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Effect of agricultural drought on wheat yields in two selected districts located in the Czech Republic

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Except for some areas located in Southern Moravia, the Czech Republic is not usually considered as an agricultural drought vulnerable area. This contribution presents an analysis of drought spells influence on wheat yields in two districts (located in the inner part of Bohemia) where a significant relation between yields and drought was found. Due to high spatial variability of drought, relatively small scale of district was selected.

For the influence of drought on yields assessment, the following five indexes were tested: 1) Palmer Z-index, 2) precipitation-temperature ratio (P-T index), 3) precipitation-evapotranspiration ratio (P-E index), 4) soil storage calculated using hydrological balance model BILAN, and 5) available soil water for plants calculated using another simple balance model. For analysis of drought spells and yield relationship, different aggregation periods of input parameters were used for calculations of these indexes.

According to observed data analysis, yields of wheat and the tested drought indexes are significantly correlated ($p \leq 0.05$) in districts Louny and Rakovník. The highest correlations were found for monthly sums of P-T and P-E indexes in May in periods 1970-1980 and 1996 -2006. For these indexes, two-week step data aggregation led to lower correlation than monthly aggregation step. Two-week aggregations show also high values of correlation. Simply P-E and P-T indexes exhibit higher correlations with yields than other tested indexes. More complicated Palmer Z-index, soil storage or available soil water for plant need more input parameters for calculations and these indexes contain higher uncertainty in calculations. Despite the above findings, all tested indexes (usually calculated for May aggregations) showed high correlations with wheat yields.

The P-E and P-T indexes in monthly step seem to be appropriate for the prediction of the potentially reduced wheat yields in tested districts. Maximum year-on-year decrease in wheat yield (probably caused primarily by drought in May) was approx. 1000 kg.ha^{-1} (decrease of 26 %) in Rakovník district (year 1976); and approx. 1300 kg.ha^{-1}(decrease of 36 %), resp. 1550 kg.ha^{-1}(39 %) in Louny district in 1976, resp. 1998.

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