

## THE INFLUENCE OF ORGANIC AND MINERAL FERTILIZATION ON THE PRODUCTION OF FESTUCA RUPICOLA GRASSLANDS IN THE TRANSYLVIAN PLAIN

Ioan Gaga\*, Ioan Rotar\*, Florin Simion Păcurar\*,  
Ioana Vaida\*,\*\*, Anca Pleșa\*

\*RTK Atlas Survey, 307289, 13, Cebza, Urseni, Romania

\*\*Banat's University of Agricultural Sciences and Veterinary Medicine "King Mihai I of  
Romania" from Timisoara, 300645, 119, Calea Aradului, Timisoara, Romania

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corresponding author: luminitacojocariu@yahoo.com

### Abstract

*It is currently a challenge to find a correct method of grassland management, to ensure the necessary quality of feed, but also to maintain to some extent the cultural heritage. However, grasslands allow the efficient use of fertilizers, either natural (manure) or mineral fertilizers (NPK complex). In this paper we tested the effect of organic and mineral fertilizers, but also combined on a grassland of Festuca rupicola in the Transylvanian Plain. During the experiment, different fertilization variants were tested, having 6 variants in 4 repetitions each. The aim of this study was to identify an optimal dose of fertilizer that brings an increase in yield and an improvement in feed quality, Festuca rupicola grasslands. The application of inputs has brought important changes, registering significant crop increases.*

**Keywords:** semi-natural grasslands, organic and mineral fertilization, Festuca rupicola, grasslands management.

### INTRODUCTION

The Transylvanian Plateau is fragmented by numerous valleys, which generally flow from East to West. Different Eocene and Oligocene bedrock types prevail clays, marls, sands, and sandstones, while reef limestones are rare (Tufescu 1974). The steeper, mostly south-facing flanks of the monoclines, the dominant relief features in the area composed of strata inclined in the same direction, support the majority of the dry grasslands of the region (Kuhn *et al.* 2021)

Today, the landscape is characterised by a mosaic of arable fields, old-fields of different ages,

several hundred-year-old secondary grasslands, ancient dry, steppe-like grasslands, and deciduous forests. Recent palaeoecological studies show that most of the Carpathian Basin was dominated by temperate deciduous wooded steppe (Magyari *et al.* 2010) or extensive, but not fully closed, forest with grassland habitats throughout the Holocene (Feurdean *et al.* 2015). Among biologists, the Transylvanian Depression is famous for its extensive grasslands of various types, most of which have traditionally been used until now, being mowed by hand or grazed extensively. This natural heritage is

now facing changes in use in the form of increased use or complete abandonment, all threatening the rich phytodiversity of these grasslands. In Transylvania there are extensive grassland with high natural value (HNV) whose biodiversity is remarkable even globally. Therefore, the protection of these grasslands must be a national priority. Continental steppe grasslands with collies are included in priority habitat type 62C0 (Ponto-Sarmatic Grasslands) of the European Union Habitats Directive. This interest in conservation has revealed a serious lack of data and information about the current state and successive transformations caused by changes in the use of these steppe meadows in the Transylvanian Plain (Ruprecht, et al. 2009, 2013)

## MATERIAL AND METHOD

In our experience, the aim was to increase the DM harvest by applying organic and mineral fertilizers.

The studies on the influence of organic and mineral fertilizers were performed on an experiment established in 2017 where the effect of organo-mineral fertilizers was studied.

The experiment has 6 experimental variants with 4 repetitions each, where the following fertilization graduates were used (V<sub>1</sub>-natural grasslands (control), V<sub>2</sub>-10 t/ha manure, V<sub>3</sub>-10 t/ha manure + 50N 25P<sub>2</sub>O<sub>5</sub> 25K<sub>2</sub>O, V<sub>4</sub>-50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O, V<sub>5</sub>-100N 50P<sub>2</sub>O<sub>5</sub>

*Festuca rupicola* grasslands are found in the area of pedunculate oak forests in the Transylvanian Plateau in the subzone of the forest and garland forests in the Western Hills up to about 600 m altitude, on slightly to moderately inclined slopes (6-140) on all exposures at higher altitudes, low and only sunny at higher altitudes. The predominant soils are cambic chernozems, gray soils, clay-alluvial browns, rendzines, regosols, erodisols. The vegetation is dominated by many non-valuable, harmful and toxic species (alias, scabies, wormwood, etc.), which greatly diminish the quality of these grasslands. Pastoral value and productivity is low-medium, with a production of 3.5-6 t/ha production and a grazing capacity of 0.4-0.6 LU/ha (Marusca, 2014).

