Comparison of Different Weed Control Technology Programs

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Summary

The development of glyphosate-resistant weeds has greatly complicated weed control in soybeans. Roundup Ready 2 Xtend and Liberty Link soybeans provide an alternative postemergence herbicide options for weed control in soybeans. Liberty Link and Roundup Ready 2 Xtend programs provided better overall weed control and slightly higher yields than Roundup Ready 2 Yield programs in this experiment. Yields of Roundup Ready 2 Yield soybeans were likely influenced by more weed competition and possibly crop injury from spray tank contamination by dicamba. Dicamba injury from tank contamination to Roundup Ready 2 Yield soybeans decreased with each subsequent treatment and also with time. At soybean maturity, injury from dicamba tank contamination was no longer evident.

Introduction

Weeds are a major production problem in soybeans, especially with the development of glyphosate-resistant weeds. Alternative technologies including Liberty Link and Roundup Ready 2 Xtend soybeans provide growers with alternative weed control programs. Using a systems approach and alternating technologies may be beneficial for weed control and herbicide-resistant weed management.

Procedures

A field experiment was established near Manhattan, KS, on a Reading silt loam soil with 2.7% organic matter and a pH of 5.8. The plot area had a natural infestation of Palmer amaranth (mixed population of glyphosate-susceptible and -resistant biotypes), velvetleaf, and ivyleaf morning glory and was field cultivated prior to soybean planting. Three different weed control programs were associated with three different traited soybeans, including Roundup Ready 2 Yield (RR2Y, glyphosate-resistant), Roundup Ready 2 Xtend (RR2X, glyphosate- and dicamba-resistant), and Liberty Link (LL, glufosinate-resistant). Asgrow 3634 RR2Y, Asgrow MON AG40X6 RR2X, and Credenz CZ3841 LL soybeans were planted at 120,000 seeds/a in 30-inch rows on May 12, 2016. Preemergence (PRE) herbicide treatments were applied to the soil surface on May 13 at 63°F, 60% relative humidity, and clear skies. A good, activating rain was received within 4 days after planting and more than 5 inches of rain was received during a 4-day period 12 to 15 days after planting. Postemergence (P) treatments were applied to 2-trifoliate-leaf soybeans (8 inch), 1- to 3-inch Palmer amaranth, 2- to 3-inch velvetleaf, and 2- to 3-inch morning glory on June 10, with 79°F, 65% relative humidity, and clear skies. Preemergence and P treatments on RR2Y and RR2X soybeans were applied with

a compressed air tractor sprayer, delivering 15 GPA at 40 psi through TTI11002 flat fan spray tips to the center 6.7 ft of 10 by 25 ft plots. Postemergence treatments on LL soybeans were applied with the same equipment, delivering 15 GPA at 26 psi through AIXR110025 flat fan spray tips. The experiment had a randomized complete block design with a split plot arrangement of three traits as the main plots, herbicide programs as the subplot, and three replications. Crop injury and weed control were visually evaluated throughout the growing season, and soybeans were harvested from the center 2 rows of the plots on October 24.

Results

A good, activating rain was received within 4 days after planting and more than 5 inches of rain was received during a 4-day period 12 to 15 days after planting. Rowel and Valor caused minor early-season stunting of soybeans, but plants eventually recovered (data not presented). Failure to properly clean out the spraying system with just a single rinse between the RR2X and the RR2Y postemergence herbicide applications resulted in sprayer contamination and dicamba injury to the RR2Y soybeans. Dicamba injury decreased with each subsequent application and was minimal by the third treatment. Soybean injury ratings decreased over time but seemed to persist more for the second subsequent application. All PRE treatments provided excellent Palmer amaranth control initially, but control started to break in early June following excessive rains in late May, especially with Rowel and Valor treatments. Palmer amaranth populations were a mix of glyphosate-susceptible and resistant biotypes. Palmer amaranth control was excellent with all RR2X and LL herbicide programs. Control was less with RR2Y programs due to the presence of glyphosate-resistant Palmer amaranth. Most PRE herbicide treatments provided good early-season control of velvetleaf, and late-season control was excellent with all treatments following postemergence herbicide applications. All PRE herbicide treatments except Warrant plus Tricor gave good early-season control of morning glory, but some late emerging plants escaped control. RR2Y herbicide programs were less effective than RR2X or LL programs for late-season morning glory control. Soybean yields were very good as a result of good precipitation through most of the growing season. Untreated checks were not harvestable due to the heavy weed pressure, and soybean yields would have been minimal. Soybean yields were higher for RR2X and LL soybeans than the RR2Y soybeans, but that may have been confounded by the dicamba injury to RR2Y soybeans. However, Palmer amaranth control was also less for RR2Y programs, which also may have contributed to lower soybean yields. Yields generally were similar among the different herbicide programs for each trait technology. Soybean yields tended to increase slightly from herbicide program 1 through herbicide program 3 for the dicamba-damaged RR2Y soybeans, but differences were minimal and not significant despite the different degrees of dicamba injury. In general, yield impact appeared to be minimal from the dicamba injury to the RR2Y soybeans.

