➧ 2.1.5 **Makunde, Goodwill S. (2007). Combining ability for drought tolerance in common beans (*Phaseolus vulgaris* L.). (Supervisors: Dr. D. M. Lungu).**

The common bean (*Phaseolus vulgaris* L.) is an important crop in Africa. The seeds are used dry or green for human consumption and leaves are occasionally used as a leafy vegetable. As a legume beans are capable of fixing nitrogen into the soil for subsequent crops. Though important as a food crop and in soil amelioration, common bean is exposed to a number of abiotic and biotic stresses, one of which is drought, exceeded in magnitude only by bean diseases. The recent land ownership in Zimbabwe have seen the opening up of new lands for agriculture, mainly cropping, resulted in marginal areas, characterized by drought environments, being put under a wide range of crops. The majority of the small scale farmers are found in these areas and these call for the development of appropriate bean varieties. The characterization of the bean germplasm so as to know the inheritance of important traits for drought tolerance is cardinal since the genetic improvement for drought tolerance is seen as a better approach for crop security than complex knowledge- based agronomic practices. This study was therefore carried out to

estimate the general and specific combining abilities for drought tolerance in 25 F_2 populations of Andean x Andean and 24 populations of Andean x Mesoamerican bean gene pools and determine the mode of gene action for drought tolerant traits. The two F_2 populations were subjected to irrigated and water-stressed conditions. Significant differences were observed in grain yield, days to 50% flowering, 100-seed weight and days to maturity at 5% level for the Andean x Andean and Andean x Mesoamerican F_2 populations under water-stressed conditions. Red Canadian Wonder gave a desirable GCA for grain yield (0.11), days to 50% flowering (-0.57) and days to 95% maturity (-1.71) under water-stressed conditions in the Andean x Andean F_2 populations. Also SAB259 had also desired GCA for grain yield (0.05), days to 50% flowering (-0.51) and days to 95% maturity (-0.11) in the same populations. In the Andean x Mesoamerican F_2 populations only two parents SER 16 (-0.59) and SEC16 (-0.46) had desired GCA for days to 50% flowering. However, Red Canadian Wonder had good GCA for grain yield (0.06) and days to 95% maturity (-1.11) in the Andean x Mesoamerican F_2 populations under water stress. Overall, Red Canadian Wonder proved to be a good parent for most of the measured traits in the two populations and can be used as a parent when breeding for both intermittent and terminal drought. SCA (dominance) effects where higher than the GCA (additive) effects for grain yield, days to maturity and days to 95% flowering under both irrigated and water-stressed conditions for both the Andean x Andean and Andean x Mesoamerican F_2 populations. Choosing parents for crosses on merit alone reduces the genetic variance for additive effects (GCA) and increases the relative importance of dominance gene effects (SCA). This was the case with the crosses that were used in the study since the male parents were selected basing on their history of drought tolerance and female parents due to their high productivity in Zimbabwe without previous studies of combining ability. Since dominance gene effects are non-fixable, it may be difficult to start selections based on yield under drought in the early breeding cycles. Selection methods such as single seed descent and bulk method could be of practical benefit in populations exhibiting low additive gene effects for individual traits with selection beginning at F_5 upwards.