DEPENDENCE OF THE GREEN MASS PRODUCTION ON THE NITROGEN AMOUNT APPLIED IN A HILL GRASSLAND

Razvan MIHĂILESCU, Alexandru MOISUC, Luminița COJOCARIU

Banat's University of Agricultural Science and Veterinary Medicine Timişoara
Calea Aradului no.119, 300645 Timişoara, Romania
E-mail: mih_razvan@yahoo.com

Abstract: The productive potential of the permanent grasslands varies depending on technological factors, station factors (altitude, supplying status with mineral elements etc.), floristic composition, and management (especially fertilization) (PORQUEDDU et al., 2004). The main goal of this paper is to find the dependence of the green mass production on the nitrogen amount applied in the grassland of Vârciorova and to determine the production increase obtained for 1 kg nitrogen active substance in the studied variants. In order to achieve the established objective, among the experiments with chemical fertilizers studied for five years (2006-2010), we selected only those variants where different amounts of nitrogen were applied (without phosphorous and potassium): V2 ($N_{100}P_0K_0$), V3 ($N_{200}P_0K_0$) and V8 ($N_{100+100}P_0K_0$). The effect of nitrogen is more pronounced after its application for a long time period. Of course, to these findings a multitude of other factors contributes also, for example, the abundant precipitations from this area which favour the nitrogen consume by plants. The achieved results showed that production increase for 1 kg nitrogen active substance is higher at the dose of 100 kg/ha (23,66 kg green mass), than for the dose of 200 kg/ha (16,2 kg green mass, respectively 16,46 kg green mass), when nitrogen is applied for three years consecutively. The same situation persists also when nitrogen is applied five years consecutively, but the increases are larger.

Key words: *green mass production, nitrogen fertilization, increase for 1 kg nitrogen active substance.*

INTRODUCTION

The productive potential of the permanent grasslands varies depending on technological factors, station factors (altitude, supplying status with mineral elements etc.), floristic composition, and management (especially fertilization) (PORQUEDDU et al., 2004).

The dry matter harvested in the natural grasslands differs from one station to another, ranging between 2 - 13 $t.ha^{-1}$ (ELSASSER 2003).

Assigning an agronomic value to each vegetal entity within grassland (genus, species, subspecies) can be relevant for some studies aiming to assess the productive potential of the natural grasslands (ROGERRO et al., 2002).

The most important measure to improve the grasslands is to apply fertilizers. This is more relevant because for one tone of dry matter there are extracted 20-21 kg N, 6-8 kg P_2O_5, 20-21 kg K_2O and 10-14 kg CaO, (MOISUC and DUKIC, 2002; NICZYPORUK A., and H. JANKOWSKA-HUFLEJT, 2003).

Fertilization of the permanent grasslands is made depending on the station conditions, grassland type; use frequency, expected dry matter harvest etc. (CARDAŞOL 1988, NILL 2002).

The response of the grassland types to the mineral fertilization differs (ROTAR 1997). The recommended optimal doses of NPK range between close limits, from one type of grassland to another, as follows: 150 - 200 kg/ha, 50-100 kg/ha P_20_5 and 0 - 50 kg/ha K_20 (CARDAŞOL et al., 1997).

MATERIAL AND METHODS

The experiments have been established in permanent grassland from Vârciorova (Caraş-Severin County).

The Vârciorova village is located in the south-western side of Romaniei, respectively in the eastern side of Banat, at the foot of the Mountains Ţarcu and Muntele Mic, at 18 km distance from Caransebeş city. The territory of the village is delimitated by the northern parallels 45°15' and 45°24', respectively by the eastern meridians 22°15' and 22°30'.

The experiments have been arranged as randomized blocks in four replicates.

The surface of a plot is by 20 m^2 (4m x 5m).

The experimental variants are the following: V1-Control ($N_0P_0K_0$), V2-$N_{100}P_0K_0$, V3-$N_{200}P_0K_0$, V4-$N_{200}P5_0K_0$ - autumn, V5- $N_{200}P_{50}K_0$ - spring, V6-$N_{200}P_{50}K_{50}$ - autumn, V7-$N_{200}P_{50}K_{50}$- spring, V8-$N_{100+100}P_0K_0$, V9-$N_{100+100}P_{50}K_{50,}$ V10-$N_{100+50+50}P_{50}K_{50}$.

