



Effectiveness of contour tillage to reduce water erosion during extreme rainfall events

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Contour tillage is the practice of tillage parallel to the contours of the slope. Contouring is considered a universal conservation practice which should significantly reduce the soil loss that would occur if a given field were ploughed along the maximum slope. On the other hand, contour tillage seldom exactly on the contour, particularly in landscapes of rolling topography. Runoff flows laterally along the furrows and collects in the low areas, where the probability of accumulated water overtops the ridges dramatically increases and then, the risk of concentrated flow erosion (rills and ephemeral gullies).

This paper presents an analysis of the influence of topography and the tillage pattern on the overland flow pattern and, consequently, on the potential runoff concentration and erosion. The effects of several scenarios of point furrow overflows on the runoff patterns are analysed.

In addition, the paper presents the erosive effects of a single extreme rainfall event in Central Spain. The total precipitation recorded in 45 minutes was 70 mm and the average rainfall intensity was 93 mm/h. Field features of severity soil loss were observed on agricultural fields where the soil was under conventional fallow conditions, i.e. soil surfaces ploughed and without any vegetation cover. A total of five sites, showing severe erosion features (rills and ephemeral gullies) were studied. Channel sections reached maximum values of more than 2 m in width and 0.5 m in depth. The highest soil loss rate was over 750 t/ha and the average soil loss for the five fields was 351 t/ha. The results show that the oriented roughness on the soil surface due to plough, i.e. direction of tillage furrows, played an important role on the overland-flow concentration process and consequently on the final runoff erosive capacity. The maximum values

of soil loss were recorder in fields where the tillage furrows were orientated along a direction parallel to the contour lines (fields with contour tillage), while the minimum erosion values were recorder in fields where tillage furrows were orientated along the direction of maximum slope gradient. Intermediate erosion rates were obtained in fields with tillage along an oblique direction to the slope.

Findings suggest the existence of a threshold value of rainfall intensity at which the contour tillage could not be an effective practice to reduce water erosion. On the contrary, this practice could significantly increase the soil losses. Moreover, in extreme rainstorms the orientation of the furrows up-downslope could represent the best condition for mitigating the formation of ephemeral gullies. Up-downslope furrows facilitate drainage along downslope parallel channels and reduce concentration of runoff.

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