

Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

## Leguminous cover crops improve the profitability and the sustainability of rainfed olive (*Olea europaea* L.) orchards: from soil biology to physiology of yield determination

CM Correia<sup>a</sup>, C Brito<sup>a</sup>, A Sampaio<sup>a</sup>, AA Dias<sup>a</sup>, E Bacelar<sup>a</sup>, B Gonçalves<sup>a</sup>, H Ferreira<sup>a</sup>, J Moutinho-Pereira<sup>a</sup>, MA Rodrigues<sup>b</sup>

<sup>a</sup>CITAB, Universidade de Trás-os-Montes e Alto Douro, 5000-801 Vila Real, Portugal

<sup>b</sup>CIMO, Instituto Politécnico de Bragança, 5301-855, Bragança, Portugal

### Abstract

The olive sector has a crucial economic, social, cultural and ecological relevance in the Mediterranean region, where tillage and herbicides application still are generalized practices. However, these techniques oppose to the recommendations of UE policy. Thus, other methods are needed to reduce adverse environmental impacts and to improve biodiversity, soil carbon sink and fertility, to save fossil fuels and to increase yield and the safety and nutritional value of food products. Meanwhile, since Mediterranean basin is particularly vulnerable to climate change, including lower precipitation in summer, olive tree will experiment some hard changes, mainly under rainfed conditions. Therefore, we propose an adequate management of cover crops to shift tillage and herbicides, in order to minimize runoff and evaporation water losses, conserve soil moisture storage and promote the infiltration of water in soil. The experiment was carried out during 4 years on a commercial orchard (cv. Cobrançosa) in Northeast Portugal. The treatments laid out were: (1) ordinary tillage techniques (OT) used by local growers (two tillage trips per year); (2) cover crop with self-reseeding annual legume species (AL); (3) natural vegetation fertilized (NVF) with 60 kg N hm<sup>-2</sup> (as in OT); (4) natural vegetation (NV) left unfertilized. The results revealed that AL treatment is the best option, reaching 37, 53 and 95% higher cumulative yield than NVF, OT and NV, respectively, in a closely association with greater physiological performance during the summer, mainly evidenced by lower oxidative damage and by favourable changes in water status and net photosynthetic rate, due to lower stomatal and mesophyll limitations. Moreover, the AL covered soil presented considerable microbial diversity and enzymatic activities, which may contribute to promote and conserve soil quality and health, as well the stability of ecosystems. Thus, leguminous cover crops improve the profitability and the sustainability of rainfed olive orchards.

Acknowledgments: FCT: Project PTDC/AGR-AAM/098326/2008

© 2015 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

*Keywords:* Cover crops; Olive; Rainfed orchards; Physiology; Soil biology; Sustainability.

---