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# Assessment of Hydrogen Peroxide Potential in Mitigating Salinity Stress on Growth and Yield of *Zea mays* (L.) - Maize

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**Abstract** Salt stress is one of the major limitations of seed germination, plant growth, productivity and nutritional composition. Hydrogen peroxide ($H_2O_2$) functions as a signalling molecule that modulates physiological and biochemical processes under abiotic stress. Therefore, this research was conducted to assess the potential of $H_2O_2$ in mitigating adverse effects of salinity stress on the growth and yield of *Zea mays* (L.). The experiment was conducted in a screenhouse using 96 pots each filled with 14 kg topsoil and arranged in a completely randomized design with eight replicates per treatment. Maize seedlings raised were grouped into two: Each pot in Group A was irrigated with sodium chloride (NaCl) solution and supplemented with 50 ml of 3% $H_2O_2$ (882 mM) which was applied to the soil, while each pot in Group B received NaCl solution without $H_2O_2$. Salinity treatments were applied at 0 (control), 50, 100, 150, 200, and 250 mM NaCl three times per week and flushed once per week to prevent salt accumulation. Growth, yield, biomass, leaf chlorophyll as well as grain nutritional composition were assessed following standard procedures, and data were analysed using One Way Analysis of Variance at $p \leq 0.05$. Plant height declined the most from 160.76 cm in control to 112.19 cm at 250 mM NaCl without $H_2O_2$, while $H_2O_2$ treated plants at the same salinity decreased to only 123.52 cm. However, other growth parameters were not significantly enhanced by $H_2O_2$. The effect of salinity on number of grains per plant was positively influenced by $H_2O_2$ as salinity decreased it from 226.25 to 84.50 without $H_2O_2$, but $H_2O_2$-treated plants maintained up to 88.12 per plant at 250 mM. Salinity treatments devoid of $H_2O_2$ had protein reduced from 15.14% to 13.44%, fat from 1.88% to 1.74%, and crude fibre from 3.40% to 2.74%. However, salinity with $H_2O_2$ treatment sustained higher values (14.31%, 2.41%, and 2.80%, respectively). This study demonstrates that hydrogen peroxide can mitigate salinity-induced stress on growth and productivity in maize, supporting its potential role as a stress modulator in crop production under saline conditions.

**Keywords** Salt stress; Hydrogen peroxide; Salinity tolerance; *Zea mays*

## 1 Introduction

Maize (*Zea mays* L.) is a major cereal crop globally, serving as a staple food for millions and a vital component of the agricultural economy (Yadesa and Diro, 2023). Its significance stems from high yield potential, economic value, and broad adaptability. The global annual production of maize exceeds 1 billion metric tons, with leading producers including the United States of America, China, Brazil, and various African countries (Galani et al., 2022). In Nigeria, maize plays a critical role in food security and rural livelihoods, being widely cultivated across subsistence and commercial farming systems (Ogunniyi et al., 2021). Maize is rich in carbohydrates, providing essential energy, and contains key micronutrients such as vitamin A, iron, and zinc, essential for human nutrition (Galani et al., 2022; Kihara et al., 2024). Its industrial importance is underscored by its use in livestock feed and as raw material for bioethanol, starch, and biodegradable plastics (Maitra and Singh, 2021).

Despite this importance, maize productivity faces considerable challenges from abiotic stresses like soil salinity, which severely limit plant growth, yield, and nutritional quality (Syed et al., 2021; Islam et al., 2024). Soil salinity, typically resulting from excessive sodium chloride accumulation, disrupts water uptake, ionic balance, and induces oxidative stress through reactive oxygen species (ROS), including hydrogen peroxide ($H_2O_2$) (Al Otaibi et al., 2024). These biochemical imbalances cause reductions in photosynthesis, biomass, and ultimately grain yield (Zhu et al., 2023).