THE INFLUENCE OF FERTILIZATION ON THE SPECIES COMPOSITION OF SEMI-NATURAL GRASSLANDS

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ABSTRACT

This paper deals with the influence of the level of fertilization on the species composition of semi-natural grasslands. This factor was examined in levels: not fertilized, fertilized PK, fertilized 90N+PK, fertilized 180N+PK. The other examined factor was relation to the intensity of use (duble-cutting, triple-cutting). Monitored factor influencing the primary production was as level of influence as weather conditions too. Evaluate growth is located at experimental habitat near village Kameničky. Evaluated years were: 1993, 1997, 2002, 2007 and 2012. Fertilization was done by mineral fertilizers. Cut was realized for triple-cutting at the beginning of June, September and October. For double-cutting in half of June and October.

The results show that species composition of semi-natural grasslands declined with increasing dose of nitrogen. On the contrary, was growing ($P<0.05$) its yield and quality. This increase was mainly cause by grass species. Aplication of nitrogen fertilizer suppressed ($P<0.05$) herbs, but especially legumes. Aplication of phosphate and potash fertilizers supported the development of legumes. Triple-cutting use had a higher species composition, double-cutting growth had higher ($P<0.05$) yield and quality.

Key words: diversity, nitrogen fertilization, habitat, grass growth

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INTRODUCTION

Semi-natural grasslands form an integral part of the cultural landscape of the Czech Republic. They are highly important culture that provides the production function and important secondary functions in the landscape. Stability of these semi-natural systems must be maintained by human intervention with deposits of energy. Interruption of human activity in grassland leads to degradation of habitats (Fiala J., Gaisler J. 1999). In the natural conditions of the Czech Republic leads to the formation of the forest. Habitat with the way and intensity of use have resulted in diverse species diversity of grassland. Representation of herb species and legumes in the stand decreases with the increasing doses of nitrogen (N), increasing yield and quality of forage. A lower species diversity is not suitable for grasslands with secondary functions. Application of phosphate (P) and potash (K) fertilizers supports the development of legumes. A higher number of cuts in grasslands reduce the yield.

The aim of this thesis is to assess the changes in species diversity of semi-naturals grasslands by influence of weather conditions and anthropogenic intervention in the form of fertilization in different variants.

MATERIALS AND METHODS

The experimental area is located near the village Kameničky in the Pardubice region. Area is at an altitude of 650 m above sea level, with an inclination 3 ° and orientation to the southwest. The average annual air temperature from long-term averages for the period 1951-2000 is 5.8 ° C; average annual rainfall is 758.4 mm. The values of climatic factors have been obtained from hydro-meteorological stations in Svratouch. Experiment was established in 1992.

Area of semi-natural grassland is organized by split parts, with four replications. Size of parts is 4.7 * 10 m, its 47 m^2. These parts are differentiated into plots with an area of 15 m^2 (1.5 * 10 m) with a different intensity of use. Another factor is the intensity of fertilization in versions: not fertilized (control), fertilized with 30 $kg.ha^{-1}$ P-fertilizer and 60 $kg.ha^{-1}$ K-fertilizer, fertilization 90 $kg.ha^{-1}$ N+PK, fertilized with 180 $kg.ha^{-1}$ N+PK. Monitored was the influence of cuts and intensity of fertilization on quantitative and qualitative species composition in selected years. Growth of triple-cutting was monitored in years 1993, 1997, 2002, 2007, 2012. Evaluation of double-cutting was started in 1997. The year 1993 is missing therefore.

Used were only mineral fertilizers. For the delivery of N was used to the ammonium nitrate with limestone. The dose was applied by parts: at spring, after the first cut. At the triple-cutting use was the last dose after the second cut. P and K fertilization were carried out every spring. K was delivered in the form of potassium salt (60 %). P was delivered like as hyperkorn (26 %).

The parts of triple-cutting were cut at the beginning of June, August and October. The parts of double-cutting were harvested in mid-June and early October. Used to do cut was mower MF-70, width of cutter bar 1.2 m, height of stubble 0.07 m.

