- **1.1.13  Mulungani, Dean. (2010). Combining ability in eleven maize (*Zea* mays L.) few tassel branch mutants (FBR) under optimum and drought stress environments. (Supervisors: Dr. D. M. Lungu and Dr. J. F. MacRoberts).**

Maize (*Zea mays* L.) is an important cereal crop and primary source of calories in Zimbabwe. Generally two groups of farmers are involved in maize production, the large scale commercial sector (LSC) and the communal farming sector (CFS) categorized based on production systems and scales of operation. Production is dominated by the CFS although yield levels are lower than the LSC. Production in highly stress prone environments with no or limited access to resources to mitigate the stresses has been responsible for the yield gap. Although the tassel is an essential reproductive organ, it often reduces yield either physiologically by competing with the ear or physically by shading effect. The competition effects and shading effects are more pronounced under stress and high density respectively. By reducing the size of the tassel, breeders can reduce the competition effects of tassels especially under drought stress and contribute to higher yields. Eleven CIMMYT few tassel branch (fbr) mutants and three testers, CML442 TAS, CML442 and CML395 were crossed in a 11 x 3 line x tester design at CIMMYT - Zimbabwe in 2008/09. The testcrosses together with checks were evaluated under. One optimum environment and two drought environments in a randomized complete block design with two replications during winter 2009. The objectives of the study were to estimate general and combining ability effects of the eleven for lines and assess the relationship between grain

each line was not used strictly as male or female. The thirty-five hybrids were evaluated in an alpha lattice design with three replications at four sites in winter 2009. The study involved the assessment of the relative importance of general (GCA) and specific combining ability (SCA) effects, additive and dominance gene action, and mid-parent heterosis in the phenotypic expression of endosperm modification (MOD), levels of tryptophan (TRP), lysine (L YS) and protein (PROT); grain yield CGY), anthesis date (AD) and anthesis-silking interval (AS!) among the inbred lines. On the basis of GCA effects, line CML511 was the best donor for MOD, L YS and PROT, and gave good GCA effects for the highest number of agronomic traits and environments. Line CZL082 was the second best donor for MOD, TRP and L YS. Line HX482P was the best general combiner in terms of desirable GCA effects for kernel quality and agronomic traits under more environments, followed by line L 7 which outperformed the other lines in terms of number of traits with desirable GCA effects. In terms of SCA effects, line CZL082 was the best donors because it was involved in more cross combinations with desirable SCA effects for kernel quality and agronomic traits under more environments. Line CML511 was the second best donor, given that it was involved in cross combinations that had the best SCA effects for MOD and LYS. Line L7 was the most outstanding line for giving the highest number of traits with desirable SCA effects for agronomic traits in addition to MOD. Line CML511 was a constituent parent in separate cross combinations with the highest means for MOD and PROTo On the basis of mid-parent heterosis, line CML511 was the best donor for featuring in crosses with the highest positive mid-parent heterosis for MOD. Lines EL 77P and L 7 had the best mid-parent heterosis by virtue of being constituent parents in the best five endosperm-modified hybrids. The mid-parent heterosis of two of the five least modified crosses was higher for TRP, L YS and PROT than that for the best modified hybrids, with line CML511 featuring in one of these crosses. Additive genetic effects were preponderant in the control of all kernel quality traits. Dominance gene action was predominant in influencing GY under MSV disease conditions and across all sites, while additive genetic effects were more important in controlling this trait under optimum conditions and drought stress. Dominance gene action was predominant in controlling AD under optimum conditions, whereas additive genetic effects were preponderant in governing the same trait under MSV disease. Both additive and dominance gene action were dominant in the control of ASI under all environments except MSV disease. Maternal additive gene action was predominant in the genetic control of ASI under all environments besides MSV disease. Narrow sense and broad sense heritability were low for all kernel quality traits and GY, while narrow sense heritability was medium for AD and low for ASI under drought stress. Broad sense heritability was high for both AD and ASI, but medium for GY under drought stress. Lines CZL082 and CML511 were therefore identified on the basis of GCA and SCA effects, mid-parent heterosis and mean performance as the most appropriate QPM donors for line conversion and recycling of non-QPM inbred lines in the national program.