

THE QUALITY OF FORAGE FROM PERENNIAL RYEGRASS (*Lolium perenne*) AND TALL FESCUE (*Festuca arundinacea*) UNDER THE CONDITIONS OF MOLDOVA

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Abstract

The main objective of this research was to evaluate the quality of green mass, hay and silage prepared from perennial ryegrass *Lolium perenne* and tall fescue *Festuca arundinacea*, grown in monoculture in the experimental plot of the “Alexandru Ciubotaru” National Botanical Garden (Institute), Chisinau, Republic of Moldova. It was established that the concentration of nutrients and energy in whole-plant dry matter of studied grass species, harvested in pre-flowering stage was 10.74-14.10% CP, 3.10-3.58 % EE, 29.95-31.66% CF, 36.35-45.76% NFE, 6.20-19.24 % sugar, 1.54-2.99 % starch, 10.45-14.31% ash, 2.9 g/kg Ca, 2.5-2.7 g/kg P, 8.93-9.49 MJ/kg ME and 4.97-5.06 MJ/kg NEL. The biochemical composition of the prepared silages was: pH= 4.06-4.21, 27.9-28.9 g/kg lactic acid, 0-0.4 g/kg butyric acid, 1.5-5.0 g/kg acetic acid, 9.12-9.67% CP, 3.37-3.99% EE, 39.16-41.30% CF, 30.53-37.37% NFE, 0.33-1.40 % sugar, 0.50-0.60 % starch, 10.98-14.51% ash, 36.34-56.33 mg/kg carotene, 8.31-9.53MJ/kg ME and 4.48-5.34 MJ/kg NEL. The nutritive value of prepared hay: 9.95-10.84% CP, 1.87-2.55 % EE, 36.90-37.32% CF, 38.48-39.99% NFE, 10.82-11.28% ash, 2.5-3.5 g/kg Ca, 2.6-2.7 g/kg P, 8.31-8.85MJ/kg ME and 4.54-4.93 MJ/kg NEL. The studied grass species contain a lot of nutrients, which make them suitable to be used as multi-purpose feed for livestock.

Key words: biochemical composition, *Festuca arundinacea*, green mass, hay, *Lolium perenne*, silage.

INTRODUCTION

Currently, the interest in conserving the remaining permanent grasslands, as well as restoring and planting temporary grasslands on degraded and polluted agricultural land is topical in many states around the world.

The Plant List includes 646 accepted species names of the genus *Festuca* and 11 accepted species names of the genus *Lolium*. According to Marusca (2011), in Romania, there are 32 species of the genus *Festuca* and 4 species of the genus *Lolium*. In the spontaneous flora of the Republic of Moldova, there are 8 *Festuca* species and 2 *Lolium* species (Negru, 2007). *Festuca arundinacea* Schreber and *Lolium perenne* L. are among the perennial species with the highest frequency in the floristic composition of grasslands, buffer strips and lawns in green spaces. They are fast-growing grasses, establishing rapidly, adapted to a wide range of soils and climatic conditions, can be used for a range of purposes including pasture, hay, silage and turf, but also as feedstock for biorefineries and bioenergy production (Duke,

1983; Mahnert et al., 2005; Marușca et al. 2011; Surmen et al., 2013; Akdeniz et al., 2019; Țîței & Roșca, 2021). In the Catalogue of Plant Varieties of the Republic of Moldova there are no registered grass cultivars, but in the Official Catalogue of Varieties of Agricultural Plants of Romania, 2022y., 10 cultivars of *Festuca arundinacea* and 12 cultivars of *Lolium perenne* are listed. The cultivars created in Romania have a productivity of 37-65 tons/ha of fresh mass or 9.3-17.0 tons of hay (Marușca et al. 2011). The main objective of this research was to evaluate the quality of green mass, hay and silage prepared from perennial ryegrass *Lolium perenne* and tall fescue *Festuca arundinacea* and the prospects of its use as feed for livestock in Republic of Moldova.