At the end of the three years, period during we studied 10 experimental variants, we continued the research in 2009 and 2010 only in few plots. Thus, among the experiments with chemical fertilizers, we selected only those variants where nitrogen was applied (without phosphorous and potassium), respectively the variants: V2 ($N_{100}P_0K_0$), V3 ($N_{200}P_0K_0$) and V8 ($N_{100+100}P_0K_0$) and the studied was continued in 2009 and 2010, to see the effect of different doses of nitrogen in a longer time period. As well, we intended to find the production increase for 1 kg nitrogen active element when this is applied for three years, 2006-2008, and respectively for five years, 2006-2010, consecutively. In the paper there will be shown only the variants with nitrogen fertilization.

The variants have been harvested each year in the second half of June, when the graminaceous were in the ear formation phase (first mowing). The second mowing was performed around 15 August.

To establish the production, the direct method of repeated mowing was used.

The production results were statistically processed. The calculation and interpretation of data achieved through the up mentioned measurements and determinations have been performed using the soft STATISTICA 8.

RESULTS AND DISCUSSION

In the table 1 can be observed that the production increase obtained for 1 kg nitrogen active substance is higher at the dose 100 kg/ha (23,66 kg green mass) than at the dose 200 kg/ha (16,2 kg green mass, respectively 16,46 kg green mass), when the nitrogen is applied for three years, consecutively.

If we consider the five years mean production, the situation is the following: the obtained increase for 1 kg nitrogen active substance at a dose of 100 kg/ha is 33,88 kg green mass, larger than the three years mean; for the dose of 200 kg/ha, the obtained production increase for 1 kg nitrogen active substance is larger than that obtained when nitrogen is gradually applied, by 20,65 kg green mass, comparative with V3 variant where the whole dose is applied at once (17,09 kg green mass).

In conclusion, the highest increase for 1 kg nitrogen active substance is obtained for the dose 100 kg/ha nitrogen.

It can be observed (table 1) that, when 100 kg of nitrogen are applied in spring, a production increase will appear over time (five years average), even the increase is lower comparative to the first years.

If a dose of N_{200} is applied, a production increase occurs, but this is lower than in the dose of 100 kg/ha.

If the dose $N_{100\text{-}100}$ is gradually applied, in two replicates, the production increases more than the whole amount is added at once.

Table 1.

The influence of nitrogen on green mass production (kg·ha^{-1} green mass) in the grassland of Vârciorova

Variant	Mean production 2006 - 2008				Mean production 2006 - 2010			
	Production (kg.ha^{-1})	%	Difference (kg.ha^{-1}) Signification	Increase for 1 kg fertilizer a.s./g.m.	Production (kg.ha^{-1})	%	Difference (kg.ha^{-1}) Signification	Increase for 1 kg fertilizer a.s./g.m.
V1 – N_0	8258	100			8288	100		
V2 – $N_{100}P_0K_0$	10624	129	2366*	23,66	11676	141	3388**	33,88
V3 – $N_{200}P_0K_0$	11498	139	3240***	16.2	11705	141	3417**	17,09
V8 - $N_{100+100}P_0K_0$	11550	140	3292***	16,46	12418	150	4130***	20,65
DL5% = 1870 kg/ha, DL1% = 2545kg/ha, DL0,1% = 3180 kg/ha					DL5% = 2760 kg/ha, DL1% = 3245kg/ha, DL0,1% = 3890			

The effect of nitrogen is more pronounced after its application for a long time period. Of course, to these findings a multitude of other factors contributes also, for example, the abundant precipitations from this area.

Dependence of the green mass production on the nitrogen amount (mean of 2006-2008) can be represented through a linear regression expressed by the first degree function:

y = 8506,66 + 16,2*x (figure 1).

