



MODELLING OF ADAPTATION PROCESSES OF CROPS TO WATER AND NITROGEN STRESS

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In the early 1980-es the author published interpretations of his observations on special adaptation processes of crops. Those days it was not yet timely to include these details into a crop model. The knowledge has grown about the systems of crops and their environment, now it is appropriate to build these into systems models. From practical reasons 4M system model was chosen for this work. 4M has been developed at RISSAC, Budapest, Hungary based on CERES model and the advices of J.T. Ritchie. It includes the work of several Hungarian scientists. The newly modelled processes were as follows: (1) nitrate and ammonium concentration of soil solution in soil layers influenced by water transport processes and nitrogen transformation and transport processes, (2) root growth and distribution by the influence of available soil water and soil nitrogen, (3) changed transpiration rate influenced by radical change of availability of nitrogen. (4) changed distribution rate and redistribution of dry matter and nutrients in plants influenced by water and nitrogen stress. These processes have different consequences in the plant production depending on the phenological stage when the stress occurs. There are weather situations under the climate of the Carpathian base under which these the summer stress reactions can cause tons of losses in biomass and yield despite of abundant supply of fertilizers in spring. The phenomena can be characterised as spoiled maize stand interrupted by a heavy rainy period with strong nitrate leaching. In the dry period after the rainy period nitrogen shortage intensifies transpiration then the lack of water supply makes the plant to grow the roots fast in the deeper horizons. That leads to redistribution of biomass, loss of above ground DM, and deficiency of nutrients in the plant. In flowering stage it may lead to poor fertilization and smaller grain numbers consequently lower yield potential.