Geophysical Research Abstracts,
Vol. 11, EGU2009-4112-1, 2009
EGU General Assembly 2009

Changes of water demand - possible adaptation of agricultural crops and management options to improve water use efficiency in the Marchfeld area

S. Thaler (1), J. Eitzinger (1), M. Dubrovsky (2), and M. Trnka (3)

(1) Institute of Meteorology, University of Natural Resources and Applied Life Sciences, Vienna, Austria (Sabina.Thaler@boku.ac.at / +43 1 47654 - 5610), (2) Institute of Atmospheric Physics, Czech Academy of Sciences, Prague, Czech Republic, (3) Institute of Agrosystems and Bioclimatology, Mendel University of Agriculture and Forestry Brno, Brno, Czech Republic

The main objective of this study was to determine the vulnerability of current agricultural cropping systems in the Marchfeld region to climate change.
The investigation area Marchfeld is located in the north-eastern (NE) part of Austria and is characterized by a semi-arid climate with low annual rainfall. It is one of the driest regions in the country, but also one of the main field crop production areas. The soil conditions in Marchfeld demonstrate a significant spatial variability, which include soils with low to moderate water-storage capacities.
Higher temperatures in the next decades imply higher evaporation and consequently higher water demand for the crops. The phenological development rates of the cultivars will accelerate and an increase of heat stress as well as drought stress can be expected. These points influence intense the water balance and subsequently the yield of the crops in the investigation area.
In order to improve water use efficiency under those changing conditions, a shift of average sowing dates and an adjustment of tillage were analyzed.
The DSSAT cropping system model was applied for winter wheat and spring barley to assess potential yield under climate scenarios for NE Austria. The scenarios were carried out with ECHAM5, HadCM3 and NCAR PCM global circulation models (GCMs) for present conditions (reference period 1961-1990) and 2035ś (2021-2050), based on SRES-A1B emission scenarios. Yield model simulations were done for all defined scenarios (climate, management, crop) and different soil classes. The simulations contain the CO2 fertilizing effect, rain fed farming, adapted sowing date and contemporary crops without consideration of potential profit cuts caused by pest or diseases.
Simulation results indicate that climate change will force a delay of the sowing date for winter wheat of maximal 14 days in October. In case of spring barley, climate change allows an earlier sowing date in spring (up to 14 days). Both crops show a decrease of potential yield, where spring barley demonstrates higher yield damage. Mainly NCAR PCM presents a slightly increase of winter wheat yield on medium soils. At the same time the interannual yield variability of both crops increased for all soils, leading to a higher economic risk for farmers.
A replacement of ploughing by minimum tillage and direct drilling would lead to a lower decrease of mean yield for winter wheat (up to 5% in comparison with ploughed soil) and spring barley (up to 6% in comparison with ploughed soil) in 2035. This effect is mainly a result of an increase of plant available field capacity, a better water supply for the crops as well as a decrease of unproductive water losses.