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The Quality Indices of Fodders from Some Common Millet Cultivars (*Panicum Miliaceum*) Under the Conditions of the Republic of Moldova

Victor Ţîţei

"Alexandru Ciubotaru" National Botanical Garden (Institute) of Moldova State University, Chişinău, Republic of Moldova

*Corresponding author. E-mail: vic.titei@gmail.com

ABSTRACT

Diversifying crop production by including neglected and underused crops would provide a solution of the problems associated with climate change resilience, food security, forage production, feedstock for the circular economy. Today, one of the neglected and underused crops is also common millet *Panicum miliaceum*, which was been growing in our region for centuries. The main objectives of this research was to evaluate the forage productivity and quality indices of the green mass, silage and hay from common millet cultivars 'Soiuz' and 'Marius' growing under the conditions of Central Zone the Republic of Moldova. We found that the forage productivity of the studied cultivars of common millet reached 35.9-46.9 t/ha green mass or 8.2-10.6 t/ha dry matter with 10.8-13.2% CP, 8.8-10.1% ash, 35.2-37.7% CF, 3.8-3.9% ADL, 33.3-35.1% Cel, 23.6-25.3% HC, 11.7-12.4% TSS, 586-599 g/kg DDM, 9.53-9.73 MJ/kg ME and 5.56-5.75 MJ/kg NEl. The prepared common millet hays contained: 9.18-13.2% CP, 8.7-10.4% ash, 36.8-40.8% CF, 3.8-3.9% ADL, 34.8-38.01% Cel, 24.3-26.3% HC, 9.3-9.4%TSS, 563-588 g/kg DDM, 9.20-9.57 MJ/kg ME and 5.22-5.59 MJ/kg NEl. The prepared silages had yellowish-green stems and leaves with pleasant smell like pickled apples, pH=3.97-4.06, 28.6-30.8 g/kg lactic acid, 3.6-4.1 g/kg acetic acid, 0.3 g/kg butyric acid, 10.9-11.6% CP, 10.3-11.1% ash, 34.7-38.9% CF, 2.6-2.9% ADL, 33.4-37.8% Cel, 25.3-26.0% HC, 572-609 g/kg DDM, 9.34-9.87 MJ/kg ME and 5.35-5.89 MJ/kg NEl. The common millet cultivars 'Soiuz' and 'Marius' can be used as forage for livestock, as natural fodder, hay, silage.

Keywords: biochemical composition, common millet, cultivar 'Soiuz' and 'Marius', green mass, hay, nutritive value, *Panicum miliaceum*, productivity, silage.

INTRODUCTION

Climate change associated environmental stresses, such as extreme temperatures, lack of precipitation or erratic rainfall during the growing season, also soil salinization, will compromise the ability of agriculture and livestock sectors to meet the food demands of an increasing global population. Diversifying crop production by including neglected and underused crops, as well as the domestication of new species and breeding new cultivars of traditional crops would provide a solution of the problems associated with climate change resilience, food security, forage production, feedstock for the circular economy.

The genus *Panicum* L. belongs to the family *Poaceae*, with nearly 450 species of annual or perennial grasses occurring throughout tropical and warm temperate regions of the world. Within this large genus, two species are of economic importance: *Panicum miliaceum* and *Panicum sumatrense.* Common millet or proso millet, *Panicum miliaceum* L., probably a native of Egypt and Arabia and has been cultivated in Asia Minor and southern Europe since prehistoric times. Today the crop is distributed globally in Asia, Australia, Africa, North America, South America, and Europe. Common millet has also been cultivated in our region. It is a C_4 short-duration summer season crop (60 to 100 days), plant height reaches 45-130 cm, and it has a shallow fibrous root system, with high tolerance to abiotic stresses such as drought, salinity, high temperatures and nutrient deficiency in the soil, grown for food and forage purposes. The millet seeds rich in protein, minerals, vitamins, fiber, carbohydrates, and the gluten-free protein, low glycemic index and high antioxidants contribute to its nutraceutical value, making it an excellent

