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Weed Control with Imazamox Rates and Timings in Herbicide-Tolerant Grain Sorghum

R.S. Currie and P.W. Geier

Summary

The objective of this trial was to evaluate weed control and crop response using imazamox (KFD-365-02) in herbicide-resistant grain sorghum. Palmer amaranth control was 80% or less late in the season due to the herbicide-resistant weed biotype in the experiment. Both velvetleaf and shattercane control exceeded 90% with most herbicides late in the year. Using KFD-365-02 at the 9.0 oz/a rate applied preemergence alone or with atrazine or Moccasin II Plus controlled green foxtail and puncturevine the best. Most early postemergence treatments caused minor sorghum necrosis 6 days after treatments, but sorghum recovered fully within one week.

Introduction

Postemergence (POST) weed control in grain sorghum has always been challenging, especially when those weeds are grasses. With the recent introductions of herbicide-tolerant grain sorghum, chemicals that would normally injure or kill the crop have potential to expand herbicide options in sorghum. One such introduction is Igrowth sorghum, which has tolerance to imazamox herbicide, and is currently under development. The objective of this study was to evaluate imazamox at two rates and two application timings for weed control in grain sorghum.

Experimental Procedures

An experiment was conducted at the Kansas State University Southwest Research-Extension Center near Garden City, KS, to evaluate imazamox (KFD-356-02) rates, application timings, and tank mix partners for efficacy in imazamox-resistant grain sorghum. Herbicides were applied POST using a tractor-mounted, compressed CO₂ sprayer delivering 19.4 gpa at 30 psi and 4.1 mph. Application, environmental, and weed information are shown in Table 1. Plots were 10 by 35 feet and arranged in a randomized complete block design with four replications. Soil was a Ulysses silt loam with 3.4% organic matter and pH of 7.9. Visual weed control was determined on July 6 and August 11, 2020. These dates were 6 days after the preemergence treatments (6 DAB) and 35 days after the late postemergence treatments (35 DAD), respectively. Crop injury ratings were taken on July 6 and July 14, 2020, and these dates were 6 days after the early postemergence treatments (6 DAB) and 7 DAD, respectively.

Results and Discussion

Common sunflower control was complete with all herbicide treatments regardless of rating date (data not shown). Early season Palmer amaranth control was similar among all herbicides except KFD-365-02 plus atrazine preemergence (PRE) followed by 2,4-D early postemergence (EPOST), and KFD-365-02 PRE followed by atrazine EPOST (Table 2). These treatments, along with KFD-365-02 plus Moccasin II Plus (*S*-metolachlor) PRE followed by atrazine EPOST were the least effective on Palmer amaranth at 35 DAD as well. However, since the Palmer amaranth biotype in this study was resistant to several herbicide modes-of-actions, no herbicide treatment provided more than 80% control at 35 DAD. Velvetleaf control was 93% or more with all herbicides except Bicep II Magnum (*S*-metolachlor/atrazine) PRE at 6 DAC. Similarly, velvetleaf control was best (93 to 100%) with all herbicides except Coyote (*S*-metolachlor/mesotrione) PRE followed by KFD-365-02 alone, or with atrazine EPOST and Moccasin II Plus plus atrazine PRE followed by 2,4-D EPOST at 7 DAD. Treatments of Coyote at 10 days preplant (10 DPP) followed by KFD-365-02 EPOST or KFD-365-02 PRE provided greater than 90% green foxtail control early, but only the 9.0 oz/a rate of KFD-365-02 applied PRE controlled foxtail more than 90% at 35 DAD. Similarly, only the high rate of KFD-365-02 applied PRE provided adequate puncturevine control at 35 DAD (Table 3). Shattercane control was good with all herbicide treatments except Bicep II Magnum PRE followed by Kochiavore (fluroxypyr/2,4-D/bromoxynil) (Table 2). Most herbicide treatments caused 8 to 14% sorghum necrosis at 6 DAC; however, injury did not persist (Table 3).

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Table 1. Application, environmental, and weed data for the imazamox grain sorghum study

Application timing	14 DPP¹	PRE¹	EPOST¹	LPOST¹
Application date	May 18, 2020	June 3, 2020	June 30, 2020	July 7, 2020
Air temperature (°F)	81	75	73	76
Relative humidity	36	44	41	62
Soil temperature (°F)	81	73	74	77
Wind speed (mph)	0 to 4	3 to 7	3 to 6	3 to 7
Wind direction	South	Northwest	South	South
Soil moisture	Dry	Dry	Fair	Fair
Grain sorghum				
Height (inches)	---	---	6 to 8	7 to 9
Leaves (no.)	0	0	3 to 5	4 to 6
Palmer amaranth				
Height (inches)	---	---	3 to 6	3 to 7
Density (plants/10 ft ²)	0	0	5	20
Velvetleaf				
Height (inches)	---	---	2 to 4	2 to 6
Density (plants/10 ft ²)	0	0	1	2
Puncturevine				
Diameter (inches)	---	---	6	8
Density (plants/10 ft ²)	0	0	1	2
Green foxtail				
Height (inches)	---	---	2 to 5	---
Density (plants/10 ft ²)	0	0	2	0
Shattercane				
Height (inches)	---	---	3 to 6	3 to 5
Density (plants/10 ft ²)	0	0	1	2

¹ 14 DPP = 14 days preplant. PRE = preemergence. EPOST = early postemergence. LPOST = late postemergence.

