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Liberty Compared to Glyphosate Products in Irrigated Corn

Abstract

Postemergence treatments of Liberty (glufosinate) were compared to Durango DMA and Roundup PowerMax (glyphosate) after various preemergence treatments for efficacy in corn. Control of common sunflower, green foxtail, Russian thistle, and quinoa exceeded 92% regardless of herbicide treatment or evaluation date. Similarly, all preemergence (PRE) treatments controlled Palmer amaranth, kochia, and crabgrass by 93% or more. Later in the season, control of kochia was slightly less when Verdict (saflufenacil/dimethenamid) and atrazine PRE was followed by Roundup PowerMax and atrazine postemergence (POST). Palmer amaranth and crabgrass control was less when Verdict and atrazine PRE was followed by Roundup PowerMax or Liberty and atrazine POST. Herbicide treatments increased grain yields by 49–70% relative to the untreated controls.

Keywords

herbicide resistance

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Liberty Compared to Glyphosate Products in Irrigated Corn

R.S. Currie and P.W. Geier

Summary

Postemergence treatments of Liberty (glufosinate) were compared to Durango DMA and Roundup PowerMax (glyphosate) after various preemergence treatments for efficacy in corn. Control of common sunflower, green foxtail, Russian thistle, and quinoa exceeded 92% regardless of herbicide treatment or evaluation date. Similarly, all preemergence (PRE) treatments controlled Palmer amaranth, kochia, and crabgrass by 93% or more. Later in the season, control of kochia was slightly less when Verdict (saflufenacil/dimethenamid) and atrazine PRE was followed by Roundup PowerMax and atrazine postemergence (POST). Palmer amaranth and crabgrass control was less when Verdict and atrazine PRE was followed by Roundup PowerMax or Liberty and atrazine POST. Herbicide treatments increased grain yields by 49–70% relative to the untreated controls.

Introduction

The use of glyphosate has increased steadily since its introduction in 1974, and became a major component of many herbicide programs with the introduction of glyphosate-resistant crops in the 1990s. Although it remains a valuable tool for weed control, the rise in glyphosate usage has led to increases in glyphosate-resistant weed species. Kochia and Palmer amaranth are examples of two troublesome weeds which have confirmed glyphosate-resistant populations in Kansas. One key management tool for combating resistance is the use of herbicides with multiple modes of action. The objective of this study was to compare postemergence treatments of Liberty (glufosinate) to Durango DMA and Roundup PowerMax (glyphosate) after various preemergence treatments for efficacy in corn.

Experimental Procedures

An experiment was conducted at the Kansas State University Southwest Research-Extension Center near Garden City, KS, to compare Liberty to Durango or Roundup PowerMax as postemergence (POST) treatments following various preemergence (PRE) treatments in corn. All treatments were applied using a tractor-mounted, compressed CO₂ sprayer delivering 19.4 GPA at 3.0 mph and 30 psi. Application, environmental, crop, and weed information is given in Table 1. Natural weed populations were supplemented by overseeding the experimental area with quinoa (to simulate common lambsquarters), domesticated sunflower (to simulate common sunflower), and domesticated crabgrass (to simulate large crabgrass). Plots were 10 × 35 feet and arranged in a randomized complete block with four replications. Soil was a Ulysses silt loam with

pH 7.6 and 2.4% organic matter. Visual weed control was determined on June 6, 2018, which was 31 days after the PRE treatments (31 DA-A), and on July 25, 2018, which was 43 days after the POST treatments (43 DA-B). Yields were determined on October 5, 2018, by mechanically harvesting the center two rows of each plot and adjusting grain weights to 15.5% moisture.

Results and Discussion

All herbicides controlled Russian thistle 93–100%, green foxtail 95–100%, common sunflower 96–100%, and quinoa 100% regardless of evaluation date, and did not differ between treatments (data not shown). Likewise, all PRE herbicides controlled Kochia and Palmer amaranth similarly at 31 DA-A (Table 2). Kochia control was slightly less with Verdict (saflufenacil/dimethenamid) and atrazine PRE followed by Roundup PowerMax and atrazine POST compared to other treatments at 43 DA-B. Palmer amaranth control at 43 DA-B was 96% or more with all herbicides, except when Verdict plus atrazine PRE was followed by Roundup PowerMax with atrazine or Liberty with atrazine POST. Preemergence herbicides controlled crabgrass by 95% or more at 31 DA-A, and only the treatments of Verdict plus atrazine PRE followed by Roundup PowerMax with atrazine or Liberty with atrazine POST provided less than 94% crabgrass control at 43 DA-B. All herbicide-treated corn yielded 56–79 bu/a more grain than nontreated corn (Table 2), and yield was greatest from corn receiving Acuron PRE followed by Liberty plus atrazine POST (194 bu/a).

