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Interactive assessment of the splash erosion and aggregate breakdown mechanism for the soils of different semi-arid land uses

S. Deviren Saygin (1) and G. Erpul (1,2)

(1) Department of Soil Science and Plant Nutrition, Faculty of Agriculture, University of Ankara, 06110, Diskapi-Ankara, Turkey (sdeviren@agri.ankara.edu.tr) , (2) Earth Sciences Application and Research Center of Ankara University, 06100 Ankara, Turkey (erpul@agri.ankara.edu.tr)

Aggregate breakdown mechanism is the most important process in splash erosion, producing the detached particles which are more easily transportable. In this study we aimed to determine the relationships between splash erosion and aggregate stability in laboratory conditions using the soils of three different land uses (agricultural land, grassland and forest). The rainfall simulations were conducted with the slope degrees (%9, 15 and 20) under two rainfall intensities (80 and 120 mm h-1). The soil samples were taken from a semi arid catchment, located in Ankara, Turkey. Before located into the test pans for rainfall simulations, the soils were sieved between 8 and 0.25 mm sieve size to obtain macro aggregate sizes and then wetted to bring them at saturation. To collect the splashed soil aggregates, the splash panels were located along two sides of a pan. Splashed particles by raindrop impacts were sampled every 5 min during 60 min rainfall simulations. Soil aggregate breakdown was evaluated by the mean weight diameter values (MWD, mm) of the collected splash sediments. The results indicated that aggregate size distributions were mostly changed with the land uses types. The MWD values were between 0.32 and 0.68 mm; 0.35 and 0.56 mm; and 0.53 and 1.20 mm for the soils of the agricultural land, grassland and forest, respectively. The forest soils having higher soil organic carbon content than those of agricultural land and grassland had more stable soil structure under destructive rainfall conditions (*$P < 0.05$) than grassland and agricultural area. The differences in the soil organic carbon content played a very crucial role in protecting the soils of the semi arid ecosystem against the aggregate breakdown by the splash erosion process. Additionally, the highest sediment amount was obtained with the rainfall simulations over the agricultural soils. Increases in the rainfall intensity or in the rainfall energy flux also resulted in MWD variations for the splash particles. For example, as the rainfall intensity increased from 80 mm h-1 to 120 mm h-1, the MWD values (mm) were 36.36% lower for the rainfall simulations incident over the forest soils with the slope gradient of 20%. However, for the same run, the amount of the splashed sediments increased 162.62 per percent more than that of 80 mm h-1. The percentage increases in the splash amount with the intensity increase were however 22.49 % and 21.51% for the agricultural and grassland soils, respectively. This finding showed that the bigger soil aggregates of the forest soils were broken down more, resulting in the larger amount of splash than the agricultural and grassland soils with the smaller soil aggregates under higher rainfall intensity condition.

Key words: aggregate breakdown, splash erosion, rainfall simulation, different land uses

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