The Applicability of Soil’s Fertilizers in Increasing of Production Effects in Lolium Perenne and Lolium Multiflorum Cultivation

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Abstract: The aim of the study was to determine the effect of soil fertilizers, used on the background of NPK fertilization on the productivity of Lolium perenne and Lolium multiflorum in different time of harvest. In 2012-2013 the following species and varieties of forage grasses: Lolium perenne and Lolium multiflorum were cultivated. It was the following experimental subjects: K-control (without fertilization and fertilizer), NPK (N-150 kg ha\(^{-1}\) as 34% ammonium nitrate, P-80 kg P\(_2\)O\(_5\) ha\(^{-1}\), K-120 kg K\(_2\)O ha\(^{-1}\)), UG-UGmax bio-preparation, EU-Eco bio-preparation (fertilizer), HA-Humus Active as bio-preparation.

Key words: Bio-preparations, soil’s medium amendment, yield, grass.

1. Introduction

Preparations as soil conditioners due to humus and microorganisms contribute to the improvement of the biological activity of soil, increasing the binding of free nitrogen from the air, reducing the erosion and loss of nutrients. Fertilizer is also seen as a preparation useful in crop protection, especially in pro-ecological crops. The aim of the study was to determine the effect of three soil fertilizers, used on the background of NPK fertilization on the productivity of Lolium perenne and Lolium multiflorum in different time of harvest.

2. Materials and Methods

On the experimental objects of Grassland Department in 2012-2013 the following species and varieties of forage grasses: Lolium perenne and Lolium multiflorum were cultivated. The following experimental treatments were used:

- K-control (without fertilization and fertilizer);
- NPK-N-150 kg·ha\(^{-1}\) as 34% ammonium nitrate was used in three divided doses, sown under each re-growth. Phosphorus fertilization P-80 kg·ha\(^{-1}\) as 46% superphosphate was sowed once for spring re-growth, K-120 kg K·ha\(^{-1}\) of 60% potassium, was applied for each regrowth, in three equal doses;
- UG-UGmax as biological preparation was used annually for spring re-growth in the shooting phase of the grass, at a dose of 0.9 L·ha\(^{-1}\);
- EU-Eco fertilizer as biological preparation was used annually for spring re-growth in the shooting phase of the grass, at a dose of 5 L·ha\(^{-1}\);
- HA-Humus Active as biological preparation was used annually for spring re-growth in the shooting phase of the grass, at a dose of 50 L·ha\(^{-1}\).

The composition of biological preparations are shown in Table 1. The formulations in the form of a spray were used. All objects were three times out in 2012-2013. An assessment of the level of dry matter yields of plants (t·ha\(^{-1}\)), was done. On this base the yield increase for each object relative to the control fertilizer-K was also calculated. The results were evaluated statistically by performing analysis of
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Variance. Differentiation medium was verified by Tukey’s test at a significance level of *p* ≤ 0.05.

Conditions area of research were typical for IX-eastern district of Polish agro-climatic. Average annual air temperature ranged from 6.7 to 6.9 °C, and in summer the average daily temperature was 15 °C. Annual precipitation were at the level of 550-650 mm and they were not frequent, but heavy. The growing season mostly started in the first decade of April and ending on the third of October, and thus lasted from 200 to 220 days.

3. Results and Discussion

When analyzing the productivity of grass species tested against experimental combinations in different cuts (Table. 2), it was showed that the significantly highest dry matter yield was obtained by cultivation of *Lolium perenne* (6.88 t DM·ha⁻¹) on the objects fertilized with mineral fertilizers and fertilizer UGmax in the third cut (P3, NPK + UG). Yields above 6 t per hectare were also obtained from *Lolium multiflorum* (6.88 t DM·ha⁻¹) supplied with mineral fertilizer with Humus Aktive preparation in the first cut (P1, NPK + HA) as well as in the first cut of *Lolium perenne* (6.40 t DM·ha⁻¹) of the objects without NPK fertilizer but Eco-fertilizer sprayed (P1, EU).

Analysing the yield increase (Figs. 1 and 2) in relation to control (without fertilization object) should be stated that in the case of *Lolium perenne*, intensive productivity of plant biomass occurred in the plots fertilized with NPK and UGmax. Increment of yield exceeded here 6 t DM·ha⁻¹. The lowest increase was achieved using only Eco-fertilizer (0.33 t DM·ha⁻¹).

The highest increase of *Lolium multiflorum* yield (7.54 t DM·ha⁻¹) reached on objects of NPK fertilizer and Humus Active preparation. Large values of this parameter were obtained using only Humus Active (5.54 t DM·ha⁻¹) and in the combination of NPK with UGmax (4.24 t DM·ha⁻¹). The lowest increase of this species was recorded in the plots supplied with Eco-fertilizer (2.53 t DM·ha⁻¹).

