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MASTER THESIS PROJECT

Assessment of cyanobacterial biomass as sustainable agricultural fertilizer: soil-experiment with plants in pot

ANABELLA MIRTHA MASSA DECON

Interdisciplinary Centre of Marine and Environmental Research (CIIMAR)

University of Porto

Porto, Portugal

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Universidad del País Vasco Euskal Herriko Unibertsitatea
université de BORDEAUX
UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR
LIÈGE université
NTNU Norwegian University of Science and Technology
U.PORTO

Abstract:

Providing food to the growing human population in a sustainable way is one of the most significant challenges of modern society. In this context, cyanobacterial biomass (CB) can function as a substitute for commercial fertilizers, because of their macronutrient content, plant growth hormones release, and exopolysaccharides that can stabilize soil, all contributing for increasing soil productivity. These organisms can be collected from the environment in considerable amounts since they tend to grow in large blooms. However, some of these cyanobacterial strains produce toxins that must be carefully monitored to avoid food accumulation. The objective of this work was to evaluate the possible use of toxic and non-toxic strains of CB as fertilizer supplements in the growth of economically relevant vegetables. One-month-old lettuce, radish and spinach plants were grown in pots in indoor controlled conditions. For lettuce there were 4 experimental conditions: (1) control (C), 0.6g of lyophilized CB of (2) non-toxic strain of *Cylindrospermopsis raciborskii*, (3) toxin strain of *C. raciborskii* , (4) toxic strain of *C. raciborskii* boiled for 5 min. Summed, radish and spinach comprised 6 experimental conditions: (1) C, (2) a recommended dose of an NK commercial fertilizer (CF), 0.6g of lyophilized CB of (3) non-toxic strain of *C. raciborskii* , (4) toxic strain of *C. raciborskii* (5) *Microcystis aeruginosa*, (6) *Anabaena* sp.. In CB, NPK and toxin concentration were estimated. In plants, the dry weight (DW), the mineral content, and toxin concentration of the edible tissues were determined. In CB the mineral content, we found no significative differences in N concentration, nevertheless, there was a significative difference in P and K concentration in the CB strains. In lettuce plants, we found a significantly higher DW of shoot when added toxic *C. raciborskii* strain than non-toxic *C. raciborskii.* In spinach, DW of the shoot in the *M. aeruginosa* treatment was significantly lower than the C, CF, and both *C. raciborskii* biomass. Besides, in radish, the DW of the shoot *M. aeruginosa* treatment was significantly lower than the toxic strain of *C. raciborskii* treatment. In mineral content in edible plant parts, radish with added toxic *C. raciborskii* had higher Co and Fe content. Regarding toxin accumulation in the edible tissues of lettuce after the experiment it was under the Tolerable Daily Intake. Overall, promising results are presented for the utilization of CB for agricultural purposes and soil fertilization, as it was shown that can lead to an enrichment in mineral content in plants and/or increase plant growth. Nevertheless, more studies are needed to confirm these results and to assess food safety since several CB have toxins that are harmful to humans.

Keywords: Lettuce, Radish, Spinach, Agricultural Fertilizer, Anabaena, Cylindrospermopsis, Microcystis.