

Summary

The concept of the doctoral thesis is based on the assumption that the introduction of sulfur (S) into maize production technology significantly increases the productivity of nitrogen (N) in the soil/plant system, and thus the grain yield. The research hypothesis sounds: „the sulfur fertilization system significantly affects N management in the pre- and post-flowering period of maize growth”. Thus, it affects the formation of grain yield structure components and, consequently, the yield.

Validation of the hypothesis was carried out in two independent experiments, differing only in water conditions: (I) natural – rainfed and (II) natural + irrigated conditions. Experimental factors: (1) three S fertilization systems (68 kg S ha^{-1}): a. NPK, b. NPK-S0 (elemental sulfur), c. NPK-CaS (calcium sulfate); (2) six N rates: 0, 40, 80, 120, 160 and 200 kg N ha^{-1} . The biometric and chemical measurements (plant and soil) were carried out in three stages of maize growth: BBCH 14; BBCH 61; BBCH 89.

Maximum grain yields for non-irrigated maize reached 8.0 on NPK; 8.1 on NPK-S0; 8.0 t ha^{-1} on NPK-CaS for N rates of 136, 200 and 126 kg N ha^{-1} . For irrigated maize, the values were as 10.5 ; 10.0 and 10.1 for 154; 123 and 119 kg N ha^{-1} , respectively. Yield prediction based on the nutrient content in the indicative plant's part was the most reliable (highest R^2) proved to be for the shoot at BBCH 61. The yield on the non-irrigated object was limited by manganese (actually) potassium and on the irrigated object were N and copper.

The pre-flowering phases from BBCH 14 to BBCH 61 were critical for the formation of the yield structure. During this period, a significant decrease in the mass of N_{min} in the soil was recorded, being clearly greater on the irrigated object. The net N_{min} release from the soil was both higher for irrigated maize and showed increase in response to the sulfur fertilization system (+32% and 45%, for NPK-S0 and NPK-CaS, respectively). The higher grain yields of irrigated maize, which yield structure was formed before flowering, resulted from an increase in grain density per unit area and to a lesser extent from an increase in the 1,000 kernels weight. Grain yield of rainfed maize, which structure was formed after flowering, depended significantly on the 1,000 kernels weight.

Key words: Grain yield, yield components, nutrient content, mineral nitrogen, pre- and postflowering nitrogen canopy balance.

