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# Water in the circular economy: using recycled water for sub-irrigation purposes

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Agricultural crop yields depend largely on soil moisture conditions in the root zone. Climate change leads to more prolonged drought periods that alternate with more intensive rainfall events. With unaltered water management practices, reduced crop yield due to drought stress will increase. Therefore, both farmers and water management authorities search for opportunities to manage risks of decreasing crop yields. Available groundwater sources for irrigation purposes are increasingly under pressure due to the regional coexistence of land use functions that are critical to groundwater levels or compete for available water. At the same time, treated wastewater from industries and domestic wastewater treatment plants are quickly discharged via surface waters towards sea. Exploitation of these freshwater sources may be an effective strategy to balance regional water supply and agricultural water demand. We present results of a pilot study in a drought sensitive region in the Netherlands, concerning agricultural water supply through reuse of industrial treated wastewater. The Bavaria Beer Brewery discharges treated wastewater to the surface water. Nevertheless, neighboring farmers invest in sprinkler irrigation to maintain their crop production during drought periods. Doing so, increasing pressure is put on the regional groundwater availability. Within a pilot study, a sub-irrigation system has been installed, by using subsurface drains, interconnected through a collector drain, and connected to an inlet control pit for the treated wastewater to enter the drainage system. Sub-irrigation is a subsurface irrigation method that can be more efficient than classical, aboveground irrigation methods using sprinkler installations. Additionally, sub-irrigated water that is not used for plant transpiration recharges the groundwater. We combine both process-based modeling of the soil-plant-atmosphere system and field experiments to i) investigate the amount of water that needs to be and that can be sub-irrigated, and ii) quantify the effect on soil moisture availability and herewith reduced needs for aboveground irrigation from groundwater.