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SALINITY AND SODICITY INDUCED RESPONSES ON GERMINATION, GROWTH AND PHENOLIC COMPOUNDS ACCUMULATION IN COWPEA (*Vigna unguiculata* (L) Walp)

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DECLARATION

This thesis is my original work and has not been presented for degree or other awards in any other university or institution of higher learning.

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ABSTRACT

Cowpea is the second commonly grown legume after common bean in Kenya. It is grown for its highly nutritious leaves and grain, which are also used as livestock feed. In cultivation, cowpea is amenable to minimal rainfall and little labour yet it has wide usage and a ready market contributing to the incomes of small holder farmers. There is notably lower productivity of cowpea compared to its potential due to environmental constraints such as salinity stress especially in ASALs where it is most commonly grown. Salinity is associated with high chlorides and carbonates of Na, K, Ca and Mg, while high levels of Na ions are associated with sodicity. Salinity hinders metabolic activity and inhibits plant growth which impacts on crop productivity. Moreover, breeding for soil abiotic stresses has been slow leading to infrequent release of adaptive cowpea varieties. Documentation on the behaviour of regularly cultivated cowpea varieties is limited. This study aimed at assessing the response of germination, growth, yield and phenolic accumulation of cowpea to saline and sodic soils. The study involved 4 cowpea varieties namely K80, M66, Kunde1 and KVU 27-1 that were subjected to elevated levels of $CaCl_{2(aq)}$ and $NaCl_{(aq)}$ at 0 (control), 4, 8 and 12 dSm-1 Simulating conditions for(salinity and sodicity). The experiment was arranged in a complete random design in replicates of three in a green house. Data on number of seeds which germinated, days to emergence and germination associated parameters were collected to compute germination parameters. The plant height, days to flowering, leaf area, chlorophyll content, and yield variables were also obtained. Total phenols, tannins, and flavonoids were analysed on fully differentiated leaves. Data obtained at intervals of time were subjected to 1-way ANOVA while those of single measurements was analysed by 2-way ANOVA for mean variety and salts levels. As salinity and sodicity levels increased above 8 dSm-1, seeds took longer to germinate and the number of seeds germinating reduced, particularly in variety M66. Similarly, as sodicity levels increased above 8 dSm-1, there was a significant decline in total chlorophyll content, leaf area and yields. Seed weight declined from 75 % to 41 % for the four varieties as salinity and sodicity levels increased from 0 to 12 dSm^{-1}. For yield M66 had significantly highest values while Kunde1 had significantly lowest values. As salinity and sodicity levels increased, the phenols, tannins and flavonoids content also increased. Variety M66 recorded the highest total phenols, tannins and flavonoids at salinity and sodicity levels above 8 dSm^{-1}. Therefore the four cowpea varieties should be cultivated in soils with lower levels 8 dSm^{-1} NaCl and $CaCl_2$ to realise maximum germination, growth and grain yield. Variety M66 was best-performing under salinity and sodicity stress hence it is recommended for cultivation in saline and sodic soils.