MATERIALS AND METHODS

The local ecotype of perennial ryegrass *Lolium perenne* and the Romanian cultivar 'Valrom' tall fescue *Festuca arundinacea*, created at the University of Agricultural Sciences and

Veterinary Medicine Cluj-Napoca, Romania, cultivated in monoculture in the experimental plot of the National Botanical Garden (Institute) "Alexandru Ciobotaru", Chişinău, latitude 46°58'25.7"N and longitude N28°52'57.8"E, served as subjects of the research. The plant samples were collected in the pre-flowering stage, in the second growing season. The prepared hay was dried directly in the field. 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 samples up to constant weight at 105°C. The silage was prepared from chopped green mass, compressed in well-sealed glass containers, stored at ambient temperature (18-20°C). After 45 days, the containers were opened, and the sensorial and fermentation indices of the conserved forage were determined in accordance with standard laboratory procedures - the standard SM 108* of R. Moldova. The fresh mass and the 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. The evaluation of fodder quality: crude protein (CP), crude cellulose (CF), crude fat (EE), nitrogen-free extract (NFE), soluble sugars (SS), starch, ash, calcium (Ca), phosphorus (P), carotene, silage pH index, concentration of organic acids (lactic, acetic and butyric) in free and fixed state were carried out in the Laboratory of Nutrition and Forage Technology of the Scientific-Practical

Institute of Biotechnology in Animal Husbandry and Veterinary Medicine, in accordance with the methodological indications. The gross energy (GE), metabolizable energy (ME), net energy for lactation (NEI) were calculated according to standard procedures:

$$GE=23.9 \times CP + 39.8 \times EE + 20.1 \times CF + 17.5 \times NFE;$$

$$ME=14.07 + 0.0206 \times EE - 0.0147 \times CF - 0.0114 \times CP + 4.5\%;$$

$$NEI=9.10 + 0.0098 \times EE - 0.0109 \times CF - 0.0073 \times CP.$$

RESULTS AND DISCUSSIONS

In the second year, the studied perennial grasses start active growth in early spring, when the average temperature is above +5-8°C. We would like to mention, for comparison, that the tall fescue, *Festuca arundinacea* at the time of first cut, reached 98.0 cm in height, but perennial ryegrass *Lolium perenne* 63.8 cm in height.

The biochemical composition and nutritive value of the harvested green mass of the studied *Poaceae* species, is presented in Table 1. The *Festuca arundinacea* fodder was characterized by a significantly higher content of crude proteins, crude fats, crude cellulose and ash. The *Lolium perenne* green mass was richer in nitrogen free extract, soluble sugar, starch and phosphorus, the concentration of calcium was at the same level as in tall fescue forage. The higher amount of organic matter and lower amount of crude cellulose had a positive effect on the energy supply of the *Lolium perenne* forage.

Table 1. The biochemical composition and the nutritive value of the green mass from the studied *Poaceae* species

Indices	<i>Festuca arundinacea</i>	<i>Lolium perenne</i>
Crude protein, % DM	14.10	10.74
Crude fats, % DM	3.58	3.10
Crude cellulose, % DM	31.66	29.95
Nitrogen free extract, % DM	36.35	45.76
Soluble sugars, % DM	6.20	19.24
Starch, % DM	1.54	2.99
Ash, % DM	14.31	10.45
Calcium, g/kg DM	2.9	2.9
Phosphorus, g/kg DM	2.5	2.7
Gross energy, MJ/kg DM	17.51	17.83
Metabolizable energy, MJ/kg DM	8.93	9.49
Net energy for lactation, MJ/kg DM	4.97	5.06

Different results regarding the biochemical composition and the nutritive value of the green mass from *Lolium perenne* and *Festuca*

arundinacea whole plants are given in the specialized literature. According to Duke (1983) the *Lolium perenne* fresh mass

