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Set-up and calibration of an outdoor nozzle-type rainfall simulator for soil erosion studies at the Masse experimental station (central Italy)

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This contribution describes the technical characteristics and the preliminary calibration of a rainfall simulator recently installed by the Department of Agricultural, Food and Environmental Sciences (Perugia University) at the Masse experimental station located 20 km south of Perugia, in the region of Umbria (central Italy). The site includes some USLE plots of different length λ = 11 and 22 m and width w = 2, 4 and 8 m, oriented parallel to a 16 % slope and kept free of vegetation by frequent ploughing. Since 2008, the station enabled to collect data from more than 80 erosive events, that were mainly used to investigate the relationship between rainfall characteristics and soil loss. The relevant soil loss variability that characterizes erosive storm events with similar overall characteristics (duration and/or depth) can be explained by the different rainfall profile of erosive storms and by the different antecedent soil aggregate stability. To analyse in more detail these aspects, recently, the Masse experimental station has been equipped with a semi-portable rainfall simulator placed over two micro-plots of 1x1 m each, having the same topographic and pedologic conditions of the adjacent USLE plots. The rainfall simulator consists of four full-cone spray nozzles for each micro-plot, placed at the angles of a 0.18-m square, centred over the plot at a height of 2.7 m above the ground. The operating pressure is regulated by pressure regulating valves and checked by pressure gauges mounted in correspondence of each nozzle. An electronic control unit regulates the start and stop of the inlet solenoid valves. A range of rainfall intensities can be achieved, by activating different combinations of nozzles (15 different intensities) also during the same simulation trial.
The particular design of the plots allows to collect separately the runoff volume deriving from the plots and the water volume fallen outside of the plot. In this way it is possible to derive, by difference, the actual infiltration volume.
The experiments are carried out simultaneously on the two adjacent micro-plots. In particular, this contribution reports the results of the first experimental trials aimed to assess the uniformity attainable by single nozzles and its reproducibility (between plots and in time). The interferences between adjacent nozzles (when they work simultaneously) were also evaluated.