensiled mass from *Festuca* species. According to Burlacu et al. (2002), *Festuca pratensis* was characterized by the following indices: 185-245 g/kg dry matter with 8.0-10.0% ash, 11.3-17.5% CP, 3.7-5.7% fats, 23.8-31.7% CF, 43.0-45.8-3% NFE, 18.5-18.8 MJ/kg GE. Guo et al. (2013) mentioned that the silage from mix-cropped tall fescue and meadow fescue from first-cut fresh mass contained 178 g/kg dry matter with 18.7% CP, 47.2% NDF, 22.8% NFC, pH=4.84, 5.59% lactic acid, 4.59% acetic acid, but the silage from fescue wilted mass contained 264-447 g/kg dry matter, 19.8-20.2% CP, 46.6-47.4% NDF, 21.4-22.4% NFC, pH=4.93-5.10, 2.95-4.25% lactic acid, 1.23-2.54% acetic acid. Purwin et al. (2014)

reported that the silage from wilted *Festuca rubra* plants had 437-485 g/kg dry matter with 1.65-1.70% total nitrogen, 59.8-61.7% NDF, 40.8-41.0% ADF, 6.2- 6.5% ADL, 34.5-34.6% Cel and 19.0-20.7% HC. Kupryś-Caruk and Kołodziejcki (2016) found that tall fescue silages were characterized by 214 g/kg dry matter, pH=5.2, 89.7 g/kg lactic acid, 2.3 g/kg acetic acid, 10.8% CP, 11.7% ash, 2.3% EE, 5.0% sugars, 3.0% ADL, 30.4% Cel, 5.7% HC. Coblenz et al. (2020) reported that the dry matter of meadow fescue silage contained 77 g/kg CP, 97 g/kg ash, 51.4 g/kg WSC, 644 g/kg NDF, 391 g/kg ADF, 30.1 g/kg ADL, 1.34 Mcal/ kg NEL, 21.7 g/kg lactic acid, 7.6 g/kg acetic acid, 3.0 g/kg butyric acid, while tall fescue silage - 85 g/kg CP, 91 g/kg ash, 74.7 g/kg WSC, 649 g/kg NDF, 366 g/kg ADF, 26.9 g/kg ADL, 1.37 Mcal/kg NEL, 16 g/kg lactic acid, 8.2 g/kg acetic acid, 2.4 g/kg butyric acid, respectively. Coşman et al. (2023) mentioned that the quality of silages from *Festuca arundinacea* was 205.4-278.4 g/kg DM, 5.00-12.31% CP, 2.04-3.64% EE, 33.47-48.77% CF, 23.56-37.45% NFE, 20.50-70.00 mg/kg carotene, while from *Festuca pratensis* 262-280 g/kg DM 10.75-12.44% CP, 3.53-3.87% EE, 28.80-36.37% CF, 37.91-41.38% NFE, 8.40-8.54% ash, 34.60-44.10 mg/kg carotene. Holmström et al. (2024) mentioned that the quality indices of tall fescue silage were: pH=5.87, 12 g/kg acetic acid, 8 g/kg lactic acid, 1.4 g/kg butyric acid, 615 g/kg dry matter with 17.8% CP, 50.4%NDF and 10.6 MJ/kg ME, while meadow fescue silage - pH=5.50, 7 g/kg acetic acid, 16 g/kg lactic acid, 1.5 g/kg butyric acid, 445 g/kg dry matter with 16.4% CP, 52.9% NDF and 10.3 MJ/kg ME.

CONCLUSIONS

The dry matter productivity of the studied local ecotypes of *Festuca* species varied from 5.7 t/ha in *Festuca valesiaca* to 10.4 t/ha in *Festuca pratensis*.

A higher concentration of crude protein and a lower content of structural carbohydrates was found in the fodders from *Festuca pratensis* plants.

The local ecotype of tall fescue *Festuca arundinacea*, meadow fescue *Festuca pratensis*, red fescue *Festuca rubra*, Wallis fescue *Festuca valesiaca* are suitable for grassland restoration, the creation of temporary grasslands, moreover, the harvested mass may be used as fodders for livestock.

The collected seeds from the studied local ecotypes of *Festuca* species may serve as material for selecting, breeding and implementing new grass cultivars.

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