Response to Selection for Grain Filling Capacity in Wheat (Triticum aestivum L.) under Heat Stress

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Abstract:

Improving tolerance to heat stress of bread wheat has been achieved through enhancing grain filling capacity by two cycles of selection imposed on five F2 populations derived from crosses among long spike□equally tall inbred lines quite variable in 1000 kernel weight (1000 KW). The first cycle was a divergent selection for 1000 KW conducted under the high temperature of a late rowing date at an intensity of 5% and the responses were measured in favorable and heat stress environments. Significant positive responses were obtained in the five populations in the two contrasting environments. Selection for higher 1000 KW resulted in greater response under heat stress (averaged 6.9% of population mean) than under favorable conditions (averaged 4.92%). The F3 families selected for higher 1000 KW were less sensitive to high temperature as they displayed less reductions due to heat stress (averaged 5.55%) than the unselected bulks (7.14% average reduction) relative to the performance under favorable conditions. The responses to selection for lower 1000 KW were greater under the favorable conditions (averaged 5.6%) than under heat stress (averaged 4.12%). Significant concurrent positive responses were obtained in stem diameter with selection for higher 1000 KW which was greater under heat stress (averaged 8.82%) than under favorable conditions (averaged 4.51%). Directional selection for stem diameter imposed on the plants of the F3 families in the second cycle resulted in significant positive responses in the five populations which averaged 16.24% of population mean as well as concurrent responses in 1000 KW (averaged 16.01%) and in grain yield /spike (averaged 19.5%). Selection for 1000 KW under heat stress produced concurrent response in stem diameter and vice versa which implies that the two characters are closely related. Increasing stem diameter by selection was more efficient than selection for 1000 KW in enhancing grain filling capacity through providing greater storage of stem reserves of water soluble carbohydrates to be remobilized into the developing grains under high temperature.

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