

Effect of salt stress on germination and seedling growth of soybean

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[Introduction]

Salinity is one of the major abiotic stresses that affect soybean [*Glycine max* (L.) Merr.] plant growth and yield. High salt concentration is known to impact on water uptake, impair seed germination, affect nodule formation and seedling growth rate, retard plant growth, fresh, and dry weight, and reduce the crop yield. The objective of the present study was to investigate the effects of NaCl concentration on water uptake, seed germination, seedling growth, and fresh, and dry weight in soybean accessions.

[Materials and Methods]

A total of 16 soybean accessions were utilized in the present study. These included four *G. max* tolerant, four *G. max* sensitive, four *G. soja* tolerant, and four *G. soja* sensitive soybean genotypes. Two replicates of seeds were grown on paper towels (120 seeds/replicate) pre-moistened with 0mM (control), 100mM and 200mM NaCl concentrations, and placed vertically in plastic trays following a completely randomized design. The trays were transferred into a plant growth chamber under a dark condition at $25 \pm 2^\circ\text{C}$ for 8d. The germination was recorded every 24 hours for 8d, with a radicle of 3 millimeters as the criterion of germination. Seedling growth rate and fresh weight were measured 4, 6, and 8 days after germination.

[Results and Discussions]

Analysis of variance for all the parameters showed significant (at $p < 0.001$) difference within the groups, salt concentrations, accessions, days, and their interactions. The average total water uptake ability of all the soybean accessions was found to reduce by 12.7% and 26.3% at 100mM and 200mM NaCl concentrations, respectively. The maximum water uptake at 100mM and 200mM NaCl concentrations was 90.6% and 79.6% in *G. soja* tolerant group, respectively, and 87.9% and 77.2% in *G. max* tolerant group, respectively. At 200mM NaCl, the *G. max* tolerant group showed a high percentage of germination compared to the other groups. The 100mM NaCl concentration had no effect on the final germination percentage (after 8th day), but the 200mM NaCl was found to reduce the germination percentage by 29.4%. The average seedling growth rate in the soybean accessions was found to be 49.0% and 10.8% at 100mM and 200mM NaCl concentration, respectively. The minimum seedling growth reduction of 46.6% and 87.3% was observed at 100mM and 200mM NaCl concentrations in *G. max* tolerant group. The average seedling fresh weight of the soybean accessions was 41.0% and 10.1% of the control at 100mM and 200mM NaCl concentration, respectively. The minimum fresh weight reduction of 43.7% and 12.6% of the control at 100mM and 200mM NaCl concentrations, respectively was observed in *G. max* tolerant group. Overall, the findings from this study show that the *G. max* tolerant accessions possess greater ability to respond to NaCl stress compared to the three other groups.

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