Observed positive effect of microbiological preparations on the growth and physiological condition of the plants, especially after the use of preparation spray according to Klama et al. [1] can be explained by microbial cell secretions. The increase in the yield of crops after application of soil fertilizer UGmax during the cultivation also presented Sulewska et al. [2], Sosnowski and Jankowski [3], Kotwicz et al. [4], Sosnowski [5-7], Zarzecka et al. [8], Kołodziejczyk et al. [9] and Zarzecka and Gugała [10].

In the literature, there are also reports in which there was no effect of soil fertilizer on production traits of crops [11].

| Preparation          | Macronutrients (g·kg⁻¹) | Micronutrients (mg·kg⁻¹) |
|----------------------|-------------------------|--------------------------|
|                      | N | P₂O₅ | K₂O | Ca | Mg | Na | Mn | Fe | Zn | Cu |
| UGmax                | 1.2 | 0.5  | 3.5 | -  | 0.1| 0.2| 0.3| -  | -  | -  |
|                      | Organic components      |                          |
| Improve soil preparation containing lactic acid bacteria, photosynthetic bacteria, *Azobacter*, *Pseudomonas*, yeasts and *Actinomyctes* and micro-and macroelements. |
| Eco fertilizer       | 0.6 | 0.6  | 0.8 | -  | -  | -  | -  | -  | -  | -  |
|                      | Organic components      |                          |
| Item breeding earthworms *Eisenia fetida*, improving the soil, it is the extract of vermicompost cattle in the form of a suspension-characterized by the presence and diversity of saprophytic fungi, including mikorytycznych, protect the root system from getting infected soil pathogens. |
| Humus Active Papka   | 0.2 | 3.0  | 5.5 | 3.0| 0.5| -  | 15 | 500| 3  | 1  |
|                      | Organic components      |                          |
| Improve soil preparation, it is composed of 90% organic matter in the form of humus and positive microorganisms (*Azotobakter*, *Nitrosomonas*, photosynthetic bacteria and fungi positive). |
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Table 2  Yield (t DM ha\(^{-1}\)) Lolium perenne and Lolium multiflorum depending on NPK fertilizer and preparation in each cut (average for year).

| Cut | Species | NPK fertilization | Mean |
|-----|---------|-------------------|------|
|     |         | Bez without NPK   | NPK  | Bez NPK NPK |
|     |         | K\(_0\) UG EU HA  | K\(_{SPK}\) UG EU HA |
| P1  | Lp      | 5.08 4.22 6.40 5.18 4.85 5.67 4.10 4.57 5.58 4.43 | 4.95 A |
|     | Aa      | Ab Ab Ab Ab Ab Ab Ab Ab Ab Ab |
|     | Lm      | 2.81 3.61 5.29 5.53 4.59 5.72 4.60 6.83 4.48 4.91 | 4.88 A |
| Mean|         | 3.95 b 3.92 a 5.85 5.30 4.72 5.70 4.35 5.70 5.20 a 4.67 b |
| P2  | Lp      | 1.61 2.89 1.56 2.44 3.53 3.32 3.14 2.98 2.23 3.14 | 2.69 A |
|     | Ab      | Ab Ab Ab Ab Ab Ab Ab Ab Ab |
|     | Lm      | 1.68 1.98 1.33 2.74 3.86 2.85 1.90 3.54 2.15 2.82 | 2.49 A |
| Mean|         | 1.65 b 2.44 a 1.45 2.59 3.70 3.09 2.52 3.20 2.20 b 2.97 a |
| P3  | Lp      | 2.61 4.10 1.67 3.97 3.66 6.88 3.89 3.74 3.78 3.60 | 3.69 A |
|     | Ab      | Ab Ab Ab Ab Ab Ab Ab Ab Ab |
|     | Lm      | 1.47 3.60 1.87 3.22 1.06 1.60 1.28 3.13 2.04 2.52 | 2.28 B |
| Mean|         | 2.04 b 3.85 a 1.77 3.60 2.36 4.24 2.59 5.31 2.91 a 3.53 |

Averages in lines marked with the same lowercase letters are not significantly different.
Average in columns marked with the same capital letters are not significantly different.

Fig. 1  Increase in yield of Lolium perenne in relation to the control in each experimental objects.
Source: own research.

Fig. 2  Increase of Lolium multiflorum yield compared to the control in each experimental objects.
Source: own research.
4. Conclusion

Regardless of the mineral fertilization, the use of soil improvers preparations increased the yield of Lolium perenne and Lolium multiflorum. Regardless of the tested species, on objects without mineral fertilization highest, yields were harvested from plots supplied with UGmax fertilizer and Humus Active. In the case of Lolium perenne best production results were obtained using spray with UGmax preparation. Lolium multiflorum the best yielding actived on objects powered by Active Humus preparation. Analysis of crop regrowth relative to control objects showed that the highest value of this parameter occurred in the cultivation of Lolium perenne on the objects of NPK with UGmax. However, in the case of Lolium multiflorum on the objects of NPK with Humus Active preparation.

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