



## Production, soil erosion and economic failure in new citrus plantations in Eastern Spain

Antonio Giménez Morera (1), Joan Carles membrado (2), Artemi Cerdà (2), and Félix Ángel González Peñaloza (2)

(1) Departamento de Economía y Ciencias Sociales, Escuela politécnica superior de Alcoy, Universidad Politécnica de Valencia, Paseo del Viaducto, 1 03801 Alcoy, Alicante, Spain. [angimo1@doctor.upv.es](mailto:angimo1@doctor.upv.es), (2) University of Valencia, Department of Geography, SEDER Soil Erosion and Degradation Research Group, Valencia, Spain. [artemio.cerda@uv.es](mailto:artemio.cerda@uv.es), [www.soilerosion.eu](http://www.soilerosion.eu)

Eastern Spain has been worldwide well known by the high quality citrus production (Piqueras, 2012). During the last century, the export of València's oranges contributed to a high income in Spain albeit during the last decade the revenues for the small farmers were short (Bono, 2010). The orange agricultural specialization in València begun at the end of the eighteenth century in the town of Carcaixent, close to the Xúquer river, where the first commercial orange groves were planted. This was due to the climatic conditions (no frosts) and the traditional flood irrigation systems.

The orange trade was not important until the second half of the nineteenth century, due to a combination of factors: i) the increasing demand of oranges from the United Kingdom, first, and then from Germany, France and other north-european industrialized countries; ii) the highly productive capacity of the Valencian soil thanks to its mild weather and irrigated fields; iii) the open mindedness of Valencian farmers towards innovation; and, iv) the development of a railways network which made it possible to bring the oranges into the shipment ports (Bono, 2010; Piqueras, 2012).

The Valencian orange trade knew its peak during the period 1925-1930 but later it experienced an economic crisis because of wars (both in Spain and Europe) and did not recover until the 1960's (Piqueras, 1999; Bono, 2010). After Spain's EEC (European Economic Community) membership (1986) and the creation of EU (1993) Valencian citrus sector grew: new orange groves were planted, new commercial varieties (especially mandarins) were promoted, and exports increased. Nevertheless, nowadays Valencian orange sector suffers from a structural problem: the small farm size and the lack of a good commercial network of distribution.

But in spite of the current crisis, the orange groves' impact on landscape is still huge in Valencia, since it creates a thick forest of orange trees stretching not only the floodplains but also their neighboring mountain slopes. The interest of orange groves is not only economic, but also environmental. Although the traditional farming developed a beautiful man made landscape of terraces and irrigation ditches, the development of new irrigation systems by means of drips contributed to new plantations that removed the ditches and the terraces. Those changes are triggering intense soil erosion rates such were shown by previous researchers in Valencia (Cerdà et al., 2009). This impact is also shown in other regions with a similar citrus production evolution, and China is a clear example (Wang et al., 2010; Liu et al., 2012).

This research evaluates the production and the cost of production, the economic investment in the establishment of the new citrus plantations and the revenues of 5 farms in the Canyoles river watershed in Eastern Spain. The soil erosion rates measured by means of rainfall simulation experiments in each farm by means of thunderstorms of 10 years return period (55 mm h<sup>-1</sup>) and by five-year survey by means of topographical measurements. The results show that the soil losses in the new plantation are extremely high, that the investments in the new plantation reached 18352 € ha<sup>-1</sup> and that the revenues do not cover the expenses of production.

Soil erosion measured since 2007 to 2011 show values that range from 7.54 to 56.76 Mg ha<sup>-1</sup> year<sup>-1</sup> and show a mean value of 28.45 Mg ha<sup>-1</sup> year<sup>-1</sup>. Rainfall simulation experiments shown that the soil losses were very high as other researched found in new citrus plantations. The comparison with other land uses and agriculture crop and managements shown that soil erosion is higher in then new chemically treated plantations (Cerdà, 2002), and even higher that on road embankments (Cerdà, 2007) and rainfed agriculture soil (García Orenes et al., 2009), although the water repellency found was very low in comparison to organic farming orange plantations (González et al., 2012).

The current situation of a high investment to develop the new plantations, an income lower than the expenses, the removal of terraces, drainage and irrigation ditches and the high erosion rates show a Desertification process

triggered by the commercial agriculture of citrus.

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