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RESPONSE OF COWPEA TO SALINITY DURING THE FIRST PHASE OF SALT STRESS DEVELOPMENT IN THE EARLY VEGETATIVE STAGE

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The overall objective of the present study was to determine the physiological basis of the response to salt stress in cowpea (*Vigna unguiculata* cv MI 35) during the first phase of salt stress development in the early vegetative stage. Two experiments were conducted with plants grown in hydroponic culture. The objective of the first experiment was to determine the responses to direct water stress and salt stress-induced water stress of equal osmotic potential. The second experiment was conducted with the objective of determining the effects of different Na^+ and Cl^- -containing salts (i.e. NaCl, Na_2SO_4 and $MgCl_2$) of equal osmotic potential on growth and physiology of cowpea.

In the first experiment, NaCl and equivalent polyethylene glycol (PEG) treatments were started at the third tri-foliate leaf stage at 25 mM NaCl and increased by 25 mM steps to 75 mM at two-day intervals. In the second experiment, salt stress was induced at the same stage using equivalent concentrations of NaCl, Na_2SO_4 and $MgCl_2$ giving equal osmotic potentials starting at 25 mM NaCl and increased at 25 mM steps at two-day intervals up to 100 mM. In both experiments, control treatments were maintained at 1 mM NaCl. The plants were harvested two days after application of the highest level of salt and water stress to ensure that they were within the first phase of salt stress.

In the first experiment, both NaCl and PEG-induced stress did not cause significant influence on total plant biomass, but induced greater biomass partitioning towards roots, thus resulting in greater root biomass. This effect was greater in PEG-induced direct water stress than in the NaCl-induced salt stress. PEG caused significant reductions in leaf area per plant and specific leaf area indicating that direct water stress reduced leaf expansion and increased leaf thickness. Both stresses caused significant reductions in leaf net photosynthetic rate and transpiration efficiency with PEG causing a greater reduction than NaCl. It is concluded that cowpea is more sensitive to water stress than salt stress during its early vegetative stage with photosynthesis, leaf expansion and biomass partitioning to roots being more sensitive than total biomass accumulation.

In the second experiment, none of the salt treatments caused a significant reduction in total biomass or root biomass during the first phase. However, leaf net photosynthetic rate, stomatal conductance, transpiration rate and transpiration efficiency showed significant reductions in all salt treatments relative to the control. The reductions were greatest under NaCl, followed by Na_2SO_4 and $MgCl_2$ indicating that cowpea is more sensitive to Na^+ than Cl^- ions during the first phase of salt stress in its early vegetative stage. Analysis of salt ion concentrations in the leaves showed higher Na^+ concentrations in the NaCl and Na_2SO_4 treatments and higher Cl^- concentrations in the NaCl and $MgCl_2$ treatments.