SOME BIOLOGICAL PECULIARITIES AND THE ECONOMIC VALUE OF THE SPECIES *Pennisetum glaucum* IN THE REPUBLIC OF MOLDOVA

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Abstract. The aim of this study was to evaluate some biological peculiarities, the quality of green mass and silage from the non-traditional annual grass species *Pennisetum glaucum* grown in an experimental field of the National Botanical Garden (Institute), Chişinău, Republic of Moldova. It has been found that the dry matter of harvested whole plants contained 112 g/kg CP, 73 g/kg ash, 332 g/kg ADF, 591 g/kg NDF, 43 g/kg ADL; the feed value – 65.5 % DDM and 60.6% OMD with 10.19 MJ/kg ME and 6.27 MJ/kg NEl. The prepared silage was characterized by an agreeable colour and a pleasant smell, with pH 4.23, it contained 17.7 g/kg DM lactic acid, 7.1 g/kg DM acetic acid, 915 g/kg organic matter, 112 g/kg CP, 337 g/kg ADF, 595 g/kg NDF, 29 g/kg ADL with 73.6 % DMD, 65.0% OMD, 11.74 MJ/kg ME and 7.07 MJ/kg NEl. The biochemical methane potential of investigated *Pennisetum glaucum* substrates was 337 - 360 l/kg ODM. *Pennisetum glaucum* contains a lot of nutrients, which make it suitable to be used as an alternative feed for livestock and feedstock for renewable energy production.

Keywords: biochemical composition, biomethane potential, feed value, *Pennisetum glaucum*.

Rezumat. Unele particularităţi biologice şi valoarea economică a speciei *Pennisetum glaucum* în Republica Moldova. Scopul prezentului studiu a constatat în evaluarea unor particularități biologice, calității masei proaspete recoltate și a silozului preparat din specia *Pennisetum glaucum*, plantă erbacee anuală netradițională introdusă și cultivată în câmpul experimental din Grădina Botanică Națională (Institut), Chișinău, Republic of Moldova. S-a stabilit că materia uscată a plantelor recoltate conține 112 g/kg proteină brută (CP), 73 g/kg cenușă, 332 g/kg fibre în detergent acid (ADF), 591 g/kg fibre în detergent neutru (NDF), 43 g/kg lignină sulfurică (ADL); valoarea nutritivă – 65.5 % substanță uscată digestibilă (S.U.D) și 60.6% materie organică digestibilă (M.O.D) cu încărcătură energetitică de 10.19 MJ/kg energie metabolozantă (ME) și 6.27 MJ/kg energienetă lactație (Nel). Silozul obținut se caracterizează printr-o culoare agreabilă și miros plăcut, indici de fermiabilitate pH 4.23, 7.1 g/kg S.U. acid lactic, 7.1 g/kg S.U. acid acetic, conținut de 915 g/kg materie organică, 112 g/kg proteină brută (CP), 337 g/kg fibre în detergent acid (ADF), 595 g/kg fibre în detergent neutru (NDF), 29 g/kg lignină sulfurică (ADL); valoarea nutritivă – 73.6 % substanță uscată digestibilă (S.U.D) și 65.0% materie organică digestibilă (M.O.D) cu încărcătură energetitică de 11.74 MJ/kg energie metabolozantă (ME) și 7.07 MJ/kg energienetă lactație (Nel). Potențialul biochimic de obținere a biometanului a substraturilor investigate de *Pennisetum glaucum* atinge valori de 337-360 l/kg M.O. Plantele de *Pennisetum glaucum* conțin un lot de nutrienți, ceea ce permit folosirea ca furaj alternativ pentru animale și materie primă pentru producere de energie renovabilă.

Cuvinte cheie: compoziția biochimică, potențial de biometan, valoare nutritivă, *Pennisetum glaucum*.

INTRODUCTION

Against the background of climate change, the extension of areas with degraded and salinized soils and the diminution of the water reserves for irrigation make it increasingly difficult to produce sufficient food and fodder, which can lead to significant economic-social problems. It is necessary to identify, mobilize, study and implement new plant species that would ensure the production of the necessary amounts of food and forage under these severe conditions. *Poaceae* is clearly the most abundant and important family, accounting for about 24% of the Earth's vegetation, and its species are the most important source of food. Approximately half of the world's grass species use C_4 pathway of photosynthesis, they are able to more efficiently fix carbon under conditions of drought, high temperatures and limitations of nitrogen or CO2, leading to greater water-use efficiency than the C_3 pathway in arid ecosystems, deserts and areas with saline soils, as they are the most productive and efficient biomass producers under these harsh conditions. Three *Poaceae* crops – maize, sorghum and pearl millet – account for about 95 % of the C_4 cereal production in the world. Millets and sorghum are food and forage grasses known for their greater resistance to drought and their tolerance to soils with low organic matter, as well as for their high nitrogen and water use efficiencies. They have still been the main sources of energy, protein, vitamins and minerals for millions of people in the semi-arid tropics of Asia and Africa for centuries (HARINARAYANA et al., 2005).

