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Studies Regarding the Influence of Organic and Mineral Fertilization on the Permanent Grassland from Maramures Depression - Petrova

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Abstract. A lot of studies were carried in Maramures, with a lot of good results but none of them in Petrova. In order to encourage people from there to fertilize the grasslands an experiment was established since May 23, 2010 and it was placed by the randomized blocks method in 3 blocks (rehearsals) with 16 experimental variants. The surface of each plot was 15 m^2. The organic fertilizer is represented by the livestock manure from Petrova farm and the mineral one based on nitrogen and phosphorus was bought from Azomures company. The first and third rehearsal were fined with 6 tons lime per ha, that means 9 kg each plot when the experiment was established. The fertilization was made in the 1st and 2nd of November 2012. Improving grasslands by amending and fertilizing the land both organic and especially mineral has led to significant improvement of yields, these being also influenced by soil conditions, altitude, evolution of climatic elements, type of grassland and NPK doses. The amendments in association with organic and chemical fertilizers improve the chemical values of the soil, leading to favorable changes of the vegetal cover through extending the good forage species value.

Keywords: permanent grassland, fertilization, amendments, nutrients, vegetation improvement

INTRODUCTION

Permanent grasslands were formed and evolved under the influence of abiotic and biotic ecological factors of environment, plus the overwhelming influence of anthropogenic factor. As a result, it is seen a high variability into floristic composition of the vegetation and hence the productivity and quality of forage produced from these categories of agricultural land.

Over the last decades, liberalization and globalization of markets led to major changes in grassland management in many European regions, traditional practices being replaced with more economical production forms. In general, management is intensified on productive permanent grasslands that are easy to manage with machines (MacDonald *et al.*, 2000; Peter *et al.*, 2008; Strijker, 2005).

It appears that in many grassland ecosystems ecological imbalances are taking place with negative impact over environment and over the primary and secondary production. In this case it is considered that grasslands are degraded (Mihai, 2006).

Grassland degradation is determined by the changes taking place in terms of plant life and vegetation structure, and when these changes are accompanied by reduced production or worsening it's quality is considered, from economical point of view, that the grassland degrades (Puia *et al.*, 1984; Samuil, 2009).

Permanent grasslands are an important source to ensure the animals feed, but only if improvement measures are provided, along with a rational use. For a long period of time were not applied even the most basic maintenance measures for grasslands, it was considered that it's possible to get efficient production without technological inputs even if the grazing began very early in spring and continue until quite late in autumn.

Researches carried out on damaged permanent grasslands, located in different ecological conditions have highlighted ways to increase crop yield and quality by applying fertilizing works, amendment, control of worthless or toxic species, removing woody vegetation and debris etc.

Extended on a considerable area, including a wide range of landforms, grasslands from the northern sector of the Eastern Carpathians were the subject of studies and research since the earliest times.

MATERIALS AND METHODS

There were a lot of studies done in Maramures and especially in Maramures Depression over the permanent and temporary grasslands during the 19th and 20th century but not so many in the last period of time.

The environmental conditions from Petrova are very representative for Maramures Depression. Petrova is located on the left bank of Viseu river, at about 12 km away from its confluence with the Tisa river, 100 km away from Baia Mare, city of residence, 35 km from Sighetu Marmatiei, former capital of historical Maramures and 24 km away from the town of Viseu de Sus. Geographically, according to the coordinates established in 1933, Petrova is between 41°53'15" east longitude and 47°49'40" north latitude, at 357.74 m above sea level. The annual average temperature is 8.6°C and the annual average rainfall is 670.3 mm. The coldest month of the year is February when are recorded temperatures of about -4.6°C in Viseul de Sus, -3.8°C in Ocna Sugatag, -4.5°C in Sighetu Marmatiei and somewhere about -10°C in the mountain area. The warmest month is July, the average annual temperature values are 18.8°C in Sighetu Marmatiei, 18.1°C in Ocna Sugatag and Viseu de Sus and 8°C in Rodnei Mountains. The entire surface of the village is 4205 ha and the total agricultural land is 2351 ha.

Tab. 1

The supply of Petrova soil with N.P.K.

Substance	Well supplied		Medium supplied		Low supplied	
	Surface (ha)	Percentage %	Surface (ha)	Percentage %	Surface (ha)	Percentage %
N	0		682	29	1669	71
P	70	3%	353	15	1928	82
K	1081	46%	776	33	494	21

The experiment was established on permanent grassland in environmental conditions from Petrova since May 23, 2010 and it was placed by the randomized blocks method in 3 blocks (rehearsals) with 16 experimental variants. The surface of each plot is 15 m^2. The organic fertilizer is represented by the livestock manure from Petrova farm and the mineral one based on nitrogen and phosphorus was bought from Azomures company. The first and third rehearsal were fined with 6 tons lime per ha, that means 9 kg each plot when the experiment was established. The fertilization was made in the 1st and 2nd of November 2012. The first variant, V1, the witness, having no fertilizer at all, V2, V3, V4 were organic fertilized with manure as it follows: V2 (N_{30}-10 t/ha), V3 (N_{100}-33.3 t/ha), V4 (N_{170}-56.6