contained 26.6% DM, including 3.0% CP, 1.3% fat, 6.7% fiber, 13.2% NFE, 2.4% ash, 0.12% Ca, P, 0.07% P, 0.51% K. Fairey (1985) mentioned that the quality characteristics of the studied cultivars of perennial ryegrass were 208 g/kg DM, 2.21% nitrogen, 66.9% DDM; hybrid ryegrass contained 191 g/kg DM, 2.07% nitrogen, 64.3% DDM; orchard grass – 206 g/kg DM, 2.16% nitrogen, 59.4% DDM and reed canary grass – 214 g/kg DM, 2.48% nitrogen and 63.2% DDM. Volchenkova (1994) found that the biomass of tall fescue, depending on the amount and type of applied fertilizers contained 4.37-9.19% CP, 1.67-2.74% EE, 28.33-40.42% CF, 7.11-13.40% ash. Burlacu et al. (2002) revealed that *Lolium perenne* green forage contained 170-250 g/kg DM, 8.6-17.8% CP, 2.8-5.0% EE, 21.2-32.7% CF, 7.2-11.4 % ash, 5.6-6.5 g/kg Ca, 2.8-4.1 g/kg P, 575-718 g/kg DDM, 18.00-18.25 MJ/kg GE, 10.77-14.05 MJ/kg DE, 8.85-11.41 MJ/kg ME. Lee et al. (2002) mentioned that *Lolium perenne* contained 172.6-173.1 g/kg DM with 92.32-92.36% OM, 2.49-3.11% N, 24.61-28.61% ADF, 45.09-54.03% NDF, 9.5-17.9% WSC, 64-68% IVDMD. Mahnert et al. (2005) found that the concentration of nutrients in fresh perennial ryegrass was 176-256 g/kg DM, 11.9-14.7% CP, 2.1-2.4% EE, 24.8-29.1% CF, 10.8-19.3% WSC, 9.4-9.9% ash. The research conducted in Australia by Hayes et al. (2010), revealed that herbage quality of tall fescue cultivars harvested in November was 8.2-9.5% CP, 35.0% ADF, 64.1-64.6% NDF, 7.0-8.0% ash, 58.6-59.6% DMD, 8.6 MJ/kg ME. Surmen et al. (2013) revealed that perennial ryegrass breeding lines were characterized by 9.43-12.09% CP, 55.31-58.52% NDF, 37.24-40.36% ADF, 49.24-53.27% TDN, RFV=92.19-98.57. Küchenmeister et al. (2014) remarked that *Lolium perenne* plants grown under moderate drought stress conditions contained 9.0% CP, 21.6% WSC, 52.7% NDF, 28.6% ADF, but under strong drought stress conditions – 11.5% CP, 12.3% WSC, 59.0% NDF and 33.1% ADF. McEniry & O’Kiely (2014), mentioned that, in Ireland, the biomass of *Festuca arundinacea*, harvested in the middle of May, contained 15.2% CP, 8.6% ash, 52.9% NDF, 26.7% ADF, 16.1% soluble carbohydrates, and the biomass harvested in the first days of June contained 11.2% CP, 9.0%

ash, 62.3% NDF, 37.2% ADF, 9.2% soluble carbohydrates. Kshniatkina et al. (2016) mentioned that the chemical composition and energy nutritional value of *Festuca arundinacea* first cut green mass was: 9.25% CP, 6.51% DP, 1.15 % EE, 29.57% CF, 52.36% NFE, 8.19% ash, 9.62 MJ/kg ME, 0.75 nutritive unit/kg DM, 86.9 g DP/nutritive unit, but in second cut green mass – 8.40% CP, 5.90% DP 1.32 % EE, 27.80% CF, 53.91% NFE, 8.42% ash, 9.74 MJ/kg ME, 0.76 nutritive unit/kg DM, 76.8 g DP/ nutritive unit, respectively. Nicolae (2016) reported that the nutritive quality of perennial ryegrass green mass was characterized by: 164-275 g/kg DM, 7.3-14.2% CP, 1.8-2.5 % EE, 23.9-32.9% CF, 8.5-10.2% ash, 47.4-50.0% NFE. Pocienė & Kadžiulienė (2016) found that the biomass of tall fescue, depending on the amount and type of applied fertilizers, contained 14-20% hemicellulose, 34-36% cellulose and 6-9% lignin. Flores et al. (2017) mentioned that, in the USA, tall fescue contained 56.5-67.8% NDF, 27.7-34.9% ADF, 28.8-34.0% hemicellulose, 25.0-28.1% cellulose, 3.61-10.05% lignin. Dronova et al (2018) mentioned that, on irrigated lands of the Lower Volga region, Russia, depending on the sowing methods and seeding rates, tall fescue fodder contained 10.3-14.1% CP, 3.12-4.15% EE, 23.8-27.2% CF, 38.2-39.9% NFE, 0.22-0.23% P, 8.49-9.38 MJ/kg ME, 0.47-0.51 nutritive unit/kg DM, 44.3-55.9 g /kg DP. Temel et al. (2018) mentioned that, in the *Festuca arundinacea* plants, cultivated on nonsaline halomorphic soil, the dry matter yield was 5.94 t/ha with 11.86% CP, 58.63% NDF, but in high saline soil – 4.59 t/ha with 10.86% CP, 55.38% NDF, respectively. Amaleviciute-Volunge et al. (2020) revealed that the chemical composition of *Lolium perenne* fresh mass was as follows: 10.28% CP, 6.67% ash, 54.75% NDF, 32.8% ADF, 3.97% ADL, 20.3% WSC, 28.9% Cel, 21.9% g HC, 57.9% DDM, but *Festuca arundinacea* green mass – 15.058% CP, 7.52% ash, 52.19% NDF, 31.3% ADF, 4.02% ADL, 16.4% WSC, 27.3% Cel, 20.9% g HC, 62.5% DDM. Coblentz et al (2020) found that the biochemical composition and nutritive value of tall fescue herbage were 75 g/kg CP, 82 g/kg ash, 107.3 g/kg WSC, 627 g/kg NDF, 356 g/kg ADF, 27.9 g/kg ADL, 1.40