Pearl millet, *Pennisetum glaucum* (L.) R. Br. (syn. *P. americanum*, *P. typhoides*, *P. typhoideum*, *P. spicatum*, *Setaria glauca*), has been grown in Africa and the Indian subcontinent since prehistoric times. The centre of diversity and the suggested area of domestication for this crop lie in the Sahel zone of West Africa. Recent archaeobotanical research has confirmed the presence of domesticated pearl millet in the Sahel zone of northern Mali over 4500 years ago (MANNING et al., 2010). Currently, Pearl millet is the 6^{th} cereal grown in the world with over 33 million hectares, accounts for approximately 50 % of the total world production of millets and it is a crop of major importance in arid and semi-arid regions.

Pearl millet or cattail millet is a robust, strongly tillering annual herbaceous grass plant, usually 1-4 m tall, with basal and nodal tillering, producing an extensive and dense root system, which may reach a depth of 1.2-1.6 m, sometimes even of 3.5 m; sometimes the nodes near ground level produce thick, strong prop roots. The stem is slender, 1-3 cm in diameter, solid, often densely villous below the panicle, with prominent nodes. The leaf sheath is open and often hairy; the ligule is short, membranous, with a fringe of hairs; the leaf blade is linear to linear-lanceolate, up to 1.5 m × 5-8 cm, and has margins with small teeth, scaberulous and often pubescent. The inflorescence is cylindrical or ellipsoidal, contracted, with a stiff and compact panicle, suggesting a spike, 15-200 cm long. The spikelet is 3-7 mm long, consisting of 2 glumes and usually 2 florets. The caryopsis globose is subcylindrical or conical, 2.5-6.5 mm long, coloured from white, pearl-coloured or yellow to grey-blueish and brown, occasionally purple; the 1 000-seed weight ranges from 2.5 to 14 g with a mean of 8 g. The size of the pearl millet kernel is about one-third that of sorghum. The relative proportion of germ to endosperm is higher than in sorghum (OYEN & ANDREWS, 1996; MARSALIS et al., 2012).

Pearl millet is well adapted to growing areas characterized by drought, low soil fertility and high temperature. It can be found in regions where annual rainfalls range from 125 to 900 mm, the ideal growth temperature ranges from 21°C to 35°C. Pearl millet is known to tolerate acidic sandy soils and is able to grow on saline soils. It can be grown in areas where other cereal crops, such as maize or wheat, would not survive. HARINARAYANA et al., (2005) reported that pearl millet uses less water per unit of forage production, tolerates both lower and higher soil pH and higher aluminum concentration, and is rich in minerals as compared to sorghum. Pearl millet is a highly prolific species because each plant, depending on variety and environmental conditions, can produce up to six tillers at different stages of development. The multi-cut nature of the crop ensures forage supply over a long period of time (HERNÁNDEZ et al., 2013; SHASHIKALA et al., 2013).

Pearl millet grains have a high potential as food for humans because they are gluten-free, with a higher dietary fibre content than rice, similar in lipid content to maize and with a higher content of essential amino acids (leucine, isoleucine and lysine) than other traditional cereals, such as wheat and rye. In addition, the crop is low cost and less susceptible to contamination by aflatoxins compared to corn, for example. Pearl millet grains can be milled, decorticated, germinated, fermented, cooked and extruded to obtain products such as flours, biscuits, snacks, pasta and non-dairy probiotic beverages. Pearl millet grains also have functional properties; they have a low glycemic index and therefore they can be used as an alternative food for weight control and to reduce the risk of chronic diseases, such as diabetes. It has higher protein and fat content than wheat or rice and its amino acid composition is more appropriate for human nutrition than that of wheat or polished rice. Pearl millet grain contains 13.8 % CP, 2.8 % CF, 17.6 % NDF, 3.42 % ADF, 64.93 % starch, 1.91 % ash, it can completely substitute corn in diets for growing rabbits (CATELAN et al., 2012), and it can be used in ducks, pig and poultry rations without adversely affecting feed efficiency or weight gain (ADEOLA et al., 1996; SINGH & PEREZ-MALDONADO, 2003).

