

INFLUENCE OF ORGANIC AND MINERAL FERTILIZATION ON GRASSLAND OF *Dichanthium ischaemum* L. ROBERTY IN THE MOLDAVIAN STEPPE

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Abstract

Given that in Moldavia and on meadows in Tutova Depression have been little research on grasslands of *Dichanthium ischaemum* L. Roberty (old world bluestem), we started at the RDCSEC Perieni, Vaslui, an experience on the effect of organic and mineral fertilization on yield and quality of forage obtained. It was administered organic fertilizer (well fermented sheep manure) in the fall of 2012, at $10 \text{ t ha}^{-1} \text{ yr}^{-1}$ and $30 \text{ t ha}^{-1} \text{ yr}^{-1}$, and at the beginning of the growing season (April, 2013) were administered $\text{N}_{50}\text{P}_{25} \text{ kg ha}^{-1} \text{ yr}^{-1}$, respectively $\text{N}_{75}\text{P}_{25} \text{ kg ha}^{-1} \text{ yr}^{-1}$. In this paper we show preliminary values in 2013 as part of a medium-term experience (2013-2015). Harvesting took place in earing dominant species. The results showed various possibilities of increasing production grasslands of old world bluestem. In the variants fertilized with sheep manure yields ranged from 1.7 to $2.5 \text{ t ha}^{-1} \text{ DM}$ and 180 - $215 \text{ kg ha}^{-1} \text{ CP}$, while the variants ranged from mineral fertilizers production 1.2 - $1.9 \text{ t ha}^{-1} \text{ DM}$ and 160 - $190 \text{ kg ha}^{-1} \text{ CP}$, and in embodiments with fertilizer production ranged from $0.6 \text{ t ha}^{-1} \text{ DM}$ to $1.05 \text{ t ha}^{-1} \text{ DM}$. The results of the harvesting period bring valuable information on the optimal harvest time. Thus, the variants where harvesting was performed at earing of old world bluestem, yields were close in value of options where harvesting took place at the beginning of flowering. Results not recommend harvesting at full flowering or seed maturity, yields are significantly lower. Crude protein (CP) content decreases with vegetation. The highest content of crude protein was recorded in variants fertilized with sheep manure ($30 \text{ t ha}^{-1} \text{ yr}^{-1}$) and harvested at early flowering earing dominant species. Regarding the content of Ca and P, and the ratio of these preliminary results strengthen the hypothesis that lead to optimal harvest must occur at earing species *Dichanthium ischaemum* L. Roberty to get the highest yield and better quality.

Key words: old world bluestem, organic and mineral fertilisation, yield and quality.

INTRODUCTION

In the past, the study of *Dichanthium ischaemum* L. Roberty grasslands in Romania and elsewhere, there has been a special concern of researchers, so in the literature are few and those of ecological data.

Grasslands of old world bluestem (OWB) is the most common type derived meadows, grazing resulted as a result of abuse, unreasonable and soil erosion (Vintu et al., 2004 Teague et al., 1996). In Asia it is considered an alternative to species *Eragrostis curvula* and *Cynodon dactylon* (Coleman et al., 1998).

In the agro-technical complex measures, mineral and organic fertilization is an important lever to increase production grasslands OWB (Koukourou Z. et al., 2004). Rodica Marinescu, 1969, mention that the amounted effect of the

means of increasing agricultural production, fertilizer intake is about 40%.

Nutritive value of forage is influenced by many factors including soil fertility, growth stage and photosynthetic pathway (Dabo et al., 1987). Investigations by Niemann et al. (2001) and Phillip et al. (2005) suggested that nutritive value of OWB was influenced by species, environmental conditions, management and physiographic location.

Morphological characteristics of forage influence and can help in predicting value (Mitchell et al., 2001). Sanderson et al., 1999, recalling that while *Dichanthium* species have been widely adopted, little information is available regarding their nutritive value and morphological responses to a variety of fertilisation regimes when growth in droughty climatic conditions.

Thus, this study aims to suggest optimal dose of mineral and organic fertilization on the production and quality of grasslands for OWB. Inquiries followed production per unit area, the quality of the obtained feed (CP, Ca, P) as a function of the age of collection and dosage of fertilizing.

MATERIALS AND METHODS

The research was conducted in 2013 at the RDCSEC Perieni, Vaslui county, situated between 46° 18' North latitude and 27° 37' East longitude, with altitudes between 114 and 140m, western exhibition.

