- 1.1.7  **Kabamba, Mwansa. (2005). Inheritance of resistance to Grey Leaf Spot (GLS) and nitrogen utilization efficiency in maize (*Zea mays* L.). (Supervisors: Dr. D. M. Lungu, Dr. C. M. Mungoma and Dr. M. Banzinger).**

Maize is an important staple and cash crop in Zambia. Abiotic and biotic stress conditions, particularly low soil fertility (low nitrogen) and grey leaf spot (*Cercospora zeae- maydis*), reduce maize yields. Most varieties developed by the Zambian National Maize Programme have neither resistance to GLS nor tolerance to low nitrogen stress. This is because earlier variety selections were done under optimum soil fertility and before GLS disease was introduced in Zambia. The objectives of the study were to (i) determine important gene action controlling the important traits in maize and how these are affected by the condition of optimum and low soil nitrogen (ii) estimate GCA and SCA of lines and testers (iii) estimate narrow sense heritabilities for yield and secondary traits under optimum and low soil nitrogen conditions, and (iv) identify good hybrids. In this study 10 inbred lines from the Zambian National Maize Programme were crossed to 12 CIMMYT single cross testers using a North Carolina Design II. The 110 progenies realized

were evaluated under fertilizer and no fertilizer (low N) conditions at 6 sites that were also endemic to grey leaf spot disease in Zambia and Zimbabwe. Results showed highly significant differences between lines, testers and crosses (entries) ($p \leq 0.01$) for grain yield (GY), anthesis date (AD), silking date (SD), anthesis silking interval (ASI), plant height (PH), leaf senescence, ears per plant, single kernel weight (SKW), number of kernels per ear and the leaf diseases grey leaf spot, Exserohilum turcicum and rust. The mean squares for General combining ability (GCA for lines and testers) were significant for all traits studied. However, the specific combining ability (SCA for line x tester) were not significant for the all the traits studied. This showed that additive gene action rather than non-additive gene action controlled the traits. Lines Ll and Lll and testers T8 and T9 consistently performed well under low N, high N and across environments. These parents had high and positive GCA effects for grain yield, plant height, and ears per plant. They were also good combiners for single kernel weight, the number of kernels per ear and had reduced leaf senescence and a short anthesis-silking interval (except line 11). Significant and negative GCA effects for GLS were exhibited by lines LI0 and L2 and testers T8 and T5 while the susceptible parents were lines Ll and Lll and tester T3 respectively. Genetic correlations between grain yield and most secondary traits were significant except for anthesis (lines and testers at low N), SKW testers under low N), ASI (testers across environments and lines at high N) and leaf senescence (line and testers). High heritability estimates under nitrogen stress were found for GY (h^2=0.51), AD (h^2=0.51), SD (h^2=0.57), PH (h^2=0.68), SKW (h^2=0.81), and turcicum (h^2=0.89). Low heritabilities under low N were observed for ASI (h^2=0.44), leaf senescence (h^2=0.29), number of kernels per ear (h^2=0.42), and EPP (h^2=0.38). High heritability was also found for GLS (h^2=0.77) as well as rust (h^2=0.89) under high N conditions. Hybrids involving Lll x T9 and LI0. x T9 were among hybrids performing well under both low N, high N and across environments and there were also resistant to GLS as well as turcicum and rust. The occurrence of GLS under high N condition was an indication that GLS incidence associated with increased nitrogen and that nitrogen stress environments may not provide suitable environment for selecting and screening maize resistant to GLS. The study provides some essential information needed to develop maize varieties with enhanced tolerance and resistance to both abiotic and biotic stresses so as to sustain maize yields.