As feedstuff, it is mainly grown to produce hay, silage, green-chop, pasture and standover feed grazed directly. The green mass productivity of pearl millet varies from 20 to 80 t/ha, up to 110 t/ha on irrigated land, the digestible nutrients from green mass reached 70 % crude protein, 60 % crude fats, 66 % crude cellulose and 70 % nitrogen free extract, while from hay – 60 % crude protein, 45 % crude fats, 53 % crude cellulose and 71 % nitrogen free extract (MEDVEDEV & SMETANNIKOVA, 1981). Unlike sorghum, pearl millet does not produce prussic acid or tannins (HARINARAYANA et al., 2005). The aim of this study was to evaluate some biological peculiarities, the quality of green mass and silage from the non-traditional annual grass species *Pennisetum glaucum*, and the possibility of use as feed for ruminant animals and feedstock for the production of biomethane.

MATERIAL AND METHODS

The non-native grass species, pearl millet, *Pennisetum glaucum*, which was cultivated in the experimental plot of the National Botanical Garden (Institute) Chişinău, N 46°58′25.7″ latitude and E 28°52′57.8″ longitude, served as subject of the research, and the fodder crop, sudangrass, *Sorghum sudanense*, was used as control. The seeds of tested species were sown at a spacing of 45 m at a depth of 3 cm.

The green mass of the studied grass was mowed in early flowering stage (early July). The green mass productivity was determined by weighing the yield obtained from a harvested area of 10 m^2. The leaves/stems ratio was determined by separating leaves and panicles from the stem, weighing them separately and establishing the ratios for these quantities, samples of 1.0 kg harvested plants. For chemical analyses, the samples were dried at 65 ± 5°C. The dry matter content was detected by drying samples up to constant weight at 105 °C. For ensiling, the green mass was shredded and compressed in well-sealed containers. After 45 days, the containers were opened, and the organoleptic assessment and biochemical composition of the silage was determined in accordance with the Moldavian standard SM 108*. The silage was prepared and evaluated in accordance with the Moldavian standard SM 108. Some assessments of the main biochemical parameters: crude protein (CP), crude fibre (CF), ash, acid detergent fibre (ADF), neutral detergent fibre (NDF) and 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 of the Research and Development Institute for Grassland Braşov, Romania. The concentration of hemicellulose (HC) and cellulose (Cel), the digestible energy (DE), the metabolizable energy (ME) and the net energy for lactation (NEl) were calculated according to standard procedures.

The biochemical biogas potential (Yb) and methane potential (Ym) were calculated according to the equations of Dandikas et al. (2015), based on the chemical compounds – protein, acid detergent lignin (ADL) and hemicellulose (HC) values:

biogas $Yb=670+0.44PB+0.16HC-3.02ADL$

biometan $Ym=370+0.21PB+0.05HC-1.61ADL$

RESULTS AND DISCUSSIONS

We could mention that, in the conditions available in the Republic of Moldova, the mass emergence of the seedlings of pearl millet occurred in 4-5 days after sowing. For germination, this plant requires more moisture and a higher soil temperature, by 1-2 °C, than corn and sorghum. The pearl millet root system, consisting of seminal or primary roots, adventitious roots and crown or collar roots, can penetrate up to 150 cm in the soil. Lateral roots and adventitious roots start to appear, respectively, 3-4 days after germination on the primary root and 6-7 days after germination in the nodal region at the base of the seedling stem. The third leaf starts to appear 5-7 days after the emergence of coleoptiles. The fifth leaf appears about 13-17 days after emergence. The tiller leaf appears from the base of the main stem on both sides, following the alternate arrangement of leaves. Compared to Sudan grass, pearl millet has the potential to produce many effective tillers that may increase under wide spacing, the colour of the investigated pearl millet plants is deep purple. At the time of the harvest, the *Pennisetum glaucum* plants (145 cm) were shorter than *Sorghum sudanense* plants (212 cm), but the stems were four times thicker and thus had a positive impact on tiller mass. The productivity of *Pennisetum glaucum* reached 3.65 kg/m^2 green mass or 0.86 kg/m^2 dry matter, with 38.1 % leaves, 25.4 % stems and 36.6 % panicles, but the yield of *Sorghum sudanense* was 2.79 kg/m^2 green mass or 0.86 kg/m^2 dry matter, 29.4 % leaves, 65.1 % stems and 5.5 % panicles (Table 1).

