1.3.1 Makhale Gerald L. (2001). Genotype and nitrogen fertilizer influence on grain yield and protein content of wheat (*Triticum aestivum* L.). (Supervisor: Dr. D. M. Lungu).

The grain yield of wheat grown in Lesotho is low because of poor soil fertility, and the wheat is regarded by the millers to be of poor quality and therefore of less value. A field study was therefore conducted at three sites in Lesotho (Maseru, Leribe and Mafeteng) to evaluate the influence of genotype and nitrogen application on grain yield and quality of wheat (*Triticum aestivum* L.). The varieties assessed were Tugela DN, Betta DN, SST 124 and Caledon at a seeding rate of 50 kg ha^{-1}. Nitrogen was applied at five rates of 0, 20, 40, 60 and 80 kg N ha^{-1}. The experiment was arranged in a split-plot design, with varieties as the main-plot factor and nitrogen rates as the sub-plot factor. The treatment combinations were replicated three times. Grain yield and yield parameters (thousand-kernel weight, grain number per head, number of heads per square meter and harvest index) were measured and / or derived. Quality parameters were protein content percent and Mixograph development time. Grain yield significantly ($P \leq 0.05$) increased with N application at Leribe averaging 3,000 kg ha^{-1}. Number of heads per square meter was also significantly ($P \leq 0.05$) increased while thousand kernel weight was significantly ($P \leq 0.05$) decreased at rates of N application higher than 40 kg N ha^{-1}. At Maseru and Mafeteng, applied N had no effect on grain yield. In fact grain yield decreased with application of N over 20kg N ha^{-1} at Mafeteng. The number of heads per square meter also significantly ($P \leq 0.05$) decreased, suggesting poor emergence or tillering. At Maseru the thousand kernel weight was significantly ($P \leq 0.05$) decreased with increasing nitrogen application. Across the three sites grain yield increased significantly ($P \leq 0.05$) when N was applied over 20kg N ha^{-1}. The number of heads per square meter also significantly ($P \leq 0.05$) decreased at higher rates of N application. Applied N fertilizer significantly ($P \leq 0.05$) increased grain protein content. However, the protein contents of wheat at Maseru and Mafeteng were higher, averaging 11 % and 15 % respectively. This observation is probably due to a concentration effect of protein content due to small grain size. Mixograph development times were within the acceptable range of 2.5 - 4.0 minutes for wheat from all the three sites. The four varieties did not significantly differ in grain

Regions I, II and III of Zambia, respectively) as the main plots, planting dates (mid April, mid May, mid June and mid July) as the sub plot and variety as the sub subplot. Five heat tolerant lines and five local varieties were used. The planting dates represented a wide range of temperature regimes and soil types. This was aimed at simulating the growing conditions of the crop when planting is delayed. The aim was to establish the extent of yield loss with delayed planting and also to determine which of the yield components are greatly affected with delayed planting and how strongly the yield components influence yield. The varieties did not differ significantly in yield across location and all planting dates. Locations had a significant influence on yield. Chirundu in the hot Zambezi valley gave the lowest average yield of the three locations. The locations and planting dates caused differences in number of spikelets/ear, number of tillers/m2, thousand kernel weight, plant height, leaf area index, and harvest index and were lower at Chirundu compared to the other locations. The optimum planting date for UNZA and Mpongwe was May and Chirundu, April. Delayed planting resulted in low yields and low number of yield components. The effect of delayed planting was more pronounced in Chirundu. The heat tolerant lines show a slight edge in yield than the local varieties. The heat tolerant varieties showed a superior performance in number of spikelets/ear, number of tillers /m^2 and plant height. A stepwise multiple regression analyses considering the coefficient of multiple determination (R^2) identified number of spikelets/ear as the most important trait explaining variation in yield and the number of tillers /m^2 and harvest index showing a marginal effect. When location and planting dates were taken as environments in all locations, July planting indicated a negative environmental index hence can be taken as an adverse environment for wheat production. The stability index using Eberhart and Russell (1966) method, considering the regression coefficient, mean square deviation from regression and mean advantage over grand mean showed that the heat tolerant lines tend to be much more stable than local varieties. If plant breeders can deliberately select for heat tolerance for yield, and targeting number of spikelets/ear and number of tillers/m^2 may result in high yielding and stable performance under even harsh temperature regimes, ensuring that good yield is obtained even when planting is delayed. The growing of heat tolerant varieties would encourage wheat production among both the small scale and large scale farmers in the hot areas, which are well endowed with water resources.