Variation and Evaluation of Mixing Tolerance, Protein Content, and Sedimentation Value in Early Generations of Spring Wheat, *Triticum aestivum* L.1

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**H**ARD wheat varieties are accepted by the milling and baking industries only if flours milled from them meet rigid standards in mixing properties. A long mixing tolerance is one of the more important quality characteristics considered in the evaluation of potential bread wheat varieties. Wheat varieties differ widely in mixing tolerance, but little is known about the genetics of variation of this characteristic. If mixing tolerance is highly heritable, a reliable, economical micro-test applied to early-generation lines could be of considerable aid in the breeding of high-quality varieties. A mixograph is now used to evaluate mixing tolerance of hard red spring wheat lines. This test usually is not applied until after preliminary yield trials at a time when sufficient grain becomes available.

Zeleny et al. (11) stated that the sedimentation test might be a useful predictive test for making early-generation wheat selections on the basis of dough characteristics. The purpose of this paper is to present data on intercharacter and intergeneration relations of mixing tolerance, protein content, and sedimentation value and on the comparison of the protein test with the sedimentation test as methods for predicting mixing-tolerance values of *F*3 and *F*6 lines derived from the *F*3 population.

**LITERATURE REVIEW**

Worzella (9), who used the dough-ball fermentation time test to measure variation in gluten strength in *F*1 segregations of a winter wheat cross, concluded that it should be the test for early-generation selection. Heyne and Finney (4) developed methods to evaluate physical dough properties of winter wheat crosses. Physical dough properties volumes of pure lines selected in *F*3 were highly correlated with the same characteristics measured in earlier generations. Pinckney et al. (5) found that selection for Farinograph characteristics in the *F*3 generation successfully advanced mean values of *F*1 and *F*3 generations.

Heritability values for physical dough properties were of the order of 56 to 64% in three durum wheat crosses, according to Heyne et al. (1). Since expected and actual gains were similar, it can be concluded that early-generation selection for dough properties should result in substantial genetic advance. Heritability values of 71 to 74% and 60 to 71% for extensibility and swelling ability of gluten, respectively, in winter wheat selections and suggested that early generations could be profitably evaluated.

Recent studies by Davis et al. (2) and Stubbe et al. (6) showed protein heritability values to be moderately large. Heyne et al. (5) estimated relatively low heritability for protein content in winter wheat crosses. Zeleny (10) and Pinckney et al. (6) discussed the sedimentation test with later improvements as a tool in evaluating bread-baking potential of wheats. Zeleny et al. (11) used the sedimentation test to an *F*3 population from a spring wheat cross. The sedimentation values proved to be positively correlated with the dough mixing times and tolerance. Protein content was not associated with these same dough mixing properties. Zeleny et al. (11) concluded that the sedimentation test may be a useful predictive test for making early-generation selections on the basis of dough properties.