50K<sub>2</sub>O, V<sub>6</sub>-10 t/ha manure + 100N 50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O.

The application of organic fertilizer was done in early spring every year, simultaneously with mineral treatments. When applying the fertilizers, the meteorological conditions and the time intervals recommended in the guide for the correct application of the fertilizers were taken into account.

The experiments were harvested every year when the grasses were in the phenological phase of flowering. The otava harvest was taken only in favorable years. The mowing was done with a rotary mower at a mowing height of

5 cm. The mechanical mowing was chosen instead of the manual mowing, because after the mechanical mowing there is a uniform celery, of 5 cm, while the manual mowing leaves behind a non-uniform celery, the mowing height being of maximum 1 cm.

## RESULTS AND DISCUSSION

The productive potential and quality of the grasslands can be increased by different fertilization regimes and types of fertilizers applied. A typical feature of fertilizers is that they influence (directly and indirectly) plant growth and development (Pozdíšek et. al 2008; Štýbnarová, et. al 2010).

In the first year after the experiments (2018) were installed, organic and mineral fertilizers have a favorable effect on the DM crop, even if the effect is quite modest. difference of 0.3 t/ha SU compared

The floristic studies were carried out with the help of the Braun - Blanquet method, modified after Pacurar and Rotar, 2014. The processing of the data from the surveys and the interpretation of the results were elaborated with the help of the Exel and PC - ORD programs.

to the control. The treatment brings a significant increase V<sub>3</sub>-10 t/ha manure + 50N 25P<sub>2</sub>O<sub>5</sub> 25K<sub>2</sub>O, which determines a harvest of 2.2 t/ha DM. Application of 50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O causes a slight decrease compared to variant 3 (2,0 t/ha DM). Intensification of the system, application of V<sub>5</sub>-100N 50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O, V<sub>6</sub>-10 t/ha manure + 100N 50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O registers an increase in production, namely 2.7 t/ha dry matter, respective 2.6 t/ha dry matter (figure 1).

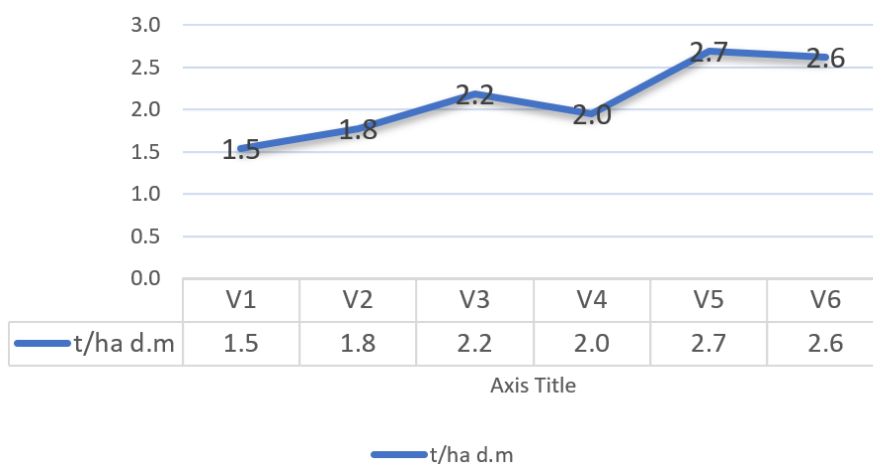


Figure 1. The influence of organic and mineral fertilizers on the dry matter production (2018)

As expected, since the first year (2018), the beneficial effect of organic and mineral fertilizers on the DM production is observed, through the harvest increases made by the treated variants, compared to the control variant. In the second year of experimentation (2019) the highest harvest of DM (4.1 t/ha DM) is achieved by the combined application of mineral and organic

fertilizers in the maximum amount (V<sub>6</sub>-10 t/ha manure + 100N 50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O; figure 2), with an extra production, of 2.4 t/ha SU, compared to the untreated variant (V<sub>1</sub>-control). The minimum increase over the control is recorded at application V<sub>4</sub>-50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O where the difference is only 0.9 t/ha DM (figure 2).

