

# Yield of Roundup Ready<sup>®</sup> vs. Conventional Soybean Varieties

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## Introduction

Many Iowa soybean producers have adopted Roundup Ready<sup>®</sup> (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 response comparisons of adapted varieties from five unique soil associations and environments. Armstrong Research Farm soils are typical of the Marshall-Exira association.

## Materials and Methods

Four seed companies were contacted to recommend their best RR variety and best conventional, high-yield variety adapted for southwest 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<sup>™</sup> 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 178,000 seeds per acre on May 19 (1998), May 25 (1999) and May 11 (2000), using a John Deere 7000 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<sup>™</sup> herbicide. The RRS and CN treatment blocks received one-time applications of broadleaf (Basagran<sup>®</sup> in 1998, Stellar<sup>®</sup> in 1999-2000) and grass herbicides (Poast Plus<sup>®</sup> in 1998, Select<sup>®</sup> in 1999-2000) herbicides at labeled rates. Plots were machine harvested on October 14 (1998), October 8 (1999), and October 2 (2000). Grain yields (adjusted to 13% moisture) are summarized in Tables 1 and 2.

## Results and Discussion

Our results suggest that yield potential of elite RR varieties is competitive with that of elite conventional varieties. Averaged across varieties, yields of CN plots were statistically greater ( $P < 0.05$ ) than that of RR+ plots in 1998; RR+ and CN treatments yielded similarly ( $P > 0.05$ ) in all other single-year and multi-year comparisons (Table 1). Yield performance of individual RR varieties averaged 1.2 bushels/acre (bu/A) greater in RR+ treatment blocks than in RRS treatment blocks (Table 2); however, yield differences between RR+ and RRS treatments were statistically significant ( $P < 0.05$ ) in only two of 12 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 hand-weeding minimized weed pressure levels in all experimental plots. Statewide results suggest that the yield potential of RR varieties remains less than that of CN varieties of similar maturity; however, Armstrong Farm results suggest that the “yield gap” has closed 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.

### Acknowledgments

Our thanks to Iowa soybean producers, whose soybean check-off dollars support this research. Thanks also to Bernie Havlovic and Brian Buzzell for their assistance with this research. Roundup Ready<sup>®</sup> and Roundup Ultra<sup>™</sup> are trademarks of the Monsanto Company. Basagran<sup>®</sup> and Poast Plus<sup>®</sup> are registered trademarks of BASF Corp. Stellar<sup>®</sup> and Select<sup>®</sup> are registered trademarks of Valent USA Corp. No endorsement is intended of herbicides used in this study, nor is criticism implied of herbicides not used.

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

Herbicide treatment	Mean yield performance			
	1998	1999	2000	1998-2000
	------(Bushels/acre)-----			
RR+	53.4 b <sup>1</sup>	68.5 a	40.8 a	54.2 a
RRS	53.4 b	65.6 b	40.0 a	52.9 b
CN	56.8 a	68.9 a	40.4 a	55.3 a
L.S.D. (P=0.05)	1.1	1.2	NS	1.2

<sup>1</sup> 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 Lewis, IA.**

Year	Treatment	Company			
		Company 1	Company 2	Company 3	Company 4
		------(Bushels/acre)-----			
1998	“RR+”	53.0 b <sup>2</sup>	53.9 a	58.5 a	48.3 b
	“RRS”	49.5 c	55.0 a	59.4 a	49.6 b
	“CN”	<u>58.2</u> a	<u>54.5</u> a	<u>59.6</u> a	<u>54.7</u> a
	Mean	53.6	54.5	59.2	50.9
	L.S.D. (P=0.05)	3.2	NS	NS	2.8
1999	“RR+”	68.4 ab	69.2 a	68.4 a	67.9 a
	“RRS”	66.2 b	64.1 b	65.4 a	66.6 a
	“CN”	<u>71.2</u> a	<u>67.3</u> a	<u>68.6</u> a	<u>68.6</u> a
	Mean	68.6	66.9	67.5	67.7
	L.S.D. (P=0.05)	3.9	3.1	NS	NS
2000	“RR+”	41.6 a	39.9 a	42.0 a	39.6 a
	“RRS”	41.8 a	37.0 a	40.5 a	40.8 a
	“CN”	<u>41.4</u> a	<u>38.7</u> a	<u>40.5</u> a	<u>41.0</u> a
	Mean	41.6	38.6	41.0	40.4
	L.S.D. (P=0.05)	NS	NS	NS	NS

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