



# Effects of Water Deficit on Growth, Chlorophyll, Proline, and Total Phenolic Content of Chinese White Radish Seedlings Pre-Treated with Low NaCl



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## ABSTRACT

Pretreatment of some plants with low NaCl concentrations before exposure to water deficit stress can promote growth and ability of water deficit stress tolerance. This research aimed to investigate the effects of water deficit stress on growth and some important physiological compounds in Chinese white radish (*Raphanus sativus* L. var. *longipinnatus* Bailey) seedlings pretreated with 10 mM NaCl. The experiment was divided into two parts. Experiment 1, growth of Chinese white radish seedlings pretreated with 10 mM NaCl under water deficit stress. Four-day-old seedlings were transferred to water deficit conditions induced by -0.5 MPa mannitol solution for 3 days. The results indicated that pretreatment with 10 mM NaCl increased shoot height, fresh weight, and water content in seedlings under water deficit stress. Experiment 2, some important physiological compounds of Chinese white radish seedlings pretreated with 10 mM NaCl under water deficit stress. The results indicated that pretreatment with 10 mM NaCl increased proline accumulation in cotyledons, hypocotyls, roots, and seedlings, as well as total phenolic contents in cotyledons and seedlings. However, chlorophyll a, chlorophyll b, and chlorophyll a+b contents in cotyledons decreased, while those in hypocotyls remained unaffected. These results indicate that pretreatment of radish seedlings with 10 mM NaCl for 4 days can promote growth and enhance tolerance to water deficit stress for 3 days.

## INTRODUCTION

**Chinese white radish**, also known as Kaiware daikon in Japan, is a fast-growing microgreens that can be harvested within 5–7 days. The seedlings have unique flavors and high nutritional value, including proteins, minerals, and vitamin. Additionally, they contain beneficial phytochemicals such as phenolic compounds, flavonoids, and glucosinolates.



"Kaiware"

**Water-deficit stress** is a major factor affecting plant growth. It influences plant morphology, such as reducing leaf size; physiology, such as decreasing the photosynthesis rate; and biochemistry, such as increasing the production of reactive oxygen species (ROS).<sup>[1]</sup> However, plants have adapted to reduce stress damage by synthesizing antioxidants, including phenolic compounds, flavonoids, and proline. These adaptations are essential for survival and maintaining plant productivity.

**Pretreatment** before exposure to environmental stress is an effective strategy to enhance growth efficiency and yield while reducing the impact of stress during early stages of plant growth. For example, pretreatment with 50 mM NaCl before exposure to salt stress increased the root and shoot length of 7-day-old mung bean seedlings.<sup>[2]</sup>

## OBJECTIVE

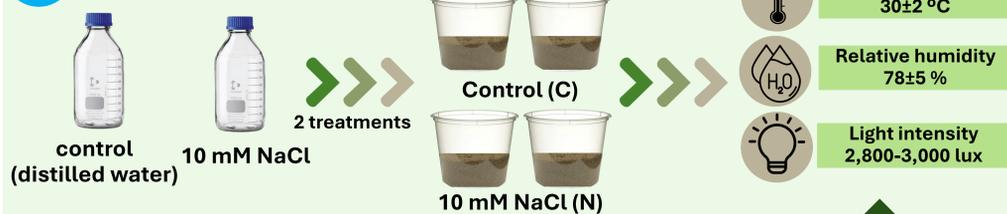
To investigate the effects of water deficit stress on growth and some important physiological compounds in Chinese white radish seedlings pretreated with low NaCl.

## MATERIALS & METHODS

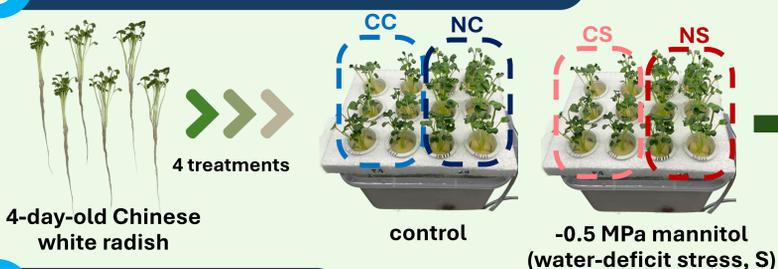
### 1 Preparation of plant materials and seeds



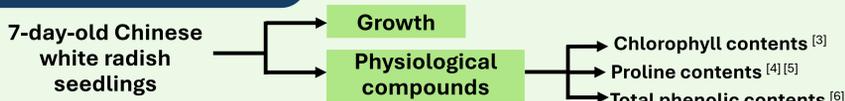
### 2 Seedling pretreatment



### 3 Seedling cultivation under water deficit



### 4 Parameter analysis



## RESULTS & DISCUSSION

The results showed that pretreatment with a low concentration of NaCl increased growth and water content in seedlings under water deficit stress (Fig. 1). Additionally, this pretreatment enhanced proline accumulation in cotyledons, hypocotyls, roots, and seedlings, as well as total phenolic content in cotyledons and seedlings (Fig. 2). However, chlorophyll a, chlorophyll b, and total chlorophyll (a+b) content in cotyledons decreased, while those in hypocotyls remained unaffected (Fig. 3). These findings indicate that pretreatment of Chinese white radish seedlings with low NaCl for 4 days can promote growth and improve tolerance to water deficit stress for 3 days.

