Electrolytic disinfection of nutrient solution to prevent dispersal of plant viruses in irrigation water

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ABSTRACT

Closed irrigation systems conserve resources and minimize production costs. Several sources of water can be used for irrigating crops. Some of them pose a high risk to disseminate plant pathogens. For instance, tailwater collected by channels and directed to ponds or tanks to be reused for irrigation poses a high risk for dissemination of plant pathogens. Thereby pathogens such as zoosporic organisms, fungi, bacteria and viruses are introduced directly from crops in cultivated fields, greenhouses or natural vegetation surrounding the fields. A considerable number of pathogens is of significant concern as those are stable, difficult to combat and cause economic losses. Among these pathogens, plant viruses are of particular interest because they can´t be cured. Therefore, effective sanitation methods are required to minimise their dispersal. Currently, the grower has the choice between different physical or chemical water treatments. Beside cost effectiveness and ecological concerns none is suitable to inactivate the multitude of relevant plant pathogens, in particular viruses.

We determined and evaluated the potential of a new sensor-based disinfection procedure to inactivate viral plant pathogens in hydroponic systems in greenhouse tomato production. An electrolytic disinfector (newtec Umwelttechnik GmbH, Germany), especially developed for disinfection of irrigation water in greenhouses was used.

The efficacy of the disinfectant, a low concentrated Potassium hypochlorite, was first tested *in vitro* according to the standard (OEPP/EPPO, 2008). Dose-effect relations were calculated for different fungal, bacterial and viral plant pathogens. As expected, contact time and dose required to eradicate pathogens varies with pathogen species and life stage. Subsequently trials under practical conditions were initiated focusing on the potential of the disinfection procedure to prevent the spread of plant viruses by recirculating nutrient solution. The disinfectant injected once weekly into the nutrient solution at 0.2 or 0.5 mg free chlorine/l nutrient solution for 60 or 30 minutes by a sensor, prevented the dispersal of *Pepino mosaic virus* in tomato crops (Bandte et al., 2016). These injection intervals assured that virus particles and even fungal spores of economic important pathogens released from infected plants do not accumulate and form an infectious reservoir. The yield of tomato plants grown in KClO-treated nutrient solution was even significantly higher than that of control plants.

References

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