Simulation of flowering and maturity time of winter wheat in years 1961-2000 in the Czech Republic

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The effectiveness of many agronomic measures depends on proper timing in respect to development of a crop. For example, the application of growth regulators and fertilizers may affect differentially yield-determining or quality traits depending on the stage of development. The effect of the measures is affected by actual environmental conditions, especially occurrence of water or temperature stresses. Year-to-year variability of crop development is for various reasons of interest to farmers, food industry and market. As there is often lack of reliable data on crop phenology and environmental conditions, crop models may help to predict development or to analyse backward the reasons of fluctuating effects of agrochemicals on yield and quality. Also, long-term shift of crop development due to climatic change is important for breeding, plant protection and long-view planning. In the contribution we simulated the date of flowering (Fl) and maturity (Ma) of winter wheat in years 1961-2000 at thirteen sites in the Czech Republic with crop model WOFOST (Diepen et al. 1989). The sites represent all main agricultural regions of the country; the range of altitude: 184-695 m a.s.l.; year average temperature and sum of precipitation: 6,7-9,4°C and 470-1017 mm; year sum of effective temperatures (SET) above zero degrees: 2773-3628°C. The model was calibrated with data from years 1995-2000 for medium early and late cultivars. RMSE of Fl and Ma dates were 1,6 and 2,0 days, MAE (mean absolute error) 1,4 and 1,8 days for two slightly different combinations of input SET (from emergence to anthesis and to maturity) and photoperiod. Fl and Ma in years 1961-2000 were simulated with three dates of sowing and the two combinations of SET and photoperiod representing two "cultivars". Transpiration and evaporation from sowing to maturity, with the same initial available soil water content were simulated as well. The results showed decreasing trend in the date of Fl and Ma at all sites, i.e. the length of wheat growth shortened in the course of years. Different date of sowing and "cultivars" produced similar results. On average of sowing terms the trend in Fl ranged between -0,07 and -0,32 day/year, in Ma it was -0,04 and -0,32 day/year in the experimental sites. The trend of Ma time was dependent on site conditions, with increasing altitude the (absolute value of) trend decreased (correlation coefficient r = 0,76 or 0,88). Climatic characteristics of the sites dependent on altitude showed similar relationship. The trend of time of Fl showed some relation to latitude of the sites (r=-0,44 and -0,42). When the experimental period was divided to two sub-periods, the years 1961-1980 produced significant positive trends of Fl days (the length increased) and negative ones

of Ma while the second sub-period gave quite opposite trends. There was a negative trend in the amount of precipitation during growth period in the most sites (up to 2,9 mm/year); the trend of transpiration and evaporation was different in sites. The trends of rain and transpiration were significantly dependent on altitude of sites. References Diepen C.A. van, Wolf J., Keulen van J., Rappoldt C. (1989): WOFOST: A simulation model of crop production. Soil Use and Management 5: 16-24.

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