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Splash erosion experiments with silt loam and loamy sand soil under simulated rainfall produced by two types of rainfall simulators

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Soil erosion by water is globally the main soil degradation process which leaves serious consequences on agricultural land and water aquifers. Splash erosion is the initial stage of soil erosion by water, resulting from the destructive force of rain drops acting on soil surface aggregates. Splash erosion studies conducted in laboratories use rainfall simulators. They produce artificial rainfall which can vary according to type of the rainfall simulator. In this study the aim was to quantify the differences in splash erosion rates affected by rainfall produced by two different rainfall simulators on two silt loam and one loamy sand soil. Splash erosion was measured using modified Morgan splash cups and the rainfall simulators were equipped with four VeeJet or one FullJet nozzle. The soil samples placed under simulated rainfall were exposed to intensity range from 28 to 54 mm h^{-1} and from 35 to 81 mm h^{-1}, depending on the rainfall simulator. Rainfall characteristics such as drop size and velocity distribution were measured with an optical laser disdrometer Weather Sensor OTT Parsivel Version 1 (Parsivel) by OTT Messtechnik. Rainfall simulator with VeeJet nozzles produced smaller drops but higher drop velocity which resulted in higher kinetic energy per mm of rainfall compared to rainfall simulator with FullJet nozzles. For the same intensity rate measured kinetic energy under the rainfall simulator with VeeJet nozzles was 45% higher than rainfall kinetic energy from rainfall simulator with FullJet nozzles. Accordingly, the average splash erosion rate was 45 and 59% higher under the rainfall simulator with VeeJet nozzles for one silt loam and loamy sand soil, respectively. Splash erosion was found to be a linear or power function of the rainfall kinetic energy, depending on rainfall simulator. The obtained results highlight the sensitivity of the splash erosion process to rainfall characteristics produced by different rainfall simulators. The heterogeneity of rainfall characteristics between different types of rainfall simulators makes a direct comparison of results obtained from similar erosion studies difficult. Further experiments including comparison between more rainfall simulators could define influencing rainfall parameters on splash erosion under controlled laboratory conditions.