THE INFLUENCE OF CLIMATE CHANGE ON MINERAL NITROGEN IN ORGANIC SOILS

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The productivity and competitiveness of agricultural production are highly dependent on the climate, which is changing faster than predicted. The challenges of adapting the agricultural sector to climate change include not only the growth of crop products, but also the conservation of soil and water resources [1]. Climate change in Lithuania in 2017 occurred with 1.5-1.9 times higher precipitation amount compared to perennial precipitation amount. The opposite result was in 2018 as the air temperature was 2^0C higher than perennial air temperature and natural drought was recorded. Therefore, in order to predict the impact of the changing climate on agriculture and environment, the 2016, 2017 and 2018 climate conditions allowed to design two different scenarios and assess their impact on organic soils. This is very important because organic soils are rich in organic carbon (SOC) and organic nitrogen (SON) [2]. As a result, climate change can affect not only CO_2 emission from organic soils, but also increase N_{min} (ammonium and nitrate nitrogen) amount [3].

To achieve the goal, 9 sites were selected in different places in Lithuania (3 locations: Vepriai - $54^0$02'59N,$61^0$26'36E; Perloja - $52^0$81'88N,$60^0$10'19E; Piktupėnai - $37^0$13'74N,$61^0$14'42). In each location, three platforms with a maximum of 10x10 meters were selected according to the exact GPS coordinates. Soil samples were taken from them, one soil sample from the probe was taken from 4 - 6 places.

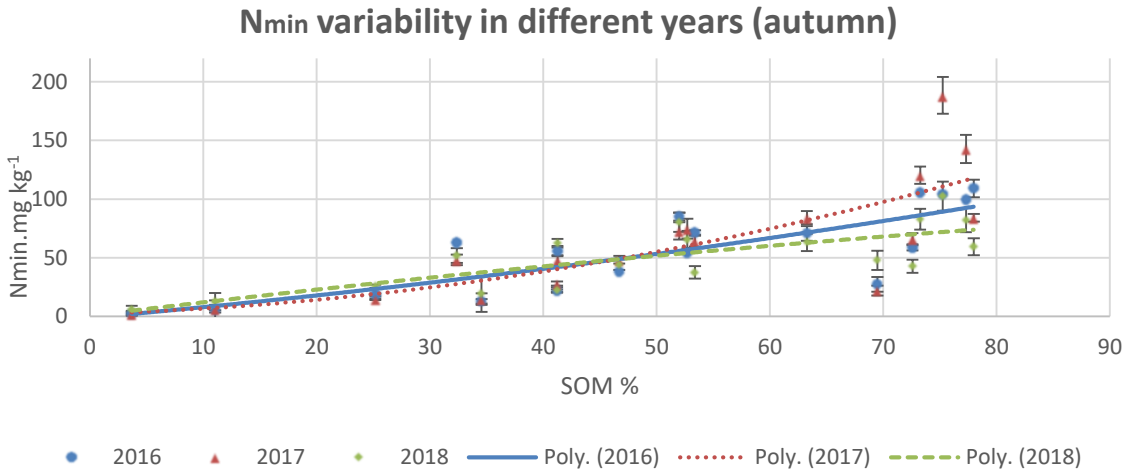

Fig. 1. N_{min} dependency on SOM in different years (2016, 2017, 2018).

The assessment of the study results showed not only relationship between SOM and N_{min} but also N_{min} dependence on different climate conditions. These results showed that although in 2017 fixed N_{min} amount was the lowest - 2.6 ± 0.9 at ≥ 40% SOC compared to other years, but at 60-80% SOM N_{min} amount was the highest - 153 ± 18.3, and this was influenced by precipitation. The 2017 reliability curve is y = 0.0045x2 + 0.8651x - 1.309 for the R^2 = 0.649 reliability score. Conversely, high air temperatures were recorded in 2018 and low precipitation resulted in a higher N_{min} amount - 4.2 ± 1.5 at ≥ 40% SOM but at 60-80% SOM N_{min} amount was the lowest - 84 ± 14.6. The reliability curve is y = - 0.0029x2 + 1.1699x + 0.4988 for R^2 = 0.5883 reliability score. In 2016 N_{min} amount was 3.2 ± 0.7 at ≥ 40% SOM, and at 60-80% SOM N_{min} amount was 97.2 ± 12.9.

Therefore, when predicting N_{min} change scenario in organic soils, the research results can provide that if the climate change increases precipitation but the air temperature will not increase, then N_{min} amount will increase when SOM is 60-80%, the opposite result will be at high air temperatures with low precipitation amount.

[1] Karofeld, E., Jarašius, L., Priede, A., Sendžikaitė, J. On the after-use and restoration of abandoned extracted peatlands in the Baltic countries. Restoration Ecology. 25 (2): 293-300. (2017).
[2] Miguel S., Castillo., Alan L., Soil phosphorus pools for Histosols under sugarcane and pasture in the Everglades, USA Geoderma 145 130–135 (2008)
[3] Steffens M., Kohlpaintner M., Buddenbaum H. Fine spatial resolution mapping of soil organic matter quality in a Histosol profile Soil Science 827-839 (2014)