Table 1. Some agro-biological peculiarities of the studied *Poaceae* species.

Indices	*Pennisetum glaucum*	*Sorghum sudanense*
Plant height, cm	145	212
Stem thickness, mm	27	7
Fresh leaf mass, g/tiller	64.7	12.5
Dry leaf matter, g/tille	14.6	3.2
Fresh stem, g/tiller	60.2	33.1
Fresh panicle mass, g/tiller	37.4	3.0
Leaves + panicle content, %	74.6	34.5
Fresh mass yield, kg/m^2	3.65	2.79
Dry matter yield, kg/m^2	0.86	0.72

The bio-morphological characteristics of the whole plant have a significant impact on the biochemical composition and feed value of the green mass. It has been found that the dry matter of the harvested *Pennisetum glaucum* plants contained 112 g/kg CP, 73 g/kg ash, 332 g/kg ADF, 591 g/kg NDF, 43 g/kg ADL, 182 g/kg TSS, 259 g/kg HC, 289 g/kg Cel (Table 2). Thus, pearl millet green mass contained a higher amount of crude protein, total soluble sugars and hemicellulose than Sudan grass. The biochemical composition had a positive impact on the digestibility and the energy value of the feed. The natural fodder from pearl millet reached 65.5 % DMD and 60.6 % OMD with 12.42 MJ/kg DE, 10.19 MJ/kg ME and 6.27 MJ/kg NEl, but from *Sorghum sudanense* – 51.7 % DMD and 50.6 % OMD with 10.39 MJ/kg DE, 8.52 MJ/kg ME and 5.28 MJ/kg NEl.

Table 2. Biochemical composition and feed value of the green mass from the studied *Poaceae* species.

Indices	*Pennisetum glaucum*	*Sorghum sudanense*
Crude protein, g/kg DM	112	85
Crude fibre, g/kg DM	327	392
Ash, g/kg DM	73	95
Acid detergent fibre, g/kg DM	332	413
Neutral detergent fibre, g/kg DM	591	656
Acid detergent lignin, g/kg DM	43	41
Total soluble sugars, g/kg DM	182	138
Cellulose, g/kg DM	289	372
Hemicellulose , g/kg DM	259	243
Dry matter digestibility, %	65.5	51.7
Organic matter digestibility, %	60.6	50.6
Digestible energy, MJ/kg DM	12.42	10.39
Metabolizable energy, MJ/kg DM	10.19	8.52
Net energy for lactation, MJ/kg DM	6.27	5.28

Several literature sources describe the productivity and nutritional performance of *Pennisetum glaucum* whole plants. SHETA et al., (2010) mentioned that forage pearl millet contained 8.08-11.95 % CP, 71.38-77.49 % NDF, 40.07-45.45 % ADF; the application of higher amounts of nitrogen increased protein yields, but decreased ADF and NDF contents, while potassium application increased protein yields and decreased NDF contents. According to HEUZE et al. (2015), the average feed value of fresh aerial part was: 19.4 % dry matter, 12.4 % protein, 2.0 % fats, 29.2 % raw cellulose, 64.8 % NDF, 34.5 % ADF, 4.2 % lignin, 2.7 % water-soluble carbohydrates, 12.3 % ash, 5.5 g/kg calcium and 2.8 g/kg phosphorus, 63.8 % DOM, 17.6 MJ/kg gross energy, 10.8 MJ/kg digestible energy and 8.7 MJ/kg metabolizable energy. BABIKER et al., (2015), reported that pearl millet contained 8.8-16.2 % CP, 29.2-43.9 % CF32.8-50.5 % nitrogen free extract, and crude protein yield varied from 560 to 1717 kg/ha. COSTA et al., (2018) found that the chemical-bromatological composition of pearl millet was 314 g/kg DM, 149 g/kg CP, 545 g/kg NDF, 308 g/kg ADF, 48 g/kg EE, 20 g/kg ash, 695 g/kg TDN with 692 g/kg IVDMD. MACHICEK et al., (2019) compared the forage production and the feed quality of green mass from pearl millet and sorghum-Sudan grass and found that pearl millet produced 6.29 - 9.87 t/ha DM with 4.3-5.1 % CP, 58.9-64.5 % NDF, 38.0-39.3 % ADF, 58.6-59.9 % TDN, RFV 85.5-90.8, while sorghum-Sudan grass hybrid 11.05-15.51 t/ha DM with 4.2-4.4 % CP, 58.3-62.0 % NDF, 38.60-39.9 % ADF, 57.9-59.5 % TDN, RFV 88.5-92.5.

