1.2.4  Chikuta Sally. (2010). Development of aluminum toxicity tolerance selection system for sorghum (*Sorghum Bicolor* (L.) Moench.) in Zambia (Supervisor: Dr M. S. Mwala)

Sorghum is a major crop of the hotter and drier regions of the tropics and subtropics grown by resource poor farmers for their subsistence. It can also be cultivated in marginal lands and areas of high rainfall characterized by low pH soils high in aluminium (Al). The overall objective of this study was to characterize selected sorghum varieties for Al tolerance, while the specific objectives were, to determine performance of selected sorghum varieties grown in Al prone environments, to identify root characteristics associated with Al tolerance and to develop a selection criterion for Al tolerance in sorghum. Twenty sorghum genotypes (previously identified) were evaluated at three sites with high soil Al levels and in the laboratory. Genotypes, concentrations and interactions were significantly different ($P \leq 0.01$) for all the parameters studied in the laboratory which included root length, shoot length, number of lateral roots, shoot and root biomass. The correlation between the laboratory attributes and grain yield were highly significant. Direct effects ranged from 0.5 for lateral roots to 0.7 for shoot length. Indirect path effects towards grain yield by root length and root biomass were 0.6 and 0.5 respectively via shoot length. Significant differences ($P \leq 0.05$) were observed in the field study for seven of the nine parameters that were measured and/or derived. Interactions were significant for plant height and grain yield. The entries were significantly different for all the measured and derived parameters except for plant count, pest score and agronomic score. Significant differences were observed for location on days to 50% flowering, plant height, pest score, sundried head weight and grain yield. Associations between the measured and/or derived parameters and grain yield were significant. The direct path effects were low except for head weight which had a significant contribution of 1.4. Direct contributions on yield by other parameters were less than 0.1. Plant height, pest score and agronomic score had significant indirect effects of 0.7, 0.7 and 0.5 respectively via head weight. Results indicate that laboratory attributes can be used to predict high yielding sorghum genotypes suitable for low pH soil with Al toxicity. Selection of head weight and head harvest index would contribute effectively to high yielding sorghum genotypes in low pH soil with high Al. The superior genotypes recommended for Al tolerance are 11, 16, 17 and 20.