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Carbon Retention in the Soil-plant System under Different Irrigation Regimes

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Abstract: The effects of elevated CO₂ concentration in the atmosphere on global warming have attracted increased attention into the research for enhancing carbon (C) sequestration in the ecosystems. Irrigation management is a potential strategy to reduce C emissions from agriculture by increasing C retention in the plant biomass. In addition, declining freshwater resources has stimulated research into developing novel irrigation strategies aiming at improving crop water use efficiency (WUE). Alternate partial root-zone irrigation (PRI) is a novel water-saving irrigation strategy being intensively studied in many countries and have been shown great potential to increase WUE as compared with full irrigation (FI) and deficit irrigation (DI) treatments. Besides saving irrigation water, PRI induced drying and wetting cycles of the soils could, however, cause the 'Birch effect' resulting in a flush of C and N, which may lead to greater C losses from the soils. Therefore, the objective of this study was to investigate the effects of different irrigation regimes on C retention in the soil-plant system in order to evaluate their environmental impacts. Tomato plants were grown in split-root pots in a climate-controlled glasshouse and were subjected to FI, DI and PRI treatments. Results showed that the concentration and the amount of total C in the soil were lower in FI and PRI as compared to DI, whereas the total C concentration in the PRI plants was significantly higher than FI and DI plants. Consequently, the total amount of C retained in the soil-plant system was the highest in FI and was similar for PRI and DI treatments.

Keywords: Carbon sequestration, Deficit irrigation, Partial root-zone drying, Water use efficiency