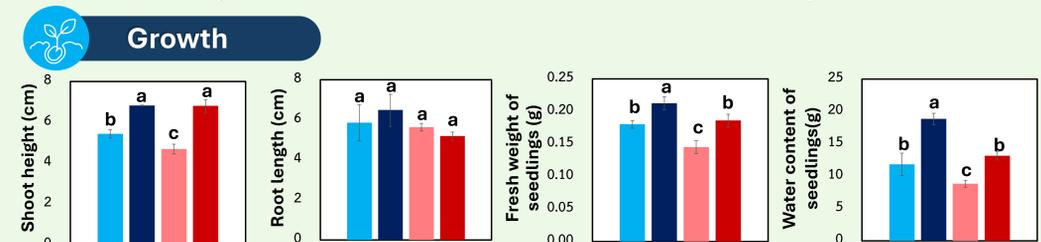


Fig. 1 Effect of water deficit stress on growth and water content of 7-day-old Chinese white radish pre-treated with low NaCl.

### Physiological Compounds

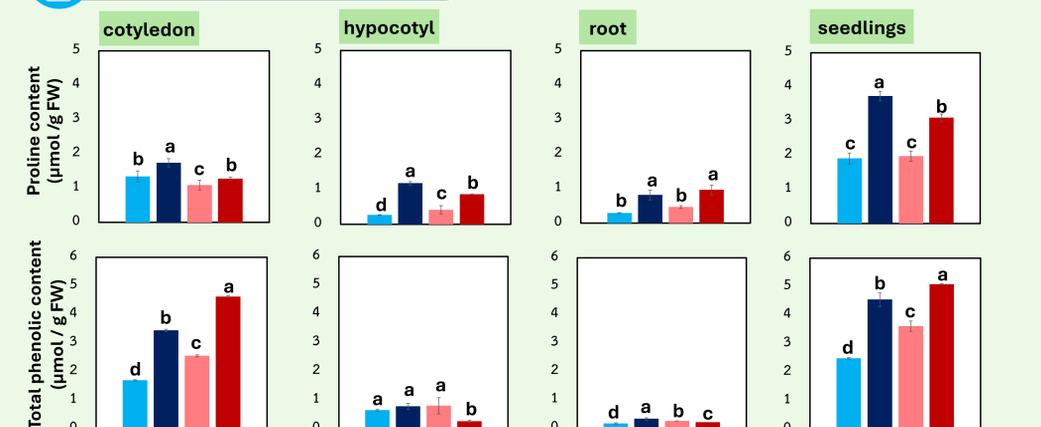


Fig. 2 Effect of water deficit stress on proline and total phenolic contents of 7-day-old Chinese white radish pre-treated with low NaCl.

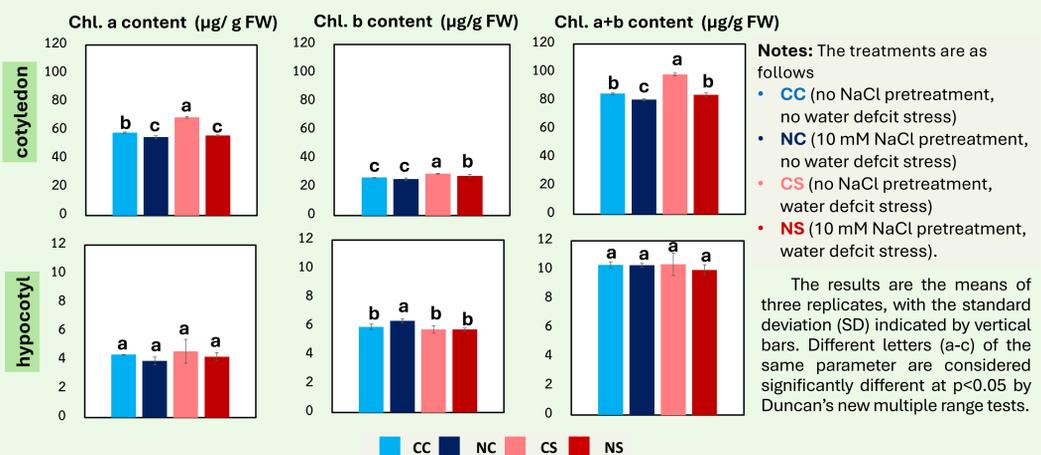


Fig. 3 Effect of water deficit stress on chlorophyll contents of 7-day-old Chinese white radish pre-treated with low NaCl.

## CONCLUSIONS

- Pretreatment with 10 mM NaCl for 4 days, followed by transfer to water deficit stress for 3 days, enhanced shoot height, fresh weight, and water content in radish seedlings.
- Pretreatment with 10 mM NaCl for 4 days can enhance seedling tolerance to water deficit stress for 3 days, as indicated by increased proline accumulation and total phenolic content.

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