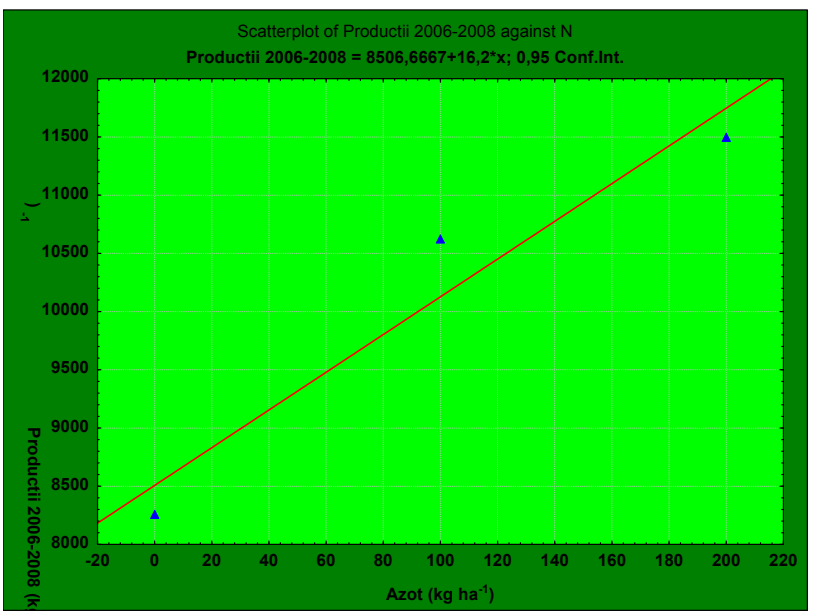

Fig. 1. Dependence of the green mass production on the nitrogen fertilization (2006-2008)

In the figure 1 can be observed that there is a positive correlation (r = 0,9664) between green mass production (mean of 2006-2008) and the applied amount of nitrogen in the grassland of Vârciorova. This fact suggests the idea that the higher is the nitrogen amount, from 100 to 200 kg/ha, the larger is the green mass production.

Dependence of the green mass production on the nitrogen amount (mean of 2006-2010) can be represented through a linear regression expressed by the first degree function:

y = 8847,83 + 17,08*x (figure 2).

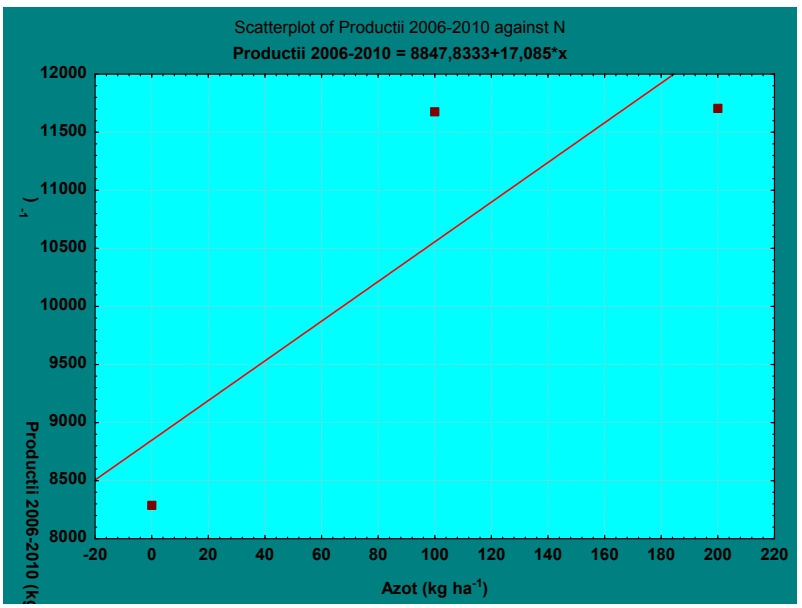

Fig. 2. Dependence of the green mass production on the nitrogen fertilization (2006-2010)

In the case of nitrogen application for five years consecutively, there was found as well a positive correlation (r = 0,8696) between green mass production (mean of 2006-2010) and the applied amount of nitrogen in the grassland of Vârciorova (figure 2).

