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Increasing soil surface roughness by means of tillage to reduce runoff generation in irrigated soils

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Surface water runoff originating in irrigated fields is one of the major environmental problems stemming from agricultural activities. Water use efficiency is severely decreased, as the runoff water does not penetrate the soil profile and is not available for the crops. As a result, more water has to be applied to meet the crop requirements. Moreover, runoff can transport both nutrients and pollutants out of agricultural fields, resulting in eutrophication and pollution of water bodies. This environmental problem can be aggravated in areas with a deficit of freshwater resources due to the extended use of recycled wastewater for irrigation, whose nutrient content is higher than that of freshwater. Therefore, reducing runoff generation is a crucial step in irrigated agriculture to increase water use efficiency and to reduce environmental pollution.

Runoff is generated when the rate of water applied to the soil surface is higher than the infiltration capacity of the soil. However, the excess water can be temporarily stored in microdepressions of the soil surface, thereby increasing the opportunity for this water to later penetrate into the soil profile and preventing its loss as runoff. Moreover, in arid and semiarid soils, where soil salinity can increase during the irrigation season, microdepressions in the soil surface can increase the amount of rain that penetrates the soil profile during the rainy season, and facilitate leaching of salts from the root zone.

In this work, we present the results of several experiments in which soil surface roughness in irrigated fields was increased by means of tillage practices such as the creation of microbasins and pitting. The objective was to study its effect on runoff, soil loss and crop productivity.