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Abstract

Increased demand for soybean with modified oil composition has led to the development of new soybean cultivars with reduced levels of linolenic fatty acids. Plant density effects on soybean oil and protein content have been documented. However, little information is available for producers regarding management for growing low-linolenic soybean. The objective of this study was to determine the effect of plant density on linolenic acid of soybean bred to have reduced linolenic acid content ($\leq 3\%$, low-linolenic) and of traditional soybean cultivars ($\approx 7\%$, high-linolenic).

Keywords

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Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

Soybean Plant Density Effect on Oil Composition in Low-linolenic Soybean Cultivars

RFR-A9032

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Introduction

Increased demand for soybean with modified oil composition has led to the development of new soybean cultivars with reduced levels of linolenic fatty acids. Plant density effects on soybean oil and protein content have been documented. However, little information is available for producers regarding management for growing low-linolenic soybean. The objective of this study was to determine the effect of plant density on linolenic acid of soybean bred to have reduced linolenic acid content ($\leq 3\%$, low-linolenic) and of traditional soybean cultivars ($\approx 7\%$, high-linolenic).

Materials and Methods

Field research was conducted at two locations during 2007 and 2008. Locations were at the Iowa State University (ISU) Armstrong Research Farm, Lewis, in southwest Iowa, and at the ISU Southeast Research Farm, Crawfordsville, in southeast Iowa. Experimental design was a randomized complete block in a factorial arrangement with four replications using four varieties and four seeding rates. The four varieties grown in 2007 were AG2422V, AG2821V, AG2406, and AG3006. In 2008, two new varieties AG2521V and AG2921V were substituted for AG2422V and AG2821V due to the fact that they were no longer available. A fungicide and insecticide seed treatment, Cruiser Maxx, was also applied prior to planting. Each plot

was four rows wide by 30 ft long and planted in 30-in. rows using a John Deere 7000 MaxEmerge planter at seeding rates of 75,000, 125,000, 175,000, and 225,000 seeds/acre. Soybeans were planted in mid May into a tilled seedbed, following corn, at a depth of 1.5 in. Weed control was accomplished by using a pre-emergence herbicide followed by a post-emergence glyphosate application. Plant stand counts were taken twice; once after emergence to ensure satisfactory stands and once prior to harvest to determine final stand. Whole plant samples were collected at physiological maturity (R8) from two random 3-ft lengths of rows within the two non-harvest rows. Pods from these samples were then separated into two subsamples—pods originating from the mainstem and pods originating from the branches. These samples were threshed and weighed to determine seed mass. The sample was then ground and subjected to near infrared spectroscopy (NIRS) to measure seed oil, protein, and fatty acid profiles. Grain yield was determined with an Almaco small-plot combine. Grain yields were adjusted to 13% moisture. Data were subjected to an analysis of variance with a significance level of $P \leq 0.05$.

Results and Discussion

No yield difference existed between the low-linolenic and high-linolenic soybean cultivars and was consistent across locations (Table 1). Seeding rate influenced yield, as yield at the lowest seeding rate of 75,000 seeds/acre yielded 2.3 bushels/acre less than the other seeding rates. No yield differences were observed among the other seeding rates. No differences were observed for oil and protein concentration between locations or cultivars. Seeding rate influenced protein concentration

of both the mainstem and branch seeds. As seeding rate increased from 75,000 to 225,000 seeds/acre, protein content increased 0.5% for seeds from the mainstem and decreased 0.5% for seed from the branches. Oil content decreased as seeding rate increased for seeds on the mainstem. Oil content for seed from the branches was similar among seeding rates. As expected, low-linolenic cultivars produced seed with an average linolenic acid content of 1.7 and 2.2% on the mainstem and branches, respectively. Seed formed on the branches of both low-linolenic and high-linolenic cultivars had greater linolenic acid content than seeds on the mainstem. Cultivars responded similarly to seeding rate and at each seeding rate linolenic acid content of branch seed was greater than mainstem seed. These data support the conclusion that linolenic acid

concentration was affected by branch or mainstem position for the seed.

Conclusion

Results from this study indicate that low-linolenic and high-linolenic cultivars respond similarly to changes in seeding rates and extreme changes in soybean composition should not be expected. This assures that producers will receive price premiums and not price discounts when growing low-linolenic cultivars at the plant densities reported in this study.

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