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food choice for people with celiac disease or gluten intolerance. *Panicum miliaceum* could be a viable alternative to main summer forages in areas where cultivation of corn or Sudan grass is restricted because of a longer growing season or poor agricultural conditions. Currently, *Panicum miliaceum* is studied in different scientific centers and universities, being elaborated and implemented new technological elements, breeding and creating new lines and cultivars with multiple uses in different regions of the Earth (Zinovenko and Gurinovich, 2008; Jahansouz et al., 2014; Tan et al., 2016; Habiyaremye et al., 2017; Kwiatkowski et al., 2017; Tran, 2017; Bhat et al., 2019; Maksimova et al., 2019; Taylor, 2019; Dağtekin et al., 2020; Ventura et al., 2020; Yilmaz, 2020; Park et al., 2022; Wei et al., 2022; Rajasekaran et al., 2023; Stybayev et al., 2023; Turkestani et al., 2023; Wimalasiri et al., 2023; Petcu et al., 2024).

The main objectives of this research was to evaluate the productivity and quality indices of the harvested green mass, prepared silage and hay from common millet cultivars ‘Soiuz' and 'Marius' growing under the conditions of Central Zone the Republic of Moldova for feeding farm animals.

MATERIAL AND METHODS

The cultivars of common millet *Panicum miliaceum*: *‘Soiuz'* created at the at the “Selectia” Research Institute of Field Crops Bălți, Republic of Moldova and *'Marius'* created at the National Agricultural Research and Development Institute Fundulea, Romania, cultivated in the experimental plot of the National Botanical Garden (Institute) “Alexandru Ciubotaru”, Chişinău, served as subjects of the research. The plant samples were collected in the 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 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 Moldavian standard SM 108*. The prepared hay was dried directly in the field. For biochemical analysis, the plant samples were dried in a forced air oven at 60°C, milled in a beater mill equipped with a sieve with diameter of openings of 1 mm and some assessments of the main biochemical parameters: crude protein (CP), ash, acid detergent fibre (ADF), neutral detergent fibre (NDF), acid detergent lignin (ADL), total soluble sugars (TSS), digestible dry matter (DDM), digestible organic matter (DOM) have been determined by near infrared spectroscopy (NIRS) technique PERTEN DA 7200. The concentration of hemicellulose (HC), cellulose (Cel), digestible energy (DE), metabolizable energy (ME), net energy for lactation (NEl) and relative feed value (RFV) were calculated according to standard procedures.

RESULTS AND DISCUSSION

Analysing some biological peculiarities of the studied common millet cultivars, we found that the local cultivar of *Panicum miliaceum ‘Soiuz’* developed more shoots, it was characterized by faster grow and development rates, and the flowering stage started 9 days earlier than *Panicum miliaceum ‘Marius’.* At the time when the green mass was cut, the *Panicum miliaceum ‘Marius’* plants were 120 cm tall, but *Panicum miliaceum ‘Soiuz’* plants were shorter - only 84 cm (Table 1). The forage productivity of *Panicum miliaceum ‘Marius’* was 46.9 t/ha green mass or 10.6 t/ha dry matter, while of *Panicum miliaceum ‘Soiuz’* - 35.9 t/ha green mass or 8.2 t/ha dry matter but the content of leaves and panicles in fodder was much higher.

Table 1. Some biological peculiarities and the productivity of the studied common millet cultivars

Cultivar	Plant height (cm)	Stem (g)		Leaf + panicle (g)		Total weight of a shoot (g)		Yield (kg/m$^{2)}$		Content of leaves and panicles in fodder (%)
		fresh mass	dry matter	fresh mass	dry matter	fresh mass	dry matter	fresh mass	dry matter	
‘Soiuz'	84	14.7	3.2	14.6	3.5	29.3	6.7	35.9	8.2	52.2
'Marius'	120	19.3	3.9	15.2	3.9	34.5	7.8	46.9	10.6	50.0