t/ha). For V5, V6, V7 is used the organo-mineral fertilization based on N as it follows: V5 (N_{30}-5 t/ha manure and 38.8 kg/ha nitrate), V6 (N_{100}-16.6 t/ha manure and 153.3 kg/ha nitrate), V7 (N_{170}-28.3 t/ha manure and 266.6 kg/ha nitrate). For V8, V9, V10 was used mineral fertilizer based on nitrate: V8 (N_{30}-93.3 kg/ha), V9 (N_{100}-313.3 kg/ha), V10 (N_{170}-533.3 kg/ha). V11, V12, V13 were mineral fertilized based on nitrate and phosphate: V11 ($N_{30}P_{30}$-93.3 kg/ha nitrate and 113.3 kg/ha phosphate), V12 ($N_{100}P_{60}$-313.3 kg/ha nitrate and 226.6 kg/ha phosphate), V13 ($N_{170}P_{100}$-533.3 kg/ha nitrate and 380 kg/ha phosphate). For V14, V15, V16 was used the organo-mineral fertilization based on N and P as it follows: V14 ($N_{30}P_{30}$-5 t/ha manure, 38.8 kg/ha nitrate and 113.3 kg/ha phosphate), V15 ($N_{100}P_{60}$-16.6 t/ha manure, 153.3 kg/ha nitrate and 226.6 kg/ha phosphate), V16 ($N_{170}P_{100}$-28.3 t/ha manure, 266.6 kg/ha nitrate and 380 kg/ha phosphate).

RESULTS AND DISCUSSIONS

Since the earliest researches in this field in Maramures Depression region, it can be said that improving grasslands by amending and fertilizing the land both organic and especially mineral has led to significant improvement of yields, these being also influenced by soil conditions, altitude, the evolution of climatic elements, the type of grassland and NPK doses. The amendments in association with organic and chemical fertilizers improve the chemical values of the soil, leading to favorable changes of the vegetal cover through extending the good forage species value.

Most species of plants with a high economic value are growing and developing normally within the range of 5.5 to 6.5 pH (Mihai, 2006) and the production level significantly decreased on the highly acidic soils with less than 4 pH or alkaline soils with higher than 7.5 pH (Hopkins, 2000; Mihai, 2006).

The most used amendments in practice are: the calcium carbonate or the finely grinded limestone ($CaCO_3$), the quick lime (CaO), the slaked lime [$Ca(OH)_2$], the marl and other secondary products rich in calcium.

The researches taken into Gutai Mountains at the following research points: "Tiganu" by Lapusan (1967), "Izvoarele" by Nistor (1978), "Ocna-Sugatag" by Lapusan and Dragomir (1977) and "Agris" by Caras (1997) allowed some conclusions with practical implications. The administration of amendments positively influenced the production and the quality of the forage at a recommended economic levels of 5 to 10 t of $CaCO_3$ * ha^{-1} every 5 to 6 years.

In the mountains area ("Tiganu", 1100 m), the administration of amendments leads to increases with 220 % higher than the variant with no amendment at the same level of fertilization with NPK.

More recently following the researches in the period of 2006 to 2008, under the same environmental conditions in a nearby region, Cozma (2009) found that amending with gypsum 6 t/ha and coal dust 10 t/ha a *Puccinellia distans* ssp. *limosa* grassland affect the production of the dry matter (DM) and were recorded yields increases from 8 to 20 % higher than the no amendment variants.

In the same period of time and on the same type of grassland, but using gypsum 3 t/ha and 6 t/ha, Toma (2010) recorded production growth from 11 to 21 % higher. Under conditions of irrigation the productions were higher with 0.6 t/ha compared to those without irrigation.

Using nitrogen (N) fertilizer without phosphorus (P) and potassium (K) helps increasing production depending on the dose of N applied and altitude. When small amounts of nitrogen are given, $N_{50\text{-}60}$ the obtained yields exceed with 15 to 50 % the witness production, these generally hovering at 2-5.2 t/ha DM. Fertilizing with $N_{100\text{-}200}$ (moderate

doses) causes doubled production of forage in the high altitude area. At altitudes between 490 m and 940 m (Ocna Sugatag -490 m; Agris -770 m; Izvoarele -940 m) the increases are with 10 to 67 % higher to the control variant. Fertilizing only with N helps to fight against *Nardus stricta* species, but also to increase the soil acidity. On acidic soils from Maramures, having poor nutrient supply, nitrogen single administration is not recommended.

Using the NPK fertilizers. The administration of phosphorus in increased doses from 45-50 kg/ha P_2O_5 up to 90-100 kg/ha P_2O_5 contributes to achieve higher production with 56 to 157 % compared to N single fertilization system.

Organic fertilizers in their capacity of complete fertilizers, exert an improved effect on the physical, chemical and biological soil properties, their use leading to significant production increases. Manure is considered as the most complete and richest in nutrients from all the organic fertilizers known. Thus a ton of manure includes: 6.5 kg nitrogen, 4.2 kg phosphorus, 5.3 kg potassium, 2.8 kg calcium and 280 kg organic matter (Dragomir, 2005).

Besides direct action on plant nutrition from grasslands, manure improves the thermal regime of soil and aeration, increases water holding capacity, intensify the work of soil's microorganisms etc.

CONCLUSION

All over the world the natural resources are limited. It's the same for our country and for this region as well. In order to exist people have to eat. For this to happen it is necessary to produce forage for livestock. Fertilizing the permanent grasslands it's an important aspect in order to increase the production of grass. The studies carried in Maramures proved that fertilizers are useful for increasing the yields so in the next articles we would like to show data and results from our own experimental field and show the benefit of each type of fertilization: organic, mineral and organic-mineral.

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