

decreased under salinity, with more pronounced reductions at 200~250 mM NaCl compared to the control. Leaf length, breadth, and area followed similar trends, with hydrogen peroxide providing partial mitigation, resulting in less severe declines than without it, likely due to improved osmotic regulation. The number of tassels remained relatively stable under salinity, with hydrogen peroxide having a negligible effect, indicating reproductive initiation was less impacted than vegetative growth.

At the end of the experiment, root growth parameters (number and length) varied depending on hydrogen peroxide treatment and salt concentration. At 50~150 mM NaCl, plants treated with hydrogen peroxide (H_2O_2) had better root development compared to those without. However, at 200~250 mM NaCl, root parameters declined more sharply without hydrogen peroxide (H_2O_2).

3.3 Plant biomass

Salinity stress significantly reduced the vegetative biomass (fresh and dry weights of roots, stems, and leaves) of *Zea mays* in both hydrogen peroxide (H_2O_2) treated (PHP) and without hydrogen peroxide (H_2O_2) (WHP) plants, with reductions intensifying at higher NaCl concentrations (200~250 mM) as shown in Table 3. Without hydrogen peroxide, fresh and dry weights of roots, stems, and leaves decreased markedly, reflecting impaired cell division and photosynthetic efficiency due to osmotic stress and ion toxicity. For instance, at 250 mM NaCl, root dry weight was significantly lower compared to the control.

In contrast, H_2O_2 treated plants exhibited less severe biomass reductions across all salinity levels. At 50~150 mM NaCl, hydrogen peroxide (H_2O_2) treated (PHP) sustained higher fresh and dry weights for roots, stems, and leaves compared to without hydrogen peroxide (H_2O_2) (WHP) plants, indicating improved water retention and metabolic activity. At 250 mM NaCl, hydrogen peroxide (H_2O_2) treated (PHP) plants still showed higher biomass than without hydrogen peroxide (H_2O_2) (WHP), though not fully restored to control levels. This suggests hydrogen peroxide mitigated salinity induced stress by enhancing antioxidant defenses and osmotic adjustment, partially preserving biomass accumulation as shown in Table 3.

Table 3 Vegetative biomass of *Zea mays* under salinity treatments with and without Hydrogen peroxide (H_2O_2) application

Growth parameters (g)		With and Salinity treatment (mM NaCl) without HP					
		0	50	100	150	200	250
Leaf fresh weight	WHP	64.91±1.05 ^a	47.60±0.81 ^b	46.85±0.58 ^b	39.28±1.00 ^{bc}	39.65±0.29 ^{bc}	30.90±5.35 ^c
	PHP	61.90±3.09 ^a	47.56±1.48 ^b	37.50±1.59 ^{bc}	46.96±1.07 ^{bc}	41.13±0.78 ^{bc}	44.32±0.35 ^b
Stem fresh weight	WHP	142.63±1.30 ^a	105.31±0.81 ^b	103.30±1.45 ^b	54.22±0.22 ^c	38.05±1.03 ^c	35.15±0.57 ^c
	PHP	149.90±0.39 ^a	113.56±0.82 ^b	102.98±0.13 ^b	61.92±0.41 ^c	41.58±0.36 ^d	35.03±0.38 ^d
Root fresh weight	WHP	52.84±0.15 ^a	37.94±1.50 ^b	33.45±0.41 ^b	24.45±0.58 ^c	28.26±0.94 ^c	28.13±0.43 ^c
	PHP	55.13±0.57 ^a	42.77±0.62 ^b	43.05±0.81 ^b	34.20±0.71 ^c	32.62±0.81 ^c	35.28±0.59 ^c
Leaf dry weight	WHP	39.98±2.10 ^a	32.87±1.93 ^a	28.12±1.56 ^{bc}	21.11±0.78 ^{bc}	17.78±0.17 ^c	15.41±0.16 ^c
	PHP	30.16±0.49 ^a	30.66±0.23 ^a	29.72±0.17 ^a	23.00±0.19 ^b	15.92±0.11 ^{bc}	15.07±0.17 ^{bc}
Stem dry weight	WHP	72.20±0.44 ^a	65.62±0.85 ^b	52.10±0.53 ^b	35.26±0.69 ^c	31.21±1.55 ^c	22.36±0.46 ^d
	PHP	69.12±0.52 ^a	68.03±0.50 ^a	64.25±0.32 ^a	57.47±1.31 ^b	27.80±0.53 ^c	27.75±0.21 ^c
Root dry weight	WHP	33.47±0.38 ^a	29.36±0.66 ^b	22.27±0.18 ^b	20.19±0.32 ^b	24.61±0.84 ^b	25.11±0.59 ^b
	PHP	34.15±0.55 ^a	23.25±0.41 ^b	23.66±0.83 ^b	25.10±1.31 ^b	24.66±0.65 ^b	23.23±0.42 ^b
Total biomass	WHP	145.24±2.21 ^a	128.58±2.0 ^b	102.80±1.52 ^c	76.63±1.16 ^d	73.71±1.69 ^d	62.90±0.71 ^d
	PHP	133.43±0.72 ^a	121.92±0.77 ^{ab}	117.65±0.88 ^{ab}	105.57±0.97 ^{ab}	68.38±0.93 ^c	65.71±0.47 ^c

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

3.4 Yield parameter

Salinity significantly reduced yield components, including ear number, ear length, grain number, and grain weight per plant (Table 4), with the most pronounced effects at 250 mM NaCl. Without hydrogen peroxide (H_2O_2) (WHP), the number of grains per plant dropped from 226.25 in the control to 84.50 at 250 mM, reflecting disrupted assimilate allocation and kernel development due to salinity stress.