Date of poster presentation: 13 April 2022

Novel insights and technologies for monitoring and improving water quality in a recirculating greenhouse system

in 't Zandt, M 1, Koeman-Stein, N 1, van der Wurff, A 2, Bonnet, J 3, van Ruijven, J 4, Streminska, M 4, van der Wielen, P 1

1 KWR Water Research, the Netherlands

2 Groen Agro Control, the Netherlands

3 Stichting Control in Food and Flowers, the Netherlands

4 Wageningen University & Research BU Greenhouse Horticulture, the Netherlands

---

The European Water Framework Directive and following national environmental legislation forces the greenhouse industry to close the water cycle at the company level, by increased reuse of drain water. As complete recirculation is obliged from 2027 onward, growers are challenged to manage the availability, quality and safety of the recirculated water Recurrent use of water may cause a build-up of a variety of organic compounds and this may affect plant growth, performance and food safety directly or indirectly via microbial activity.

Currently, however, there is not enough knowledge on the composition of the recirculated organic matter fractions and how these fractions affect the microbial composition, including plant pathogens and its interactions with the plant. Since these factors affect crop health, yield and safety, enhanced knowledge on the mechanisms for interaction will help improve crop performance as well as food safety. Furthermore, it can direct applied treatments to selectively remove any problematic organic matter fractions.

A study on rapid water quality parameters with water from horticulture showed that the addition of specific fractions of organic matter to the nutrient solution of substrate-grown tomatoes resulted in a more resilient microbial community in the rhizosphere. Microbial growth parameters (heterotrophic plate count (HPC) and ATP-analysis) indicated an increase in microbial activity in drain water compared to the nutrient solution. This work highlighted that HPC provides a solid parameter to monitor water quality from feeding source to water treatment, but generating results with these method takes three days. In contrast, ATP measurements or flow cytometry provide similar insights within minutes. For effective and efficient assessment of crop performance and food safety, there is a need for rapid screening methods to gain insights in horticulture water quality.

Using next-generation sequencing (NGS) we could find significant effects on the bacterial composition in the rhizosphere after addition of plant-pathogenic Fusarium oxysporum. These findings highlight the potential to steer rhizosphere microbiology to maintain a healthy and safe cultivation system, but detailed information on the effects of specific fractions of organic matter is currently lacking.

Overall, we conclude that water reuse has a great potential for a circular horticultural system, but that rapid and effective insights into the effects of recirculation water are crucial to guarantee crop performance in a closed irrigation system. Future research aims at developing rapid screening methods for microbiology and organic matter to be able to manage crop performance parameters for improved crop health and yield.

Keywords: substrate cultivation, greenhouse horticulture, microbiological detection, water quality monitoring