Result summary for growers

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**Field-testing *ELP* genes for effects on seed composition and yield – year two**

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Efforts to breed soybean varieties with improved yields and seed compositions would be greatly facilitated by the availability of greater genetic diversity. For example, part of the reason some soybean varieties have higher yields than others is likely because certain genes are more active in the higher-yielding varieties. However, many genes do not exhibit great variation in their activity levels between different soybean varieties. If genes whose expression levels are important for seed yield or composition are identified, genetic engineering approaches can be used to generate novel soybean varieties that express those genes at higher levels than in existing soybean varieties. These varieties would then be predicted to have improved yields or seed compositions. To test this idea, we identified six “ELP” genes that we predicted will increase seed yield and/or alter seed composition if the genes are made more active. To make the genes more active, extra copies of the genes were introduced into the Williams82 soybean variety (Williams82 was used as it is relatively easy to transform).

During the summer of 2018 we conducted a field test of our ELP transgenic soybean lines, plus the parental line from which the transgenic lines were generated. We grew 15 plots of each of 21 different soybean lines that carry one of the six ELP genes. We also grew 30 plots of the non-transgenic soybean line from which the transgenic lines are derived. At the end of the growing season mature seeds were harvested and weighed separately for each plot. This data was then used to calculate the average weight of seeds produced per plant for each soybean line. Analysis of this data showed that two of the transgenic soybean lines had statistically significant increases in seed yield per plant. Relative to the non-transgenic control plants, seed yields per plant for these two transgenic lines were increased by approximately 30%.

We also measured seed composition in the transgenic lines and the non-transgenic control line. These analyses showed that four of the transgenic lines tested had statistically significant increases in seed protein levels, relative to seeds from all plants grown at the same time. These increases in seed protein levels ranged from approximately 1 to 5%. In other words, the seeds harvested from all plants grown at the same time had average seed protein levels of 40.6% on a dry weight basis, as compared to 41.1 to 42.5% for the four best transgenic lines. Although the transgenic line with the highest seed protein content was found to have significantly decreased yields, another transgenic line exhibited a 2.3% increase in seed protein (to 41.5%) and does not exhibit a decrease in yield and thus appears promising for future work.

Going forward, we plan to study the mechanism(s) by which different ELP genes affect seed yield and composition. We also want to test the reproducibility of these results in other parts of Minnesota and to introduce the most promising ELP genes into an elite Minnesota variety.