Some authors have mentioned various findings about the biological peculiarities and forage productivity of *Panicum miliaceum* cultivars. Zinovenko and Gurinovich (2008) found that, under the climatic conditions of the Republic of Belarus, the proso productivity was 38 t/ha fresh mass, 6.48 t/ha dry matter and 5.70 t/ha fodder units. Svirskis (2009) reported that the yield of studied common millet *‘Juosvės’* was 13.3-22.1 t/ha fresh mass or 2.04-6.80 t/ha dry matter, *‘*Gelsvės’ 15.0-19.2 t/ha fresh mass or 2.88-6.01 t/ha dry matter and *‘Rudes’* 13.2-16.5 t/ha fresh mass or 2.31-4.90 t/ha dry matter. Zhang et al. (2010) mentioned that, in northern China, the biomass yield in 15 week stages of proso millet was 5.57 t/ha dry matter, Sudan grass - 5.25 t/ha dry matter and maize - 6.54 t/ha dry matter. Mohajer et al. (2013) found that the dry matter of the studied common millet cultivars varied from 10.57 to 18.07 t/ha. Jahansouz et al. (2014) mentioned that the yield of common millet was 16.1 t/ha fresh mass and 3.61 t/ha dry matter, but foxtail millet - 18.7 t/ha fresh mass and 4.57 t/ha dry matter. Kertikov and Kertikova (2016) reported that the forage yield of *Panicum miliaceum* as non-traditional forage crop, grown in the Pleven Region of Bulgaria, was 541.8 kg/ha dry matter. Tan et al. (2016) mentioned that the proso millet plant at the irrigated experimental field in Erzurum, Turkey, in the non-fertilized variant, plants reached 51.4 cm in height and 2924 kg/ha dry matter yield, but in the variant with different doses of nitrogen - 56.6-70.7 cm and 4017-4640 kg/ha dry matter. Maksimova et al. (2019) found that, under the conditions of the Republic of Sakha (Yakutia), Russian Federation, the green forage dry matter yield of proso millet *‘Baganskoye 88’* was 3.26 t/ha in the control variant and 4.86-6.10 t/ha in the variants with mineral fertilizers. Avetisyan et al. (2020) determined that the forage yield of proso millet *‘Kinelskoe 92’* was 42.5 t/ha green mass or 8.7 t/ha dry matter, but proso millet *‘Rossiyanka’* - 46.7 t/ha green mass or 10.1 t/ha dry matter. Dağtekin et al. (2020) studied 11 genotypes of proso millet and remarked that plant height varied from 72.2 to 142.8 cm, green mass yield - from 112.2 to 790.2 g/plant, dry mater yield - from 28.6 to 165.9 g/plant and leaf ratio from 19.7 to 51.9%. Khishigbuyan and Gungaanyam (2021) reported that the millet variety *‘Saratovskaya 853’* grown in Mongolia had a productivity 24.09-30.88 t/ha green mass or 5.44-8.36 t/ha dry matter. Park et al. (2022) stated that in *Panicum miliaceum ‘Native’*, depending on the seeding period, the plant height varied from 98.8 to 175.1 cm and the dry matter yield - from 1.96 t/ha to 11.51 t/ha. Wei et al. (2021) mentioned that the forage yield of proso millet was 25.4 t/ha fresh matter or 7.69 t/ha dry matter.

Table 2. The biochemical composition and nutritional value of fresh mass from the studied common millet cultivars

Indices	‘Soiuz'	'Marius'
Crude protein, g/kg DM	132	108
Crude fibre, g/kg DM	352	372
Minerals, g/kg DM	101	98
Acid detergent fibre, g/kg DM	372	389
Neutral detergent fibre, g/kg DM	608	642
Acid detergent lignin, g/kg DM	39	38
Cellulose, g/kg DM	333	351
Hemicellulose, g/kg DM	236	253
Digestible dry matter, g/kg DM	599	586
Relative feed value	92	86
Digestible energy, MJ/ kg	11.86	11.62
Metabolizable energy, MJ/ kg	9.73	9.54
Net energy for lactation, MJ/ kg	5.75	5.56

The availability and balance of nutrients in a forage play an important role for the health, wellbeing, reproduction and productivity of ruminant farm animals. The analysis of the chemical composition in combination with dry matter digestibility and can be a very useful tool in the preliminary evaluation of the nutritive value of feed resources. The biochemical composition of the dry matter of the harvested green mass from the common millet cultivars are presented in Table 2. The dry matter nutrients and energy value of studied common millet cultivars ranged between the following limits: 10.8-13.2% CP, 8.8-10.1% ash, 35.2-37.7% CF, 37.2-38.9% ADF, 60.8-64.2% NDF, 3.8-3.9% ADL, 33.3-35.1% Cel, 23.6-25.3% HC, 11.7-12.4% TSS, 586-599 g/kg DDM, RFV=86-92, 11.62-11.86 MJ/kg DE, 9.53-9.73 MJ/kg ME and 5.56-5.75 MJ/kg NEl. The dry matter from the local cultivar of *Panicum miliaceum ‘Soiuz'* was characterized by high content of crude protein and low amount of structural carbohydrates, which had a positive effect on the digestibility, nutritional value and energy supply of the feed, which is partly due to the higher content of leaves and panicles in fodder. Besides, the crude protein yield of *Panicum miliaceum 'Marius'* reached 1145 kg/ha, while *Panicum miliaceum ‘Soiuz'* only 1085 kg/ha.

