

Does lettuce and pak choi benefit of intercropping with the halophyte glasswort ?

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Introduction

- Environmental stresses such as drought, high temperature, flood, and soil salinity impact agricultural production¹.
- Soil salinity is increasing by approximately 10% annually due to factors like poor agricultural practice, high surface evaporation, etc¹.
- Salinity imposes osmotic stress and ion toxicity which negatively affects the nutritional, safety, and economic aspects of glycophytes (salt-sensitive crops)¹.
- FAO estimates 1.5 million hectares of cultivable land are unusable annually due to salinity².
- Alternative cultivation systems are required to meet the demand of increasing population and simultaneous decreasing freshwater availability³.
- Halophytes, such as glasswort, are tolerant up to 1000 mM salt stress and can benefit glycophytes through intercropping^{1,4}.

Purpose

- To study whether glycophytes, lettuce (*Lactuca sativa*) and pak choi (*Brassica rapa* subsp. *chinensis*), could benefit from the presence of halophyte glasswort (*Salicornia europaea*) in an intercropping system under saline conditions.
- To study the accumulation of selected bioactive compounds and chloride ions between monoculture and intercropping under different treatment conditions.

Experimental design

- Plants were grown under three conditions: control (fresh water) and in two salinity conditions, 50 mM NaCl and 100 mM NaCl solution.
- The design consisted 9 individual plants in monoculture and combination of 3 lettuce, 3 pak choi and 3 glasswort in an intercropping system.
- Each treatment consisted 3 trays for monoculture and 3 trays for intercropping.
- This set-up was replicated for all three treatment types.



