

B-192

Stability analysis of soybean seed protein concentration in the quality traits tests

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Soybean seed is an important source of protein for human and animal consumption. Extensive research has been accomplished on the measurement and genetics of soybean seed protein concentration, which has helped facilitate development of varieties with higher seed protein concentration. Very little work, however, has been done on studying the stability of soybean seed protein concentration across environmental variations. To help fill this gap, we performed a stability analysis of soybean seed protein concentration using the data collected as part of the Quality Traits Tests. The data from these trials is ideal for this analysis because of the wide range of genetic variation for protein concentration included, as well as the large number of maturity group zones, locations, and years represented. A preliminary analysis of seed protein concentration of soybean genotypes from nine maturity groups (MG) tested in 43 locations in the United States and two locations in Canada during 2016 revealed extensive genotype-by-environment interactions. A Finlay-Wilkinson regression analysis indicated that approximately 50% of the genotypes analyzed displayed significant responses to environment for protein concentration (i.e., $\beta_1 > 0$, $p < 0.05$). A test of heterogeneity of regression coefficients among genotypes within a MG was significant for all MGs except for MGs I and VII. This result indicates that genetic variation for protein concentration stability is prevalent. The correlation between average seed protein concentration and β_1 (measure of Type I and II stability) was not significantly different from 0 except in the MG V trials. The correlation between average seed protein concentration and the regressions R^2 (measure of Type III stability) also was not significantly different from 0. These preliminary results suggest that variation in average seed protein concentration among soybean varieties is not related to variation in protein stability among varieties.