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Heritability of Heat Tolerance in Winter and Spring Wheat

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Abstract

Cell membranes are the site for many biological activities of the plant and play a key role in heat-induced damage to wheat (Triticum aestivum L.). This study evaluated the genetic variability of wheat using two assays of heat tolerance, and estimated their heritability by parent-offspring regression, parent-offspring correlation, and realized heritability using F3 plants and their F4 progeny means. One assay of heat tolerance was membrane thermal stability (MTS) which measures electrolyte leakage from leaf tissue after exposure to high temperature. Heat injury was also assessed by quantifying the reduction of triphenyl tetrazolium chloride (TTC) to formazan by mitochondrial dehydrogenase respiratory enzymes in heat-stressed seedlings. Results from the two assays were highly associated (r = 0.62, n = 14, P < 0.05). Parent-offspring regression and correlation heritability was intermediate to high (0.50–0.65) for TTC and relatively low (0.32–0.38) for MTS. Realized heritability, based on 15% selection intensity, was intermediate to high (0.49–0.64) for TTC and low to intermediate (0.27–0.47) for MTS. The high heritability of TTC warrants good progress from selection in early generations. The relatively lower heritability of MTS suggests the use of multiple replications during selection to limit environmental effects.

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