Different results regarding the nutrient content of the harvested mass from *Panicum miliaceum* are given in the specialized literature. According to Burlacu et al. (2002), the *Panicum miliaceum* green mass contained 230 g/kg DM with 8.7% ash, 14.0% CP, 4.7% EE, 27.1% CF, 45.5% NFE and 18.5 MJ/kg GE, but *Setaria italica* green mass - 300 g/kg DM, 10.0% ash, 9.4% CP, 3.1% EE, 29.7% CF, 46.3% NFE and 17.0 MJ/kg GE, respectively. Svirskis (2009) found that, under the climatic conditions of Lithuania, the dry matter of the studied common millet cultivars contained 12.6-19.6% CP, 28.0-35.6% CF, 56.6-65.3% NDF, 25.3-33.1% ADF, 4.56-11.39% WSC and 48.4-65.3% DMD. Avetisyan (2013) reported that the quality indices of the green mass from proso millet were 200 g/kg dry matter with 9.8% CP, 38.9% CF, 6.2% sugar, 9.7 MJ/kg ME and from Sudan grass - 250 g/kg DM, 7.6% CP, 30.5% CF, 8.0% sugar, 8.8 MJ/kg ME, respectively. Zhang et al. (2010) mentioned that, in northern China, dry biomass from proso millet contained 12.8% CP, 73.3% NDF, 40.2% ADF, from Sudan grass - 12.0% CP, 62.7% NDF, 38.4% ADF and maize fodder dry matter - 10.8% CP, 66.1% NDF and 42.8% ADF. Mohajer et al. (2013) mentioned that the dry matter of the studied common millet cultivars contained

9.15-10.78% CP, 43.45-44.84% CF, 5.58-7.16% WSC, 28.17-29.50% ADF and 64.74-65.90% DMD. Jahansouz et al. (2014) reported that the quality indices of green mass from *Panicum miliaceum* were 10.91% CP, 76.34% NDF, 50.82% ADF, 6.29% WSC, 49.31% DMD, 0.98 Mcal/kg NEl and RFV=60.1. Kertikov and Kertikova (2016) revealed that the crude protein productivity of true millet *Panicum miliaceum* was equal to 57.1 kg/da. Tran (2017) remarked that proso millet forage was characterized by the following quality indices 7.9% ash, 10.1% CP, 73.7% NDF, 36.0% ADF, 4.5% lignin, 3.6 g/kg Ca, 1.6 g/kg P, 58.5% DOM. Maksimova et al. (2019) reported that the dry matter quality indices of green mass from *Panicum miliaceum 'Baganskoye 88'* were 0.56 feed units/kg, 107.17-126.23 g/kg digestible protein, 8.3-8.4 MJ/kg metabolic energy. Avetisyan et al. (2020) found that the nutritive value of forage from the studied cultivars of *Panicum miliaceum* was 0.23 feed units/kg green mass, 24 g digestible protein/kg green mass, and 10.3-10.4 MJ/kg DM exchange energy, while the forage from *Sorghum sudanensis* - 0.21 feed units/kg fresh mass, 23 g digestible protein/kg fresh mass, 9.8 MJ/kg DM exchange energy. Wei et al. (2021) reported that proso millet green mass had 303.4 g/kg dry matter with 6.31% CP, 32.6% ADF, 607.2% NDF and 649.5 g/kg IVDMD; corn green forage 277.3 g/kg dry matter, 5.93% CP, 28.78% ADF, 53.01% NDF and 863.2 g/kg IVDMD, but sorghum-Sudan grass 192.8 g/kg dry matter, 5.47% CP, 43.39% ADF, 66.25% NDF, 649.5 g/kg IVDMD, respectively. Park et al. (2022) stated that forage from *Panicum miliaceum 'Native'* contained 5.7-10.4% CP, 63.1-65.4% NDF, 36.3-37.0% ADF, 59.7-60.2% TDN and RFV=86-89, but green forage from *Panicum coloratum 'Selection'*, respectively, 12.0-12.4% CP, 57.8-62.2% NDF, 30.3-31.7% ADF, 63.9-64.9% TDN and RFV=95-105. Van Die and Entz (2022) reported that the green forage dry matter from *Panicum miliaceum 'Crown Proso'* had 8.0-10.0% CP and 64.8% TDN, while that from *Sorghum bicolor* × *Sorghum sudanense 'Common'* - 4.7-4.8% CP and 63.3-64.3% TDN. Wei et al. (2022) mentioned that the forage quality of proso millet was 631 g/kg TDN and RFV=91, but the forage of the Sorghum-Sudan grass hybrid 541g/kg TDN and RFV=77.

