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Modelling the effect of atmospheric origin black carbon on some members of radiation and water budgets in maize

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Field trial was conducted at Keszthely to study the atmospheric origin black carbon (BC) on some properties of maize during the seasons of 2011 and 2012. Maize hybrid of Sperlona served as test plant. Low doses of 3 g m-2 BC were applied in weekly intervals using a motorized sprayer. Half of the treatments were placed into compensation evapotranspirometers. The change in radiation properties of the canopy (net radiation, sensible and latent heat) was also determined. The heat and water budgets were connected by applying the Bowen ratio. Meteorological data were obtained from the local climate station of QLC-50. The most important crop characteristics, phenology, weekly LAI, and plant height were measured. In the end of the season the final dry matter production of maize was also defined.

There was no significant impact of BC on either the length of different phenological phases or duration of the growing seasons. Surprisingly, the size of assimilatory surface of polluted maize increased in both years. The cumulative evapotranspiration of polluted crops increased with a few per cent in the wet summer of 2010. The water loss of dry and warm 2011 was three times higher (12%) than in the previous crop year. The surplus energy coming from albedo and net radiation change increased the energy retention - canopy surface temperature included - of polluted maize. This might lead to more intense transpiration of contaminated crops. Statistically proved dry matter production decline was only observed in rainfed canopy. The grain yield loss of these plots was two times higher (close to 20%) during the arid weather of 2011 than in 2010, when the season was specifically wet. The yield decrease was much less in evapotranspirometers.
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