



Systematic assessment of seedling-stage salinity tolerance in rice genotypes under controlled stress conditions in Ghana

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INTRODUCTION & AIM

- Local rice production meets only about 50% of the total demand, leading the country to spend over 400 million dollars annually on rice imports (MoFA, 2023).
- Rice production is influenced by both biotic and abiotic factors. (Onyango, 2014; Acharya *et al.*, 2019; Simkhada, 2021).
- Salinity threatens rice, impacting 1 billion hectares of land worldwide (Kakar, Jumaa, Redoña, Warburton, & Reddy, 2019).
- Soil and irrigation water salinity are significant abiotic stresses that severely impact crop production worldwide. Salinization is a major contributor to soil degradation, affecting up to 20% of irrigated land and 2.1% of dryland agriculture globally (Hee et al., 2013).
- Salinity threatens rice, impacting 1 billion hectares of land worldwide (Kakar, Jumaa, Redoña, Warburton, & Reddy, 2019).
- The aim of this study was to evaluate the response of rice genotypes to increasing salinity levels at the seedling stage.

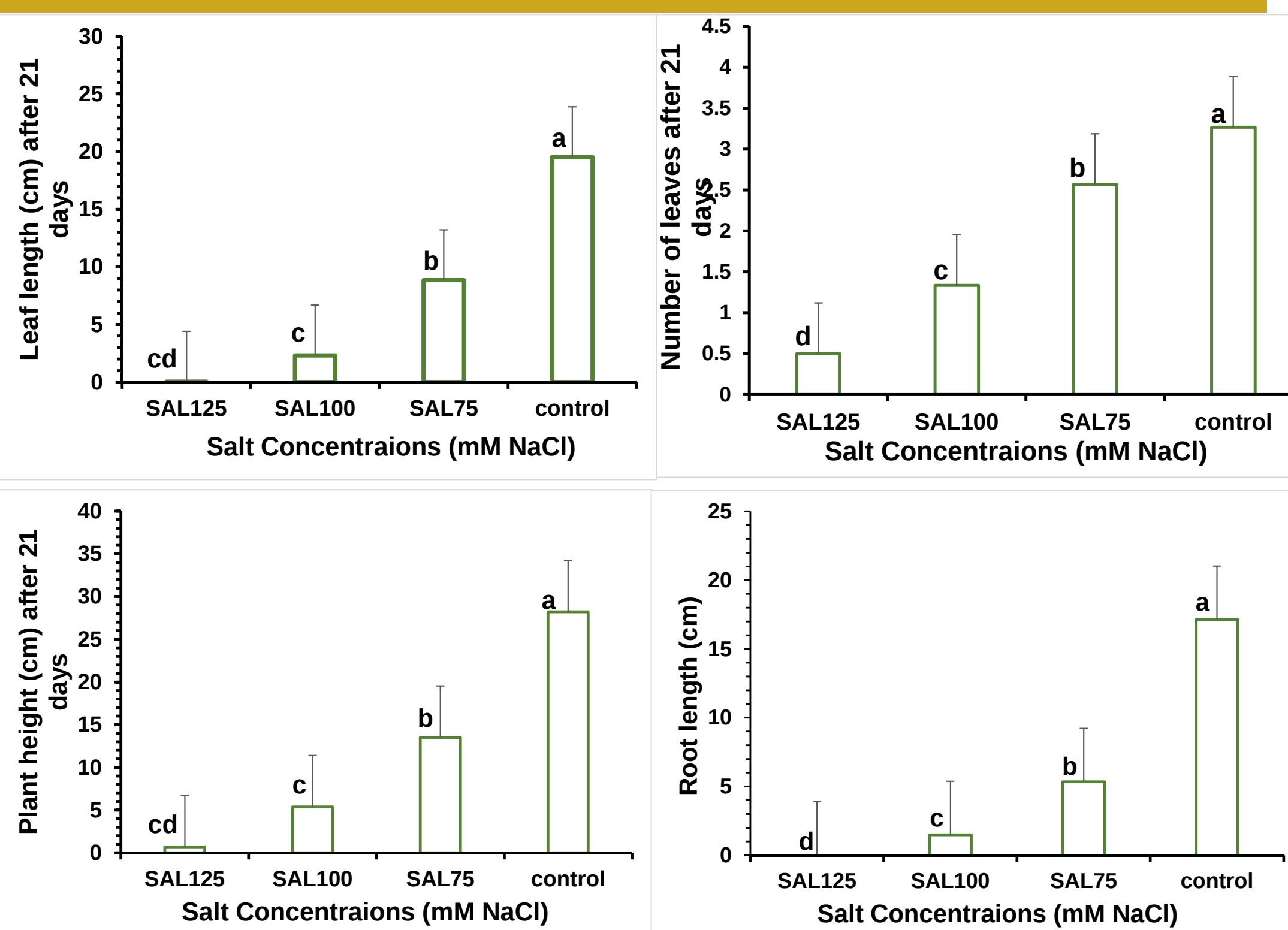
RESULTS & DISCUSSION

- Salt stress significantly impairs rice seedling growth, with increasing NaCl concentrations (75, 100, 125 mM) causing progressive reductions in leaf number, plant height, root and shoot length, and biomass.
- The severity of impact was dose-dependent, with higher salinity levels leading to more pronounced physiological decline. Genotypic variation in salt tolerance was evident: while six genotypes survived at 75 mM, only five persisted at 100 mM, and none at 125 mM after 21 days, highlighting the threshold beyond which survival fails (Arif et al., 2024).
- These findings confirm rice's high sensitivity to salinity stress and align with prior studies showing that elevated salt levels disrupt water uptake, nutrient balance, and cellular function (Khan et al., 2023; Zuo et al., 2024).
- The results underscore the need for breeding salt-tolerant varieties and developing adaptive agronomic strategies for saline-prone environments.



METHOD

- The experiment was conducted during the major rainy season of 2025 at CSIR-Crops Research Institute, Fumesua, Kumasi.
- 4 × 10 factorial arrangement in a randomized complete block design (RCBD) with three replications.
- Filled seeds were separated from unfilled seeds by water separation and suspension.
- Filled seeds were disinfected in a Mancozeb 640 g/kg + Metalaxyl 80 g/kg WP solution, then air dried for 24 hours.
- Ten rice genotypes were used for the study and treated with salt concentrations at 0, 75, 100 and 125 mM NaCl under controlled rain house shelter.
- Plant growth and development data were collected over time till 21 days after termination of experiment and the data subjected to Agricolae package in "R" 4.3.1.



CONCLUSION

The results showed that salt stress markedly inhibited the growth and biomass accumulation of rice seedlings, with all measured traits showing progressive declines as NaCl concentration increased. The observed genotype-specific responses indicate varying tolerance levels, while complete mortality at 125 mM underscores the severity of high salinity stress.

FUTURE WORK

Further research should focus on screening a broader range of genotypes and elucidating the physiological and molecular mechanisms underlying salt tolerance to facilitate the development of resilient rice varieties and enhance food security.