ISSN 1788-5345

ORGANIC FERTILIZER FOR IMPROVEMENT OF FORAGE QUALITY ON PERMANENT GRASSLANDS

MIHAI NOAGHEA, MARIA RAZEC, IOSIF RAZEC

Grassland Research and Development Institute, Brasov, Romania
office@pajisti-grassland.ro

ABSTRACT - Organic fertilizer for improvement of forage quality on permanent grasslands
The paper presents the effect of organic fertilization with different doses of manure 20, 40 and 60 t ha^{-1} for the feed quality of *Agrostis capillaris* type of permanent pasture. There was studied some chemical compositions (crude protein (CP), ash, and the composition of cell walls (ADF and NDF, cellulose, hemicellulose, lignin) in the first harvest cycle of grass on two different stage of maturity during 2 years. The parameters of feed quality have improved by organic fertilizer: In the first year the CP content increased and slightly decreased the cellulose content of grass compare to the untreated control. The amount of cell walls components were relatively high values, 30.0-31.7% and 54.8-58.3% ADF and NDF respectively but less than that of the control. In the second year the cell wall content was decreased: ADF 22.4-26.5% and NDF 48.2-52.1 % respectively. Considerable change of composition of plant species was detected by usage of organic fertilizer. The chemical composition of grass was influenced by botanical structure of vegetation. A good value of feed on the permanent pastures can be achieved by organic fertilization with 40 t ha^{-1} every 3-4 years and the first harvest to be done before full earing of dominant grass species.

Keywords: feed quality, organic constituents, organic fertilization, permanent grassland, cell walls.

ÖSSZEFOGLALÁS - Szervestrágyázás alkalmazása a takarmányminőség javítására állandó legelőn
A dolgozat a takarmány minőség javítása céljából alkalmazott különböző dózisú (20-; 40-; és 60 t.ha-1) szervestrágyázás hatását kívánja bemutatni az Agrostis capillaris vezérnövényű ősgyepen. 2 éves kísérletben vizsgálták az első kaszálásból származó 8-10 cm magas valamint a vezérnövény kalászolásakor betakarított gyeptermés botanikai- és kémiai összetételét. Meghatározták a nyersfehérje és a hamu tartalmat valamint a sejtfal alkotókat (cellulóz, hemicellulóz , lignin, ADF, NDF). Megállapították, hogy a takarmány minőségi paraméterei javultak a szervestrágyázás hatására. Az első évben növekedett a fű nyersfehérje-tartalma és kis mértékben csökkent a cellulóz-tartalma a trágyázatlan kontroll fűterméshez viszonyítva. A sejtfalalkotók mennyisége relative magas: 30,0-31,7% az ADF és 54,8-58,3% az NDF-tartalom, bár ezek az értékek kisebbek a kontrollnál. A második évben a sejtfal-tartalom csökkent: ADF 22.4-26.5% és az NDF 48.2-52.1 % volt. A szervestrágyázás hatására a gyep botanikai összetétele figyelemre méltóan megváltozott., mely a takarmány kémiai összetételét is befolyásolta. A 3-4 évenként 40 tonnás szervestrágyázás alkalmazásával jó minőségű takarmány termeszthető az állandó legelőkön. Az első kaszálást a vezérnövény kalászolása előtt kell elvégezni.

Kulcsszavak: takarmány minőség, szerves alkotórészek, szervestrágyázás, állandó legelő, sejtfal,

INTRODUCTION

To increase animal products is necessary to obtain sufficient and optimum forage quality. This requirement can be achieved by a good management of grasslands. The fertilization and methods of using have a decisive role.
Number of research results have shown the effect of organic fertilization on improvement of the species present in vegetal cover and their quality (FRAME 1992; BAARS 2001; ROTAR et al. 2002; RAZEC 1994; RAZEC et al.2002, 2006; VÎNTU et al. 2008). It is also necessary to pay special attention to protect the grass against soil and water pollutants that can get through fertilization and the maintenance of biodiversity (BAARS 2006; GYÜRE et al. 2006; RAZEC I. and RAZEC M. 2006; VINTU et al.2008). Changing of climatic conditions have also influence for increasing more productive grasslands. New studies and researches are required all of them.

ISSN 1788-5345

The main objective of this study was to analyze the effect of organic fertilization on forage quality in terms of organic constituents. On the assumption that the system of fertilization with organic fertilizers in doses and frequency of application are additional factors that have influence for the yield, botanical composition and evolution of forage quality. Data were compared with those obtained in similar studies.

