Improved Winterhardiness In Turf-type Perennial Ryegrass?

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The market for turf-type perennial ryegrass *(Lolium perenne)* continues to grow with over $70 million in seed sales in 1994. Breeders in private companies are capitalizing on this increasing ryegrass popularity by continuing to make improvements in turf quality traits such as color, density, texture, mowability and disease resistance. However, all current improved turf-type cultivars do not have adequate levels of winterhardiness for the northern USA and Canada. Thus, the use of perennial ryegrass has been confined primarily to areas with mild winters, or as temporary turf.

Grass seed production is an important component of the economy of rural northern Minnesota. However, lack of winterhardiness remains the major limitation to the production of perennial ryegrass seed. Increasing the winter survival of these improved types would positively impact Minnesota by expanding the grass seed producer's options, and extending the range of adaptation for perennial ryegrass turf.

Efforts are underway at the University of Minnesota to increase the winterhardiness of turf-type perennial ryegrass. Although many breeders have suggested a complete lack of variation for winterhardiness in the available turf-type germplasm, repeated tests have shown that only an older, unacceptable turf variety ('NK-200') possesses sufficient winterhardiness to consistently survive northern Minnesota winters. NK-200 is characterized as having poor turf quality including coarse leaf texture and crown rust susceptibility. The objectives of our research were: 1) develop a perennial ryegrass breeding population using NK-200 as the pollen parent and elite turf-type cultivars as the seed parent, 2) evaluate the winterhardiness and turf quality of these progeny under field conditions and 3) determine if adequate variation for improved turf quality exists within this population for cultivar development.

The results of the research have been more promising than we had ever hoped. The progeny from the NK-200 crosses were established in Rosemount and St. Paul, MN in 1993. During the summers of 1994 and 1995, the 8250 spaced-plants were evaluated for winterhardiness, leaf texture, turf-quality, and crown rust resistance. Results from this data revealed there were significant differences in winterhardiness between crosses. This was an important discovery because it refuted previous claims of no variation for winter survival in turf-type perennial ryegrass. Variation also existed for the important turf traits. In general, the progeny performed better than the elite varieties of perennial ryegrass for winterhardiness and had higher turf quality than NK-200, indicating the progeny contained desirable characteristics from both parents. Overall, turf quality was negatively correlated with winterhardiness; however, some crosses exhibited better winterhardiness than NK-200 and similar turf quality as the elite check varieties. These results indicate the possibility of developing elite turf-type germplasm with improved winterhardiness. To verify these predictions, crosses that exhibited high winterhardiness and turf quality were selected for seed increase and further evaluation. Also turf plots were established in the fall of 1995 of experimental populations selected for excellent turf quality and increased winterhardiness.

These research efforts include investigating the use of artificial freezing as a selection method for winterhardiness. Equipment and technology for these tests were developed by Dr. Donald B. White, turfgrass specialist, in the Dept. of Horticulture Sciences. Our results suggest that artificial freezing tests take only 16 weeks to complete compared to two years and two locations for field tests. These results indicate that using artificial freezing, to accumulate freezing tolerance genes, combined with field tests could more quickly lead to the development of winter-hardy germplasm than either method used alone.

Other related research efforts include introgressing winterhardiness and herbicide tolerance from red fescue *(Festuca rubra)* into perennial ryegrass, and development of aggressive turf-type perennial ryegrass that spreads with short stolons. Putative Lolium X Festuca hybrids are being investigated using molecular genetic techniques. Potentially aggressive spreading turf-type perennial ryegrass has been included in our turf-plots. We are extremely excited about the possibilities indicated by our research results. The results of our prediction equations are every plant breeder's dream. However, because this is a new program it will be several years before we know if we have been successful in developing elite turf-type perennial ryegrass germplasm with improved winterhardiness.

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