ROUNDUP READY â SOYBEAN PERFORMANCE IN THE MIDWEST

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Weed control is a critical component of successful soybean production for almost all of the acres grown each year. Most growers use a combination of herbicides, tillage, and crop competition to control annual and perennial weeds. Beginning about 1997, soybean varieties with resistance to glyphosate became available to growers in the upper Midwest. Using glyphosate as the primary herbicide in soybeans allowed growers more flexibility in herbicide application timing, simplicity with less confusion of herbicide mixes and rates, and greater control of perennial broadleaf weeds. For these and other reasons, the adoption rate of glyphosate-resistant soybean varieties has been greater than that of any other new technology in recent history.

Because of the newness of this technology, not much was known about the field performance of these new varieties, which contained a gene that gave the entire plant resistance to high levels of glyphosate. Many new and publicly untested Roundup Ready ® (RR) varieties entered the market with little known about their plant characteristics, disease resistance, or yield potential. Therefore, it is important to compare the performance of these varieties to other elite, conventional (CN) varieties.

Wisconsin Results

In 1997 at the University of Wisconsin-Madison, we began field evaluations of RR soybean varieties for yield potential, disease resistance, and plant lodging characteristics. These trials were part of the WI Soybean Variety Evaluation Program. Since 1997, the RR varieties have been grown under a management system where glyphosate is applied postemergence and conventional varieties are grown using conventional preemergence or postemergence herbicides. Hand weeding is used to ensure soybean yields are not affected by weed competition. RR varieties were entered by private companies into the trials at 3 locations in 1997 and 14 locations each year from 1998 through 2001. The number of RR entries in the program have steadily increased over those years (Fig. 1). In 2001, a total of 338 varieties were entered for evaluation and RR varieties accounted for 68% of all entries.

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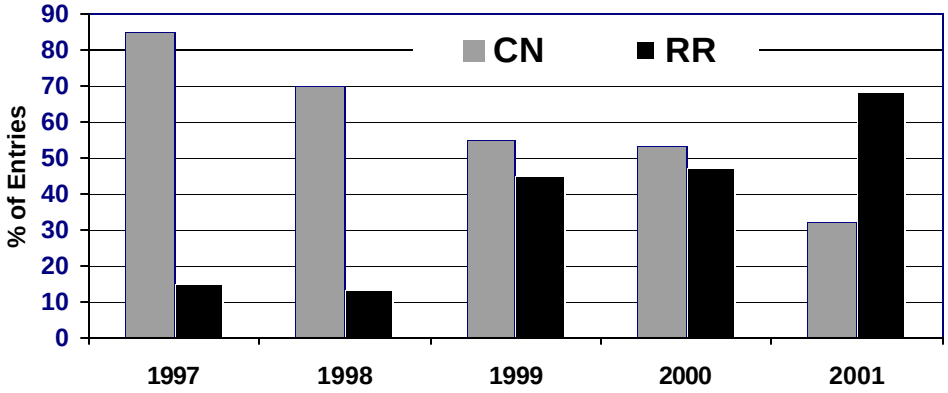

Fig. 1. Conventional (CN) and Roundup Ready (RR) varieties, expressed as a percent of all entries, tested in the WI Soybean Variety Evaluation Program from 1997 to 2001.

Yield performance of the top yielding RR variety has lagged behind the top yielding conventional variety in 4 of 13 region/year comparisons (Table 1). In 2001, the yield of the top RR variety was equal to the top CN variety in 2 of 3 regions. The greater percentage of RR entries may have increased the odds of having a high yielding RR soybean variety in 2001 as compared to previous years.

Table 1. Top yield of conventional (CN) and Roundup Ready (RR) varieties in Wisconsin. 1997-2001.

	Southern region		Central region		North-Central region	
Year	CN	RR	CN	RR	CN	RR
	---------- Yield (bu/a) ----------					
1997	66	63				
1998	*77	73	79	76	*64	57
1999	73	70	63	61	64	65
2000	66	64	*65	61	56	55
2001	66	66	56	59	*65	58

* indicates the highest yielding CN variety yielded more than the highest yielding RR variety for the same year and region.