Table 1. Soybean injury and yield, Manhattan, KS

Trait and herbicide treatment*	Application timing	Application rate	Soybean injury#		Soybean yield
			July 7	August 12	
		oz/a	------------ % ------------		bu/a
RR2Y					
Rowel/Roundup PMax	PRE/P	3/32	25	6	70
Warrant+Tricor/Roundup PMax	PRE/P	48+5/32	15	12	72
Warrant+Tricor/ Roundup+Warrant Ultra	PRE/P	48+5/32+50	3	0	74
RR2X					
Rowel/Roundup Xtend	PRE/P	2/64	0	0	77
Rowel+Xtendimax/Roundup Xtend	PRE/P	2+22/64	0	0	78
Rowel+Xtendimax/ RU Xtend+Warrant	PRE/P	2+22/64+48	0	0	79
LL					
Valor SX/Liberty	PRE/P	2/29	1	0	80
Authority Maxx/Liberty	PRE/P	6.4/29	2	0	80
Authority Maxx/Liberty+Zidua	PRE/P	6.4/29+2	2	0	77
Least significant difference ($P < 0.05$)			3	3	4

* / indicates sequential application; all Liberty applications included ammonium sulfate at 1.5 lb/a; PRE = preemergence; and P = postemergence.

Injury to RR2Y soybeans a result of spray tank contamination with dicamba following a single rinse and each subsequent application.

Table 2. Weed control prior to P treatment on June 10, 2016, Manhattan, KS

Trait and herbicide treatment*	Application timing	Application rate	Palmer amaranth	Velvet-leaf	Morning glory
		oz/a	----------------- % control -----------------		
RR2Y					
Rowel/Roundup PMax	PRE/P	3/32	82	93	88
Warrant+Tricor/Roundup PMax	PRE/P	48+5/32	92	83	7
Warrant+Tricor/Roundup+Warrant Ultra	PRE/P	48+5/32+50	94	88	7
RR2X					
Rowel/Roundup Xtend	PRE/P	2/64	77	92	90
Rowel+Xtendimax/Roundup Xtend	PRE/P	2+22/64	80	93	98
Rowel+Xtendimax/RU Xtend+Warrant	PRE/P	2+22/64+48	85	90	97
LL					
Valor SX/Liberty	PRE/P	2/29	85	95	90
Authority Maxx/Liberty	PRE/P	6.4/29	98	87	97
Authority Maxx/Liberty+Zidua	PRE/P	6.4/29+2	98	83	95
Least significant difference (P < 0.05)			4	9	7

* / indicates sequential application; all Liberty applications included ammonium sulfate at 1.5 lb/a; PRE = preemergence; and P = postemergence.

Table 3. Weed control prior to P treatment on July 7, 2016, Manhattan, KS

Trait and herbicide treatment*	Application timing	Application rate	Palmer amaranth	Velvet-leaf	Morning glory
		oz/a	----------------- % control -----------------		
RR2Y					
Rowel/Roundup PMax	PRE/P	3/32	88	100	75
Warrant+Tricor/Roundup PMax	PRE/P	48+5/32	95	98	65
Warrant+Tricor/Roundup+Warrant Ultra	PRE/P	48+5/32+50	95	98	63
RR2X					
Rowel/Roundup Xtend	PRE/P	2/64	96	100	82
Rowel+Xtendimax/Roundup Xtend	PRE/P	2+22/64	95	100	82
Rowel+Xtendimax/RU Xtend+Warrant	PRE/P	2+22/64+48	100	100	85
LL					
Valor SX/Liberty	PRE/P	2/29	100	100	88
Authority Maxx/Liberty	PRE/P	6.4/29	100	100	95
Authority Maxx/Liberty+Zidua	PRE/P	6.4/29+2	100	100	96
Least significant difference ($P < 0.05$)			5	2	11

* / indicates sequential application; all Liberty applications included ammonium sulfate at 1.5 lb/a; PRE = preemergence; and P = postemergence.
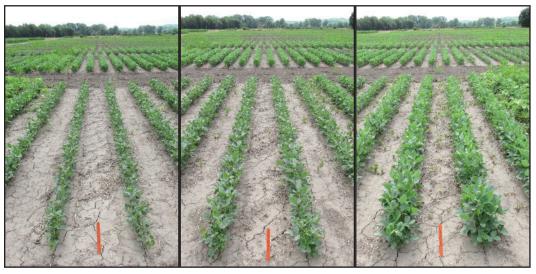

Figure 1. Soybean response from dicamba sprayer contamination following a single rinse and each subsequent application.