

Summary of doctoral dissertation

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Effect of fertilization and irrigation on the content of nitrogen, phosphorus and potassium in the soil and sward after dry meadow liming and renovation

Abstract

The research was conducted in 2009-2014 (in two stages) and established on long-term experiment on a permanent, dry meadow in Falenty.

The aim of research was the evaluation of the influence of irrigation and fertilization on yielding and botanical composition of meadow sward, nitrogen, phosphorus and potassium content in herbage and in soil before and after renovation preceded by liming. Five levels of mineral fertilization were applied: N-60, N-120, N-180, N-180bis (without phosphorus fertilization), N-240 and two levels of natural- mineral: G1 (at N-180 level) and G2 (at N-240 level) applied with liquid manure that covered the needs of potassium. The nitrogen and phosphorus were supplemented to given dose. On every fertilization object the research was carried out in conditions of temporary deficit of water in the soil (without irrigation) and in conditions of irrigation on level of 55-100% of water capacity.

Every year the soil reaction and the content of mineral forms of nitrogen and phosphorus in fresh soil were determined. Before starting and after each stage of the research the contents of assimilable forms of phosphorous and nitrogen in the soil were determined. The yields of meadow sward and the content of nitrogen, phosphorus and potassium in herbage were determined annually in every cut. In autumn, 2001 the liming (the dose: 1.44 t CaO·ha⁻¹ and 0.4 t MgO·ha⁻¹) was done and the selective herbicide (Starane 250 EC at the dose 1.5 l·ha⁻¹) to eliminate dicotyledonous weeds was applied.

In the first stage, the influence of fertilization and irrigation due to the progressive drop of soil reactions was limited. Low soil pH significantly altered the absorption of nutrients from the soil and contributed to continuous degradation of meadow sward, which resulted in the meadow productivity and quality. The irrigation caused slight yields growth, and mainly the increase in phosphorus content and decrease in nitrogen content. Valuable grass species, recommended for cut utilization, were substituted by less valuable grass species

and persistent weeds causing the decrease in yielding regardless of the fertilization. In 2011, on the objects with higher levels of fertilization a dynamic growth of weeds took place what indicated the necessity of overseeding.

In spring of 2012, in the second stage of the research, the renovation using the method of overseeding by streaked aggregate harrowing the turf was conducted. A mixture of grasses and legume plants seeds was used in an amount of 25 kg·ha⁻¹.

The liming together with renovation caused the acceleration of growth in soil reaction at all examined objects. It was accompanied by the decrease in the content of mineral forms of nitrogen N-NO₃ and N-NH₄, and phosphorus P-PO₄. The content of assimilable phosphorus in the soil increased at the irrigated objects and potassium decreased, regardless of irrigation and fertilization. The irrigation resulted in the decrease of the assimilable forms of phosphorus and potassium in the soil at all objects, independently of fertilization level.

In the following years of the second stage, the dynamic growth of fodder types of grasses (mainly high species), introduced by overseeding, that significantly improved the yielding. The most expansionist species was tall oat grass (*Arrhenatherum elatius* (L.) P. Beauv. ex J. & C. Presl). The share of legume plants was slight, even at the N-60 object which had the lowest level of nitrogen fertilization. Herbs and weeds were at the desired level below 10%.

The results of irrigations were significantly bigger yields of biomass and more effective use of fertilizer. The influence of irrigation on average content of nitrogen and potassium in herbage at both stages of the research was negative and phosphorus - positive.

The amount of phosphorus in herbage at most objects and during both stages of the research was located at the top of the range for meadow fodder, with the exception of herbage from N-180bis object where it was in its optimal range. Potassium content, oscillating on the border of insufficient level, was lower during the second stage of research.

That method of renovation with simultaneous liming of meadow turned out to be the preferred treatment due to the improvement of highly negative balances of nutrients at most objects - both irrigated and not irrigated.