Fig 1. Experimental design for control treatment

Methods

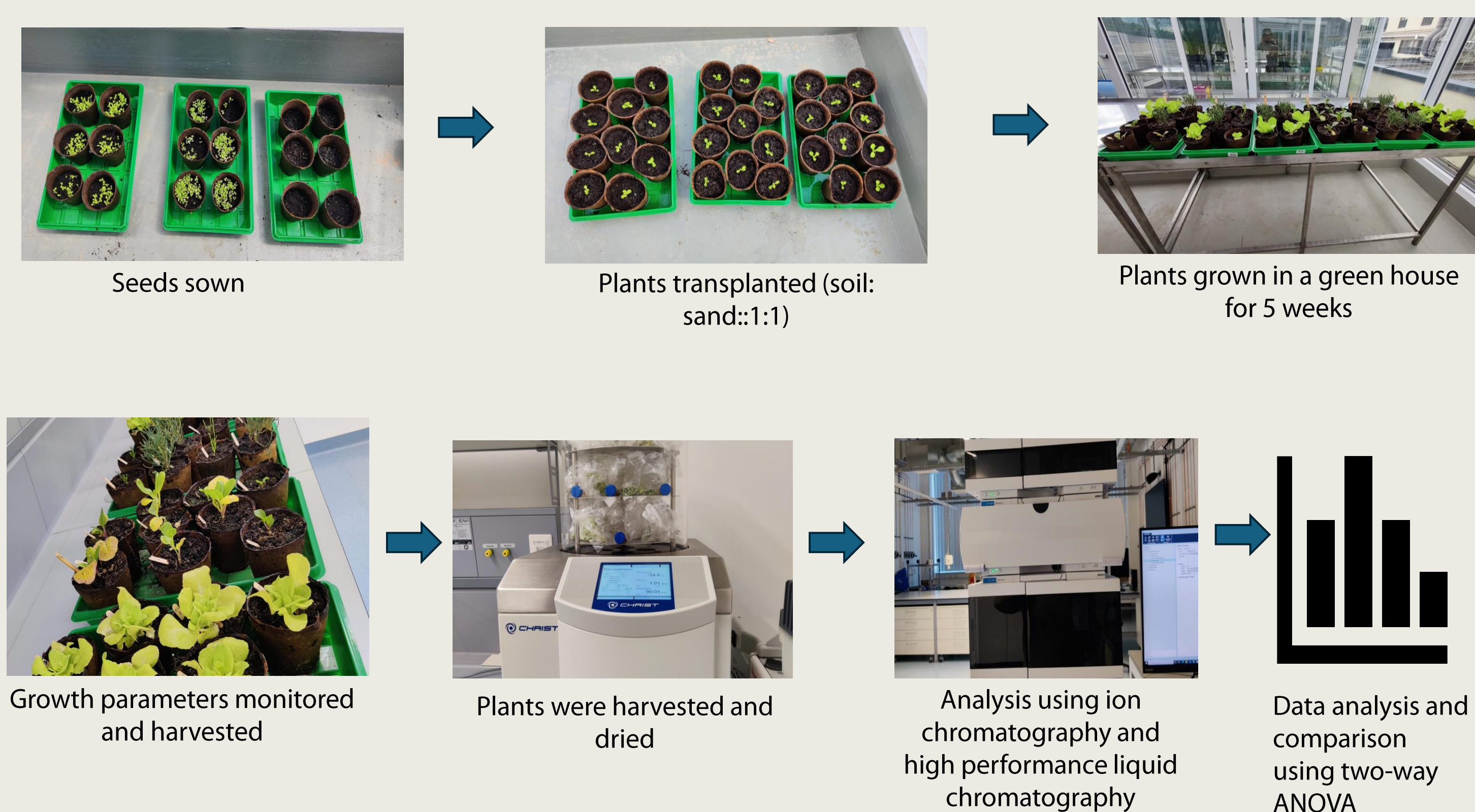


Fig 2. Experimental scheme

Results

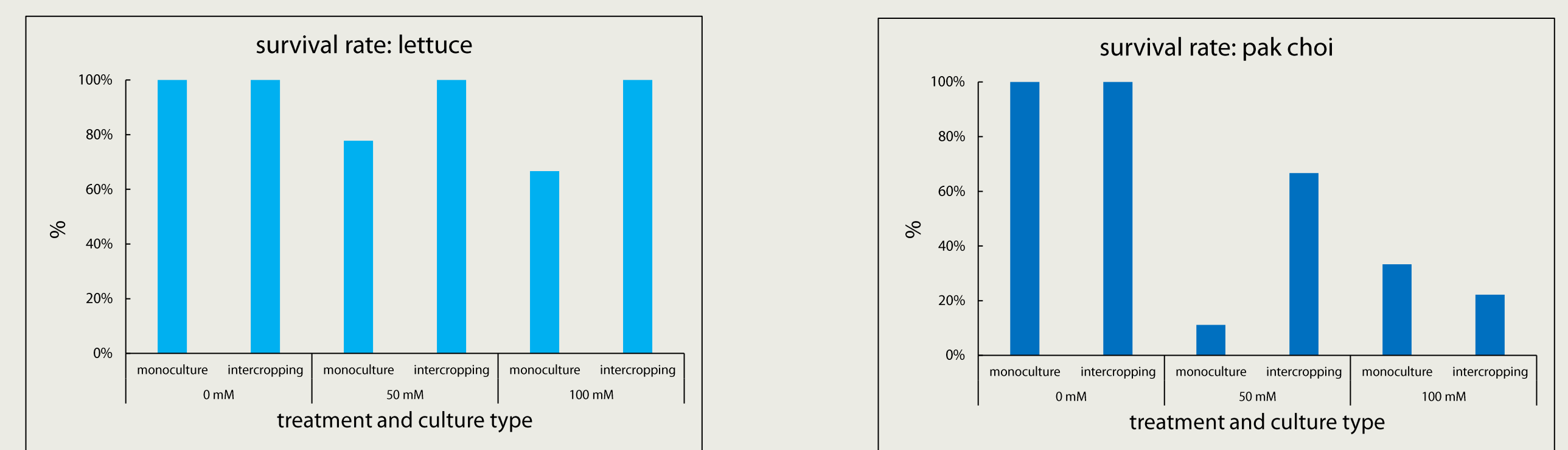


Fig 3. Survival rate of lettuce and pak choi

- 13 plants (2 lettuce, 11 pak choi) and 16 plants (3 lettuce, 13 pak choi) did not survive 50 mM and 100 mM salinity, respectively.

