

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
Investigator: Karla L. Gage, Ph.D.

Trial Status: F one-year/final Initiation Date: 5-22-16 Completion Date: 10-7-16	Trial Location
City: Carlyle Country: USA State/Prov.: Illinois IL Postal Code: 62231	

Objectives: Evaluate FMC herbicide concepts on PPO- and glyphosate-resistant waterhemp.

Study Director: Karla Gage, Ph.D. Title: Assistant Professor of Weed Science Organization: Southern Illinois University Carbondale Address: 1205 Lincoln Drive MC 4415 Phone No.: 618-453-7679 City+State/Prov: Carbondale, IL Postal Code: 62901 E-mail: kgage@siu.edu Country: USA	Contacts
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Crop 1: GLXMA Glycine max Soybean Variety: AG3832 BBCH Scale: BSOY Description: RR2Y Planting Rate, Unit: 140000 S/A Planting Date: 5-22-16 Depth, Unit: 1 IN Planting Method: SEEDED Row Spacing, Unit: 30 IN	Crop Description
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Pest 1 Type: W Code: AMATA <i>Amaranthus rudis</i> Sauer Common Name: waterhemp, common Description: PPO-resistant waterhemp	Pest Description
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Treated Plot Width: 6.67 FT Total Plot Width: 10 FT Treated Plot Length: 30 FT Total Plot Length: 30 FT Experimental Unit: 1 PLOT Replications: 3 Tillage Type: REDTIL reduced-till Untreated Arrangement: INCLUDED single control randomized in each block Study Design: RACOB� Randomized Complete Block (RCB)	Site and Design Site Type: FIELD						
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">No.</th> <th style="width: 15%;">Previous Crop</th> <th style="width: 10%;">Year</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>GLXMA</td> <td>2015</td> </tr> </tbody> </table>	No.	Previous Crop	Year	1.	GLXMA	2015	
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1.	GLXMA	2015					

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No.	Maintenance Product Name				
1.	N 0 LB/A, P2O5 0 LB/A, K2O 0 LB/A				

Description Name: Clinton PPO site 2016 % Sand: 6.5 % OM: 1.93 Texture: SIL silt loam % Silt: 75.56 pH: 6.2 Soil Name: Cisne-Huey complex % Clay: 17.94 CEC: 8.27	Soil Description									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Element</th> <th style="width: 15%;">Quantity</th> <th style="width: 15%;">Unit</th> </tr> </thead> <tbody> <tr> <td>P1</td> <td>144</td> <td>lb/A</td> </tr> <tr> <td>K</td> <td>212</td> <td>lb/A</td> </tr> </tbody> </table>	Element	Quantity	Unit	P1	144	lb/A	K	212	lb/A	Additional Measured Elements
Element	Quantity	Unit								
P1	144	lb/A								
K	212	lb/A								

Overall Moisture Conditions: NORMAL Closest Weather Station: Carlyle Reservoir	Moisture and Weather Conditions Distance, Unit: 6.75 MI
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No.	Date	Amount	Unit	Type	Type Description	Interval	Unit	Min Temp	Max Temp	Temp Unit
1.	4-29-16					7	DAY	46	75	F
2.	5-1-16	0.66	IN	RAIN	rain	4	DAY			
3.	5-6-16					7	DAY	44	87	F
4.	5-8-16	2.52	IN	RAIN	rain	7	DAY			
5.	5-13-16					7	DAY	41	76	F
6.	5-17-16	0.76	IN	RAIN	rain	2	DAY			
7.	5-20-16					7	DAY	51	83	F
8.	5-27-16					7	DAY	62	88	F
9.	5-27-16	0.89	IN	RAIN	rain	2	DAY			
10.	6-1-16	0.05	IN	RAIN	rain	4	DAY			
11.	6-3-16					7	DAY	55	89	F
12.	6-5-16	0.38	IN	RAIN	rain	1	DAY			
13.	6-10-16					7	DAY	65	96	F
14.	6-17-16					7	DAY	67	97	F
15.	6-24-16					7	DAY	57	95	F
16.	7-1-16					7	DAY	60	91	F
17.	7-1-16	0.05	IN	RAIN	rain	1	DAY			
18.	7-3-16	1.57	IN	RAIN	rain	5	DAY			
19.	7-8-16					7	DAY	67	93	F
20.	7-13-16	0.13	IN	RAIN	rain	1	DAY			
21.	7-15-16					7	DAY	68	93	F
22.	7-17-16	0.73	IN	RAIN	rain	1	DAY			
23.	7-20-16	0.59	IN	RAIN	rain	1	DAY			
24.	7-22-16					7	DAY	72	94	F
25.	7-22-16	0.39	IN	RAIN	rain	1	DAY			
26.	7-25-16	0.69	IN	RAIN	rain	3	DAY			
27.	7-29-16					7	DAY	69	91	F
28.	8-1-16	0.52	IN	RAIN	rain	4	DAY			
29.	8-5-16					7	DAY	66	93	F
30.	8-12-16					7	DAY	68	91	F
31.	8-13-16	5.38	IN	RAIN	rain	5	DAY			
32.	8-19-16					7	DAY	57	93	F
33.	8-20-16	0.05	IN	RAIN	rain	1	DAY			
34.	8-26-16					7	DAY	62	93	F
35.	9-1-16	0.13	IN	RAIN	rain	1	DAY			
36.	9-2-16					7	DAY	57	94	F
37.	9-9-16					7	DAY	54	89	F
38.	9-9-16	4.49	IN	RAIN	rain	2	DAY			
39.	9-16-16					7	DAY	59	89	F
40.	9-17-16	0.92	IN	RAIN	rain	1	DAY			
41.	9-23-16					7	DAY	48	91	F
42.	9-26-16	0.91	IN	RAIN	rain	1	DAY			
43.	9-30-16					7	DAY	55	87	F
44.	9-30-16	0.51	IN	RAIN	rain	3	DAY			
45.	10-7-16					7	DAY	42	81	F
46.	10-14-16					7	DAY	43	87	F
47.	10-20-16	1.93	IN	RAIN	rain	2	DAY			

Comment:

Rainfall was recorded 6.75 miles WNW and at the Carlyle Reservoir.
 Air temperature was recorded at Scott Air Force Base 33 miles WSW.
 Data provided by NOAA's National Centers for Environmental Information.
 Air temperatures given are summarized as weekly high and low,
 detailed weather data is available on request.