Making silage is an important way for farmers to feed cows and sheep during times when pasture isn't good, such as the dry season. Silages supply energy, protein and digestible fibre to ruminant diets and the ensiling process will have substantial effects on the nutritive value of the prepared feed and animal performance. Silage quality is a key to good animal performance, reducing feed costs and increasing profitability during the housing period. Grass silage is the basis of most winter-feeding systems and satisfactory animal performance is largely dependent on the adequate intake of good quality silage. During the sensorial assessment, it was found that, in terms of colour,the silage from pearl millet had specific dark green leaves and red-maroon stems and panicle, with pleasant smell, specific to pickled apples, while the silage made from Sudan grass was homogeneous green-yellow with pleasant smell, specific to pickled vegetables. The pH values of prepared silage depended on the species, *Pennisetum glaucum* silage had higher pH value than *Sorghum sudanense* silage (Table 3). It has been determined that the content of organic acids in the silages prepared from *Poaceae* species varied from 24.5 g/kg in *Pennisetum glaucum* silage to 30.0 g/kg in *Sorghum sudanense* silage. Most organic acids were in fixed form. The butyric acid not was detected in *Pennisetum glaucum* silage, but acetic acid level reached 7.1 g/kg, which was higher in comparison with *Sorghum sudanense* silage.

Table 3. The fermentation quality of the silages from the studied *Poaceae* species.

Indices	*Pennisetum glaucum*	*Sorghum sudanense*
pH index	4.23	3.82
Content of organic acids, g/kg DM	24.5	30.0
Free acetic acid, g/kg DM	3.1	2.3
Free butyric acid, g/kg DM	0.0	0.0
Free lactic acid, g/kg DM	4.8	10.2
Fixed acetic acid, g/kg DM	4.0	2.1
Fixed butyric acid, g/kg DM	0.0	0.2
Fixed lactic acid, g/kg DM	12.9	15.2
Total acetic acid, g/kg DM	7.1	4.4
Total butyric acid, g/kg DM	0.0	0.2
Total lactic acid, g/kg DM	17.7	28.4
Acetic acid, % of organic acid	28.63	14.67
Butyric acid, % of organic acids	0.00	0.66
Lactic acid, % of organic acids	71.37	84.67

The biochemical composition of the silage dry matter was: 57-112 g/kg CP, 85-109 g/kg ash, 322-392 g/kg ADF, 595-652 g/kg NDF, 29-39 g/kg ADL, 108-182 g/kg TSS, 250-258 g/kg HC, 308-363 g/kg Cel (Table 4). It was found that during the process of ensiling, the concentrations of crude protein in *Pennisetum glaucum* silage had not modified in comparison with the green mass, but it had decreased essentially in *Sorghum sudanense* silage. In both silages, the mineral content increased and the lignin content decreased, the digestibility of nutrients was significantly higher. In *Pennisetum glaucum* silage, the amount of crude protein was high and acid detergent lignin – low, the concentrations of energy reached very acceptable values: 11.74 MJ/kg ME and 7.07 MJ/kg NEl compared to *Sorghum sudanense* silage- 9.38 MJ/kg ME and 5.54 MJ/kg NEl.

Some authors mentioned various findings about the silage quality from *Pennisetum glaucum* species. According to HERNÁNDEZ et al., (2013), the chemical composition of the silage depending on the harvest period, the silage made from green mass harvest in flowering period contained 10.26 % CP, 8.68 % DP, 61.87% NDF, 37.12% ADF, 5.24% EE, 13.04% ash, 0.48% calcium, 0.18% phosphorus with 61.9 % DDM, but from green mass harvest in grain formation period - 10.98 % CP, 9.31% DP, 57.80% NDF, 35.05% ADF, 6.01% EE, 12.82 % ash, 0.48% calcium, 0.17% phosphorus with 64.0 % DDM. COSTA et al., (2018) found that the monocropped pearl millet silage was characterized by pH 3.75, 19.5 g/kg DM ammoniacal nitrogen, 22.42 g/L titratable acidity, 31.60 Emg 100 g buffering capacity, 47.3 g/kg DM lactic acid, 6.7 g/kg DM acetic acid, 1.8 g/kg DM propionic acid and 0.1 g g/kg DM butyric acid, 148.1 g/kg CP, 573.2 g/kg NDF, 337.1 g/kg ADF, 47.3 g/kg EE, 16.7 g/kg ash, 689 g/kg TDN with 683.5 g/kg IVDMD. ALIX et al., (2019) compared the forage ensilability of sweet pearl millet, silage corn hybrid and sweet sorghum and remarked that, after 90 ensiling days, the *Pennisetum glaucum* silage had pH 3.8, contained 55-60 g/kg lactic acid, 10-12 g/kg acetic acid, 0.33-0.46 g/kg propionic acid 0.33-0.46 g/kg, the silage corn had pH 3.7-3.8, 34 g/kg lactic acid, 8-12 g/kg acetic acid, 0.07-0.17 g/kg propionic acid, sweet sorghum silage had pH 3.8, 49-73 g/kg lactic acid, 14-17 g/kg acetic acid, 0.17-0.43 g/kg propionic acid and 0.02-0.43 g/kg butyric acid.