The experiment, established in 2012, was bifactorial, arranged in randomized plots in three replicates. The experimental factor had five graduations, represented by the fertilization: V₁ - unfertilized (control), V₂ - 10 t ha⁻¹ annually, well fermented sheep manure, V₃ - 30 t ha⁻¹ annually, well fermented sheep manure, V₄ - N₅₀P₂₅ kg ha⁻¹ annually, V₅ - N₇₅P₂₅ kg ha⁻¹ annually. Fertilization was done with two types of fertilizer: organic represented by well fermented sheep manure (older than two years) and mineral represented by complex fertilizer with nitrogen and phosphorus.

The manure with a content of 0.42% total N, 0.19% P₂O₅ and 0.27% K₂O was manually applied late fall and the mineral fertilizer was administrated very early on spring after local practice.

Yield was determined by weighing the biomass harvested from an area of 12 m². Dry matter (DM) was determined by drying samples at 105°C for 5 hours.

Crude protein content (CP) was determined by the Kjeldahl method using a device Inkjel P and distillation Behrotest WD20, Labor Technik, Germany. The calcium content in the plant was measured by atomic absorption spectrometry (SR ISO 6869/2004) and the phosphorus content of the plant was determined by the spectrophotometric method.

RESULTS AND DISCUSSIONS

Flora and vegetation of the RDCSEC Perieni presents a considerable wealth due landforms, altitude, pedological substrate, and some

climatic factors, which by their uniformity influences on the distribution of species in space and time, bringing together elements of different origin in floristic a frame so small (Dionița et al., 2005; Turenschi E., 1966).

From a climate perspective Perieni RDCSEC territory and its surroundings within the continental climate type with shades of excessively, characterized by very cold winters and hot-dry summers (Figure 1). The essential characteristic of the climate is the small amount of rainfall around 450 mm, below the national average, and the mean annual temperature levels of 11.8°C in 2013.

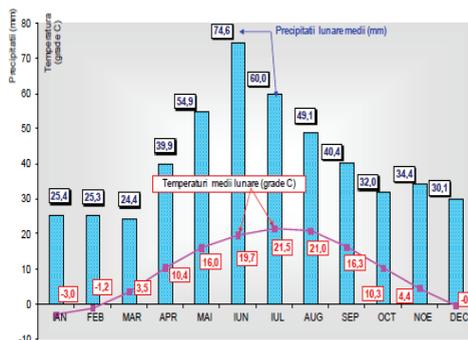


Figure 1. Average monthly precipitation and temperature in 2013 at RDCSEC Perieni

The RDCSEC Perieni are soils with the potential for fertility. These are the preluvisols and alluvisols in class Luvisols, Protisols respectively.

In the territory we investigated a relatively small area found a number of 115 species, of which the structure of phytocoenoses was dominated usually *Dichanthium ischaemum* L. Roberty species. The floristic structure of grasslands is dominated by *Poaceae* species (85%), in which OWB (64%); also present leguminous (4%), and other plants of the botanical families (11%).

Unfertilized pasture production was 1.05 t ha⁻¹ DM (dry matter). Proposed variants of fertilization, the most advantageous variant was 30 t ha⁻¹ sheep manure, where the production was 2.5 t ha⁻¹ very significant compared to the control.

Also, the variants fertilized with 10 t ha⁻¹ sheep manure and N₇₅P₂₅ kg ha⁻¹ annually were very significant relative to controls.

No significant difference production records between the version control and fertilized with N₅₀P₂₅ kg ha⁻¹ (Figure 2).

Regarding the values of CP (crude protein) content it is very significant in all fertilized variants (Figure 2). Values of CP content fertilized variants are included in range 160 - 214 kg ha⁻¹ and the control variant this indicator was 117 kg ha⁻¹. The differences obtained between and organic and mineral fertilized variants, are very significant in terms of content of the feed in CP, Ca and P (Table 1).

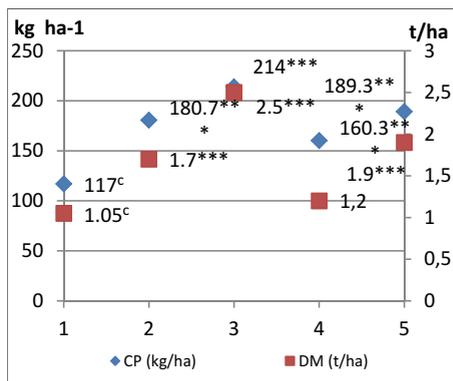


Figure 2. Influence of fertilization on the DM and CP yield

Table 1. Influence of organic and mineral fertilization on some indicators of quality

Experimental variant	Quality indicators						
	Organic fertilisation			Mineral fertilisation			
	CP (kg ha ⁻¹ from DM)	Ca (kg ha ⁻¹ from DM)	P (kg ha ⁻¹ from DM)	CP (kg ha ⁻¹ from DM)	Ca (kg ha ⁻¹ from DM)	P (kg ha ⁻¹ from DM)	
V ₁ (control)	117.0 ^c	4.51 ^c	3.60 ^c	117.0 ^c	4.51 ^c	3.60 ^c	
V ₂	180.7***	9.20***	6.12***				
V ₃	214.0***	15.25***	10.52***				
V ₄				160.3***	6.12***	4.52***	
V ₅				189.3***	11.02***	7.68***	
LSD	5%	1.51	0.11	0.129	7.28	0.23	0.42
	1%	2.54	0.19	0.31	12.04	0.47	0.74
	0.1%	4.78	0.27	0.54	22.41	0.76	1.31

Studies were undertaken in order to recommend the optimal harvest time, resulting in a high yield with superior quality.

