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Assessing the effects of caroon intercropping with different cover crops on soil physical quality with BEST-2K method and automatic infiltrometers

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Caroon (*Cynara cardunculus* L.) is a promising energy crop for marginal areas in Mediterranean environment. Temporary intercropping with cover crops can provide multiple services such as weed suppression, additional and diversified biomass production and soil physical quality (SPQ) improvement.

A number of studies have demonstrated that the Beerkan estimation of soil transfer parameters (BEST) method appears promising for assessing SPQ in agricultural soils, given that it allows the entire determination of the water retention and hydraulic conductivity curves, and the derivation of both static and dynamic SPQ indicators in the field. However, BEST is suitable only for single-permeability (SP) soils. Lassabatere et al. (2019) designed a method for the hydraulic characterization of dual-permeability (DP) soils named BEST-2K to address the case of the soils prone to preferential flow. DP models are increasingly adopted in soil science to take better account of water flow dynamics in heterogeneous soils. Moreover, recent investigations suggested that a comprehensive assessment of SPQ of agricultural soils also involving DP approaches may substantially improve our capacity to evaluate the effect of specific management practices on key “domain-oriented” processes. Indeed, DP models assume that soil encompass two domains, including the matrix and the fast-flow domain that respectively host the smallest and the largest pores. While in the matrix domain the intra-aggregate pores constitutes the primary source of plant-available water and nitrous oxides, in the fast-flow domain the inter-aggregate pores are the primary region for root-essential air, carbon dioxide generation and nutrient leaching losses (Reynolds, 2017).

We investigated the effects of temporary intercropping with cover crops belonging to different functional groups on SPQ. In October 2019, an experimental trial intercropping *Cynara cardunculus* cv Bianco Avorio with four different cover types (3 cover crops: *Vicia villosa* Roth. cv Haymaker Plus, *Eruca sativa* L. cv Nemat and *Camelina sativa* (L.) Crantz. cv Italia and spontaneous weeds) was set up at the Ottava experimental station of the University of Sassari (Sardinia, IT).

The new BEST-2K method was used for assessing SPQ of the different intercropping systems. At this aim, we carried out multi-tension infiltration experiments in order to selectively activate only the matrix or the whole pore network, and for the characterization of the water retention and hydraulic conductivity functions of matrix and fast-flow domains. Then, we used these functions to determine SPQ indicators for the two domains. A zero-point scenario (1 month after sowing) has been already drawn. The field measurements will be repeated in summer after the harvest of the above-ground biomass of both cardoon and cover crops.

References

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