In this situation, the increase of the nitrogen dose determines as well the increase of the green mass production.

CONCLUSIONS

Analyzing the grassland of Varciorova, Caras-Severin County, we can conclude the followings:

- the production increase obtained for 1 kg nitrogen active substance is higher at the dose of 100 kg/ha (23,66 kg green mass), than at the dose 200 kg/ha (16,2 kg green mass, respectively 16,46 kg green mass), when the nitrogen is applied for three years, consecutively.
- if we consider the five years mean production, the obtained increase for 1 kg nitrogen active substance at a dose of 100 kg/ha is 33,88 kg green mass, larger than the three years mean; for the dose of 200 kg/ha, the obtained production increase for 1 kg nitrogen active substance is larger than that obtained when nitrogen is gradually applied, by 20,65 kg green mass, comparative with V3 variant where the whole dose is applied at once (17,09 kg green mass).

- the positive correlation (r = 0,9664) between green mass production (mean of 2006-2008) and the applied amount of nitrogen in the grassland of Vârciorova suggests the idea that the higher is the nitrogen amount, from 100 to 200 kg/ha, the larger is the green mass production.

BIBLIOGRAPHY

1. CARDAŞOL V., CIUBOTARIU C., POPOVICI D., 1997, Cercetări şi rezultate privind punerea în valoare a pajiştilor permanente din România, Lucrări ştiinţifice SCPCP Măgurele-Braşov, volumul jubiliar 50 ani de cercetare
2. CARDAŞOL V., GH. MOTCĂ, C. BĂRBULESCU, C. PAVEL, N. SIMŢEA, A. IONEL, A. LĂPUŞAN, I. ŢUCRA, N. DRAGOMR, CONSTANTINA CFFLPER, I. CAPSA, STELA CAPSA, I. RAZEC, V. PANAIT, T. IACOB, N. PETCU, FI. DINCĂ, D. ŞTEFAN, 1988, Efectul aplicării îngrăşămintelor chimice asupra producţiei şi calităţii unor pajişti permanente şi temporare din R.S. România, Lucrări ştiinţifice SCPCP Măgurele-Braşov, vol. XIII, pg. 13-48
3. ELSASSER M., 2003, Auswirkung reduzierten Stickstoffdungung auf Ertrăge und die botanische Zusammensetzung von Dauergruland sowie Nährstoffverhältnisse im Boden, www.infodienst-mlr.bwl.de
4. MOISUC AL., I. SAMFIRA, COJOCARIU LUMINIŢA, HORABLAGA M., PLEŞA CLAUDIA, 2000 - Evoluţii ale valorii pastorale şi producţiei în pajiştile din şesul Banatului, Lucrările Sesiunii Anuale de Comunicări Agricultura- o provocare pentru mileniul III
5. MOISUC A., DUKIC D., 2002 Cultura plantelor furajere, Editura Orizonturi Universitare Timişoara, România,pg 50-52, 97-101.
6. NICZYPORUK A., AND H. JANKOWSKA-HUFLEJT, 2003, Evaluation of the influence of long-therm manure and mineral fertilization on the state and productivity of meadows, Grassalnd Science in Europe, vol.8, pg. 548-551
7. PĂCURAR F. AND I. ROTAR, 2004, Maintaining biodiversity and incresing the production of dry matter on mountain meadows, Grassland Science in Europe, vol.9,pg. 216-218
8. PORQUEDDU C, G. PARENTE AND M. ELSASSER, 2004, Potenţial of asslands, Grassalnd Science in Europe, vol.8, pg. 11-20
9. ROGGERO P., BAGGELA S. AND FARTNA R., 2002, Un archivio daţi di specifici per la valutazione integrata del valore pastorale, Revista di Agronomia, nr.36 pg. 149-156
10. SAMFIRA I., MOISUC A., LUMINIŢA COJOCARIU, VERONICA SARATEANU, MIHAELA PĂCURAR, 2003 - Some degradation aspects on the natural meadows in Banta's hill area, Zilele academice timişene, Ediţia a VIII-a, Timişoara, Lucrări ştiinţifice XXXV, p.167-172