MATERIAL AND METHODS

The experiment was carried out during 2008-2009 years on a natural grassland dominated of *Agrostis capillaris* species on chernozom soil, a good supply of P_{AL}109 ppm, K_{AL}361 ppm,
N 0.205 % and a pH_{H2O} 6.5.
Three doses of manure 20, 40 and 60 t/ha were applied in autumn after the end of vegetation period. The first harvest was taken at two stages of maturity of dominant species: about 8-10 cm height of plants and in full earing, achieving four and three annually cutting. Harvest height was 5 cm above the ground. After each harvesting the dry matter yield and botanical composition were determined. There was determined cellular constituents (organic), crude protein (CP), ash, cellulose, hemicellulose, lignin and cell walls ADF and NDF on the samples of first harvest .
Qualitative measurements were made with NIRS PERTEN DA 7200 device.

RESULTS AND DISCUSSION

The plants of permanent grassland reflects the soil, climate and the applied management conditions. The most important factors which are influenced the quality of the feed efficiency are fertilization and harvesting regime (JARRIGE 1994). Mean cellular constituents have been influenced by the dose of organic fertilizer applied and the stage of growth. In 2008 year the values of crude protein (CP) content ranged between 15,10 % and 11,88 % (*Table 1*), The highest CP content was in the harvesting stage of apex.8-10 cm height .

Table 1: Chemical composition of forage at first cut 2008, % of dry matter

Doze of manure $t.ha^{-1}$	Stage of harvest	Cell constituents % DM						
		Ash	CP	Cellu-lose	Hemicel-lulose	Lignin	ADF	NDF
20	apex 8-10 cm	7,4	14,2	27	25,3	3,3	30,3	55,6
	full heading	6,8	11,9	28	26,7	3,6	31,7	58,3
40	apex 8-10 cm	7,1	15,1	26,6	24,8	3,4	30,0	54,8
	full heading	6,8	12,2	27,2	25,1	3,6	30,8	55,9
60	apex 8-10 cm	6,9	13,4	27,8	23,5	2,9	30,7	54,2
	full heading	6,3	12,9	28,2	24,6	3,5	31,7	56,3
Nonfertilizer Control plot	apex 8-10 cm	7,1	13,1	29,8	26,8	3,4	33,2	60,0
	full heading	6,8	10,2	29,9	26,6	3,9	33,8	60,4

ISSN 1788-5345

It can be stated that the cutting at full earing stage of maturity caused an increase of crude fiber (CF) content in the plants. The grass originated from the nonfertilizered control plot contained the largest amount of CF compare to the fertilized variants. The highest CF content among the treated samples was recorded by the application dose of 20 t ha^{-1} organic fertilizer, and the smallest by the dose of 40 t ha^{-1}.
Cellulose content was between 26.6 % and 28.2 %. Lignin content was 2.9 - 3.6 % in fertilized variants, which shows a mean digestibility of the feed (RAZEC 1994; CARLIER et al. 1998; ROTAR et al. 2002). Content of ADF and NDF in the cell walls correlates with the content of feed CF. ADF values ranging between 30% and 31.7 % and NDF contents are from 58.3 % to 54.2 %, which are lower compared to the nonfertilized grass.
Organic fertilization causes a slight increase in ash content indicating an improvement in plant nutrition mineral elements.

During 2009 year (*Table 2*) CP content of grass originated from the fertilized plots were higher compared to 2008 year. Ranging between 12.8 % and 14.6 % shows an improvement in plant nutrition for all variants, was found as in the first year. The CP content of the feed are higher in the stage of apex 8-10 cm than in full heading stage of maturity. Analyzing the cellulose and hemicellulose content of feed was found lower values of cellulose from 18.7 to 22.2 % and hemicellulose from 22.3 to 26 % for which leads us to conclude feed digestibility increased by applied organic fertilization.

Table 2: Chemical composition of forage at first cut 2009, % of dry matter

Doze of manure t.ha^{-1}	Stage of harvest	Cell constituents % DM						
		Ash	CP	Cellu-lose	Hemi-cellulose	Lignin	ADF	NDF
20	apex 8-10cm	8,2	14,6	20,4	25,5	3,5	23,9	49,4
	full heading	8,2	12,8	22,2	26,0	3,8	26,1	52,1
40	apex 8-10 cm	9,3	14,6	20,0	24,8	3,8	23,8	48,6
	full heading	8,8	12,9	21,3	25,1	4,3	25,6	50,7
60	apex 8-10 cm	9,0	14,6	18,7	25,8	3,7	22,4	48,2
	full heading	8,9	14,0	22,1	23,3	4,4	26,5	49,8
Nonfertilizer Control plot	apex 8-10 cm	7,5	11,9	25,6	28,1	3,9	29,5	57,6

