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Effects of airborne black carbon pollution on maize

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The black carbon (BC) changes the radiation balance of the Earth and contributes to global warming. The airborne BC deposited on the surface of plant, changing the radiation balance, water balance and the total dry matter (TDM) content of plant. The objective of our study was to investigate the impact of soot originated from motor vehicle exhaust on maize. The field experiment was carried out in Keszthely Agrometeorological Research Station (Hungary) in three consecutive years (2010, 2011, 2012) of growing season.
The test plant was the maize hybrid Sperlona (FAO 340) with short growing season. The BC was chemically "pure", which means that it is free any contaminants (e.g. heavy metals). The BC was coming from the Hankook Tyre Company (Dunaújváros, Hungary), where used that for improve the wear resistance of tires. We used a motorised sprayer of SP 415 type to spray the BC onto the leaf surface. The leaf area index (LAI) was measured each week on the same 12 sample maize in each treatment using an LI 3000A automatic planimeter (LI-COR, Lincoln, NE). Albedo was measured by pyranometers of the CMA-11 type (Kipp & Zonen, Vaisala), what we placed the middle of the plot of 0.3 ha. The effects of BC were studied under two different water supplies: evapotranspirometers of Thornthwaite type were used for "ad libitum" treatment and rainfed treatment in field plots.
In 2010 and 2012, a big difference was not observed in the case of LAI in the effects of BC. However, in 2011 there was a significant difference. The LAI of the BC polluted maize was higher (10-15%, $P<0.05$), than the LAI of the control maize in the rainfed plot and in the ET chambers, respectively. The albedo of the BC contaminated maize decreased (15-30%, $P<0.05$) in all three years.
We also detected that the green plant surface of maize increased on BC contaminated treatment. These results may suggest that the plant is able to absorb the additional carbon source through the leaves. The albedo decreased because of the dark color of soot, so more energy left in the plant stand. Irrigation could be the solution against the harmful effects of soot.

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