Mcal/kg NEL, but meadow fescue herbage contained 71 g/kg CP, 90 g/kg ash, 98.3 g/kg WSC, 609 g/kg NDF, 364 g/kg ADF, 27.5 g/kg ADL, 1.40 Mcal/kg NEL, respectively. Karbivska et al (2020) mentioned that the chemical composition and energy nutritional value of *Lolium perenne* green mass was: 11.4% CP, 2.8% EE, 29.6% CF, 48.3% NFE, 58% DDM, 8.2 MJ/kg ME, 109 g DP/nutritive unit, but with applied mineral fertilizers – 11.5-15.6% CP, 2.8-2.9% EE, 29.6-30.0% CF, 43.7-48.3% NFE, 8.2-8.3 MJ/kg ME, 115-151 g DP/nutritive unit, respectively. Wang et al. (2020) studied effects of cutting time and cultivar on chemical compositions on perennial ryegrass found the harvested herbage were characterized by 934-940 g/kg OM, 32.0-

39.8 g/kg N, 112-217 g/kg WSC, 388-414 g/kg NDF, 78.4-83.0 % IVDMD. Dong et al. (2021) revealed that *Festuca arundinacea* forage contained 306 g/kg DM, 7.29% CP, 24.8% ADF, 54.7% NDF, 14.4% WSC, 9.08% ash, 6.97% EE. Olszewska (2021) reported that the studied perennial ryegrass cultivars contained 13.0-143.4 g/kg CP and 144.2-148.3 g/kg WSC. Rancâne et al. (2021) remarked that the nutritive value of the tested *Lolium perenne* genotypes was 6.99-10.68% CP, 38.79-46.74% NDF, 19.92-25.11% ADF, 69.34-73.38% DDM and 6.71-7.02 MJ/kg NEL. Sosnowski et al. (2022) The average net energy of lactation (NEL) was greater in *Lolium perenne* forage (5.98 MJ/kg DM)

Table 2. The biochemical composition and the nutritive value of the silage from the studied *Poaceae* species

Indices	<i>Festuca arundinacea</i>	<i>Lolium perenne</i>
pH index	4.06	3.81
Content of organic acids, g/kg DM	30.4	30.8
Free acetic acid, g/kg DM	2.6	0
Free butyric acid, g/kg DM	0	0
Free lactic acid, g/kg DM	7.3	5.5
Fixed acetic acid, g/kg DM	5.5	1.5
Fixed butyric acid, g/kg DM	0	0.4
Fixed lactic acid, g/kg DM	15.0	23.4
Total acetic acid, g/kg DM	6.1	1.5
Total butyric acid, g/kg DM	0	0.4
Total lactic acid, g/kg DM	22.3	28.9
Acetic acid, % of organic acids	24.64	4.87
Butyric acid, % of organic acids	0	1.30
Lactic acid, % of organic acids	73.36	93.83
Crude protein, % DM	9.67	9.12
Crude fats, % DM	3.64	3.30
Crude cellulose, % DM	31.30	39.16
Nitrogen free extract, % DM	40.88	37.37
Soluble sugars, % DM	0.33	1.40
Starch, % DM	0.55	0.60
Ash, % DM	14.51	10.08
Calcium, g/kg DM	0.29	2.90
Phosphorus, g/kg DM	0.23	2.60
Carotene mg/kg	56.53	36.34
Gross energy, MJ/kg DM	17.20	17.84
Metabolizable energy, MJ/kg DM	9.53	8.31
Net energy for lactation, MJ/kg DM	5.34	4.48

