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Effect of salt (NaCl) stress on germination and early seedling growth of four vegetables species

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Objectives

The present study was initiated to investigate the influence of salinity on the germination and early seedling growth of sugar beet, cabbage, amaranth and pak-choi and also find a relationship between salt stress and growth.

Materials and Methods

This experiment was conducted to observe the influence of different NaCl concentrations on germination, germination rate (1/t50, where t50 is the time to 50% of germination) root and shoot length and on fresh weight of root and shoot of the seedlings. Plastic Petri dishes (87 mm diameter, 15 mm height) with a tight-fitting lid were used for the experiment. The solution used for the study consisted of 0.0 (control), 4.7, 9.4 and 14.1 dS m^{-1} NaCl. For each plant species 10 seeds for each of the four NaCl treatments were used. Seed were allowed to germinate in laboratory condition on filter paper (Whatman No 2) in Petri dishes soaked in a solution of the respective salt concentration.

Results

The results revealed that different concentrations of salt stress had considerable effect on germination and germination rate (1/t50, where t50 is the time to 50% of sugar beet, cabbage, amaranth and pak-choi. Final germination in all vegetables species showed significant reduction with increasing salt stress up to 14.1 dS m^{-1} NaCl. (Fig.1A). The required time for germination increased with increasing concentration of salt (Fig. 1B). The seedling growth was strongly inhibited in all four vegetables species by all salt levels, particularly at 14.1 dS m^{-1}. Root growth of all four vegetables species were more affected then shoots growth by salt stress (Fig.2A, 2B). Fresh root and shoot weight was also severely affected by all salinity treatments. Fresh shoot weight was reduced more as compared to fresh root weight (Fig.3A, 3B). Linear regression revealed significant negative relationship between salinity and germination, germination rate (1/t50), root length, shoot length, fresh root weight and fresh shoot weight. Strong negative significant (R2=0.71, $P<0.001$) relationship was examined between salt stress and root length while weak negative significant (R2=0.27, $P=0.04$) relationship was observed between salinity and fresh shoot weight.

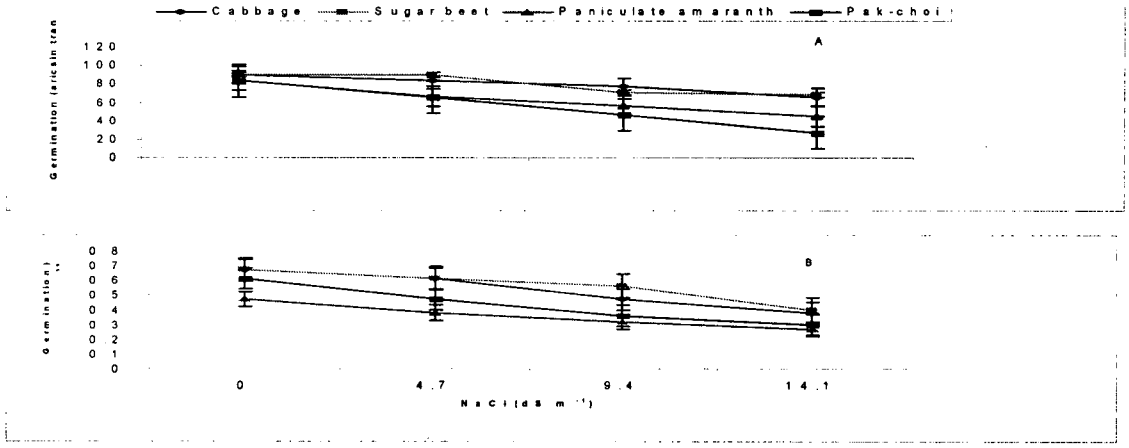

Figure 1. Effect of salt (NaCl) stress on the germination (arcsin transformed) (A) and germination rate (B) of four different vegetables. Error bars are not shown if smaller than symbols.

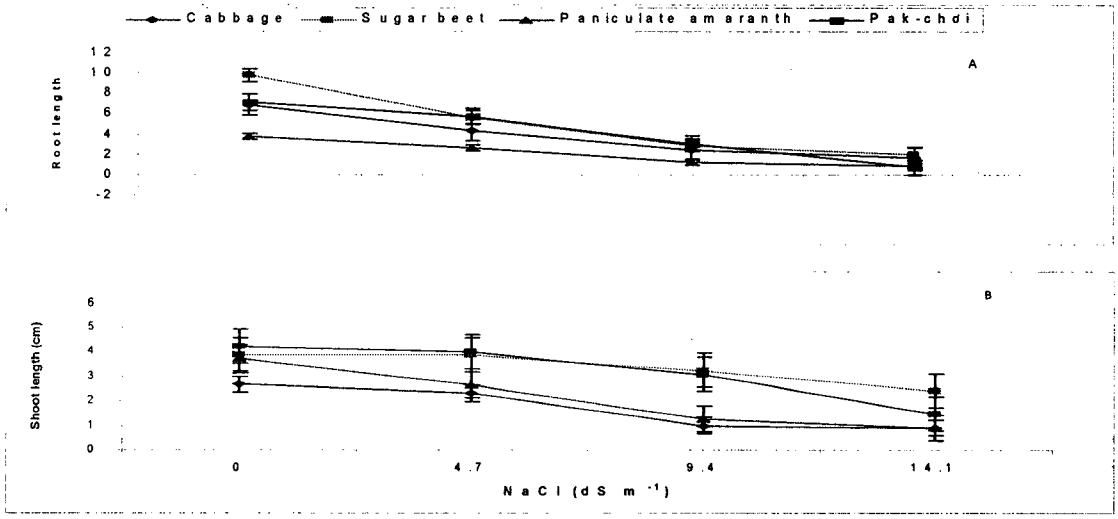

Figure 2. Effect of salinity (NaCl) stress on the root length (A) and shoot length (B) of four different vegetables. Error bars are not shown if smaller than symbols.

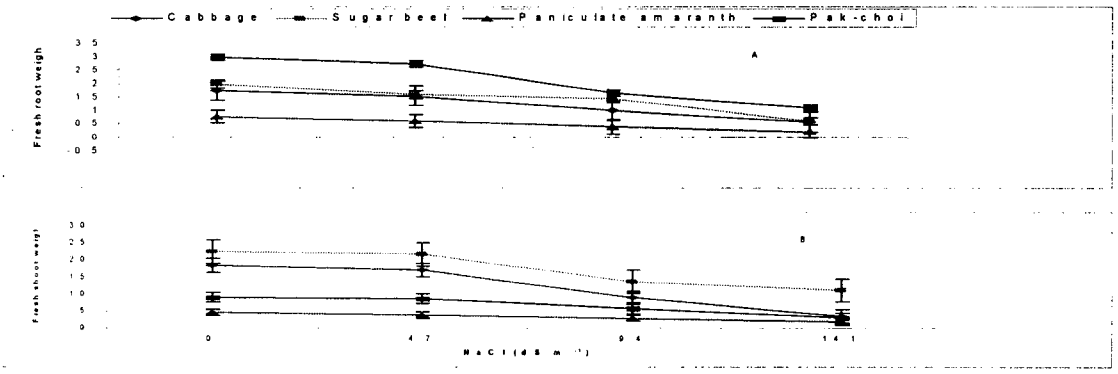

Figure 3. Effect of salinity (NaCl) stress on the fresh root weight (A) and fresh shoot weight (B) of four different vegetables. Error bars are not shown if smaller than symbols.