biology and life sciences forum

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Abstract

Cyanobacterial Biomass Used as Biofertilizer in Lettuce Plants: Effects on Growth and Cyanotoxin Accumulation †

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† Presented at the 7th Iberian Congress on Cyanotoxins/3rd Iberoamerican Congress on Cyanotoxins, Ponta Delgada, Portugal, 18–20 July 2022.
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Citation: Santos, É.; Massa, A.; Azevedo, J.; Martins, D.; Reimão, M.; Vasconcelos, V.; Campos, A.; Freitas, M. Cyanobacterial Biomass Used as Biofertilizer in Lettuce Plants: Effects on Growth and Cyanotoxin Accumulation. *Biol. Life Sci. Forum* **2022**, *14*, 35. https://doi.org/10.3390/blsf2022014035

Academic Editor: Vitor Gonçalves

Published: 26 July 2022

Abstract: The use of cyanobacterial biomass as a biofertilizer is promising in terms of sustainable agriculture. Nevertheless, cyanobacteria can be considered a threat to human and environmental health due to the potential presence of cyanotoxins, since some studies report that the use of contaminated water for agricultural irrigation can impair plant growth and lead to contamination of food products. Interestingly, at environmentally relevant concentrations, cylindrospermopsin (CYN) seems to cause no deleterious effects in plants, and it might even promote their yield. However, studies assessing CYN accumulation in the edible tissues at environmental concentrations are lacking. The objective of this work was to evaluate the effects of cyanobacterial biomass CYN producing or non-producing on lettuce plant growth, and that of CYN accumulation in edible tissues. This study consisted of growing lettuce plants, under controlled conditions, for 25 days in soil (1) with no extra nutrient addition (control) and supplementation with (2) cyanobacterial biomass that did not produce CYN, (3) cyanobacterial biomass that produced CYN (~10 µg of dissolved CYN), and (4) cyanobacterial biomass that produced CYN, treated by boiling for 5 min (~25 µg of dissolved CYN). At the end of the exposure, lettuce growth was assessed, as well as CYN accumulation in tissues and soil. The results showed that leaf growth was significantly increased ($p < 0.05$) in lettuce plants supplemented with cyanobacterial biomass, especially at condition (3), which was five-fold higher compared with the control group. Regarding CYN accumulation, for conditions (3) and (4), the toxin was detected in the tissues of plants, as well as in soil at the following decreasing order of concentrations: soil > roots > leaves. Interestingly, the concentration determined in lettuce leaves in condition (4) was three-fold lower when compared with the condition (3). Nevertheless, for both conditions, although CYN has been detected in lettuce leaves, the concentration in the edible part did not exceed the proposed provisional tolerable daily intake (TDI) of 0.03 µg/kg/BW. In conclusion, these results suggest that the use of cyanobacterial biomass as lettuce biofertilizer, even containing CYN at environmentally relevant concentrations, can positively influence plant growth and development without compromising the safety of edible tissues.

Keywords: cyanobacteria; cylindrospermopsin; biofertilizer; plant growth; accumulation; *Lactuca sativa*

Author Contributions: Conceptualization, A.C., M.F. and V.V.; methodology, É.S., A.M., J.A., D.M., M.R., M.F. and A.C.; software, É.S., A.M., J.A. and A.C.; validation, É.S., A.M., J.A., M.F. and A.C.; formal analysis, É.S., A.M. and J.A.; investigation, É.S., A.M., J.A., M.F. and A.C.; resources, É.S., A.M., J.A., D.M., M.R., M.F., A.C. and V.V.; data curation, É.S., A.M. and J.A.; writing—original draft preparation, É.S., A.M. and M.F.; writing—review and editing, É.S., A.M., A.C., M.F. and V.V.; supervision, M.F. and A.C.; project administration, A.C. and V.V.; funding acquisition, A.C. and V.V. All authors have read and agreed to the published version of the manuscript.

Funding: This work received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No. 823860.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.