Fodder conservation is necessary in most parts of Earth to maintain feed supply, particularly during winter season. Silage is the main conserved green succulent roughage fodder for domestic herbivores and its quality is the key to a good animal health and productivity, lowering the need to feed animals with concentrated fodder and increasing profitability

during the housing period. During the sensorial assessment, it was found that, in terms of colour, the ensiled mass from tall fescue had yellow homogeneous olive colour with pleasant smell, like pickled cucumbers; the ryegrass ensiled mass was light olive, with pleasant smell, specific to pickled apples. The results regarding the silage quality are shown in Table

2. It has been determined that the biochemical composition and the nutritive value of the ensiled forage depended on the grass species, thus, ryegrass silage had higher amount of organic acids in fixed form, butyric acid was detected in very small quantities (0.4 g/kg), but the level of acetic acid was very low in comparison with tall fescue silage. It was found that during the process of ensiling of tall fescue, the concentrations of crude protein decreased considerably, the concentrations of crude fats, crude cellulose and minerals are at the same level, but the amount of nitrogen free extract is increased. As compared with the initial fresh mass, the silage from perennial ryegrass had high concentration of crude cellulose, which had negative impact on energy concentrations. Several studies have evaluated the quality of grass silages. According to Fisher et al. (1991), the *Festuca arundinacea* silage contained 449 g/kg DM, 154 g/kg CP, 337 g/kg ADF, 550 g/kg NDF, 6.3 g/kg Ca, 3.4 g/kg P, but – from *Dactylis glomerata* – 229 g/kg DM, 125 g/kg CP, 370 g/kg ADF, 595 g/kg NDF, 3.9 g/kg Ca, 3.3 g/kg P, respectively. Burlacu et al. (2002) reported that the quality of perennial ryegrass silage was characterized by: 205-235 g/kg DM, 11.9-13.1% CP, 3.8-4.9 % EE, 27.3-31.4% CF, 8.4-9.3% ash, 5.9-6.0 g/kg Ca, 3.4 g/kg P, 614-671 g/kg DDM, 18.85-19.12 MJ/kg GE, 12.07-13.38 MJ/kg DE, 9.84-10.93 MJ/kg ME. Pozdniek et al. (2003) reported that nutritive value of *Festuca arundinacea* silage was: 118.5 g/kg CP, 33.8 g/kg EE, 261.9 g/kg CF, 477.4 g/kg NFE, 528.9 g/kg NDF, 308.6 g/kg ADF, 108.4 g/kg ash, 9.54 MJ/kg ME, 5.65 MJ/kg NEI. Mahnert et al. (2005) found that the silage from perennial ryegrass was characterized by 187 g/kg DM, pH 4.6, 17.0 % CP, 4.9 % EE, 31.3 % CF, 3.4 % WSC and 11.5 % ash, but from cocksfoot – 273 g/kg DM, pH 6.1, 18.4% CP, 4.6% EE, 30.3% CF, 3.1% WSC and 11.2% ash, respectively. Burke et al (2007) mentioned that the chemical composition and energy value of silage, prepared without any additives, from the first cut of a predominantly perennial ryegrass sward were 204 g/kg DM, pH=3.9, 39 g/kg lactic acid, 33 g/kg acetic acid, 2 g/kg butyric acid, 17.9% CP, 7.4% ash, 4.5% EE, 76.2% DMD, 76.1% OMD, 10.6 MJ/kg ME. Dewhurst et al. (2009) revealed that perennial