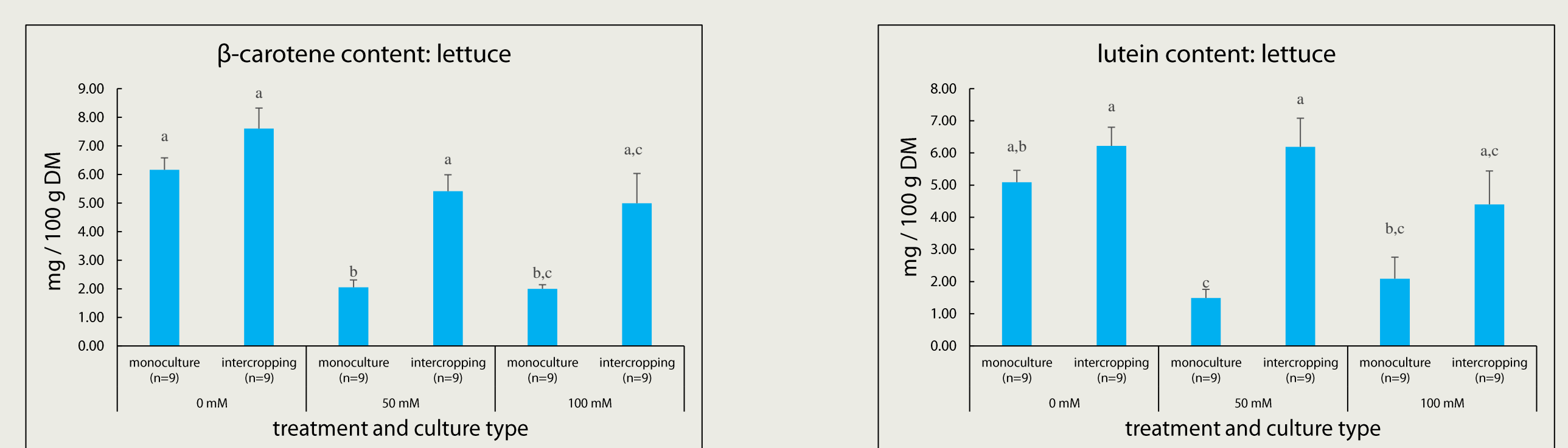


Fig 4. Average β -carotene and lutein content in lettuce

- The β -carotene and lutein content in intercropped lettuce at 50 mM was significantly higher than its monoculture counterpart. Furthermore, these results were comparable to those reported for freshwater monoculture lettuce.

