

## **Crops nutrition management as measures for climate change adaptation**

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The main feature of climate change in most countries worldwide is the increasing frequency of extreme weather events such as unpredictable floods, droughts and another abiotic stress for crops. It is not surprising that most countries are interested in technologies for adapting agriculture to climate change, and Ukraine is no exception. But traditional measures which exist in the world practice do not sufficiently take into account the importance of interactions between soil and plants. For example, from 138 projects of the European Climate Adaption Platform only 16 are correlated with the soil, but only one of them investigates the interaction in "soil-plant" system. In this connection, the main aim of our research was to determine the effectiveness of agrochemical techniques in plant nutrition management for crops adaptation to extreme weather fluctuations.

The influence of different agrochemical measures in "soil-plant" system on the resilience of crops to different climate conditions of the growing season were investigated in a long-term field experiment that was started in 1969. The experiment was on a Chernozem at the Grakivske Experimental Station in Kharkiv region, Ukraine. Soil samples were taken during the growing season from field under different crops. Soil and plant samples analyses included macro- and micronutrients content, soil moisture.

Research in the field experiment has demonstrated a close correlation between the average annual rainfall and content of available forms of macronutrients in the soil (especially for nitrate nitrogen the correlation coefficient was 0.98). Studies have shown that increasing the annual rainfall by 100 mm increases the content of nitrate nitrogen in the soil at 7 mg per kg. Another correlation has shown that the decrease amount of precipitation reduces the range of the N:P and consequently the availability of these elements to crops. Thus, in drought conditions, efficiency of the use of available nutrients by crops depends on the soil moisture and water use efficiency depends on the presence of the necessary nutrients for the crop.

In our investigation, the following agrochemical crop nutrition management measures were used. Creating a high phosphate level of the soil contributes to the preservation of soil moisture reserves by 4% higher than in other agricultural background; optimizing the use of water by plants (the use of water per 1 ton of dry matter is reduced by 20-25%); improving the use of nitrogen from the soil to 18-30%. Implementation of integrated fertilizer system as an application macronutrients, micronutrients, biological preparations and humates in the critical phases of plant growth provides a 60% yield increase in extreme weather conditions. The formation of two strips of mineral fertilizers application at different depth contributes to improvement the use of nutrients by plants and to the increase of crop yields by 43% in drought conditions.

Optimization of forms and kinds of fertilizer placement in the soil system and feeding time in the critical phases of plant growth, formation of agrochemical background significantly increase the stability of crop yields in different years by the hydrothermal conditions and increase their resistance to stress.