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Salt and N leaching and soil accumulation due to cover cropping practices

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Nitrate leaching beyond the root zone can increase water contamination hazards and decrease crop available N. Cover crops used in spite of fallow are an alternative to reduce nitrate contamination in the vadose zone, because reducing drainage and soil mineral N accumulation. Cover crops can improve important characteristics in irrigated land as water retention capacity or soil aggregate stability. However, increasing evapotranspiration and consequent drainage below the root system reduction, could lead to soil salt accumulation. Salinity affects more than 80 million ha of arable land in many areas of the world, and one of the principal causes for yield reduction and even land degradation in the Mediterranean region. Few studies dealt with both problems at the same time. Therefore, it is necessary a long-term evaluation of the potential effect on soil salinity and nitrate leaching, in order to ensure that potential disadvantages that could originate from soil salt accumulation are compensated with all advantages of cover cropping.
A study of the soil salinity and nitrate leaching was conducted during 4 years in a semiarid irrigated agricultural area of Central Spain. Three treatments were studied during the intercropping period of maize (Zea mays L.): barley (Hordeum vulgare L.), vetch (Vicia villosa L.) and fallow. Cover crops were killed in March allowing seeding of maize of the entire trial in April, and all treatments were irrigated and fertilised following the same procedure. Before sowing, and after harvesting maize and cover crops, soil salt and nitrate accumulation was determined along the soil profile. Soil analysis was conducted at six depths every 0.20 m in each plot in samples from four 0 to 1.2-m depth holes dug. The electrical conductivity of the saturated paste extract and soil mineral nitrogen was measured in each soil sample. A numerical model based on the Richards water balance equation was applied in order to calculate drainage at 1.2 m depth, using daily soil water content measurements, based on calibrated capacitance probes. Our results showed that drainage during the irrigated period was minimized, because irrigation water was adjusted to crop needs, leading to soil salt and nitrate accumulation on the upper layers after maize harvest. Then, during the intercrop period, most of salt and nitrate leaching occurred. Cover crops use led to shorter drainage period, lower drainage water amount and lower nitrate and salt leaching than treatment with fallow. These effects were related with a larger nitrate accumulation in the upper layers of the soil after cover crop treatments. But there was not soil salt accumulation increase in treatments with cover crops, and even decreased after years with a large cover crop biomass production. Then, adoption of cover crops in this kind of irrigated cropping system reduced water drainage beyond the root zone, salt and nitrate leaching diminished as a consequence but did not lead to salt accumulation in the upper soil layers.
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