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### Abstract

The drainage of sports field directly effects the quality of sports organization. This study aims to develop a new rainfall simulator (RS) with a drainage tank (DT) to investigate processes of drainage in the multi-layered soil of sports field. The laboratory setup includes two main components with RS and DT that consists of two identical tanks with 1.5mx1.3m surface area and 75cm depth. Simulating natural rainfall is considerably significant for especially laboratory-scale studies. The RSs have been used for soil crusting, soil erosion, infiltration and drainage processes of soils for decades. The presented RS was also used to simulate natural rainfall and produce various rainfall conditions in this study. Most of the simulators have been performed for constant intensity of rainfall, however, in this study different rainfall rates were produced ranging from 26 to 266.6 mmh<sup>-1</sup> to be able to obtain desired hyetograph. Spatial uniformity of produced rainfall was sufficiently accurate to simulate the natural rainfall with uniformities ranging from 90.24 to 92.74%. Raindrop diameters, falling velocities and kinetic energies of simulated rainfall were also investigated. The flour pellet method was used to determine the raindrop diameters. Median diameter was calculated between 1.68-2.52 mm for different rainfall intensities between 30.4-125 mmh<sup>-1</sup>. The DT was set-up to have different drainage layers and to obtain drainage outflow for corresponding rainfall hyetographs. The performance of the RS was sufficient to simulate natural rainfall. Drainage layers in the DT also showed the ability to drain rainwater through the layers effectively. In the present study, it is clearly showed that the newly developed RS and DT setup successfully produce and measure the various range of natural-like rainfall patterns, and measure resulted drainage rates. With these measurement abilities, it was also shown that this RS-DT setup was successfully used to evaluate the processes of sports field drainage and its relation to hydrological processes.

**Keywords:** Rainfall simulator, raindrop, drainage, sports field, hyetograph, hydrograph.

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