Biogas production is one of the sustainable technologies with the considerable benefit of being able to generate useful energy carrier from various raw materials of biomass origin including plants and plant residues. Energy crops can be a suitable feedstock for anaerobic digestion and if ensiled it can be supplied to biogas plants continuously throughout the year.

Table 4. Biochemical composition and feed value of the silages from the studied *Poaceae* species.

Indices	*Pennisetum glaucum*	*Sorghum sudanense*
Crude protein, g/kg DM	112	57
Crude fibre, g/kg DM	322	392
Ash, g/kg DM	85	109
Acid detergent fibre, g/kg DM	337	402
Neutral detergent fibre, g/kg DM	595	652
Acid detergent lignin, g/kg DM	29	39
Total soluble sugars, g/kg DM	182	108
Cellulose, g/kg DM	308	363
Hemicellulose , g/kg DM	258	250
Dry matter digestibility, %	73.6	57.5
Organic matter digestibility, %	65.4	53.8
Digestible energy, MJ/kg DM	14.31	11.43
Metabolizable energy, MJ/kg DM	11.74	9.38
Net energy for lactation, MJ/kg DM	7.07	5.54

The quality of feedstock for biogas production depends on nutrient composition and how accessible it is to enzymes and microbes (VINTILĂ et al., 2012; TRULEA et al., 2013; Dandikas et al., 2015). We found that the substrate of *Pennisetum glaucum* herbage, according to the C/N ratio, which was 29, had an amount of lignin of 43 g/kg and hemicellulose of 259 g/kg, reached a biogas potential of 630 l/kg and biochemical methane potential of 337 l/kg. No essential differences were observed between the *Sorghum sudanense* herbage substrate, in the potential for biogas 622 l/kg and biomethane production 334 l/kg. The obtained data showed that the concentrations of nitrogen, carbohydrates and their compositional content in silage differed significantly, depending on the species. The prepared *Pennisetum glaucum* silage was characterized by the highest concentrations of nitrogen (17.9 g/kg), total soluble sugars (182 g/kg), hemicellulose (258 g/kg) and low concentrations of lignin (29 g/kg), and this fact benefit biogas production potential to 673 l/kg and biomethane potential to 360 l/kg.

CONCLUSIONS

The non-native annual grass species, pearl millet, *Pennisetum glaucum*, was characterized by a high growth rate, the productivity reached 3.65 kg/m^2 green mass or 0.86 kg/m^2 dry matter, with 74.7 % leaves and panicle content, surpassing the productivity of *Sorghum sudanense.*

The dry matter of harvested *Pennisetum glaucum* plants contained 112 g/kg CP, 73 g/kg ash, 332 g/kg ADF, 591 g/kg NDF, 43 g/kg ADL, 182 g/kg TSS, 259 g/kg HC, 289 g/kg Cel, with 12.42 MJ/kg digestible energy, 10.19 MJ/kg metabolizable energy and 6.27 MJ/kg net energy for lactation.

The prepared silage from *Pennisetum glaucum* was characterized by specific colour with pleasant apple smell, pH 4.23, 17.7 g/kg lactic acid, 7.1 g/kg acetic acid, 112 g/kg CP, 337 g/kg ADF, 595 g/kg NDF, 29 g/kg ADL with 11.74 MJ/kg metabolizable energy and 7.07 MJ/kg net energy for lactation.

The biochemical methane potential of *Pennisetum glaucum* substrates were 337 - 360 l/kg ODM.

Pennisetum glaucum contains a lot of nutrients, which make it suitable to be used as an alternative feed for livestock and feedstock for renewable energy production.

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