

Restoring woody agroecosystems in Mediterranean drylands through Regenerative Agriculture

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Motivation

- Intensive tillage-based agriculture has exacerbated soil degradation compromising crop production and long-term sustainability of agroecosystems
- In Mediterranean regions woody crops cover most arable land and are especially affected by soil erosion
- Regenerative agriculture (RA) could be a plausible solution for restoring degraded agroecosystems
- The lack of empirical evidence on RA impacts is limiting its adoption in Mediterranean drylands



We aim to understand

The capacity of different regenerative managements to restore the soil quality and the nutritional status of almond agroecosystems in areas prone to degradation

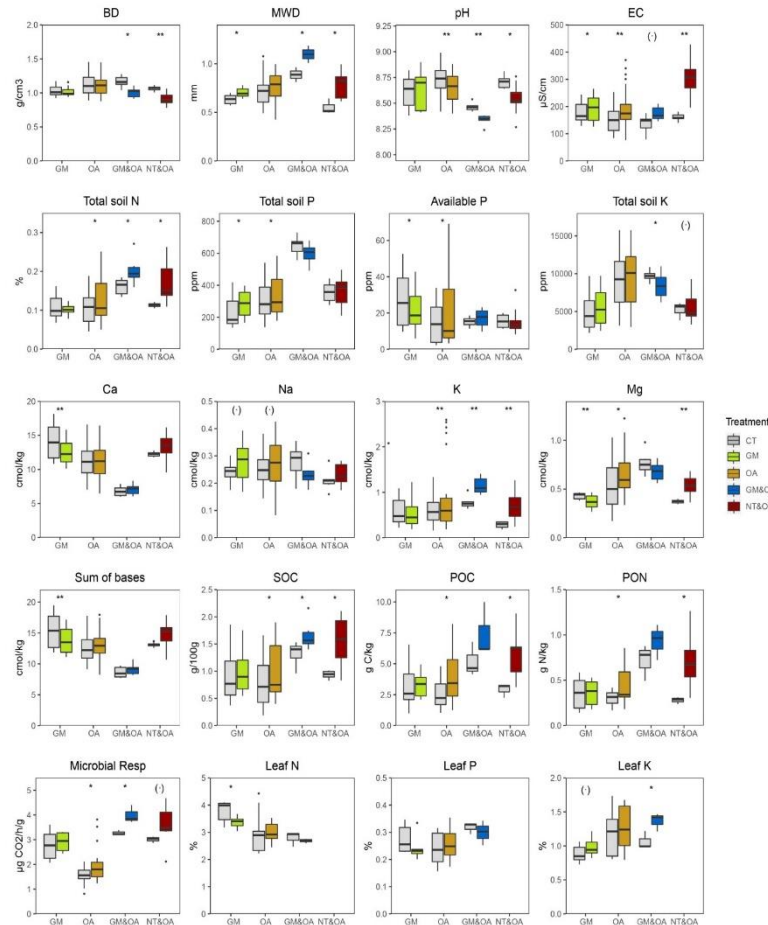
Approach



- 4 regenerative managements (GM, OA, GM&OA, NT&OA) in 12 farms compared with conventional tillage (CT) used as control
- Field work in 2018 and 2019 to assess:

- Physical soil quality:** bulk density (BD), aggregate stability (MWD)
- Chemical soil quality:** pH, EC, total N, P, K, available P, Ca²⁺, Mg²⁺, K⁺, Na⁺
- Biological soil quality:** SOC, POC, PON, microbial respiration
- Tree performance:** foliar N, P and K

Results



Key findings



- Physical soil quality**
- Improved soil resistance to erosion and tree nutrition. Aggregates +10%. Foliar K +10%
- Soil restoration effectiveness might be conditioned by management (seeding, tilling, grazing, mulching), climatic conditions and time

Chemical and biological soil quality

- Increases in macronutrients up to +40%
- SOM+20%. Microbial activity +30%.
- Higher amount and/or application time is needed to achieve physical soil quality restoration



Physical, chemical and biological soil quality

- Aggregates, total N, SOC, microbial activity and foliar K ≈ +25%
- Combination of GM and OA also combines its benefits.



Physical, chemical and biological soil quality

- Greatest physical and biological increases. Large increment in total N and total K
- Increased SOM from OA, natural covers, and reduced exposure to oxidation.
- No data on foliar nutrients to support it



Take home messages

- Combination of regenerative practices including ground covers and organic amendments is more effective to enhance soil quality than individual practices.
- Regenerative Agriculture is a sustainable farming approach to restore soil quality while maintaining the nutritional status of tree crops in degraded agroecosystems in the semi-arid Mediterranean.