treated plants preserved higher chlorophyll content across all salinity levels, supporting sustained photosynthetic capacity and contributing to better grain quality.

Table 5 Grain nutritional and proximate compositions of *Zea mays* under salinity treatments with and without hydrogen peroxide (H_2O_2) application

Proximate (%) and nutritional (mg/kg) composition	With and without HP	Salinity treatment (mM NaCl)					
		0	50	100	150	200	250
Moisture	WHP	7.11±0.11[a]	7.82±0.22[a]	8.14±0.11[a]	8.83±0.28[a]	8.03±0.55[a]	8.74±0.27[a]
	PHP	7.10±0.10[a]	8.87±0.34[a]	8.01±0.18[a]	8.82±0.18[a]	9.39±0.02[a]	9.84±0.28[a]
Fat	WHP	1.88±0.13[a]	1.83±0.03[a]	2.04±0.08[a]	2.02±0.02[a]	1.82±0.06[a]	1.74±0.05[a]
	PHP	1.78±0.11[a]	1.75±0.06[a]	1.58±0.02[a]	1.83±0.19[a]	1.89±0.02[a]	2.41±0.11[b]
Ash	WHP	3.22±0.22[a]	4.94±0.07[a]	2.79±1.59[a]	4.20±0.21[a]	3.76±0.18[a]	4.06±0.05[a]
	PHP	3.22±0.27[a]	3.91±0.11[a]	3.77±0.17[a]	4.14±0.12[a]	3.73±0.13[a]	3.89±0.21[a]
Crude fibre	WHP	3.40±0.01[b]	2.48±0.23[a]	2.92±0.09[ab]	2.55±0.26[ab]	3.08±0.07[ab]	2.74±0.09[ab]
	PHP	2.99±0.02[a]	2.83±0.08[a]	2.97±0.04[a]	2.21±0.23[a]	2.67±0.08[a]	2.80±0.23[a]
Crude protein	WHP	15.14±0.58[b]	11.21±0.23[ab]	11.50±0.51[ab]	10.36±0.38[ab]	12.48±0.31[ab]	13.44±0.57[ab]
	PHP	15.17±0.58[a]	12.24±0.24[b]	13.50±0.51[b]	10.96±0.01[b]	14.50±0.63[b]	14.31±0.34[b]
Carbohydrate	WHP	69.26±0.81[a]	71.72±0.12[a]	72.61±0.97[a]	72.03±0.55[a]	70.83±1.03[a]	69.28±0.65[a]
	PHP	69.29±0.83[a]	70.40±0.56[a]	70.17±0.14[a]	72.03±0.26[a]	67.82±0.79[a]	66.76±0.07[a]
Nitrogen (N)	WHP	5.07±0.01[a]	3.80±0.15[b]	3.90±0.20[b]	3.52±0.00[b]	4.25±0.02[ab]	4.28±0.10[ab]
	PHP	5.10±0.00[a]	4.15±0.00[a]	4.58±0.01[a]	3.72±0.02[a]	4.92±0.02[a]	4.85±0.02[a]
Potassium (k)	WHP	329.80±0.30[a]	331.50±0.60[a]	328.15±0.2[5a]	329.80±0.30[a]	331.50±0.60[a]	328.15±0.25[a]
	PHP	329.80±0.30[a]	335.05±0.45[a]	336.50±0.30[a]	339.95±0.35[a]	342.80±0.30[a]	333.50±0.20[a]
Calcium (Ca)	WHP	10.45±0.25[a]	11.05±0.65[a]	11.00±0.10[a]	11.45±0.25[a]	12.05±0.35[a]	12.50±0.40[a]
	PHP	10.47±0.25[a]	5.50±0.30[ab]	7.80±0.30[ab]	10.30±0.10[a]	11.15±0.75[a]	12.70±0.20[a]
Phosphorus (P)	WHP	318.45±0.05[a]	320.45±0.05[a]	317.15±0.25[a]	318.45±0.05[a]	320.45±0.05[a]	317.15±0.25[a]
	PHP	316.55±0.05[a]	318.15±0.05[a]	316.15±0.2[5a]	322.80±0.30[a]	320.85±0.25[a]	318.75±0.15[a]

Note: Values are mean ± standard error of 8 replicates (Tukey HSD test at $p≤0.05$). Mean with the same alphabet(s) along the column are not significantly different from each other. PHP: plus hydrogen peroxide (H_2O_2); WHP: without hydrogen peroxide (H_2O_2)

Overall, hydrogen peroxide application consistently reduced the adverse effects of salinity on *Zea mays* by approximately 10%~20% across biomass, yield, and nutritional/proximate composition metrics, particularly at moderate salinity levels. However, under severe stress (250 mM NaCl), mitigation was partial, indicating that while hydrogen peroxide enhances resilience, it does not fully counteract extreme salinity effects.

4 Discussion

The results of this study clearly show that hydrogen peroxide (H_2O_2) serves as an effective agent in reducing the harmful impacts of salinity stress on *Zea mays* (maize). This aligns well with the established understanding that HP functions as a key signaling molecule in plants' responses to various abiotic stresses. At low concentrations, HP acts not as a damaging oxidant but as a regulator that triggers protective mechanisms, such as activating antioxidant systems, modulating gene expression, and facilitating cellular acclimation to adverse conditions like high salt levels.

One prominent benefit observed from this experiment was H_2O_2 capacity to lessen the salinity induced decline in plant height. Specifically, plants treated with HP reached an average height of 123.52 cm under 250 mM NaCl stress, in contrast to only 112.19 cm in untreated stressed plants. This improvement reflects H_2O_2 contributions to processes like osmotic adjustment where plants accumulate compatible solutes to maintain cell turgor and enhanced scavenging of reactive oxygen species (ROS), which otherwise accumulate excessively under salt stress and cause cellular damage. Such effects are supported by prior research demonstrating H_2O_2 involvement in these protective pathways in plants facing osmotic challenges (Qureshi et al., 2022; Zulfiqar et al., 2022).