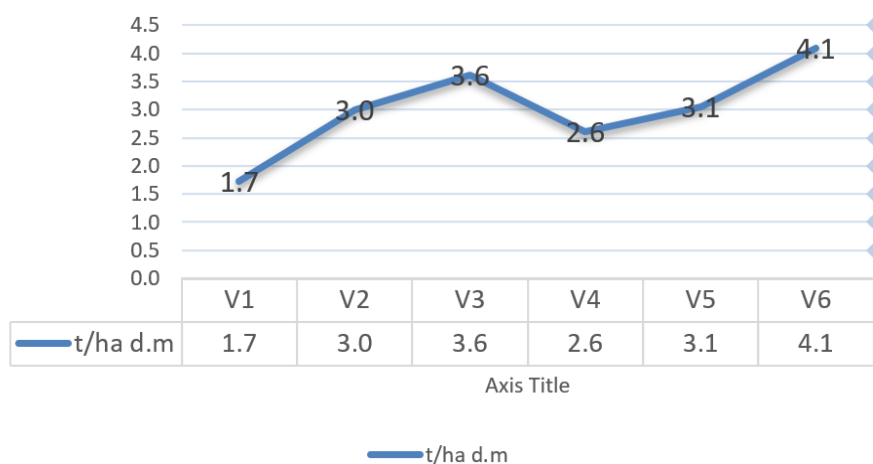


Figure 2. The influence of organic and mineral fertilizers on the dry matter production (2019)

In 2020, all crop increases from fertilized variants bring a significant increase to the control variant (V<sub>1</sub>). Thus we can see in figure 3 that the variants that were fertilized with combined fertilizers

(variant V<sub>3</sub> 10 t/ha manure + 50N 25P<sub>2</sub>O<sub>5</sub> 25K<sub>2</sub>O and V<sub>6</sub>-10 t/ha manure + 100N 50P<sub>2</sub>O<sub>5</sub> 50K<sub>2</sub>O) recorded the highest yield increases compared to the control variant (figure 3).

## CONCLUSIONS

The phytocenoses of Festuca rupicola from the Transylvanian plain are poorly productive, but they react very well to the application of mineral and organic fertilizers.

The combined use of manure and mineral fertilizers, respectively,

leads to significant production increases.

The highest harvest is obtained in 2020 of 4.2 t/ha D.M at v<sub>6</sub>, and the lowest in the first year after its establishment (2018) of 1.8 t/ha D.M.

Organo-mineral fertilization results in a higher yield compared to

the use of only mineral fertilizers.

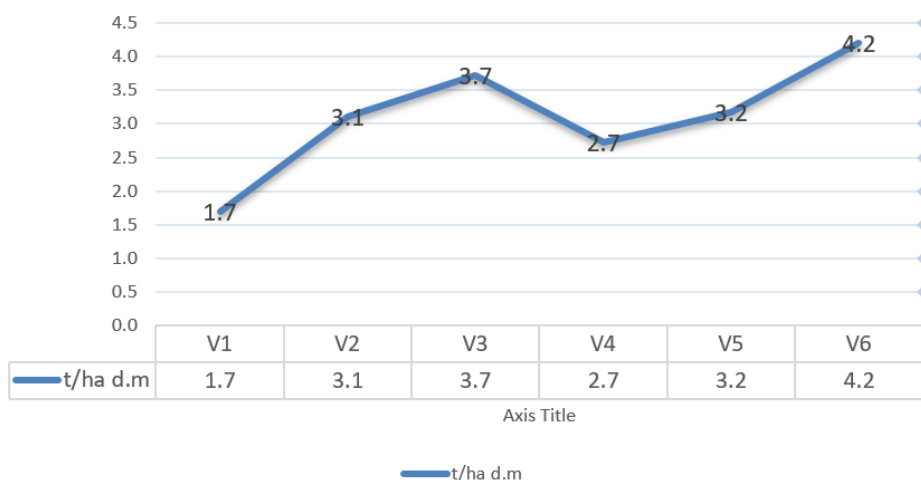


Figure 3. The influence of organic and mineral fertilizers on the dry matter production (2020)

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