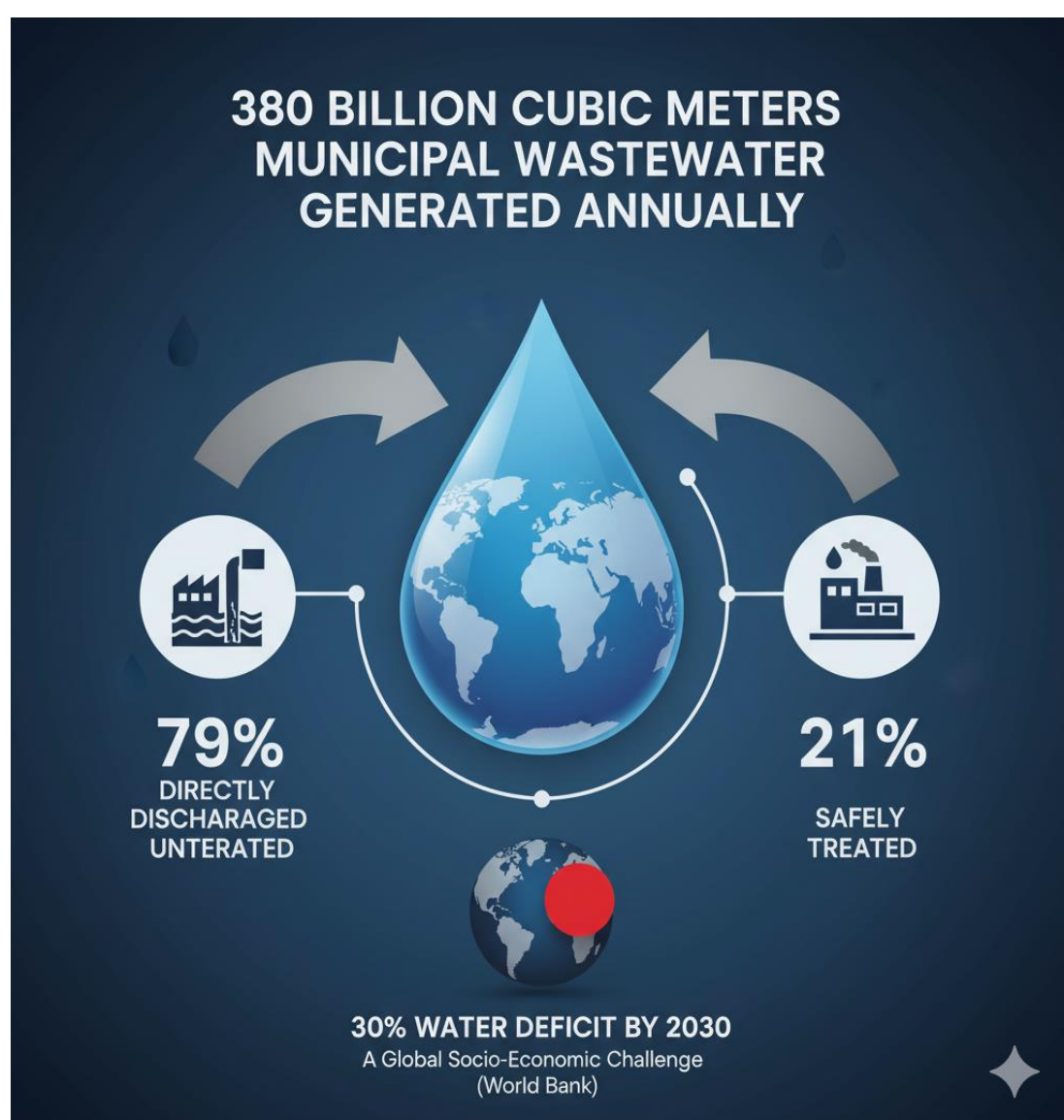
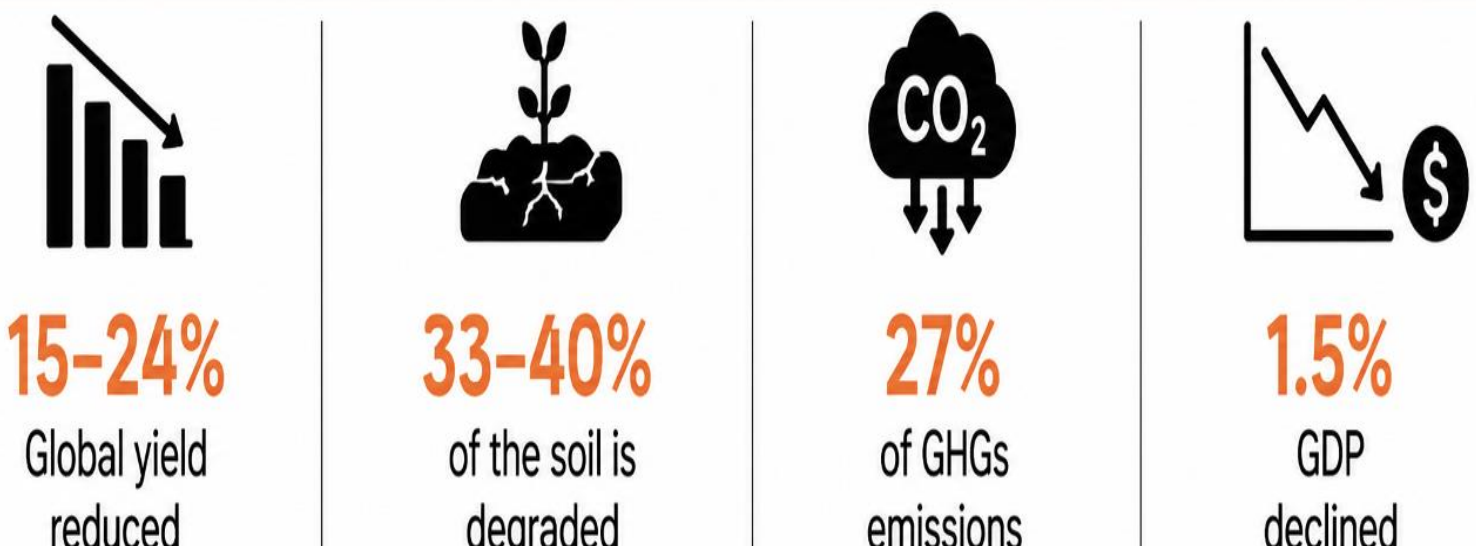


