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Genetic Advance versus Environmental Impact toward Sustainable Protein, Wet Gluten and Zeleny Sedimentation in Bread and Durum Wheat

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Abstract : The wheat grain quality properties are influenced by genotype, environmental conditions and genotype × environment interaction (GEI). The increasing request of more nutritious wheat products will direct future breeding programmes. Therefore, the aim of investigation was to determine: i) variability of the protein content (PC), wet gluten content (WG) and Zeleny sedimentation volume (ZS); ii) components of variance, heritability in a broad sense (hb2), and expected genetic advance as percent of mean (GAM) for PC, WG, and ZS; iii) correlations between PC, WG, ZS, and most important agronomic traits; in order to assess expected breeding success versus environmental impact for these quality traits. The plant material consisted of 30 genotypes of bread wheat (Triticum aestivum L. ssp. aestivum) and durum wheat (Triticum durum Desf.). The trials were sown at the three test locations in Serbia: Rimski Šančevi, Zemun Polje and Padinska Skela during 2010-2011 and 2011-2012. The experiments were set as randomized complete block design with four replications. The plot consisted of five rows of 1 m2 (5 × 0.2 m × 1 m). PC, WG and ZS were determined by the use of Near infrared spectrometry (NIRS) with the Infraneo analyser (Chopin Technologies, France). PC, WG and ZS, in bread wheat, were in the range 13.4-16.4%, 22.8-30.3%, and 39.4-67.1 mL, respectively, and in durum wheat, in the range 15.3-18.1%, 28.9-36.3%, 37.4-48.3 mL, respectively. The dominant component of variance for PC, WG, and ZS, in bread wheat, was genotype with the genetic variance/GEI variance (VG/VG × E) relation of 3.2, 2.9 and 1.0, respectively, and in durum wheat was GEI with the VG/VG × E relation of 0.70, 0.69 and 0.49, respectively. hb2 and GAM values for PC, WG and ZS, in bread wheat, were 94.9% and 12.6%, 93.7% and 18.4%, and 86.2% and 28.1%, respectively, and in durum wheat, 80.7% and 7.6%, 79.7% and 10.2%, and 74% and 11.2%, respectively. The most consistent through six environments, statistically significant correlations, for bread wheat, were between PC and spike length (-0.312 to -0.637); PC, WG, ZS and grain number per spike (-0.320 to -0.620; -0.369 to -0.567; -0.301 to -0.378, respectively); PC and grain thickness (0.338 to 0.566), and for durum wheat, were between PC, WG, ZS and yield (-0.290 to -0.690; -0.433 to -0.753; -0.297 to -0.660, respectively); PC and plant height (-0.314 to -0.521); PC, WG and spike length (-0.298 to -0.597; -0.293 to -0.627, respectively); PC, WG and grain thickness (0.260 to 0.575; 0.269 to 0.498, respectively); PC, WG and grain vitreousness (0.278 to 0.665; 0.357 to 0.690, respectively). Breeding success can be anticipated for ZS in bread wheat due to coupled high values for hb2 and GAM, suggesting existence of additive genetic effects, and also for WG in bread wheat, due to very high hb2 and medium high GAM. The small, and medium, negative correlations between PC, WG, ZS, and yield or yield components, indicate difficulties to select simultaneously for high quality and yield, depending on linkage for particular genetic arrangements to be broken by recombination.

Keywords : bread and durum wheat, genetic advance, protein and wet gluten content, Zeleny sedimentation volume
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