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EFFECTS OF TREATED WASTEWATER IRRIGATION ON SOIL QUALITY

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Available freshwater is a limited resource worldwide, especially under a growing population and climate change. Wastewater reuse for irrigation is increasing globally, because of its potential to contribute to sustainable agriculture and circular economy. The use of treated wastewater (TWW) can decrease the pressure on freshwater resources, and it adds nutrients to the soil which may be beneficial for crop growth. However, its use on agricultural land can lead to soil contamination, salinization and structure degradation. In Flanders, Belgium, there is a high risk of water scarcity during drought events, but TWW irrigation is hardly used. Especially salinity problems associated with TWW irrigation on soil structure and water infiltration have not been studied so far. This study, therefore, aims to investigate the effects of TWW irrigation on soil physical quality in Flanders, Belgium.

Five experimental objects were established in 2019 at Inagro (50°91'N, 3°12'E), Beitem, Belgium under a spinach-cauliflower-potato-spinach rotation. In rainout shelters, four plots were irrigated with rainwater, treated domestic wastewater (TWW household), treated wastewater from the frozen-vegetables processing industry (TWW vegetable), and treated wastewater from the potato processing industry (TWW potato). The fifth plot was an open-air field and received precipitation directly. The total irrigation water volume in each rainout shelter object was almost equal to the precipitation of the rainfed object. In 2019 (spinach and cauliflower) the TWW irrigation dose was ~135 mm, while in 2020 (potato and spinach) it was ~150 mm.

After two years of TWW irrigation, using TWW potato and TWW vegetable irrigation tended to increase soil salinity and sodicity. Soil electrical conductivity (EC) under TWW vegetable and potato irrigation was not significantly different from that under rainwater irrigation, while irrigation with TWW from households showed a lower EC ($p < 0.05$) at soil depths of 0-20, 20-40 and 40-60 cm. Preliminary data show no significant difference in visually assessed soil structural quality among different plots, while hydraulic conductivity of treatments under TWW household and potato irrigation was significantly higher than under TWW vegetable and rainwater irrigation at different matric tensions. The 2020 potato yield under TWW potato treatments was significantly lower than that

under rainwater but not higher than that of the rainfed treatments, while under TWW vegetable and household it was not different from that of the other treatments except rainfed. Preliminary data indicate that TWW reuse for irrigation can be a potential alternative to conventional irrigation in Belgium.

Keywords: treated wastewater irrigation (TWW), soil quality