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Replacing bare fallow with cover crops in an irrigated cropping system: soil salinity and salt leaching

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In irrigated areas where cover crop establishment can be assured, consequent soil or nutrient conservation could increase sustainability of cropping systems. Replacing bare fallow with cover crops may increase sustainability by enhancing soil aggregate stability, water retention capacity or controlling nitrate leaching. Nevertheless, adoption of cover crops increase evapotranspiration and reduce water percolation beyond the root systems; therefore, it could lead to salt accumulation in the upper soil layers. This study was conducted during four years to determine the effect of replacing bare fallow by a cover crop on soil salt accumulation and salt leaching in an irrigated maize production system. A three factor (bare soil and two cover crops) experiment with four replications was carried out on a silty clay loam soil in Aranjuez (Madrid, Spain). Each experimental plot was 144 m² and treatments studied were: barley (*Hordeum vulgare* L.), vetch (*Vicia villosa* L.) and bare fallow during the intercropping period of maize (*Zea mays* L.). Cover crops were killed in late winter allowing seeding of maize of the entire trial in early spring, and all treatments were irrigated and fertilised (210 kg N ha⁻¹ of ammonium nitrate) following the same procedure. Biomass production and yield were recorded at harvest for maize and each cover crop. Soil electrical conductivity was measured along the soil profile before sowing, and after harvesting maize and cover crops. During the whole experiment, daily soil water content measurements based on capacitance probes were used to calculate drainage at 1,2 m depth, by applying the water balance equation. Salt leaching at 1,2 m depth was calculated as the drainage volume multiplied by the salt concentration of the soil solution extracted in ceramic cups. Our results showed that when irrigation water was adjusted to crop needs, drainage during the irrigated period was minimized and lead to a slight accumulation of soil salt on the upper layers after maize harvest. Salt leaching associated to drainage took place mainly during the period between the two maize crops. In treatments sown with a cover crop, the drainage period was shorter, and the amount of drainage water and salt leached was lower than in bare soil. Nevertheless, soil salt accumulation did not increase in treatments with cover crops, and even decrease in years with a large cover crop biomass production. Maize production (biomass and yield) was not affected by treatment. Therefore, adoption of cover crops in this irrigated cropping system reduced water percolation beyond the root zone, but did not lead to salt accumulation in the upper soil layers.

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