



Abstract

# Contributions of TOXICROP Project for the Assessment of the Impacts of Toxic Cyanobacteria in Agriculture <sup>†</sup>

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**Abstract:** Water contaminated with microcystins (MCs) or other cyanotoxins is recurrently used in agriculture and for crop irrigation. Several deleterious effects of MCs in plants that may impair crop productivity, including a decrease in growth and tissue necrosis, as well as an inhibition of photosynthesis and metabolic changes, have been reported. Studies also revealed a significant accumulation of MCs in edible tissues and plant organs, which raise concerns related to food safety. The European project TOXICROP precisely tackles this environmental problem. The main aims of the project are to map agricultural risk areas of cyanotoxin occurrence, to assess the fate of cyanotoxins in crops, and evaluate the impacts of using low-quality water for crop irrigation. The project also develops research on water remediation, exploring nature-based technologies. Here, we review part of the research carried out in the project, concerning the toxicity of cyanotoxins in crops. The research from TOXICROP Consortium has revealed for instance that adult strawberry or faba bean plants are susceptible to moderate concentrations of MCs (10 to 20 µg MCs/L). Furthermore, experiments with faba bean and common wheat grown in sterile (microorganism-free) and non-sterile (microorganism-rich) soil, watered with 100 µg MCs/L, revealed that native rhizospheric microbiota play an important role in the mitigation of the phytotoxic impact of MCs on plant growth, reducing toxin accumulation in both soils and plant tissues. Our studies also revealed that leaf vegetables, such as lettuce and spinach, growing in hydroponics are more susceptible to MCs than to the toxin, cylindrospermopsin (CYN). The lowest toxin concentrations affecting spinach and lettuce growth were 5 + 5 and 25 + 25 µg/L CYN/MC mixtures, respectively. The results also reveal that the accumulation of MCs and CYN in plants depends on the conditions in which plants grow and concentrations of toxins in the irrigation water. In some cases, MCs are accumulated in plant tissues and exceed the tolerable daily intake proposed by the World Health Organization. We highlight the importance and contributions of this research to the definition and implementation of regulatory limits for cyanotoxins in irrigation waters.

**Keywords:** toxic cyanobacteria; cyanotoxins; water quality; alqueva; crop irrigation



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