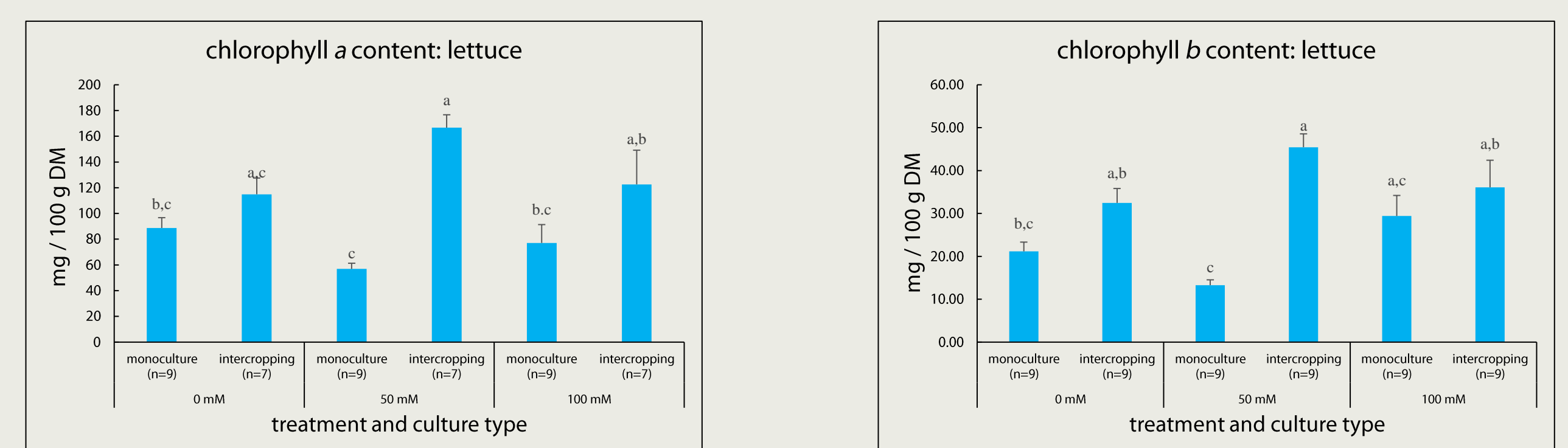


Fig 5. Average chlorophyll a and chlorophyll b content in lettuce

- Chlorophyll a and chlorophyll b accumulation in lettuce were significantly higher in intercropping than its monoculture counterpart at 50 mM salinity.

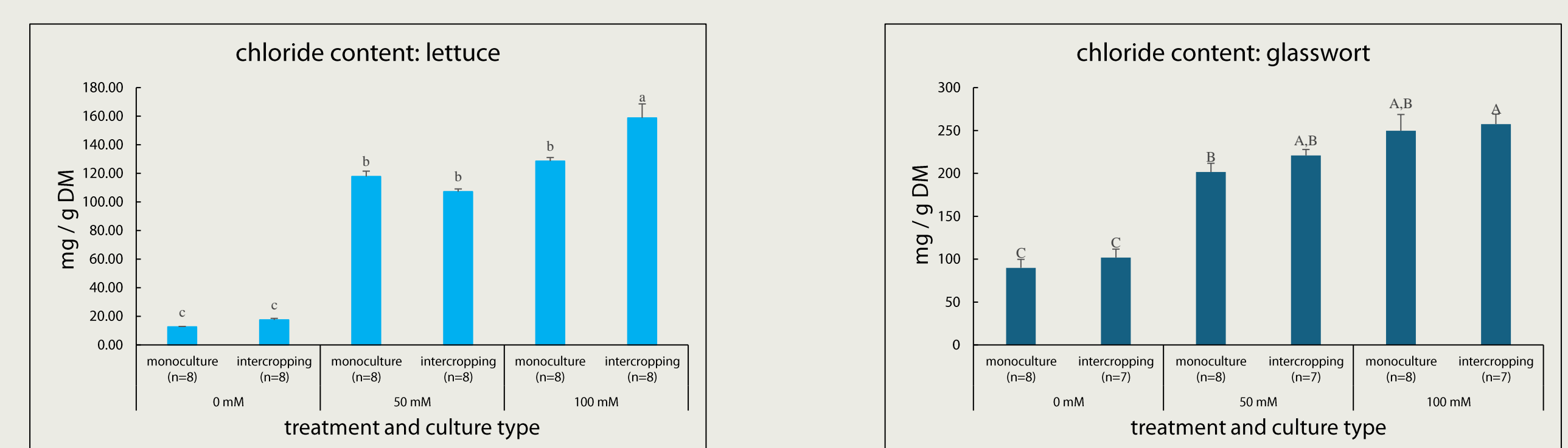


Fig 6. Average chloride content of lettuce and glasswort

- The chloride concentration in intercropping lettuce at 50 mM was lower compared to its intercropping counterpart.

Significance

- These results suggest that lettuce could be grown in an intercropping system with glasswort up to 50 mM salinity with comparable accumulation of important bioactive compounds to control plants.
- Glasswort could be used as an intercropping system to reduce salinity stress in lettuce and findings could contribute to the development of alternative cultivation strategies on saline soils.

References

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