Performance of Triticale Substituted Lines (W.H. Pfeiffer, M. Mergoum, J. Pena and A. Lukazewski)

Comparisons of near isogenic Rhino 6D(6A) and its 6A(6A) controls indicate significant genetic gains for grain yield for Rhino carrying 6A(6D) under both irrigated and moisture stress conditions. The adaptive advantage associated with the 6D(6A) substitution suggests the likely value of other D(A), D(B), and D(R) substitutions and/or translocations by TCL breeders to enhance TCL's agronomic performance and bread making quality.

Eighty-two sister lines, therefore, reselected from the Rhino substitution series developed by A.J. Lukaszewski (Univ. of CA, Riverside, CA) and their controls, were planted under full and limited irrigation at Cd Obregon and Toluca (located in the highland of Central Mexico, 18°N and 2640 m above sea level) in a "Alfa" lattice design. Each entry was planted in two 3 m long beds. Data were collected on grain yield and its components, test weight, plant height and days to anthesis and maturity. Industrial quality parameters, including flour yield, protein, grain hardness, SDS-sedimentation and the alveographic dough strength parameters W, were also measured. Grain samples were milled into flour using a Brabender Quadrumat Sr. Mill. Grain hardness and flour protein were determined by Near-Infrared Reflectance, and flour SDS sedimentation measurements were also undertaken. Alveographic dough strength parameter W was obtained by testing 60g flour samples following manufacturer's

instructions. Mixograph mixing time and bread loaf volume were obtained using AACC methods 54-40A and 10-09, respectively.

Agronomic performance: Agronomic data analysis revealed significant differences between "Rhino" substitution lines and the Rhino control, for grain yield, test weight, plant height, grain weight and days to anthesis and maturity. Grain yield of Rhino 6D(6A) substitutions showed significantly higher yield than the Rhino control. On average, the 6D(6A) lines yielded 0.7 t/ha above Rhino control (7.3 vs 6.6 t/ha). These results agree with recent data from the International TCL Yield Nurseries (ITYN) and the 1991-1996 global variety release data which suggest an adaptive advantage of complete TCL carrying the 6D(6A) substitution under both high and low inputs conditions. The 6D(6A) substitution spread into the winter TCL germplasm gene pool through WxS crosses. Under optimum conditions, except for 6D(6B) which had a slightly higher test weight (77.4 kg/hl), most of the other substituted lines had similar or lower test weight when compared with the Rhino control (76.7 kg/hl). The 5D(5A) substitution lines are extremely late in maturity due to the presence of vernalization genes from winter wheat. In contrast, the 2D(2B) substitutions group are late in certain environments due to photoperiod sensitivity. 1D(1B) and 6D(6A) substitutions lines are shorter than the Rhino control (123 cm); 4D(4B) is very tall (168 cm) due to the absence of RhT2 dwarfing genes and has reduced awns. Compared to Rhino (44 g), 1000 grain weight of the substitution lines varied markedly from 31 to 55 g for 6D(6B) and the 4D(4B) groups, respectively.

Industrial quality: The data analyses for industrial quality parameters revealed significant differences among Rhino substitution lines for SDS-sedimentation, grain hardness and bread making quality parameters. Previous results showed drastic increases in SDS sedimentation values in both poor quality genetic background (Rhino) and good quality genetic background (Passi). This indicates good possibilities for quality improvement in substitution lines. While average SDS of the Rhino control was 5.6 ml, 1D(1B), 1D(1A) and 1D(1R) substitution lines exhibited average SDS values of 7.9, 10.0 and 10.5, respectively. Similarly, the near isogenic lines carrying the 1RS.1DL translocation showed significantly higher SDS values (7.6 to 8.1 ml) compared with Rhino control. The availability of Glu-D1 HMW-GS 2+12 and 5+10 in 1D(1R), in addition to 1D(1B) and 1D(1A) substitutions, and 1RS.1DL translocations which improved the SDS-sedimentation values had, therefore, a significant positive impact on dough strength (ALV W). This is a very important characteristic closely associated with loaf volume. Grain hardness was also variable among the substitution lines. It ranged from hard-textured Rhino grain types (<40%) in 1RS.1DL lines to soft (48-54%) in 2D(2R), 3D(3B) and 5D(5A) lines. Flour yield and protein, however, were not significantly affected in the substitution lines when compared to Rhino. Presently, TCLs with two or more doses of Glu-D1 HMW-GS are being developed. Once Glu-D1 HMW-GS has been exploited, future research should be extended to gliadins and secalins.

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