ryegrass silage had 925 g/kg OM 14.0 % CP 52.6% NDF and 309% ADF. Jancik et al (2011) found that the chemical composition of dry matter silage prepared from *Festuca arundinacea* was: 17.80% CP 2.76% EE, 8.59% ash, 51.20% NDF, 31.10% ADF and 2.66% ADL, but from *Dactylis glomerata* – 14.90 CP%, 3.08% EE, 7.66% ash, 54.10% NDF, 33.30% ADF, 3.12% ADL and from the hybrid *Lolium multiflorum* × *Festuca arundinacea* – 11.90% CP, 2.92% EE, 8.78% ash, 59.5% NDF, 34.90% ADF and 2.51% ADL, respectively. Kupryś-Caruk & Kołodziejwski (2016) reported that the dry matter content and chemical the composition of tall fescue silages was 214 g/kg DM, pH=5.2, 89.7 g/kg lactic acid, 2.3 g/kg acetic acid, 10.8% CP, 11.7% ash, 2.3% fats, 5.0% mono sugars, 3.0% ADL, 30.4% cellulose, 5.7% hemicellulose. Coblenz et al. (2020) compared the feed quality and energy value of grass silage found than tall fescue silage was characterized by pH=5.63, 16 g/kg lactic acid, 8.2 g/kg acetic acid, 2.4 g/kg butyric acid, 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; meadow fescue silage – pH=5.60, 21.7 g/kg lactic acid, 7.6 g/kg acetic acid, 3.0 g/kg butyric acid, 77 g/kg CP, 97 g/kg ash, 51.4 g/kg WSC, 644 g/kg NDF, 391g/kg ADF, 30.1 g/kg ADL, 1.34 Mcal/ kg NEI, but orchard grass silage – pH=5.50, 17.8 g/kg lactic acid, 7.8 g/kg acetic acid, 3.2 g/kg butyric acid. 104 g/kg CP, 115 g/kg ash, 34.3 g/kg WSC, 611 g/kg NDF, 357 g/kg ADF, 26.2 g/kg ADL, 1.34 Mcal/kg NEI. Richard et al. (2020) remarked than tall fescue silage contained 341 g/kg DM, 903 g/kg OM, 136 g/kg CP, 543 g/kg NDF, 353 g/kg ADF, 21.2 g/kg EE, 86.13% IVTD, 1.26 Mcal/kg NEI.

Haying is the most common method of storing forages. In some cases, hay is the major, if not the only source of essential fibre, energy, protein, vitamins and minerals for many classes of livestock during the winter season. Hay quality varies because of different factors such as forage species, fertilization, stage of maturity, harvesting/preserving practices and storage. Making better quality hay can significantly reduce the need for supplemental feed purchases and help keep adequate condition on animals. It is the best source of

energy, protein, vitamins, minerals and, most importantly, fibre that is necessary for normal gut function.

The biochemical composition, nutritive and energy value of the prepared hays are presented in Table 2. The prepared hays contained 9.95-10.84% CP, 1.87-2.65 % EE, 33.38-36.90% CF, 39.99-40.54% NFE, 11.28-12.59% ash, 2.60-3.50 g/kg Ca, 2.30-2.70 g/kg P, with 17.44-17.84 MJ/kg GE, 8.31-8.85 MJ/kg ME, 4.45-4.93 MJ/kg NEL. The tall fescue hay is characterized by higher concentration of crude protein, crude fats and ash. The concentration of nitrogen free extract did not differ significantly in prepared hays. The energy concentrations were higher in tall fescue hay as compared with perennial ryegrass hay.

Some authors mentioned various findings about the yield and quality of the perennial ryegrass and tall fescue hays. Duke (1983) remarked the *Lolium perenne* hay contains 88% DM, 9.2% protein, 3.1% fat, 24.2% fibre, 43.4% NFE, 8.1% ash. Aitchison et al. (1986) mentioned that chemical composition of perennial ryegrass hay was 911 g/kg OM, 619 g/kg NDF, 332 g/kg ADF. Burlacu et al. (2002) reported that nutritive value of perennial ryegrass hay were: 11.5-17.0% CP, 2.7-4.0% EE, 22.0-29.0% CF, 8.5-12.0 % ash, 5.4-6.6 g/kg Ca, 3.0-4.4 g/kg P, 604-686 g/kg DDM, 17.95-18.10 MJ/kg GE, 11.40-13.28 MJ/kg DE, 9.33-10.79 MJ/kg ME. Angima & Kallenbach (2008) revealed the hay prepared from tall fescue cv. Kentucky 31 contained 6.37- 7.85% CP with RFV 96-98. Gallo et al (2013) reported that grass hays contained 825-920 g/kg DM, 62-14 g/kg ash, 51-130 g/kg CP, 21-32 g/kg EE, 540-730 g/kg

