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The Effects of Fungicide and Genetics on Fungal Diseases on Wheat in Nebraska With Emphasis on Stem Rust

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Abstract : Wheat (Triticum aestivum L.) production continues to be challenged by foliar fungal diseases although significant improvement has been made to manage the diseases through developing resistant varieties and the fungicide use to ensure sufficient wheat is produced to meet the growing population's need. Significant crop losses have been recorded in the history of grain production and yield losses due to fungal diseases, and the trend continues to threat food security in the world and particularly in the less developed countries. The impact of individual fungal diseases on grain yield has been studied extensively to determine crop losses. However, there is limited research available to find out the combined effects of fungal diseases on grain yield and the ways to effectively manage the diseases. Therefore, the objectives of this research were to study the effect of fungal pathogens on grain yield of pre-released winter wheat genotypes in fungicide treated and untreated plots, and to determine whether S7b gene was present in 'Gage' wheat as previously hypothesized. Sixty winter wheat genotypes in fungicide treated and untreated plots were studied across four environments. There was a significant effect of fungicide on grain yield consistently across four environments in three years. Fungicide treated wheat lines demonstrated (4,496 kg/ ha-1) grain yield compared to (3,147 kg/ ha-1) grain yield in untreated wheat lines indicating 43% increased grain yield due to severity of foliar fungal diseases. Furthermore, fungicide application also caused an increase in protein concentration from 153 (g kg-1) to 164 (g kg-1) in treated plots in along with test weight from 73 to 77 (kg hL-1) respectively. Gage wheat variety and ISr7b-Ra were crossed to determine presence of Sr7b in Gage. The F2 and F2:3 segregating families were screened and evaluated for stem rust resistance. The segregation of families fell within 15:1 ratio for two separate resistance genes suggesting that Sr7b segregates independently from an unknown resistance gene in Gage that needs to be characterized for its use in the future wheat breeding program to develop resistant wheat varieties.

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