We are losing 30 soccer fields of soil every minute, and if we do not control this, we will have lost 2/3 of arable land by 2050 (Food and Agriculture Organisation).

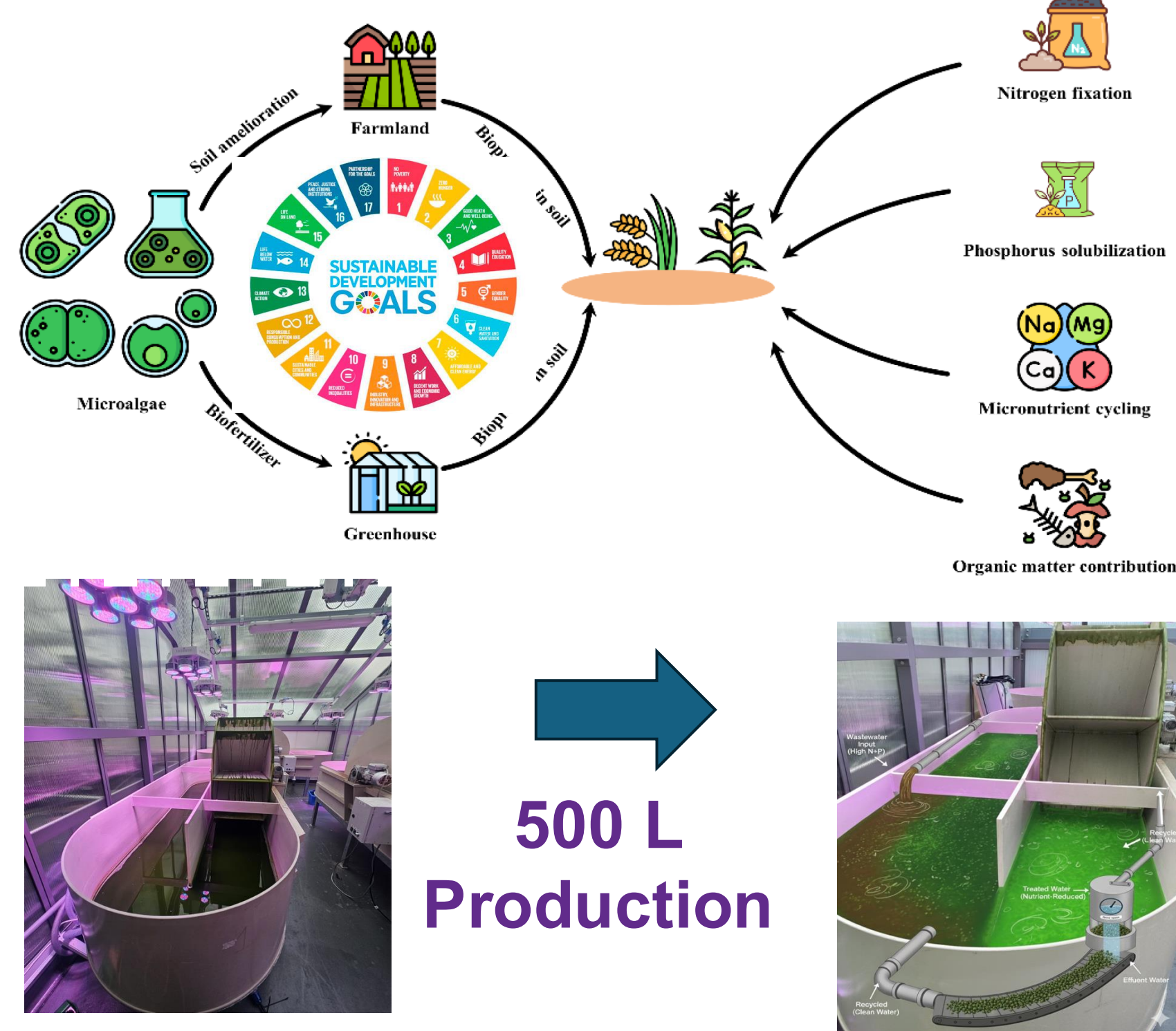


With the rising global population, Chemical fertilizer use has increased to meet food demand; however, excessive and continuous application has led to soil degradation, which causes nutrient imbalance and declining crop yields over time.



Target SDG#6.6: Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

Microalgae fertiliser and SDGs



Aim of the study

To Protect and Restore Degraded Soils
40% reduction in chemical fertiliser use by 2030 (EU Soil Strategy)