NDF, 303-448 g/kg ADF, 19-116 g/kg ADL, 96-94 g/kg NFC, 0.85-1.52 Mcal/kg NEL. Bender et al. (2016) mentioned that tall fescue hay contained 143 g/kg CP, 107 g/kg ash, 30 g/kg fats, 644 g/kg NDF, 81 g/kg ADL and 16 g/kg starch. Nicolae (2016) reported that hay quality prepared from perennial ryegrass was: 6.9-11.5% CP, 1.2-1.4% EE, 28.7-34.7% CF, 8.7-9.1% ash, 47.4-49.7% NFE, 0.64-0.81 UFL/kg and 0.55-0.74 UFV /kg. Akdeniz et al. (2019) found that perennial ryegrass hay prepared in the second year contained 9.13% ash, 12.75% CP, 1.52% EE, 36.33% CF, 35.51% NDF, 24.82% ADF, 61.24% DDM, but tall fescue hay respectively 9.54% ash, 9.86% CP, 1.15% EE, 44.85% CF, 64.05% NDF, 47.64% ADF, and 51.79% DDM. Silva Déley et al. (2019) revealed that the hay prepared from *Lolium perenne* contained 163.4-183.3 g/kg CP, 274.7-320.9 g/kg CF, 71.2-115.3 g/kg ash, 612-637 g/kg NDF, 508-521 g/kg ADF, 41-43 g/kg ADL, 65.99-71.13% DDM, 66.73-73.70% ODM, but *Cenchrus clandestinum* hay contained 121.5-19.5 g/kg CP, 348.4-372.2 g/kg CF, 70.4-96.0 g/kg ash, 344-376 g/kg NDF, 263-297 g/kg ADF, 19-23 g/kg ADL, 65.13-81.71% DDM and 68.54-82.68% ODM, respectively. Xu et al. (2019) reported that the nutritive quality of wild-type *Lolium perenne* herbage dried under natural condition was 3.25% EE, 11.13% ash, 49.46% NDF, 26.79% ADF, 3.40% lignin, 9.45% sugars, 80.75% IVTDMD, but in generated *Lolium perenne* transgenic lines 3.09-3.75% EE, 10.36-11.16% ash, 45.50-51.20% NDF, 21.50-25.58% ADF, 3.83-4.51% lignin, 8.46-10.18% sugars, 78.83-85.49% IVTDMD, respectively.

Table 3. The biochemical composition and the nutritive value of the hay from the studied *Poaceae* species

Indices	<i>Festuca arundinacea</i>	<i>Lolium perenne</i>
Crude protein, % DM	10.84	9.95
Crude fats, % DM	2.65	1.87
Crude cellulose, % DM	33.38	36.90
Nitrogen free extract, % DM	40.54	39.99
Ash, % DM	12.59	11.28
Calcium, g/kg DM	2.60	3.50
Phosphorus, g/kg DM	2.30	2.70
Gross energy, MJ/kg DM	17.44	17.84
Metabolizable energy, MJ/kg DM	8.85	8.31
Net energy for lactation, MJ/kg DM	4.93	4.54

CONCLUSIONS

The local ecotype of perennial ryegrass *Lolium perenne* and the Romanian cultivar 'Valrom' of tall fescue *Festuca arundinacea* under the climatic conditions of the Republic of Moldova were characterized by optimal growth rates and productivity. The green mass and the prepared hay and silage contain a lot of nutrients, which make them suitable to be used as a part of diverse livestock diets.

ACKNOWLEDGEMENTS

The study has been carried out in the framework of the projects: 20.80009.5107.02 "Mobilization of plant genetic resources, plant breeding and use as forage, melliferous and energy crops in bioeconomy".

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