Table 2. Weed control with imazamox in imazamox-tolerant grain sorghum

Treatment ¹	Rate	Timing ²	Palmer amaranth		Velvetleaf		Green foxtail		Shattercane	
			6	35	6	35	6	35	6	35
			DAB ³	DAD ³	DAB	DAD	DAB	DAD	DAB	DAD
	oz/a		----- % Visual -----							
Coyote KFD-356-02 COC	64 6.0 1.0%	14 DPP EPOST EPOST	89	75	98	88	93	85	99	95
Coyote KFD-356-02 Atrazine COC	64 6.0 32 1.0%	14 DPP EPOST EPOST EPOST	91	70	96	90	91	80	98	98
Coyote KFD-356-02 2,4-D ester	64 6.0 8.0	14 DPP EPOST EPOST	91	70	100	100	90	70	100	100
KFD-356-02 Atrazine 2,4-D ester	9.0 32 8.0	PRE PRE EPOST	70	35	100	100	100	100	100	100
KFD-356-02 Moccasin II Plus Atrazine COC	9.0 16 32 1.0%	PRE PRE EPOST EPOST	91	80	100	100	100	95	100	100
KFD-356-02 Moccasin II Plus Atrazine COC	6.0 16 32 1.0%	PRE PRE EPOST EPOST	86	63	100	100	98	85	98	100
KFD-356-02 Atrazine COC	9.0 32 1.0%	PRE EPOST EPOST	71	20	100	100	100	95	100	100
Moccasin II Plus Atrazine KFD-356-02 COC	16 32 6.0 1.0%	PRE PRE EPOST EPOST	86	68	98	100	88	83	96	100
Moccasin II Plus Atrazine KFD-356-02 2,4-D ester	16 32 6.0 8.0	PRE PRE EPOST EPOST	89	73	96	98	83	73	100	100
Moccasin II Plus Atrazine 2,4-D ester	16 32 8.0	PRE PRE EPOST	88	73	93	83	85	60	93	95
Bicep II Magnum Kochiavore	67 24	PRE LPOST	90	80	78	93	86	63	88	85
LSD (0.05)			10	15	8	10	9	8	6	7

¹ COC = crop oil concentrate.

² 14 DPP = 14 days preplant. PRE = preemergence. EPOST = early postemergence. LPOST = late postemergence.

³ 6 DAB = days after 6 days after the preemergence treatments. 35 DAD = 35 days after the late postemergence treatments.

Table 3. Puncturevine control and crop response in the imazamox-tolerant grain sorghum study

Treatment ¹	Rate	Timing ²	Puncturevine			Sorghum necrosis		
			35 DAD ³	6 DAC ³	7 DAD ³	% Visual		
	oz/a		-----			-----		
Untreated	---	---	---	0	0			
Coyote	64	14 DPP	40	10	0			
KFD-356-02	6.0	EPOST						
COC	1.0%	EPOST						
Coyote	64	14 DPP	55	14	0			
KFD-356-02	6.0	EPOST						
Atrazine	32	EPOST						
COC	1.0%	EPOST						
Coyote	64	14 DPP	43	10	0			
KFD-356-02	6.0	EPOST						
2,4-D ester	8.0	EPOST						
KFD-356-02	9.0	PRE	90	10	0			
Atrazine	32	PRE						
2,4-D ester	8.0	EPOST						
KFD-356-02	9.0	PRE	90	14	0			
Moccasin II Plus	16	PRE						
Atrazine	32	EPOST						
COC	1.0%	EPOST						
KFD-356-02	6.0	PRE	75	8	0			
Moccasin II Plus	16	PRE						
Atrazine	32	EPOST						
COC	1.0%	EPOST						
KFD-356-02	9.0	PRE	93	14	0			
Atrazine	32	EPOST						
COC	1.0%	EPOST						
Moccasin II Plus	16	PRE	30	10	0			
Atrazine	32	PRE						
KFD-356-02	6.0	EPOST						
COC	1.0%	EPOST						
Moccasin II Plus	16	PRE	33	10	0			
Atrazine	32	PRE						
KFD-356-02	6.0	EPOST						
2,4-D ester	8.0	EPOST						
Moccasin II Plus	16	PRE	30	5	0			
Atrazine	32	PRE						
2,4-D ester	8.0	EPOST						
Bicep II Magnum	67	PRE	48	0	0			
Kochiavore	24	LPOST						
LSD (0.05)			16	6	NS			

¹ COC = crop oil concentrate.

² 14 DPP = 14 days preplant. PRE = preemergence. EPOST = early postemergence. LPOST = late postemergence.

³ 35 DAD = 35 days after the late postemergence treatments. 6 DAC = days after 6 days after the early postemergence treatments. 7 DAD = 7 days after the late postemergence treatments.



Figure 1. Untreated control.



Figure 2. Coyote at 64 oz/a applied 14 days preplant followed by KFD-356-02 at 6.0 oz/a and atrazine 32 oz/a applied early postemergence. Photo taken 28 days after the early postemergence treatment.



Figure 3. KFD-356-02 at 9.0 oz/a plus Moccasin II Plus at 16 oz/a applied preemergence followed by atrazine at 32 oz/a early postemergence. Photo taken 28 days after the early postemergence treatment.



Figure 4. Moccasin II Plus at 16 oz/a plus atrazine at 32 oz/a applied preemergence followed by KFD-356-02 at 6.0 oz/a applied early postemergence. Photo taken 28 days after the early postemergence treatment.



Figure 5. Bicep II Magnum at 67 oz/a applied preemergence followed by Kochiavore at 24 oz/a applied late postemergence. Photo taken 21 days after the late postemergence treatment.