In most parts of the world, forage conservation is a key element for productive and efficient livestock farms. Forage conservation allows a better supply of quality feed when forage production is low or dormant. Forage conservation provides a more uniform level of high quality forage for ruminant livestock throughout the year. Hay making is one of the oldest techniques used for preserving green forage. Hay quality indices depending of plant species and cultivars, leafiness, mowing period, suitable weather conditions at harvest and drying time, harvesting and post-harvest handling, storage conditions and on many other factors. The quality indices of the prepared hays from cultivars of common millet are shown in Table 3. We would like to mention that common millet hays contained: 9.18-13.2% CP, 8.7-10.4% ash, 36.8-40.8% CF, 38.6-41.9% ADF, 62.9-68.2% NDF, 3.8-3.9% ADL, 34.8-38.01% Cel, 24.3-26.3% HC, 9.3-9.4% TSS, 563-588 g/kg DDM, RFV=86-87, 11.21-11.56 MJ/kg DE, 9.20-9.57 MJ/kg ME and 5.22-5.59 MJ/kg NEl. In the haymaking process, we noticed an increase in the level of structural carbohydrates and a decrease in digestibility, relative feed value and energy concentration as compared with the harvested green mass. It has been determined that the concentration of crude protein in the hay prepared from *Panicum miliaceum 'Marius'* lowered in comparison with the initial green mass. The hay prepared from *Panicum miliaceum 'Soiuz'* was characterized by high level of crude protein and minerals, low concentration of hemicellulose and cellulose, and did not differ significantly in the concentration of acid detergent lignin and total soluble sugars in comparison with the hay prepared from *Panicum miliaceum 'Marius'*.

Table 3. The biochemical composition and nutritional value of hay from the studied millets cultivars

Indices	‘Soiuz'	'Marius'
Crude protein, g/kg DM	132	91
Crude fibre, g/kg DM	368	408
Minerals, g/kg DM	104	87
Acid detergent fibre, g/kg DM	386	419
Neutral detergent fibre, g/kg DM	629	682
Acid detergent lignin, g/kg DM	38	39
Cellulose, g/kg DM	348	380
Hemicellulose, g/kg DM	243	263
Total soluble sugars, g/kg DM	93	94
Digestible dry matter, g/kg DM	588	563
Relative feed value	87	86
Digestible energy, MJ/ kg	11.66	11.21
Metabolizable energy, MJ/ kg	9.57	9.20
Net energy for lactation, MJ/ kg	5.59	5.22