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Table 1. Application information

	Preemergence	Postemergence
Application timing		
Application date	May 11, 2018	June 12, 2018
Air temperature (°F)	89	74
Relative humidity (%)	32	63
Soil temperature (°F)	77	73
Wind speed (mph)	0 to 4	4 to 6
Wind direction	South	East-southeast
Soil moisture	Good	Good
Corn		
Height (inch)	---	8 to 12
Leaves (number)	0	5 to 6
Palmer amaranth		
Height (inch)	---	2 to 3
Density (plants/10 feet ²)	0	0.1
Kochia		
Height (inch)	---	1 to 3
Density (plants/10 feet ²)	0	0.8
Russian thistle		
Height (inch)	---	1 to 4
Density (plants/10 feet ²)	0	0.1
Common sunflower		
Height (inch)	---	2 to 4
Density (plants/10 feet ²)	0	0.1
Quinoa		
Height (inch)	---	2 to 3
Density (plants/10 feet ²)	0	0.1
Green foxtail		
Height (inch)	---	1 to 2
Density (plants/10 feet ²)	0	0.1
Crabgrass		
Height (inch)	---	---
Density (plants/10 feet ²)	0	0

Table 2. Liberty and glyphosate comparisons in corn

Treatment ^a	Rate	Timing ^a	Kochia		Palmer amaranth		Crabgrass		Corn yield bu/a
			31 DA-A ^b	43 DA-B ^c	31 DA-A	43 DA-B	31 DA-A	43 DA-B	
	per acre		----- % Visual -----						
Balance Flexx	4.0 oz	PRE	99	100	94	96	95	96	181.1
Atrazine	32 oz	PRE							
Liberty	32 oz	POST							
Capreno	3.0 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Corvus	4.0 oz	PRE	100	100	95	96	96	94	179.7
Atrazine	32 oz	PRE							
Liberty	32 oz	POST							
Diflexx Duo	24 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Harness Max	2.5 qt	PRE	98	100	98	99	100	98	179.0
Atrazine	32 oz	PRE							
Durango	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Harness Max	2.5 qt	PRE	100	100	98	98	100	95	178.3
Atrazine	32 oz	PRE							
Liberty	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Resicore	2.5 qt	PRE	100	100	100	98	99	94	185.9
Atrazine	32 oz	PRE							
Durango	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Resicore	2.5 qt	PRE	100	100	100	99	100	94	171.7
Atrazine	32 oz	PRE							
Liberty	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Verdict	14 oz	PRE	96	94	99	93	98	90	171.1
Atrazine	32 oz	PRE							
RU PowerMax	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Verdict	14 oz	PRE	99	100	98	88	99	93	186.5
Atrazine	32 oz	PRE							
Liberty	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							

continued

Table 2. Liberty and glyphosate comparisons in corn

Treatment ^a	Rate	Timing ^a	Kochia		Palmer amaranth		Crabgrass		Corn yield bu/a
			31 DA-A ^b	43 DA-B ^c	31 DA-A	43 DA-B	31 DA-A	43 DA-B	
	per acre		----- % Visual -----						
Acuron	2.5 qt	PRE	100	98	100	99	100	99	187.0
RU PowerMax	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Acuron	2.5 qt	PRE	100	100	99	100	100	96	194.4
Liberty	32 oz	POST							
Atrazine	16 oz	POST							
AMS	1.0%	POST							
Balance Flexx	4.0 oz	PRE	98	100	99	99	95	100	184.2
Atrazine	32 oz	PRE							
Halex GT	3.6 pt	POST							
Status	5.0 oz	POST							
AMS	1.0%	POST							
Balance Flexx	4.0 oz	PRE	98	100	93	100	100	100	190.4
Atrazine	32 oz	PRE							
Halex GT	3.6 pt	POST							
Liberty	32 oz	POST							
AMS	1.0%	POST							
Untreated	---	---	---	---	---	---	---	---	114.6
LSD (0.05)			NS	3	NS	5	4	5	18.1

^aAMS = ammonium sulfate. Durango = Durango DMA. RU PowerMax = Roundup PowerMax.

^bPRE = preemergence. POST = postemergence.

^cDA-A = days after the preemergence applications.

^dDA-B = days after the postemergence applications.



Figure 1. Untreated control.



Figure 2. Verdict 14 oz/a plus atrazine 32 oz/a applied preemergence followed by Round-up PowerMax 32 oz/a plus atrazine 16 oz/a postemergence, picture taken 1 day after postemergence application.



Figure 3. Verdict 14 oz/a plus atrazine 32 oz/a applied preemergence followed by Liberty 32 oz/a plus atrazine 16 oz/a postemergence, picture taken 1 day after postemergence application.



Figure 4. Acuron 2.5 qt/a applied preemergence followed by Roundup PowerMax 32 oz/a plus atrazine 16 oz/a postemergence, picture taken 1 day after postemergence application.



Figure 5. Acuron 2.5 qt/a applied preemergence followed by Liberty 32 oz/a plus atrazine 16 oz/a postemergence, picture taken 1 day after postemergence application.