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Impact of very low crop residuescover on wind erosion in the Sahel

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Abstract

In the cultivated Sahel, with average annual precipitation of the order of 500mm yr-1, wind erosion occurs mainly on cultivated millet fields whose surfaces are only partially covered by crop residues. The role of these residues on wind erosion was not clearly established. The objective of this study is thus to quantify the actual amount of crop residues in traditional Sahelian fields and to quantify their impacts on wind erosion by reference to a bare surface throughout the seasonal cycle over several years.
By the beginning of the year during dry season, Sahelian farmers use to “clean” their fields, i.e. cut and lay flat on the soil surface any millet stalks still standing and yearly sprouts of shrubs. After this clearing, the crop residues cover (CRC) regularly decreases passing from 12% to less than 2% four months later. On traditional cultivated plot, crop residues efficiently prevent soil losses by wind erosion during the dry season and considerably reduce erosion fluxes at the beginning of the rainy season. However, for CRC lower than 2%, wind velocities were sufficient to produce important erosion even during dry season. A minimal cover rate of about 2 % (100 Kg.ha-1) thus appears as critical to reduce wind erosion. This reduction is driven by the higher aerodynamic roughness length which increases the wind erosion threshold velocity. If field clearing is made in January, as currently done, the CRC just after clearing should be about 800 Kg.ha-1 to maintain CRC above 2% at beginning of the rainy season when wind velocities are the highest and wind erosion the most intense. As a result, soil losses by wind erosion on bare surface are currently more than 4 times higher than on traditional cultivated plot for the whole experiment period.
Our results also demonstrate that during the second part of rainy season wind erosion is dramatically reduced on the two studied plots, not due to vegetation development but rather to a decrease in the number and the intensity of high winds events. This work shows the importance of monitoring wind erosion during the entire seasonal cycle and not just during the most intense erosion period.