MORPHO-PHYSIOLOGICAL RESPONSES OFSPRING WHEAT (*TRITICUMAESTIVUM* L.) TO HEAT STRESS

By

Alimo Syanyunta

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DECLARATION

I Alimo Syanyunta hereby declare that this dissertation represents my own work and this has not been previously submitted for a Degree, Diploma or any other qualification at this or any other University.

Signature..

Date ....

APPROVAL

This dissertation of Alimo Syanyunta has been approved as partial fulfilment of the requirements for the award of Master of Science in Plant Breeding and Seed Systems by the University of Zambia.

Nameof ExaminerSignature Date

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ABSTRACT

Constant or transitory high temperatures affect wheat growth and development leading to diverse morphological, physiological and biochemical changes that eventually decrease grain yield. It is against this background that this study was conducted to identify morpho-physiological traits associated with heat tolerance and establish the most appropriate indirect selection criteria for heat stress tolerance in wheat. In this respect, eighteen spring wheat genotypes were evaluated in a randomised complete block design with four replications at School of Agricultural Sciences, field station in Lusaka. These genotypes were grown under optimal environment (E_1) and heat stress environment (E_2) created by separation of sowing dates from May to November, 2012. Thus, yield and morpho-physiological traits were examined. These wheat genotypes exhibited significant differences for traits studied in each environment with considerable reduction in mean trait values measured under heat stress environment.The above ground biomass recorded the highest mean trait reduction of 28. 75% followed by tillers per unit area (25.87%), grain yield (21.65%), and thousand kernel weight (17.62%). Spike length exhibited the lowest percentage reduction of 0.57% under heat stress.Environmental effects were highly significant for most of morpho-physiological characters except for spike length and number of spikelets per spike. Similarly, the genotypes x environment interactions were highly significant for most of the traits except for the spike length. Strong and positive correlations were observed under heat stress between grain yield and canopy temperature depression (r = 0.79**); tillers per unit area (r = 0.78**);chlorophyll stability index (r = 0.71**); membrane thermostability (r = 0.68**); and plant height (r = 0.53**). This study identified membrane thermostability as a trait that explained most of variations in grain yield (80.7%); followed by tillers per unit area (10.2%) and canopy temperature depression (2.4%). This scenario provides a suggestion that such traitscontribute towards the capacity of plant to tolerate heat stress and could therefore be used as indirect selection criteria for yield in heat stressed environments.It could thus be concluded that there are genetic variations among wheat genotypes in their response to heat stress and that membrane thermostability with canopy temperature depression and number of tillers per unit area could be utilised in breeding for heat tolerance in wheat. Based on heat tolerance indices of genotypes, Entry 20 was identified as the most heat tolerant genotype with heat tolerance index of 1.12. Other genotypes that exhibited high heat tolerance were Entry 10, Entry 41, Entry 44, Unza II and Pungwa. Thus, these genotypes could therefore be used as sources of genetic material in wheat breeding programmes.It is recommended that this study should be repeatedin many locations including hot river valleys endowed with water resources for irrigation and should include other traits.

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