Several literature sources described the quality indices of *Panicum miliaceum* hay. According to Burlacu et al. (2002) the *Panicum miliaceum* hay contained 850 g/kg dry matter with 12.5% ash, 5.8% CP, 2.1% EE, 33.5% CF, 51.2% NFE and 17.9 MJ/kg GE, but *Setaria italica* hay - 850 g/kg dry matter with 12.3% ash, 7.4% CP, 2.0% EE, 32.7% CF, 45.6% NFE and 17.1 MJ/kg GE, respectively. Berhane et al. (2006) described the variations in the forage quality of hay among several millet species and mowing periods, *Panicum miliaceum* hay contained 889-915 g/kg DM with 10.5-12.4% ash, 15.7-17.3% CP, 69.2-72.5% NDF, 33.7-37.4% ADF, 2.2-6.1% ADL, but the hay from *Panicum coloratum*, respectively, 881-914 g/kg DM with 6.1-7.6% ash, 6.3-11.4% CP, 81.6-83.5% NDF, 35.9-44.1% ADF, 2.8-6.3% ADL. Tan et al. (2016) mentioned that proso millet hay in the variant without nitrogen fertilization had 12.39% CP, 58.40% NDF, 36.05% ADF, but in the variants with nitrogen fertilizers, 13.16-14.24% CP, 58.09-60.02% NDF, 35.73-36.10% ADF, respectively. Tran (2017) reported that the concentration of nutrients and energy in proso millet hay were 7.9% ash, 12.5% CP, 2.5% EE, 33.9% CF, 72.3% NDF, 39.9% ADF, 5.9% lignin, 6.6% ash, 59.3% DOM, 18.9 MJ/kg GE, 10.7 MJ/kg DE, 8.6 MJ/kg ME. Dağtekin et al. (2020) found that the hays from 11 genotypes of proso millet contained 16.3-20.5% CP, 28.7-36.3% ADF, 60.0-70.6% NDF, 0.373-0.434% P, 0.58-0.824% Ca, 0.270-0.393% Mg, 3.17-3.96% K. Stybayev et al. (2023) reported that the chemical composition of the proso millet hay in the variant without cover crop was 9.07% CP, 2.76% EE, 30.32% CF, 3.32% sugar, 9.25% ash, 1.11% Ca, 0.23% P, but in the variant with cover crop, the proso millet hay contained 9.62% CP, 3.74% EE, 31.32% CF, 10.20% sugar, 4.23% ash, 2.1% Ca, 0.33% P, respectively. As a result of our previous studies (Țîței, 2024) we found that the hay prepared from proso millet contained: 13.40% CP, 2.37% EE, 32.22% CF, 42.29% NFE, 9.72% ash, 0.32% Ca and 0.27% P, 18.02 MJ/kg GE.

The fermented fodders, silage and haylage, are an important source of nutrients for farm animals in the late autumn/early winter period. Also, fermented fodders are a staple forage in dairy farms, providing a balanced diet with an appropriate amount of protein and amino acids, carbohydrates, minerals, vitamins under year-round uniform feeding.

When opening the glass containers with proso millet silages, there was no gas or juice leakage from the preserved mass. As for the organoleptic properties, the prepared silages

had yellowish-green stems and leaves with pleasant smell like pickled apples; the texture of the chopped plants stored as silage was preserved well, without mold and mucus. The biochemical composition and nutritional value of silage from the studied millet cultivars is shown in Table 4. The fermentation indices of proso millet silages were: pH=3.97-4.06, 28.6-30.8 g/kg lactic acid, 3.6-4.1 g/kg acetic acid, 0.3 g/kg butyric acid, the most organic acids were in fixed form, lactic acids constituted 88% of organic acids. The obtained proso millet silages met the standard SM 108 for the 1-st class quality. In the *Panicum miliaceum 'Marius'* silage the concentration of organic acids lactic acid was higher as compared with the silage prepared from *Panicum miliaceum ‘Soiuz'*. The dry matter from proso millet silages contained 10.9-11.6% CP, 10.3-11.1% ash, 34.7-38.9% CF, 36.0-40.7% ADF, 62.0-66.5% NDF, 2.6-2.9% ADL, 33.4-37.8% Cel, 25.3-26.0% HC, 572-609 g/kg DDM, RFV=81-91, 11.37-12.03 MJ/kg DE, 9.34-9.87 MJ/kg ME and 5.35-5.89 MJ/kg NEl. It was found that during the process of ensiling, the concentrations of acid detergent lignin decreased and ash content increased. In comparison with the initial green mass, in the prepared silage from *Panicum miliaceum ‘Soiuz'* the level of crude protein, crude fibre, acid detergent fibre decreased, the and concentration of hemicellulose increased substantially, which had a positive impact on the digestibility and energy value. In the silage from *Panicum miliaceum 'Marius'* the crude protein, hemicellulose and ash did not change essentially, while the content of acid detergent fibre, cellulose increased substantially and energy concentrations were lower than in the silage from *Panicum miliaceum ‘Soiuz'*.