Regarding the influence of organic fertilizer applied dose is noted that the application of larger quantities (40-60 t/ha^{-1}) biochemical changes in plants occur in a longer period of time. Lignin content of the feed has slightly increased, but close to those obtained in the first year, between 3.5 % and 4.4 %. Content of ADF and NDF cell walls are close to averages in the literature, results of 29 % and 47 % (CARLIER et al. 1998). The highest value being 26.5 % to 57.6 % for ADF and NDF respectively. Ash content also have higher values, between 8.2 and 9.3 %, showing an improvement in plant nutrition.
The evolution of the chemical composition of feed is influenced by botanical structure of vegetation The data presented in *Table 3* shows the prevalence rate of 70-87 % grasses, legumes species are present in a proportion of 3-15 % and 8-24 % among other species. Variability of species of legumes and other species is more being influenced by the fertilization (ROTAR ET AL. 2006). Dominance of grasses can increase the nutritional value of feed conditions and reduce the content of cell walls increased cellular content above 50%, which is 98% digestible according to assessments of VAN SOEST and MOORE (1965).

ISSN 1788-5345

Table 3: The evolution of botanical composition in vegetal cover, 2008 and 2009 years (first cut)

Doze of manure t . ha^{-1}	Stage of harvest	2008			2009		
		Grass %	Legumes %	Other species %	Grass %	Legumes %	Other species %
20	apex 8-10 cm	71	15	14	78	8	14
	full heading	75	10	15	83	5	12
40	apex 8-10 cm	70	11	19	83	9	8
	full heading	78	6	16	85	5	10
60	apex 8-10 cm	78	6	16	81	8	11
	full heading	84	7	9	87	3	10
Nonfertilizer	apex 8-10 cm	65	11	24	70	8	22
Control plot	full heading	72	9	19	77	5	18

CONCLUSIONS

Comparing the relationship between the systems of organic fertilization and the development of the chemical composition of grass in various stages of growth, gives us information for the requirements of grassland management. The evolution of chemical content of the feed must be conducted to reduce the content of cell walls and increased cellular content. This can be achieved by fertilization with organic fertilizer dose of 40 t .ha^{-1} every 3-4 years and the first harvest to be done before full earing of dominant grass species.

REFERENCES

1. BAARS, T. (2001): Effects of animal manure on growth dynamic of grass/clover on sandy soils. Grassland Science in Europe, 6, p. 291-294;
2. CARLIER L., I. PUIA, I. ROTAR, (1998): Pentru producţii mai bune de furaje, Ed. Risoprint, Cluj-Napoca;
3. FRAME, I. (1992): Soil fertility and grass production Nitrogen, in improved Grassland Management. Farming Press Book, p. 101-118;
4. GYÜRE P., JUHÁSZ L., NAGY G. (2006): The role of natural grassland and croplands in the diet of wild geese, EGF Vol 11, Badajos Spain p 445-447;
5. JARRIGE, R., (1994) : Alimentaţia bovinelor şi caprinelor, INRA-Paris, p.309-318;
6. VAN SOEST, P.J., MOORE, L.A. (1965): New chemical methods for analysis of forages for the purpose of predicting nutritive value, Proc. 9-th, Int. Grassland Congress, Sao Paolo, Brazil, p. 783-789;
7. RAZEC, I. (1994) : Cercetări privind producţia, calitatea şi pretabilitatea la realizarea unor amestecuri simple şi complexe de graminee şi leguminoase perene de pajişti, Teză de doctorat;
8. RAZEC, I., RAZEC, MARIA (2006): The potential yield of grass-legume mixtures under different conditions of growth, EGF Vol. 11, Badajos Spain p 411-413;
9. RAZEC, MARIA, RAZEC, I., CHIPER, C., OPREA, G. (2002): Yield and quality improvement by N–use efficiency in grass-clover sward. *Grassland Science in Europe*, 7, p. 154-155;
10. RAZEC MARIA, RAZEC, I., MICU VALUCA (2006): Nitrogen mineral nutrition of Festuca arundinacea in mixture with legumes species, EGF Vol. 11, Badajos Spain p 414-416;

ISSN 1788-5345

11. ROTAR I., N. SIMA, L. CARLIER, MARIANA RUSU, ROXANA VIDICAN, (2002): Calitatea furajului obţinut pe o pajişte de *Festuca rubra- Agrostis capillaris* din munţii Cindrel, Ed. Universităţii Transilania, Braşov p 96-106;
12. ROTAR I., PĂCURAR F., ROXANA VIDICAN (2006): The influence of organic fertilizers on the biodiversity of a *Festuca rubra meadow*, EGF Badajos Spain p 110-112;
13. VÎNTU V., SAMUIL C., IACOB T., POSTOLACHE ST., POPOVICI I. (2008): Influence of fertilization and management on degraded pastures, EGF Vol. 11 Badajos Spain p 86-88.