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The barley straw residues avoid high erosion rates in persimmon plantations. Eastern Spain

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World persimmon production is 4 Millions tones and China produce more than 80 % of the total world yield. Korea and Japan are the second and the third producers respectively with 0.4 and 0.2 millions tones, and all three Asian countries concentrate more than 95 % of the world production. Spain produce less than 0.1 million tones but there is a sudden increase in new plantations due to the high prices and the new marked developed in Europe, Brazil and Arabic countries. The new chemically managed and highly mechanized plantations in Eastern Spain are using high doses of herbicides and the lack of vegetation is triggering high erosion rates. This paper aims to contribute with information about the soil losses on this new persimmon plantations and to develop strategies to reduce the soil and water losses.

A 15 years old plantation of persimmon (Dyospirus lotus) was selected in Eastern Spain (Canals Municipality, La Costera District) to measure the soil losses on No-Tillage bare (herbicide treatments) management and on barley straw covered plots. The straw cover was applied 3 days before the expereriments at at doses that cover more than 50 % of the soil surface using 75 gr of straw per m2. Rainfall simulations under 55 mm h-1 rainfall intensity during one hour on 0.25 m2 plots were carried out on plots paired plots: bare and covered with straw. The measurements were carried out during July 2014 on paired plots, under very dry soil moisture contents ranging from 4.65 to 7.87 %.

The results show that the 3% cover of vegetation of the control plots moved to more than 60% due to the application of the straw. This induced a delayed ponding (from 60 to 309 seconds) and surface runoff (from 262 to 815 seconds) and runoff outlet (418 to 1221 seconds). The runoff coefficients moved from 60 % in the control plots to 29 % in the straw covered and the runoff sediment concentration was dramatically reduced from 11 to 1 g l-1. The total soil losses were higher that 1 Kg per plot in the bare control plots to 47 gr in the straw covered plots, which resulted in a low erosion rate when the soil is covered with straw (0.23 Mg ha-1 y-1), but extremely high when the soil is not covered (5.07 Mg ha-1 y-1). The results show also a delayed runoff generation due to the effect of the straw. From ponding to surface runoff the bare plots last 198 seconds, but under straw covered soils the time is 506 seconds. Moreover, when runoff is found on the soil surface the time to reach the plot outlet is much delayed under the straw cover, as range from 156 seconds on the bare plots to 406 to the straw covered plots.

The management of the agriculture soils in many parts of the Planet is triggering land degradation (Borelli et al., 2013; Haregeweyn et al., 2013; Zhao et al., 2013). The most intense soil erosion rates use to affect agriculture land (Cerdà et al., 2009), and in Eastern Spain it was found that citrus orchards are being seeing as one of the crops with the highest erosion rates due to the managements that avoid the catch crops, weeds or litter, and this is also found in China (Cerdà and Jurgensen, 2008; 2009; Cerdà et al., 2009a; 2009b; Cerdà et al., 2011; 2012) and in China (Wu et al., 1997; Xu et al., 2010; Wang et al., 2011; Wu et al., 2011; Liu et al., 2011; Lü et al., 2011; Xu et al., 2012). The worse land managements found in many of the citrus plantations results in soil degradation too (Lu et al., 1997; Lü et al., 2012; Xu et al., 2012) and we can confirm here that the new Persimmon plantations are triggering the same effect and it is necessary to develop new strategies to reduce the soil losses. The use of cover crops to reduce the soil losses (Lavigne et al., 2012; Le Bellec et al., 2012) and the use of residues such as dried citrus peel has been found successful, but also it is well know the effect of the litter it is a key cover to avoid soil erosion. Meginnis (1935) was one of the pioneers on the research of the cover of litter to avoid the high

erosion losses. There is a need to find new plants or residues to protect the soils on persimmon orchards and they should be developed now that the farmers are increasing the land that produce persimmon. Straw has been seen as a very efficient to reduce the water losses in other agriculture lands (García Moreno et al., 2013), the soil losses in fire affected land (Robichaud et al., 2013a; 2013b; Fernandez and Vega, 2014), and soil properties on agriculture land (García Orenes et al., 2009; 2010; Jordán et al., 2010; García Orenes 2012). Those findings and the ones we show here must support the change to a more sustainable agriculture. This new advances in agronomy affect the control of the soil erosion (Tejeda and Benitez, 2014) but also the recovery of the soil quality (Mahmoud and Abd El-Kader, 2015). More research is need to find the right doses to be also sustainable from the economical point of view, and it is necessary to convince the farmers of the need to protect the soil.

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