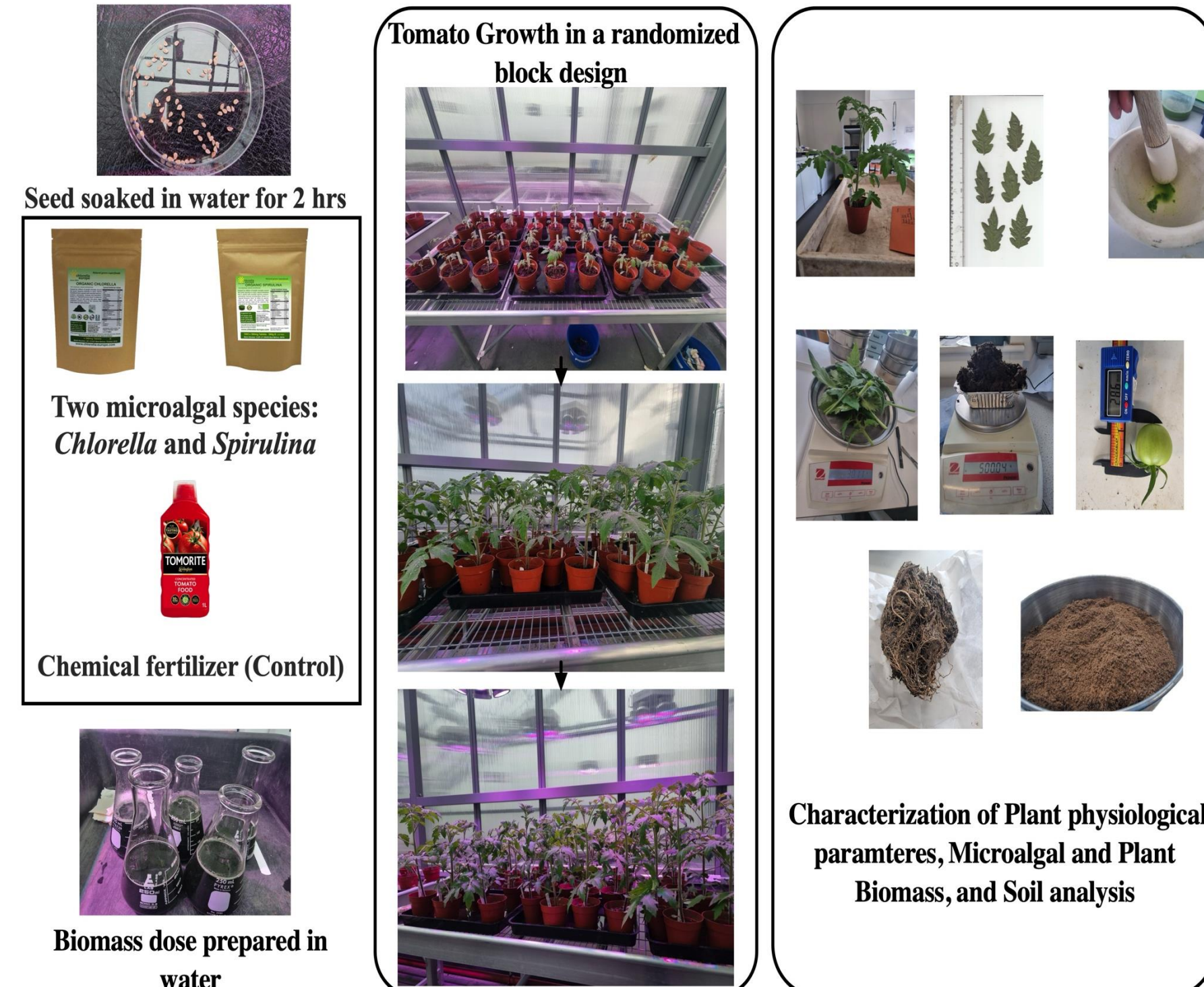


- 100% organic
- 18 macro and micronutrients
- Improves soil fertility
- Increases crop production
- 20-40% reduction in nitrate runoff