Data analysis on the content of CP shows that organic and mineral fertilizer doses correlate

with harvest age, the differences being significant (figure 3). The proposed variants of fertilization is observed that the yields of CP were obtained when the meadow was harvested from earing dominant species.

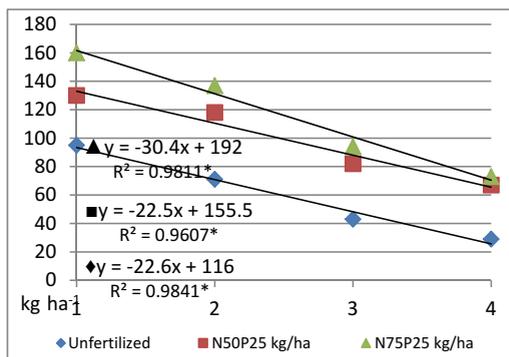
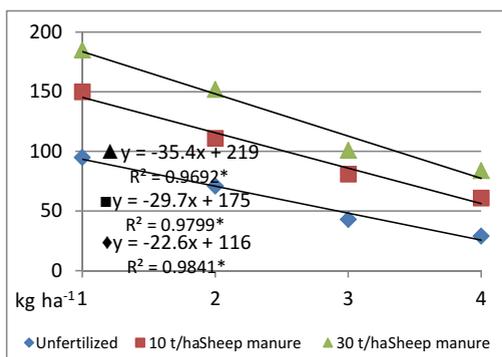


Figure 3. Correlation between applied organic (left) and mineral (right) fertilisation and harvest age regarding the crude protein (CP) content

The same trend is observed in the content of Ca and P. The feed obtained has the highest content in Ca and P when the harvesting has been the dominant species in earing, the trend is to decrease the content of these delay

elements with harvest, even if the doses of fertilizer are increasing, the differences being statistically significant except for the variant fertilized with 10 t ha⁻¹ sheep (Figure 4).

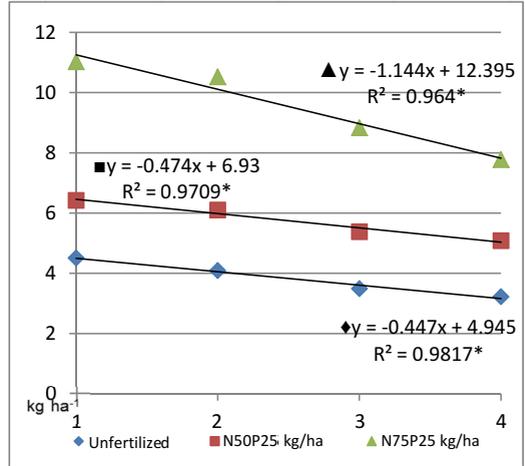
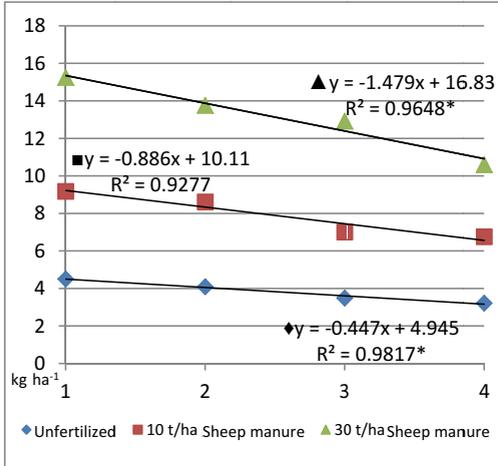


Figure 4. Correlation between applied organic (left) and mineral (right) fertilisation and harvest age regarding the calcium (Ca) content

Distinct differences significant at P content recorded variants fertilized with 30 t ha⁻¹ sheep and fertilization N₅₀P₂₅ kg ha⁻¹ (Figure 5). P content in plants is the largest when the

plants are harvested grasses earing. The evolution towards maturity there of having a distinct significant trend with significant delay harvest.

