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Genotype by environment interactions influencing soybean seed protein content and amino acid composition

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As consumers look for healthier dietary alternatives, many have recognized the soybean (*Glycine max* (L.) Merrill) as a prominent source of protein, amino acids, vitamins and minerals. Soy protein contains all essential amino acids for proper human nutrition, although many commercial cultivars lack sufficient amounts of sulfur-containing amino acids (i.e., cysteine and methionine). The composition of soybean seeds is dependent on different genetic and environmental factors. Protein content has proven to be a relatively stable trait in high-protein soybean cultivars, while amino acid composition is strongly affected by the environment and genotype-by-environment interactions. Understanding the interactions that influence these seed composition traits will aid in the improvement of value-added high-protein soybean cultivars. The objective of this study was to determine the effects of genetics, the environment, and genotype-by-environment interactions on seed protein, and amino acid composition in a multi-year, multi-location trial in southern Ontario. Two populations of recombinant inbred lines (RILs) were derived from crosses between one very-high protein cultivar (49%, dry basis), AC X790P, and two elite high-protein (41-42%, dry basis) cultivars, S18-R6 (Population 1), and S23-T5 (Population 2). Population 1 and Population 2 were comprised of 192 and 195 RILs, respectively. The RILs were grown in three locations over two years, accounting for five environments. Preliminary results from three environments show mean protein content ranging from 41.2% to 45.2%, mean cysteine content from 0.5408% to 0.6062%, and mean methionine content from 0.5188% to 0.5607%. Protein content, and cysteine were significantly (α=0.05) influenced by environmental effects; while genotype-by-environment interactions were not significant. Significant genotype-by-environment interactions were observed for methionine, which was not significantly influenced by environmental effects. While these preliminary results are specific to the bi-parental RIL populations, understanding the effects that influence protein and amino acid composition may prove beneficial in the development of high-protein soybeans.