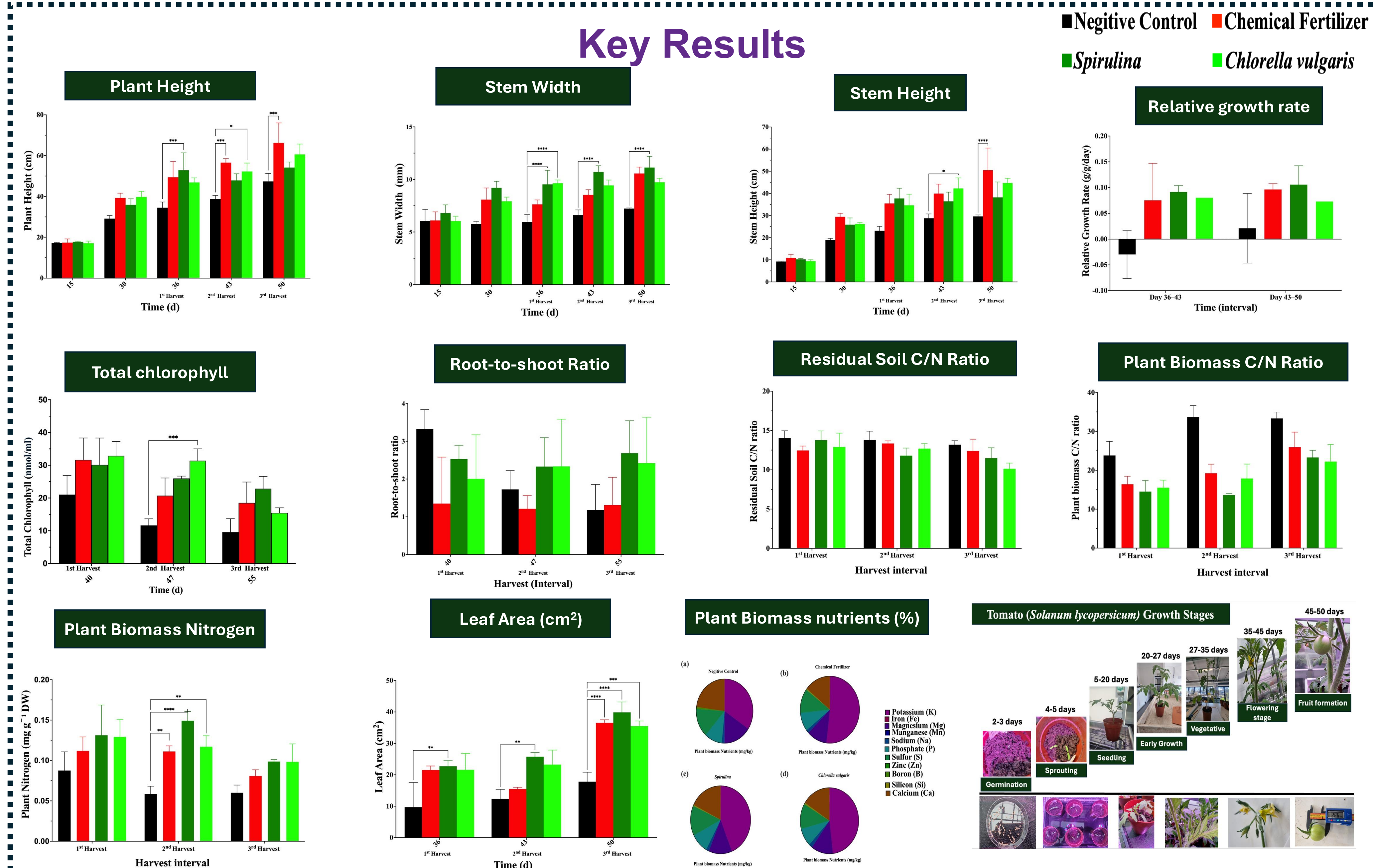
Research Objectives

1. Compare nutrient transfer and soil improvement using two microalgae, *Chlorella* and *Spirulina*, and chemical fertiliser as a control.
2. Assess plant physiological responses using standard analytical methods and harvested biomass for nutritional composition to evaluate its potential as a fertiliser.

Methodology



Key Results



Key Findings

- a) Root biomass accumulation was greater under *Spirulina* treatment, with the relative growth rate being **22.5% higher than Tomorite** (0.087 vs. 0.071 g g⁻¹ d⁻¹). At the 3rd harvest (Day 50), tomato plant height increased by **341% in Tomorite**, **274% in *Chlorella vulgaris***, and **211% in *Spirulina*** compared to the control (17.4 cm).
- b) Tomorite recorded the tallest plants (76.8 ± 1.12 cm), followed by *Chlorella vulgaris* (65.1 ± 0.98 cm) and *Spirulina* (54.2 ± 1.04 cm) (p < 0.05). *Spirulina* treatment produced the **highest stem width (11.6 ± 0.28 mm)**, **branch number (18.0 ± 0.75)**, and **leaf number (212.6 ± 35.64)** compared to other treatments (p < 0.01).
- c) Biomass accumulation under *Spirulina* was markedly improved, showing a **~25% increase over *Chlorella vulgaris*** and substantially greater biomass than Tomorite and the negative control (15.8 ± 0.45 g; p < 0.0001). *Spirulina* treatment recorded the highest relative growth rate and leaf specific area, with leaf area increasing by **~18–20% compared to *Chlorella vulgaris* and Tomorite** (39.87 ± 3.30; p < 0.0001).