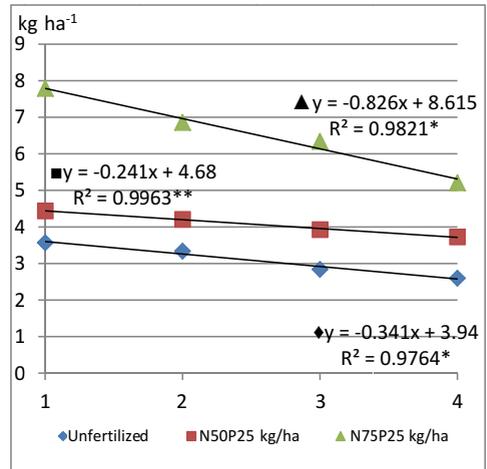
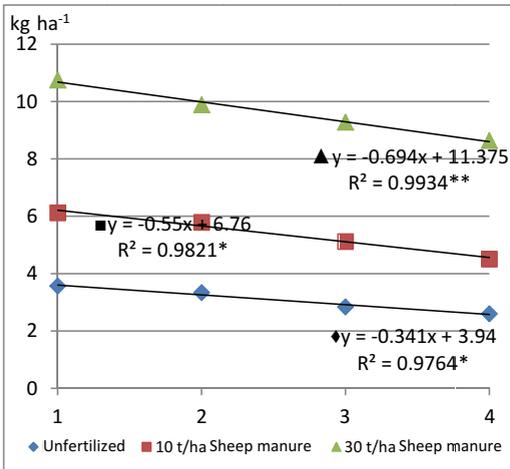


Figure 5. Correlation between applied organic (left) and mineral (right) fertilisation and harvest age regarding the phosphorus (P) content

CONCLUSIONS

The results showed that organic fertilization improved very significantly the production capacity of *Dichanthium ischaemum* L. Roberty meadow from the Moldavian steppe. Regardless of the applied dose, using organic fertilizers on grasslands determines a high-quality forage with a crude protein content and forage value significantly higher compared to unfertilized variant or mineral fertilizers. Following the results obtained from this study we recommend to use sheep manure as a fertilizer in the grasslands of *Dichanthium ischaemum* L. Roberty to obtain high yields and superior forage quality.

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REFERENCES

- Coleman S.W., Forbes T.D.A., 1998. Herbage characteristics and performance of steers grazing old world bluestem. *Journal of Range Management* (51)4, p. 399:407.
- Dabo S.M., Taliaferro C.M., Coleman S.W., Horn F.P., Claypool P.L., 1987. Yield and digestibility of Old World bluestem grasses as affected by cultivar, plant part and maturity. *Journal Range Management*, 40: 10-5.
- Dioniță N., Popescu A., Comănescu Mihaela, Mihăilescu Simona, Biriș I.A., 2005. *Habitatele din România*. Editura Tehnică Silvică, București.
- Koukoura Z., Mamolos A.P., Kalburtji K.L., 2004. Decomposition of dominant plant species litter in a semi-arid grassland. *Applied Soil Ecology*, 23 (1):13-23.
- Marinescu R., 1969. Influența îngrășării pajiștilor cu doze mari de azot asupra compoziției proteinei brute a nutrețului. *Simpozionul Național de Agrochimie – Biochimia Nutriției Minerale*, București.
- Mitchel R., Fritz J., Moore K., Moser L., Vogel K., Redfearn D., Wester D., 2001. Predicting forage quality in switchgrass and big bluestem. *Agronomy Journal*, 93:1073-1077.
- Niemann D., Allen V., Brown C., 2001. Potential of old world bluestems and lovegrass for grazing lambs in the southern High Plains. In *Annual Meeting Abstracts*. ASA, CSSA and SSSA, Madison, WI.
- Phillip D., Allen V.G., Mitchell R.B., Brown C.P., Wester D.B., 2005. Forage nutritive value and morphology of three old world bluestems under a range of irrigation levels. *Crop Sci.* 45:2258-2268.
- Sanderson M.A., Voight P., Jones R.M., 1999. Yield and quality of warm-season grasses in central Texas. *Journal Range Management*, 52:145-150.
- Teague W.R., Dowhower S.L., Pinchak W.E., Tolleson D.R., Hunt L.J., 1998. Increasing utilization efficiency of continuously stocked Old World bluestem pasture. *Journal of Range Management*, Vol. 49(6), p. 535:540.
- Turenschi E., 1966. *Flora și vegetația din Colinele tutovei – Teză de doctorat*, Institutul Agronomic „Ion Ionescu de la Brad”, Iași.
- Vîntu V., Moisuc A., Motcă Gh., Rotar I., 2004. *Cultura pajiștilor și a plantelor furajere*. Ed. Ion Ionescu de la Brad, Iași.