The average yield of all CN and RR varieties tested from 1997 to 2001 is shown in Table 2. Comparing 2001 to previous years, RR varieties yielded the same or more than CN varieties on average for all three regions in Wisconsin. This is potentially due to more RR varieties developed for use in northern growing regions and less selection effort in soybean breeding programs for high yielding CN varieties. Previously observed yield-lag or yield-drag penalties for planting RR soybean varieties in WI have mostly disappeared.

Table 2. Average yield of conventional (CN) and Roundup Ready (RR) varieties in three regions in Wisconsin. 1997-2001.

	Southern region		Central region		North-Central region	
Year	CN	RR	CN	RR	CN	RR
	---------- Yield (bu/a) ----------					
1997	59	59				
1998	70	68	72	70	54	53
1999	67	64	58	56	57	59
2000	58	57	58	54	51	49
2001	59	61	50	52	53	52

Midwest Results

Roundup Ready soybeans are being evaluated in all the major growing regions of the US. Similar to Wisconsin, the ratio of RR to CN varieties has increased steadily over the past 5 years. In Iowa and Michigan, the average yield of all CN varieties was 1 bu/a greater than the average of all RR varieties in 2001 (Table 3). In Minnesota, the average yield of all CN varieties was 6 bu/a greater than the average of all RR varieties. These results may indicate that RR technology has not yet been incorporated into top varieties grown in the northern-most areas of the US soybean growing region. In IL university tests, RR varieties averaged 58 bu/a compared to 57 bu/a for CN varieties. With the exception of results from Minnesota, other regional variety performance data from 2001 also suggests that current RR soybean varieties have similar yield potential as CN varieties.

Table 3. Performance of Roundup Ready soybeans in the Midwest. 2001.

	Conventional		Roundup Ready	
State-Region	Variety/site comparisons	Yield (bu/a)	Variety/site comparisons	Yield (bu/a)
IA – all	246	59	636	58
IL – N	67	60	149	59
IL – NC	62	60	165	60
IL – C	62	58	169	61
IL – SC	40	54	138	54
IL – S	37	46	99	51
MI – all	65	45	194	44
MN – all	137	52	327	46

The Future of Roundup Ready Soybean

Projections by seed companies and industry analysts point to increased use of Roundup Ready soybean varieties by US growers. Broad-spectrum weed control with a single glyphosate herbicide and wider application windows are cited by growers as reasons for using this technology. Table 4 as adapted from

Seed Today, Oct. 2001, shows a 10% increase in the amount of RR varieties being offered by selected seed companies.

Table 4. Roundup Ready® soybean varieties marketed by selected seed companies as a percent of total varieties marketed.

	2001		2002	
Seed Company	Total	RR	Total	RR
Dairyland Seeds	44	48%	42	67%
Garst and Agripro	115	50%	136	65%
Golden Harvest	165	56%	159	67%
Great Lakes	34	53%	31	71%
Midland Genetics	25	52%	22	77%
Monsanto	110	85%	111	75%
Mycogen	46	33%	47	57%
NC+ Hybrids	41	61%	30	71%
Pioneer	114	48%	88	51%
Syngenta	57	42%	58	60%
Total	751	55%	724	65%

In addition to variety performance, soybean growers need to assess the total cost of production and market opportunities to determine the profitability of their soybean enterprise as they evaluate the use of RR soybean varieties on their farm. Distinct markets still exist for CN soybeans such as organic soybeans and non-GMO food grade soybeans. Premiums for non-GMO crops may offer an incentive for growers not to adopt new technological advances as offered by RR soybeans. In a survey over a thousand elevators in 11 Midwestern states conducted by the American Corn Growers Association, almost 20% reported offering premiums ranging from 5 to 35 cents per bushel for non-GM corn or non-GM soybeans. Market opportunities exist for both RR and CN soybeans, but selection of varieties with high yields or specific agronomic traits is critical in either case.

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