The evaluated characteristics were proportion of agrobotanical groups and yield of dry forage. Were monitored weather conditions at the habitats in selected years. The effect of them on the primary production of above-ground fytomass. Were processed values of average monthly precipitation and values of average monthly air temperatures in years 1993,1997, 2002, 2007, 2012 (Fig. 1, Fig. 2).

To evaluate the effect of fertilization was used statistical program Statistica 10.0 (effect of fertilization on agro botanical groups and yield of dry forage). Evaluated was by the multi-factor analysis of variation (ANOVA) followed by Tukey test.

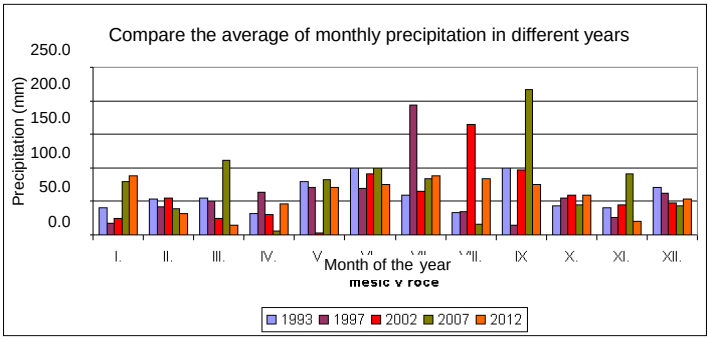

Fig. 1 Compared of average monthly precipitation in years 1993, 1997, 2002, 2007, 2012

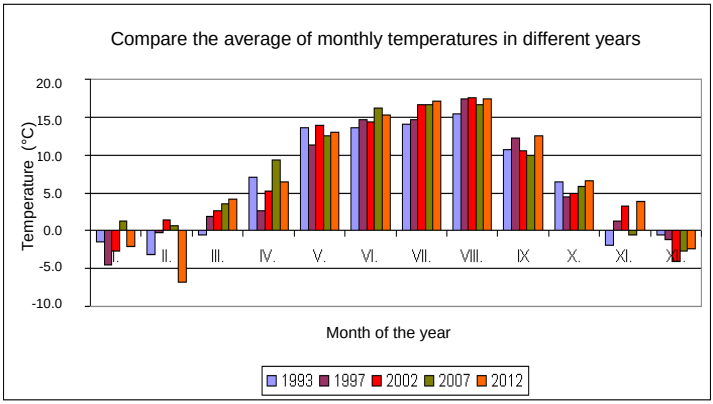

Fig. 2 Compared of average monthly air temperatures in years 1993, 1997, 2002, 2007, 2012

RESULTS AND DISCUSSION

In the evaluation agro botanical groups it was found that share of grasses was lower ($P < 0.05$) at not fertilized growth (37.1 %). Fertilization significantly ($P < 0.05$) increased the share of grasses at the expense of herbs (Fig. 3). Representation of legumes in the growth was supported ($P < 0.05$) by the application of K and P fertilizers (10.9 %). According to Hrabě and Buchgraber (2004) low-dose PK-fertilization reduces the representation of grasses and herbs, on the contrary, supports the representation of legumes. This presumption, however, don't meet the grass, which was a higher proportion in the variant fertilized with PK (39.1 %) compared to the variant not fertilized (37.1 %). This conclusion may cause because of symbiosis *Rhizobium* with legumes. In case of higher proportion of legumes (PK fertilization) could be enough accessible nitrogen in the soil, which then promote the development of grasses. Fertilizing PK could also leveled phosphorus deficiency in soil, which is at fertilized variants. Phosphorus is limiting nutrient for growth of cultural grass species.

