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**SHORT COMMUNICATION**



# EFFECT OF SALINITY-HEAVY METAL INTERACTIONS AS EVALUATED BY SOIL EXTRACTION AND PLANT ANALYSIS

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**Abstract:** A pot experiment was conducted to evaluate the effect of salinity on growth and heavy metal uptake by maize *(Zea mays)* plant. The results of the study show that NaCl and NaCl+$CaCl_2$ treatments decreased the growth of maize plant (plant height, shoot weight and root weight) significantly. The proportion of viable roots and root fresh weight declined with time. In contrast, salinity treatments enhanced root length. NaCl and NaCl+$CaCl_2$ treatments increased the accumulation of Cd, Zn and Cu in maize plant considerably both in shoot and root.

**Key words:** Soil salinity, Heavy metal, Interaction

Due to various degrees of salinity in soil and water bodies agricultural production is hampered very much in the South-Western part of Bangladesh. Contaminated fertilizer and industrial effluents increases heavy metals in soil and other environmental segments to a greater degree. Therefore, the main objectives of the present research work will be to measure the effect of heavy metal salinity interactions by evaluating the soil and plant analyses.

Agricultural soils near a city waste dumping site of Khulna metropolitan city were collected for the study. Soil sample was taken into earthen pots which were then irrigated with water or with salt solution comprised of three treatments, namely- distilled water (control), Salt (Na) Solution: 24 mM NaCl and Salt (Na +Ca) solution : 24 mM NaCl + 7 mM $CaCl_2$. Heavy metal concentration in soil extract and plant material was determined by atomic absorption analysis after acid ($HNO_3$ + $HC1O_4$, 2:1) digestion. Root length was estimated by a gridline intersect method as described by Tenant (1975). Root viability was measured by REL method as described by Radoglou, *et al.* 2007. The significance of differences between treatments was evaluated by the analysis of variance.

***Plant Height and Weight:*** Plant height of the maize plant decreased up to 10% with NaCl treatment and more than 20% with NaCl+$CaCl_2$ treatment as compared to control (Table 1). The highest shoot fresh weight (161.86 gm $pot^{-1}$) and dry weight (81.77 gm $pot^{-1}$) and the lowest root fresh weight (15.21gm $pot^{-1}$) dry weight (10.15 gm $pot^{-1}$) were observed with distilled water and with NaCl respectively (Table 1). Significant difference was found between control and NaCl+$CaCl_2$ treatment ($LSD_{0.05}$). Khoshgoftarmensh *et al.,* (2008) concluded that increasing rates of salinity level decreased plant growth significantly.

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Table 1: Effect of salt water treatment on height (cm) and weight (gmpot$^{-1}$) of the maize

| Treatment | Height (cm) | | | | |
|---|---|---|---|---|---|
| | 2nd week | 4th week | 6th week | 8th week | 10th week |
| Control | 36.08±1.01 | 62.17±1.04 | 100.13±1.31 | 126.08±1.01 | 138.13±1.11 |
| NaCl | 31.00±1.15 | 51.58±1.81 | 87.33±1.15 | 114.88±1.08 | 124.33±1.38 |
| NaCl+$CaCl_2$ | 26.83±1.01 | 44.54±1.13 | 73.98±1.15 | 96.33±1.04 | 105.20±1.00 |
| | Weight ( gm pot$^{-1}$) | | | | |
| Treatment | Shoot fresh weight | | Shoot dry weight | Root fresh weight | Root dry weight |
| Control | 161.86±5.15 | | 81. 77 ±0.83 | 15.21±0.56 | 10.15±1.15 |
| NaCl | 121.43±6.85 | | 61.55±1.10 | 9.65±0.57 | 5.44±0.74 |
| NaCl+$CaCl_2$ | 138.94±5.35 | | 70.80±1.05 | 13.61±0.45 | 8.80±0.55 |
| Mean±sd | | | | | |

***Root Length (RL), root electrolyte leakage (REL) and root protein(RP):***The highest (414.59 cm plant$^{-1}$) and the lowest (280.49 cm plant$^{-1}$) RL were observed with NaCl+$CaCl_2$ and with distilled water respectively; while the highest REL and RP values observed with NaCl and the lowest values were observed with distilled water (Table 2). NaCl increased RL 1.3 times while NaCl+$CaCl_2$ treatment increased RL 1.5 times. The proportion of viable roots declined sharply under salinity stress and protein content decreased more with NaCl+$CaCl_2$ than that with NaCl. REL values showed significant ($LSD_{0.05}$) differences at different salinity levels.

Table 2: Effect of salt water treatment on root length, REL and RP content of the maize

| Treatment | Root length (cm plant$^{-1}$) | REL(%plan$^{-1}$) | RP (%plant$^{-1}$) |
|---|---|---|---|
| Control | 280.49 ±4.37 | 88.68±0.51 | 1.32±0.02 |
| NaCl | 367.18±2.76 | 97.22±0.34 | 1.54±0.01 |
| NaCl+$CaCl_2$ | 414.59±4.35 | 94.34±0.42 | 1.48±0.04 |
| Mean±sd | | | |

***Accumulation of heavy metals in plant****:* The highest and the lowest accumulation of heavy metal in root and shoot were observed with NaCl and distilled water respectively; intermediate accumulation was observed with NaCl+$CaCl_2$ (Table 3). The accumulation of heavy metals in shoot follows the order of Cu>Zn>Cd with NaCl treatment while in shoot was Zn>Cu>Cd with NaCl+$CaCl_2$ treatment. But heavy metal accumulation in root occurred in similar order of Cu>Zn>Cd with both treatments. Zurayk, *et al.* (2001) observed similar result.

Table 3: Effect of salt water treatments on the accumulation of heavy metals in maize

| Treatment | Shoot | | | Root | | |
|---|---|---|---|---|---|---|
| | Cd (mg.kg$^{-1}$) | Cu (mg.kg$^{-1}$) | Zn (mg.kg$^{-1}$) | Cd (mg.kg$^{-1}$) | Cu (mg.kg$^{-1}$) | Zn (mg.kg$^{-1}$) |
| Control | 0.03±0.00 | 1.69±0.03 | 2.51±0.13 | 0.04±0.00 | 2.48±0.16 | 2.27±0.09 |

| | | | | | | |
|---|---|---|---|---|---|---|
| NaCl | 0.08±0.01 | 4.08±0.02 | 3.17±0.01 | 0.10±0.00 | 4.74±0.10 | 2.81±0.15 |
| $NaCl+CaCl_2$ | 0.05±0.01 | 2.05±0.03 | 2.63±0.15 | 0.06±0.00 | 3.07±0.05 | 2.57±0.08 |
| Mean±sd | | | | | | |

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