Table 4. The biochemical composition and nutritional value of silage from the studied millets cultivars

Indices	‘Soiuz'	'Marius'
pH index	4.06	3.97
Organic acids, g/kg DM	32.5	35.2
Free acetic acid, g/kg DM	2.0	1.8
Free butyric acid, g/kg DM	0	0.1
Free lactic acid, g/kg DM	10.6	11.4
Fixed acetic acid, g/kg DM	1.6	2.3
Fixed butyric acid, g/kg DM	0.3	0.2
Fixed lactic acid, g/kg DM	18.0	19.4
Total acetic acid, g/kg DM	3.6	4.1
Total butyric acid, g/kg DM	0.3	0.3
Total lactic acid, g/kg DM	28.6	30.8
Acetic acid, % of organic acids	11.1	11.6
Butyric acid, % of organic acids	0.9	0.8
Lactic acid, % of organic acids	88.0	87.6
Crude protein, g/kg DM	116	109
Crude fibre, g/kg DM	347	389
Minerals, g/kg DM	103	111
Acid detergent fibre, g/kg DM	360	407
Neutral detergent fibre, g/kg DM	620	660
Acid detergent lignin, g/kg DM	26	29
Cellulose, g/kg DM	334	378
Hemicellulose, g/kg DM	260	253
Digestible dry matter, g/kg DM	609	572
Relative feed value	91	81
Digestible energy, MJ/ kg DM	12.03	11.37
Metabolizable energy, MJ/ kg DM	9.87	9.34
Net energy for lactation, MJ/ kg DM	5.89	5.35

Some authors mentioned various findings about the quality of the silage prepared from *Panicum* species. Zinovenko and Gurinovich (2008) reported that the proso silage was characterized by the following indices: pH=4.12, 68.42% lactic acid of organic acids, 14.14% CP and 620 g/kg. Maksimova et al. (2019) found that the quality indices of proso millet silage was pH=5.0, 0.55 feed units/kg dry matter, 39.0 g/kg digestible protein, and 8.21 MJ/ kg exchange energy and 72.5 g digestible proteins/feeding unit. Nematpour et al. (2020) mentioned that the proso millet silage had pH=4.68, 1.68% acetic acid, 265 bg/kg dry matter with 8.14% ash. 16.1% CP, 55.4% NDF, 27.3% ADF, 65.2% DDM, RFV=114 and 1.58 Mcal/kg NEl. Wei et al. (2021) found that the chemical composition and nutritive value of proso millet was pH=4.35, 4.01% lactic acid, 1.41% acetic acid, 0.23% butyric acid, 266 g/kg dry matter with 5.66% CP, 35.8% ADF, 62.4% NDF, 58.0% IVDMD, 605.5 g/kg TDN and RFV=91; corn silage pH=3.86, 6.15% lactic acid, 4.86% acetic acid, 263 g/kg dry matter, 5.20% CP, 26.52% ADF, 46.51% NDF, 68.46% IVDMD, 692.8 g/kg TDN and RFV=137; but sorghum-Sudan grass silage pH=4.07, 7.67% lactic acid, 4.52% acetic acid, 175.4 g/kg dry matter, 4.69% CP, 42.80% ADF, 65.48% NDF, 54.76% IVDMD, 547.6 g/kg TDN and RFV=78, respectively. In our previous research (Ţîţei, 2023, 2024), the quality indices of common millet silages were as follows: 11.0-13.3% CP, 4.0% EE 36.7-37.0% CF, 37.1% ADF, 63.0% NDF, 2.0% ADL, 6.8% TSS, 35.1% Cel, 23.7% HC, 9.7-11.5% ash, 0.31% Ca, 0.27% P, 600 g/kg DDM, RFV=92, 18.38 MJ/kg GE, 11.87 MJ/kg DE, 9.75 MJ/kg ME, 5.76 MJ/kg NEl. Turkestani et al. (2023) mentioned that proso millet silages had pH=4.5-4.8 and contained 343-395 g/kg dry matter with 9.0-12.1% CP, 28.8% ADF, 47.4-50.5% NDF, 3.38-3.56% ADL, 593-633 g/kg DMD.

CONCLUSIONS

The local common millet cultivar *'Soiuz'* stands out due to a faster pace of development, lower plant height and dry matter productivity, but the prepared fodders have high content of crude protein and lower content of structural carbohydrates.

The studied Romanian common millet cultivar *'Marius'* is characterized by long vegetative period, high dry matter productivity, optimal content of minerals, crude protein and fibre concentration.

The common millet cultivars *'Soiuz'* and *'Marius'* can be used in monoculture or as components of the mix of annual legume crops, and the harvested mass may be used as forage for livestock, as natural fodder, hay or silage.

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