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Evaluation of potential as cover crops of three autochthonous species for Mediterranean conditions in Southern Spain through calibration and validation of a temperature-based phenology model

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The provision of ecosystem services is increasingly relevant in the definition of agricultural policies and cover crops can play a major role in it. Blanco-Canqui et al. (2015) discussed how the provision of ecosystem services by cover crops needs to reach a balance between a high production of biomass by the cover and agricultural production, indicating that this balance is much more difficult to achieve in regions with limited available water for cultivation. One of these regions is the Mediterranean where use of cover crops is usually mentioned as necessary to reduce soil degradation (e.g. Gómez, 2017). Several studies, e.g. Gómez (2017), Winter et al. (2018), noted the risk of decreasing yield in this agricultural system if the use of temporary cover crops is not properly managed. The literature shows that still been necessary the identification of new species better adapted to serve as cover crops for Mediterranean conditions. Studies for this identification will have higher impact if they could go beyond the local conditions in which they have been performed.

This study present the evaluation of three natives species of annual plants, Bromus rubens, Anthemis arvensis and Medicago truncatula, as cover crops in Andalusia, Southern Spain. A phenological model for was calibrated and validated experimentally for each of this species. Using these models their maturity dates were analysed for seven locations in Andalusia for two different germination dates assumptions: fixed on October 20th or with the first significant after September 1st. These results provided the probability distribution of maturity dates and allowed the determination of an empirical model for determining the average maturity date in the region based on the average daily mean T^a. This model was used to calculate a regional map of maturity dates based on long-term average daily T^a. The analysis shown how the management of a temporary cover crop based on an early killing date (early April) to prevent competition for soil water with the tree crops needs to be regionalized and adapted to the specific conditions of the tree crops. While in the western part of the Guadalquivir River valley the three species can produce viable seed by early April, especially Anthemis arvensis and Medicago truncatula, in the rest of the region management of the cover crop needs to be adapted to allow a lower maturity date. Our analysis suggests that new cover crop species with shorter cycles are needed, particularly grasses. Our calibrated models and approach might be directly applicable to similar areas in the Mediterranean or re-calibrated, for different conditions or species, with relatively simple experiments.

References

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