

Abstract of Doctoral Thesis

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„Changes of the mineral nitrogen content in grassland soils
depending on air temperature and precipitation”

Air temperature and precipitation (rainfall) are the most important climatic factors controlling nitrogen (N) cycle in soil environment. Their changes, in the context of global warming, affect the processes of mineralization of organic matter contained in the soil, N microbial transformation and its displacement in the soil profile. As should be expected, these changes will particularly impact the N cycle in organic matter rich soils, including grassland soils.

The aim of the doctoral thesis was to determine the relationship between air temperature and amount of precipitation and the amount of mineral forms of N (nitrate nitrogen N-NO₃ and ammonium nitrogen N-NH₄) in grassland soils in Poland, in terms of water quality protection, based on data from ten-year period 2008-2017.

The research hypothesis was that air temperature and precipitation are factors affecting the quantitative state of mineral forms of N in grassland soils and this impact is additionally associated with the type of soil. It is assumed that the air temperature and the sum of precipitation are positively and negatively correlated with N-NO₃ and N-NH₄ content in soil, respectively.

The analysis of study subject was based on the results of monitoring studies of permanent grassland soils in Poland in years 2008-2017 in the scope of mineral N (N-min) content, carried out by the National Chemical-Agricultural Station (KSchR) and subordinated regional stations with the participation of the Institute of Technology and Life Sciences in Falenty (ITP), and meteorological data covering monthly means of air temperature and total monthly precipitation from the period 2007-2017 collected by the Institute of Meteorology and Water Management (IMGW-PIB). In the work 322 monitoring points of permanent grassland soils were selected, including 256 and 66 points representing mineral and organic soils, respectively, in which N-min content testing has been conducted continuously since 2008. The average values of N-NO₃, N-NH₄ and N-min content as well as N-min resources were calculated and compiled in a system referring to the spring and autumn dates of soil sampling, soil layers: 0-30 cm, 30-60 cm, 60-90 cm and years of research from 2008 to 2017. For selected soil monitoring points, in the gridding process of modified Shepard's method (spatial interpolation), meteorological conditions prevailing in the summer (May-October) and winter (November-April) half-years of the examined decade were determined. The obtained test results were developed statistically – descriptive statistics, linear and multiple regression analysis were prepared and primarily correlations between N-min content and

resources in soils, including N-NO₃ and N-NH₄, and air temperature and precipitation were determined.

Based on the analysis of the research results, it was found that in the years 2008-2017 in Poland there were simultaneous growing trends of average half-year air temperature values and average N-NO₃ and N-NH₄ content in grassland soils. Studies have shown that during the decade considered the air temperature and precipitation had a high or moderate impact on the change in quantitative state of mineral forms of N in the top layer of the soil profile – there were positive correlations between meteorological factors and the amount of N-NO₃ in grassland soils as well as negative correlations in case of N-NH₄, but only in selected soil types and at a strictly defined soil depth-profile.