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Cereal-forage crop rotations and irrigation treatment effect on water use efficiency and crops sustainability in Mediterranean environment

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Author(s)

Pasquale Martiniello

ABSTRACT

Agricultural systems based on crop rotations favour sustainability of cultivation and productivity of the crops. Wheat-forage crops rotations (annual winter binary mixture and perennial alfalfa meadow) combined with irrigation are the agronomical techniques able to better exploit the weather resources in Mediterranean environments. The experiment aimed to study the effect of 18 years of combined effect of irrigation and continuous durum wheat and wheat-forage rotations on productivities of crops and organic matter of topsoil. The experiments were established through 1991-2008 under rainfed and irrigated treatments and emphasized on the effect of irrigation and continuous wheat and wheat-forage crop rotations on water use efficiency and sustainability of organic matter. The effect of irrigation increased 49.1% and 66.9% the dry matter of mixture and meadow, respectively. Continuous wheat rotation reduced seed yield, stability of production, crude protein characteristics of kernel and soil organic matter. The yearly gain in wheat after forage crops was 0.04 t (ha · yr)$^{-1}$ under rainfed and 0.07 t (ha · yr)$^{-1}$ under irrigation treatments. The crude protein and soil organic matter of wheat rotations, compared to those of continuous wheat under rainfed and irrigated was increase in term of point percentage by 0.8 and 0.5 in crude protein and 5.1 and 4.4 in organic matter, respectively. The rotations of mixture and meadow under both irrigated treatments increased the point of percentage of organic matter over continuous wheat (9.3.and 8.5 in mixture and 12.5 and 9.5 meadow under rainfed and irrigation, respectively). Irrigation reduce the impact of weather on crop growing reducing water use efficiency (mean over rotations) for dry mater production (15.5 in meadow and 17.5 in mixture [L water (kg · dry · matter)$^{-1}$]) and wheat seed yield. The effect of agronomic advantages achieved by forage crops in topsoil expire its effect after three years of continuous wheat rotation.

KEYWORDS

Alfalfa; Binary Mixture; Durum Wheat; Irrigation; Mediterranean Environment; Soil Organic Matter; Water Use Efficiency; Wheat-Forage Rotations

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