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Soybean seed protein, oil, fatty acids, N, and S partitioning as affected by node position and cultivar differences

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ABSTRACT

The mechanisms controlling the partitioning of seed composition constituents along the main stem in soybean are still controversial. Therefore, the objective of this study was to investigate seed protein, oil, and fatty acids partitioning in soybean cultivars along the main stem. The cultivars were DT97-4290, maturity group (MG) IV; Stressland, MG IV; Hutcheson, MG V; TracyM, MG VI. Seeds were harvested based on position on the plant (top nodes, middle nodes, and bottom nodes). At R8 (physiological maturity stage), DT97-4290, Hutcheson, and Stressland had higher percentage of protein and oleic acid and lower percentage of oil and linolenic acid in top node seed compared with bottom node seed. The increase of protein in top node compared with the bottom node across the two experiments ranged from 15.5 to 19.5%, 7.0 to 10.5%, 14.2 to 15.8%, 11.2 to 16.5%, respectively for DT97-4290, Hutcheson, Stressland, and TracyM. Except for TracyM, the increase of oleic acid in the top node ranged from 45.4 to 93%, depending on the cultivar. Conversely, the decrease in the top node seed ranged from 14.4 to 26.8% for oil and from 5.7 to 34.4% for linolenic acid, depending on the cultivar. The partitioning trend of seed composition constituents at R6 (seed - fill stage) was inconsistent. Except for Stressland, seed oleic acid was higher at R6 than at R8. The higher protein and oleic acid concentrations in the top node seed was accom- panied by higher activity of nitrate reductase activity, higher chlorophyll concentration, higher nitrogen (N) and sulfur (S) percentages in the fully expanded leaves at R5-R6 growth stage, and higher seed nitrogen (N) and sulfur (S) percentages in DT 97-4290 and Stressland. The current research suggests that the partitioning of seed protein, oil, and fatty acids in nodes along the plant depended on the position of node on the main stem, cultivar differences, seed N and S status, and tissue N and S partitioning. The higher nitrate reductase activity at the top nodes, accompanied higher protein and oleic acid, and the changes of oleic acid at R6 and R8 along the stem, were not previously reported, and need further investigation. The current knowledge is useful for soybean germplasm selection for desirable traits such protein and oleic acid, and for accurate measurements of seed composition constituents in breeding lines.

KEYWORDS

Seed Composition; Nitrogen Assimilation; Soybean; Nitrogen; Sulfur

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