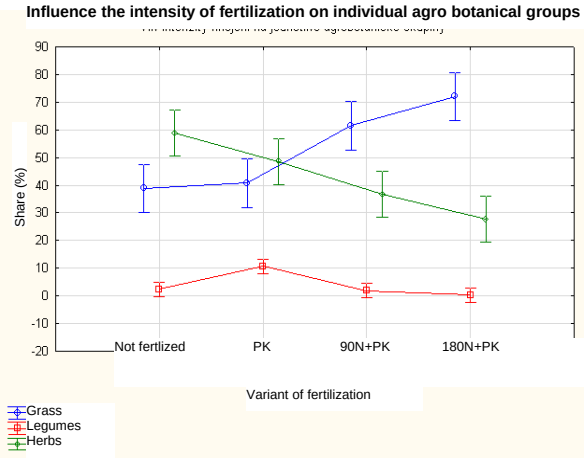

Fig. 3 Effect of fertilization intensity to a share in agrobotanical groups

The effect of recent years was (P <0.05) at legumes (Pic. 4). Highest representation (P<0.05) of legumes was in 2012 (6.9 %), while the lowest (P<0.05) ten years before, in 2002 (0.5 %), (Fig. 4). That year in the month of May, was decline in rainfall, which could cause the low proportion of legumes. Other cause could be Allelopatic relationships. The main species which representing the legumes is *Trifolium repens* L. This species is having a high annual frequency of occurrence. This is usually caused by sunlight spectrum and Allelopatic relationships affecting tolerance of legumes in years after another. In 2002 could legumes suppress themselves. As a result of absence of this group could lead to their reintroduction in the following years.

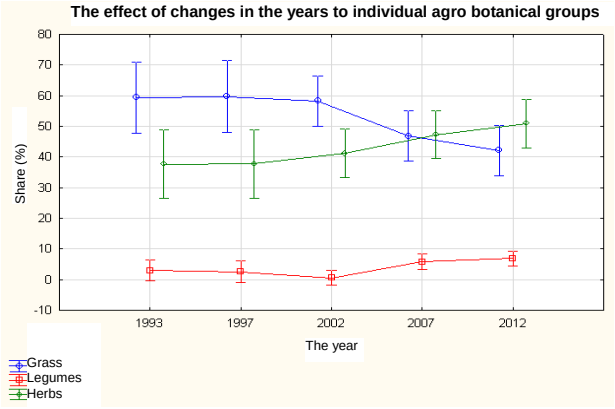

Fig. 4 The effect of changes in the years to various agrobotanical groups

Effect of fertilization on yield of dry forage was statistically highly significant (P <0.01); (Tab. 5). Although Hrabě and Buchgraber (2004) reported that PK fertilization does not increase forage

yield. Evaluated results represent the opposite of this statement. It is important to realize that the experimental station is a lack of available phosphorus. In this case is the phosphorus the limiting nutrient for plant growth. After his addition to the soil (at PK variants) was compared his lack and plants respond by increasing production. This increase in production could be supported by the development of legumes at variants with PK (see above). Double-cutting growth had higher yields than triple-cutting.

Tab. 5 Effect of fertilization on dry forage yield at different using

Year	Yield (t.ha^{-1})	
	Double-cutting	Triple-cutting
Not fertilized	3.3^{b}	2.6^{c}
PK	5.0^{a}	3.9^{a}
90N+PK	5.0^{a}	4.1^{a,b}
180N+PK	5.7^{c}	4.5^{b}

Effect of monitored years at the dry forage yields was statistically highly significant (P <0.01); (Tab. 6). The yields of triple-cutting growth show a high lability. As reported by Rychnovská *et al.* (1985), production fluctuates according to the year and the proportion of species in biomass.

Tab. 6 The influence of the year at yields dry forage at different using

Year	Yield (t.ha^{-1})	
	Double-cutting	Triple-cutting
1993	x	3.7^{a}
1997	5.2^{a}	4.5^{b}
2002	5.3^{a}	3.6^{a}
2007	5.0^{a}	4.8^{b}
2012	3.4^{b}	2.9^{c}

CONCLUSION

Higher species diversity was supported by PK fertilization. Nitrogen fertilization support the representation of grasses and reduced proportion of legumes and herbs. Development of legumes was supported applications of phosphate and potash fertilizers. Purposed care of semi-natural grasslands at mezo hygrophite habitats with lack of accessible phosphorus is a combination of PK fertilization and triple-cutting use. Dry forage yields increase with the dose of nutrients. Triple-cutting habitats had lower yields than double-cutting.

The results support the generally known relationship that the higher humidity of habitat, higher doses of nutrients and higher frequency of cutting semi-natural grasslands declines species diversity.

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