

## UNDER-VINE COVER CROPS AS A MANAGEMENT TOOL FOR IRRIGATED MEDITERRANEAN VINEYARDS: AGRONOMIC IMPLICATIONS AND CHANGES IN SOIL PHYSICAL AND BIOLOGICAL PROPERTIES

**Authors:** Francisco Javier ABAD<sup>1,2</sup>, Bosco IMBERT<sup>3,4</sup>, Iñigo VIRTO<sup>3,5</sup>, Carlos GARBISU<sup>6</sup>, José Félix CIBRIAIN<sup>7</sup>, Ana SAGÜÉS<sup>7</sup>, Diana MARÍN<sup>2,4</sup>, Luis Gonzaga SANTESTEBAN<sup>2,4\*</sup>

<sup>1</sup>INTIA, Edificio de Peritos, Villava, Navarra, Spain

<sup>2</sup>Dept. of Agronomy, Biotechnology and Food Science, Public University of Navarra, Pamplona, Spain

<sup>3</sup>Dept. of Science, , Public University of Navarra, Pamplona, Spain

<sup>4</sup>Institute for Multidisciplinary Research in Applied Biology-IMAB, Pamplona, Spain

<sup>5</sup> Institute for Innovation & Sustainable Food Chain Development-IS-FOOD, Pamplona, Spain

<sup>6</sup>NEIKER-Basque Institute of Agricultural Research and Development, Parque Científico y Tecnológico de Bizkaia, P812, Derio, Spain

<sup>7</sup>Estación de Viticultura y Enología de Navarra , Government of Navarra, Olite, Spain

\*Corresponding author: [gonzaga.santesteban@unavarra.es](mailto:gonzaga.santesteban@unavarra.es)

### Abstract:

**Context and purpose of the study** - Cover crops are increasingly considered in Mediterranean climate vineyards due to a combination of agronomic and regulatory considerations. However, the soil under the vines themselves is typically kept free of vegetation by mechanical plowing or herbicide spraying. Taking into account that these practices may convey a number of non-favourable economic and environmental implications, and the fact that drip irrigation can ease the use of cover crops under the vines, the aim of this work was to evaluate the agronomic implications and the changes in soil physical and biological properties caused by an under-vine cover crop in a Mediterranean area.

**Material and methods** – A *Trifolium fragiferum* under-vine cover crop was evaluated during four consecutive seasons (2018-2021) in cv. a Merlot vineyard in Traibuenas (Navarra, Spain). The evaluation included a complete monitoring of the ability of the cover crop to manage the presence of undesired weed species, a study of the agronomic effects in terms of yield, vegetative growth and berry composition, as well as an assessment of the implications that the presence of the cover had on soil physical and biological properties.

**Results** - The *T. fragiferum* cover was successfully established and maintained throughout the four seasons, did not need reseeding, and managed to control the presence of undesirable weeds better than mechanical tillage. The yield was only slightly reduced, with little changes in the grape composition, which coincided with the few differences observed between the wines obtained from both treatments. Establishing the under-vine cover crop led to an increase in the topsoil (0-30 cm) organic and particulate carbon stocks. Soil aggregation parameters, measured as the abundance and mean diameter of the water-resistant aggregates, were also improved. The soil porosity increased in the 15-30 cm soil layer, associated with a remarkable decrease in soil compaction and improved infiltration rates. From a biological point of view, the presence of the cover crop resulted in greater respiration rates, microbial carbon and functional diversity of soil bacterial communities. Taking all the results obtained into account, this soil management technique constitutes a promising sustainable tool for weed management under the vines in irrigated Mediterranean vineyards.

### Keywords:

*Trifolium fragiferum* L., cover crops, yield, grape composition, water use, soil carbon, soil aggregation, soil microbial biomass