

Fire against chipped pruned branches mulches in olive orchards. Their effect on soil hydrology

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Abstract

Soil and water losses resulting from conventional citrus plantations are often considered non-sustainable due to the high rates of soil degradation. To achieve sustainability and land degradation neutrality in citrus production new strategies should be developed to avoid non-sustainable soil and water losses. The use of chipped pruned branches as mulch is evaluated here as an alternative option to traditional burning carried out by farmers. We selected two paired plots under Glyphosate treatment for 30 years, with bare soils (no weeds or catch crops), in the control plot the branches were burnt (CON), meanwhile on the chipped pruned branches plot were chopped as a mulch (BRA). The pruning was done on March 30th, 2019, and the pruned branches were collected and chopped in a nearby field (30 m). After July 21st a set of 25 paired plots (50 plots) were established in the field with plots covered with chopped pruned branches (CON) and bare (CON). The amount of mulch applied was 125.9 ± 30.9 g m⁻² of chipped pruned branches. We used a rainfall simulator at 55 mm h⁻¹ rainfall intensity for one hour on a 0.25 m² plot to properly determine the time to ponding, the time to runoff, and runoff and sediment discharge. The results show that the soils of the Control (CON) and chipped pruned branches mulch-covered ones (BRA) are similar in grain size, organic matter, water content, and bulk density. However, the cover increased in the BRA ones due to the mulch created by the chopped branches. The ponding, runoff initiation, and runoff outlet were faster in the CON plots (49'; 96'; 133') than in the BRA plots (104'; 242'; 458'), respectively. Runoff discharge also found large differences: 72% versus 44 % for the CON and BRA plots, on average. Runoff concentration was 9.2 and 5.9 g l⁻¹, Sediment delivery 112.43 and 33.38 g, and soil erosion 2.22 and 0.55 Mg ha⁻¹ h⁻¹, respectively for CON and BRA plots. The use of chipped pruned branches as mulch caused a sudden decrease in runoff and soil losses, increase soil moisture, and reduced soil erodibility due to the cover of the litter. The use of chipped pruned branches contributes to an immediate soil and water loss reduction which is due to the mulch effect.

Keywords: Spain, olive, Runoff, Soil Erosion, Rainfall Simulators

References

Borrelli, P., Alewell, C., Alvarez, P., Anache, J. A. A., Baartman, J., Ballabio, C., ... & Panagos, P. (2021). Soil erosion modelling: A global review and statistical analysis. *Science of the total environment*, 780, 146494. Camera, C., Djuma, H., Bruggeman, A. A., Zoumides, C., Eliades, M., Charalambous, K., ... & Faka, M. (2018). Quantifying the effectiveness of mountain terraces on soil erosion protection with sediment traps and dry-stone wall laser scans. *Catena*, 171, 251-264. Cerdà, A., Morera, A. G., & Bodí, M. B. (2009). Soil and water losses from new citrus orchards growing on sloped soils in the western Mediterranean basin. *Earth Surface Processes and Landforms: the Journal of the British Geomorphological Research Group*, 34(13), 1822-1830. Cerdà, A., Novara, A., & Moradi, E. (2021). Long-term non-sustainable soil erosion rates and soil compaction in drip-irrigated citrus plantation in Eastern Iberian Peninsula. *Science of The Total Environment*, 787, 147549. Cerdà, A., Novara, A., & Moradi, E. (2021). Long-term non-sustainable soil erosion rates and soil compaction in drip-irrigated citrus plantation in Eastern Iberian Peninsula. *Science of The Total Environment*, 787, 147549. Cerdà, A., Rodrigo-Comino, J., Giménez-Morera, A., Novara, A., Pulido, M., Kapović-Solomun, M., & Keesstra, S. D. (2018). Policies can help to apply successful strategies to control soil and water losses. The case of chipped pruned branches (CPB) in Mediterranean citrus plantations. *Land Use Policy*, 75, 734-745.

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