



→ 2.3.2 Simango Kennedy. (2010). Evaluation of physiological and morphological traits conferring drought tolerance in cowpea (*Vigna unguiculata* (L.) Walp.) (Supervisor: Dr D. M. Lungu)

Two studies, a field and green house experiment were carried out to assess the genotypic variation in physiological and morphological traits associated with drought tolerance in cowpea and to determine relationships among these traits. A field study was conducted at Gwebi VTC in August 2009 and a green house study was established at Harare Research Station during the same period. Fifteen advanced cowpea genotypes developed in Zimbabwe Crop Breeding Institute were planted in RCBD with three replications at Gwebi V.T.C under two trials, water stressed and unstressed conditions. Drought stress determined by Drought Intensity Index (011) was severe (0.782) and this probably caused all the genotypes under the study to be of moderate susceptible to drought. The Drought Susceptibility Index (DSI) of the genotypes used ranged from 0.561 to 1.102, with genotype C/68/4/5 being the least susceptible of the fifteen genotypes. However the same genotype had the least GM of 35.95 meaning that it had the least performance. The index, Geometric Mean (GM) ranged from 35.95 to 1266.87. GM was found to be positively correlated to grain yield under water stressed conditions. Genotypic variation was observed in physiological and morphological traits, yield and yield components both under water stressed and unstressed conditions. Combined analysis of variance indicated that there was genotype by environment (GXE) interactions which shows that some genotypes behaved differently under the different growing environments. Significant GXE interactions were observed in grain yield, stomatal conductance chlorophyll absorbance at three weeks after water stressing and number of pods per plant. Yield components such as number of pods per plant (r

=0.882**), 100 seed weight ($r = 0.88^{**}$) and harvest index (0.84^{**}) had the highest relationship with grain yield under water stressed and unstressed conditions. This was mainly caused by positive direct effects of these yield components. Direct selection through number of pods per plant, harvest index and 100 seed weight would be effective under water stressed conditions. Stomatal conductance at three weeks after water stressing was significantly and negatively correlated to grain yield and yield components such as number of pods per plant and harvest index. A positive and significant correlation was observed between chlorophyll absorbance at three weeks after water stressing and the same morphological trait was also found to be positively correlated to number of pods per plant and harvest index. The negative relationship between days to 95% maturity and grain yield was mainly due to negative indirect effects of harvest index, number of pods per plant and 100 seed weight. In the green house study, root dry matter was found to be significantly correlated to water use (0.666^{**}) under water stressed conditions. Stomatal conductance at 14 days after water stressing was significantly and negatively correlated to water use efficiency. Stomatal conductance was also found as an important physiological attribute of water use since there were significant and negative correlations between these two traits. Moreover, stomatal conductance at three weeks after water stressing and root dry matter was found to be significant and negatively correlated. Positive correlations were found between water use efficiency and total dry matter weight. The improvement in grain yield under water stressed will be efficient, if the selection is based on morphological traits such chlorophyll absorbance at three weeks after water stressing, stomatal conductance at three weeks after water stressing, high water use efficiency and yield components such as the number of pods per plant and 100 seed weight.