Biostimulant effect of Eukaryotic Microalgae on greenhouse grown *Solanum lycopersicum*.

Biological Research Centre

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Introduction

Conventional farming practices rely on chemical fertilizers to increase crop yields in order to meet global food demand. However, nutrients from applied fertilizers can end up accumulating in the environment, disrupting ecosystems and reducing biodiversity.

Organic fertilizers could be a solution to this problem. Unfortunately, large scale applications can be expensive. Microalgae (MA) are photosynthetic organisms, they require considerably less space to cultivate and generate huge biomass within a short time. These microorganisms produce a wide range of bioactive compounds which could promote crop quality and yield. They are eco-friendly and could be used directly in the farms without further processing (Coban et al. 2020).

The aim of our study was to investigate if small doses of MA from two genera (*Chlamydomonas reinhardtii* cc124 and *Chlorella* sp. MACC-360) could improve tomato quality and yields. Plants treated with Distilled Water (DW) served as the Control. Tomato represents an economic crop whose cultivation requires addition of many nutrients as it is a heavy-feeder.

Materials & Methods

Figure 1: Microalgae strains

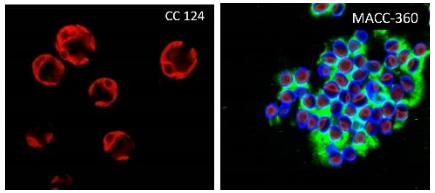


Figure 2: Experimental design

1.Replication, randomization and repetition
•2 plants per pot, 3 pots per treatment on a tray, 2 trays per treatment. Each Experiment regime (Week 1 and week 5) was repeated thrice.

2.Algae preparation
•**For soil,** 50ml 7day old cultures centrifuged; resuspended in 1L, applied on Week 1 or Week 5
•**For foliar**; 50ml 7day old cultures centrifuged, pellet crushed, slurry diluted with water to 300ml , applied on Week 5

3.Control: Prepared as above but with 50ml Distilled water (DW)

5. Experiment termination Upon complete ripening of fruits

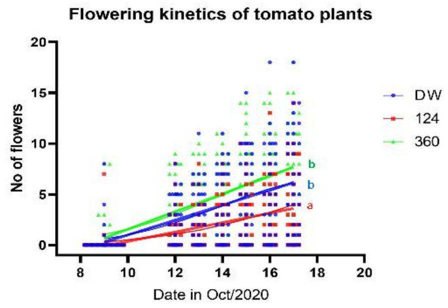
6. Phenotyping
•Flowers, fruit parameters and pigment content

7. Data analysis: Graphpad prism for graphing and statistical analysis (ANOVA and Mann Whitney test)

Illustrative figure created with Biorender.com

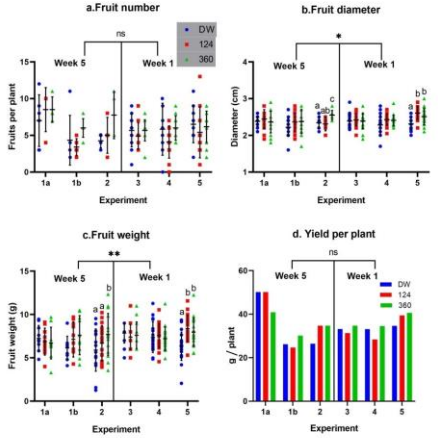
Results

Figure 3: Flowering kinetics



Alphabetical letters at the end of the best line of fit for every treatment signify significant differences; same letters show no significant difference, different letters show significant difference.

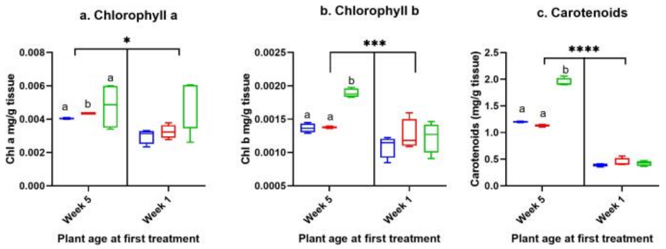
Figure 4: Fruit parameters



Fruit parameters: a) Fruit number, b) Fruit diameter, c)Fruit weight, d) Yield per plant. Different letters on bars represent significant differences between groups within an experiment. Horizontal line on top of graphs show differences between week 5 and week 1 regime where asterisks (*) show significant difference at p= 0.05 while ns means no significant differences based on ANOVA analysis.

Results

Figure 5: Pigment data



Pigment content: a) Chl a, b) Chl b and c)Carotenoids. Different letters on bars represent significant differences between groups within an experiment regime. Horizontal line on top of graphs show differences between week 5 and week 1 regime where asterisks (*) show significant difference at alpha p= 0.05 based on ANOVA analysis.

Conclusions

- ✓ The applied *Chlorella* strain (MACC-360) promoted flowering while *Chlamydomonas reinhardtii* cc124 reduced/delayed flowering, consequently MACC-360 slightly increased yields while *Chlamy* cc124 reduced yields.
- ✓ Both strains had significant effects on measured parameters especially on fruit diameter, weight and pigment content.
- ✓ The strain-specific effects could be due to the strains' different cellular composition and ability to produce extracellular components.
- ✓ Time of MA application affected the outcome with application at week 5 proving to be more beneficial than week 1.
- ✓ Our results on yields resonate with Coppens et al., (2016) while those of pigments and fruit size were as reported by Ali et al. 2016 and Coban et al. (2020).

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References

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