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Roundup Ready vs. Conventional Soybean Variety Yield Test

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Abstract

Many Iowa soybean producers have adopted Roundup Ready (RR) technology on their farms in recent years. Reduced weed control costs, greater flexibility in herbicide application timing, and the potential for “cleaner” soybean fields are often cited as reasons for using RR technology; however, questions remain about potential profit-robbing yield reductions associated with RR varieties. A soybean yield performance comparison of adapted, elite RR varieties and elite conventional varieties was initiated in 1998. Our research objective was to compare genetic yield potential of commercial varieties, not to analyze the economics of one soybean variety-herbicide program versus another. Establishment of similar studies at four other university research farms statewide afforded yield comparisons of adapted varieties from five unique soil associations and environments. Northeast Research Farm soils are typical of the Kenyon-Floyd-Clyde soil association.

Keywords

Agronomy

Disciplines

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Roundup Ready[®] vs. Conventional Soybean Variety Yield Test

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Introduction

Many Iowa soybean producers have adopted Roundup Ready[®] (RR) technology on their farms in recent years. Reduced weed control costs, greater flexibility in herbicide application timing, and the potential for “cleaner” soybean fields are often cited as reasons for using RR technology; however, questions remain about potential profit-robbing yield reductions associated with RR varieties.

A soybean yield performance comparison of adapted, elite RR varieties and elite conventional varieties was initiated in 1998. Our research objective was to compare genetic yield potential of commercial varieties, not to analyze the economics of one soybean variety-herbicide program versus another. Establishment of similar studies at four other university research farms statewide afforded yield comparisons of adapted varieties from five unique soil associations and environments. Northeast Research Farm soils are typical of the Kenyon-Floyd-Clyde soil association.

Materials and Methods

Four seed companies were contacted to recommend their best RR variety and best conventional, high-yield variety adapted for southeast Iowa. In no instance were varieties from a single company identified as “sister lines” (varieties with identical genetic makeup except for the herbicide-resistance gene). A total of 12 treatments were compared, with two RR variety “blocks” per replication. One RR variety herbicide treatment block received a postemergence Roundup Ultra[™] herbicide application (RR+).

The other RR variety block was treated with a postemergence selective herbicide application (RRS). A third block of four conventional varieties (CN) was treated with the same postemergence selective herbicides. Experimental plots were planted at 180,000 seeds per acre on May 18 (1998), May 26 (1999) and May 3 (2000), using a Kinze planter with 30-inch row spacing. Herbicide treatments and varieties were included in a split-plot design with four replications. Main plot treatments were herbicide treatments, and subplot treatments were varieties. Herbicide treatments were applied three to four weeks after soybean emergence. Experimental plots in RR+ treatment blocks were treated with labeled rates of Roundup Ultra[™] herbicide. The RRS and CN treatment blocks received single applications of broadleaf (Pursuit[®]/Cobra[®]; mixed with Basagran[®] in 1999 and Pinnacle[®] in 2000) and grass (Assure[®] or Fusion[®]) herbicides at labeled rates. Plots were machine harvested on October 11 (1998 and 1999) and September 29 (2000). Grain yields (adjusted to 13% moisture) are summarized in Tables 1 and 2.

Results and Discussion

Three years of data suggest that yield potential of elite conventional varieties remains higher than that of elite RR varieties. Averaged across varieties, yields of CN plots were statistically greater ($P < 0.05$) than those of RR plots in all single- and multi-year comparisons (Table 1).

Yield performance of individual RR varieties averaged 0.5 bushel/acre (bu/A) greater in RR+ treatment blocks than in RRS treatment blocks (Table 2). Herbicide treatment effect on yield of RR varieties was inconsistent, with RR+ and RRS treatments each producing statistically significant ($P < 0.05$) yield differences in individual comparisons. Properly-timed herbicide application minimized soybean “stunting” symptoms in both CN and RRS-

treated plots; moreover, weed pressure was not a yield-determining factor because all experimental plots were maintained relatively weed-free. Our results suggest that the yield potential of RR varieties remains less than that of CN varieties of similar maturity; however, the “yield gap” seems to be closing as new RR varieties are released each year. Producers are advised to review unbiased, replicated yield comparisons from multiple environments when making RR or conventional soybean variety selections.

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Table 1. Effect of herbicide treatment on soybean yield in 1998, 1999, and 2000 at Nashua, IA.

Herbicide treatment	Mean yield performance			
	1998	1999	2000	1998-2000
	------(Bushels/acre)-----			
RR+	59.9 b ¹	50.1 b	63.0 c	57.6 b
RRS	55.9 c	50.5 b	65.1 b	57.1 b
CN	62.3 a	56.7 a	67.6 a	62.2 a
L.S.D. (P=0.05)	1.4	0.9	1.2	0.8

¹ Within columns, herbicide treatment mean yields followed by different letters are statistically different (P<0.05).

Table 2. Soybean yield performance by company (1998-2000) at Nashua, IA.

Year	Treatment	Company			
		Company 1	Company 2	Company 3	Company 4
		------(Bushels/acre)-----			
1998	"RR+"	60.0 a ²	59.1 b	61.2 a	59.1 b
	"RRS"	57.4 b	56.5 c	55.1 b	54.6 c
	"CN"	<u>61.9</u> a	<u>63.0</u> a	<u>62.4</u> a	<u>62.0</u> a
	Mean	59.8	59.5	59.6	58.5
	L.S.D. (P=0.05)	2.5	2.4	4.0	2.7
1999	"RR+"	50.7 c	49.5 b	49.2 b	51.1 b
	"RRS"	51.4 b	48.5 b	50.7 b	51.3 b
	"CN"	<u>57.4</u> a	<u>57.1</u> a	<u>54.9</u> a	<u>57.4</u> a
	Mean	53.2	51.7	51.6	53.3
	L.S.D. (P=0.05)	0.6	3.9	3.5	3.0
2000	"RR+"	62.4 b	62.8 b	62.4 b	64.2 b
	"RRS"	64.2 ab	64.2 b	65.9 a	65.9 ab
	"CN"	<u>66.0</u> a	<u>69.5</u> a	<u>67.7</u> a	<u>67.4</u> a
	Mean	64.2	65.5	65.3	65.9
	L.S.D. (P=0.05)	3.0	3.3	2.7	2.2

² Within each company comparison, yields followed by the same letter are statistically similar (P>0.05).