- d) Root-to-shoot ratio at Day 55 was greatest under *Spirulina* treatment (2.69 ± 0.86), representing an **11% increase over *Chlorella vulgaris*** and indicating enhanced biomass partitioning towards roots.
- e) Total chlorophyll content declined across harvests; however, during the 2nd harvest, *Chlorella vulgaris* showed the highest chlorophyll content, while by the 3rd harvest, *Spirulina* exhibited a **significant recovery and the highest chlorophyll concentration** (22.85 ± 3.76; p = 0.0137).
- f) Nitrogen accumulation in plant biomass and soil was highest in *Spirulina*-treated plants, with nitrogen content increasing substantially compared to *Chlorella vulgaris*, Tomorite, and the negative control (0.099 ± 0.003 mg/g).

Conclusion

Microalgae proved to be a sustainable alternative to chemical fertilisers, enhancing plant growth while improving nutrients in soil and plant biomass. It not only supports healthy crop growth but also reduces the harmful effects of chemical fertilisers. This study highlights the dual role of microalgae as a promising, eco-friendly and sustainable fertiliser for next-generation agriculture.

References

1. Alobwede, E., Cotton, A., Leake, J. R., & Pandhal, J. (2022). The fate and distribution of microalgal nitrogen when applied as an agricultural soil fertiliser and its effect on soil microbial communities. *Phycology*, 2(3), 297-318.
2. <https://www.fao.org/soils-portal/soil-degradation-restoration/en/>

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