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Application Description

	A	B	C	D	E
Application Date:	5-22-16	6-14-16	6-29-16	6-19-16	6-14-16
Appl. Start Time:	19:00	17:40	13:15	13:20	17:40
Appl. Stop Time:	19:30	18:00	13:20	13:25	18:00
Application Method:	Spray	Spray	Spray	Spray	Spray
Application Timing:	PRE	4"W-1	4"W-2	28DAP	2-3T
Application Placement:	BROSOI	BROFOL	BROFOL	BROFOL	BROFOL
Applied By:	KNW	MCG	MCG	MCG	MCG
Air Temperature, Unit:	85 F	97 F	76 F	90 F	97 F
% Relative Humidity:	37	50	35	57	50
Wind Velocity, Unit:	1 MPH	8 MPH	5 MPH	7 MPH	8 MPH
Wind Direction:	NNW	S	N	SW	S
Dew Presence (Y/N):	N	N	N	N	N
Soil Temperature, Unit:	70 F	90 F	80 F	95 F	90 F
Soil Moisture:	NORMAL	BELNOR	BELNOR	BELNOR	BELNOR
% Cloud Cover:	0	30	30	40	30
Next Moisture Occurred On:	5-27-16	7-1-16	7-1-16	7-1-16	7-1-16
Time to Next Moisture, Unit:	5 DAY	17 DAY	2 DAY	12 DAY	17 DAY

Crop Stage At Each Application

	A	B	C	D	E
Crop 1 Code, BBCH Scale:	GLXMA	GLXMA	GLXMA	GLXMA	GLXMA
Stage Scale Used:	DESC	DESC	DESC	DESC	DESC
Stage Majority, Percent:	NA	V2	V5	V3	V2
Stage Minimum, Percent:		V2	V4	V3	V2
Stage Maximum, Percent:		V2	V5	V3	V2
Height, Unit:		4 IN	8 IN	6 IN	4 IN
Height Minimum, Maximum:		3 4	6 8	4 6	3 4

Pest Stage At Each Application

	A	B	C	D	E
Pest 1 Code, Type, Scale:	AMATA W	AMATA W	AMATA W	AMATA W	AMATA W
Stage Majority, Percent:	NA	8	30	NA	NA
Stage Minimum, Percent:		COTY	3		
Stage Maximum, Percent:		12	50+		
Height, Unit:		4 IN	6 IN		
Height Minimum, Maximum:		0.25 8	0.5 10		
Density, Unit:		40 FT2	2 FT2		

Application Equipment

	A	B	C	D	E
Appl. Equipment:	CO2 sprayer	CO2 sprayer	CO2 sprayer	CO2 sprayer	CO2 sprayer
Equipment Type:	BACSPR	BACSPR	BACSPR	BACSPR	BACSPR
Operation Pressure, Unit:	30 PSI	30 PSI	30 PSI	30 PSI	30 PSI
Nozzle Type:	XR	XR	XR	XR	XR
Nozzle Size:	8002	8002	8002	8002	8002
Boom Length, Unit:	6.67 FT	6.67 FT	6.67 FT	6.67 FT	6.67 FT
Spray Volume, Unit:	15 GPA	15 GPA	15 GPA	15 GPA	15 GPA

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Pest Code	Crop Code	Rating Date	Rating Type	Rating Unit	Rating Timing	Trt-Eval Interval	GLXMA 10-7-16 Moisture Percent	GLXMA 10-7-16 Test wt. lb/bu	GLXMA 10-7-16 Yield bu/A	
Trt No.	Treatment Name	Form Type	Form Rate	Rate Unit	Other Rate	Other Unit	Growth Stage	Appl Code		
1	MARVEL	3	SL	0.17 lb ai/a	7.25 fl oz/a	4"W-1	B		36 e	
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	4"W-1	B			
	COC (PRIME OIL)	100	SL	0.5 % v/v	0.5 % v/v	4"W-1	B			
	COBRA	2	EC	0.156 lb ai/a	10 fl oz/a	4"W-2	C			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	4"W-2	C			
	COC (PRIME OIL)	100	SL	0.5 % v/v	0.5 % v/v	4"W-2	C			
2	AUTHORITY ELITE	7	SC	1.42 lb ai/a	26 fl oz/a	PRE	A	12.9 a	52.5 a	45 cd
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
3	AUTHORITY ELITE	7	SC	1.42 lb ai/a	26 fl oz/a	PRE	A	13.6 a	52.5 a	43 cde
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
4	AUTHORITY MTZ	45	WG	0.42 lb ai/a	15 oz/a	PRE	A	14.1 a	50.9 bc	45 cd
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
5	AUTHORITY MTZ	45	WG	0.42 lb ai/a	15 oz/a	PRE	A	13.1 a	52.2 ab	37 de
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
6	AUTHORITY MTZ	45	WG	0.42 lb ai/a	15 oz/a	PRE	A	12.9 a	50.0 c	48 bc
	PROWL H2O	3.8	CS	0.71 lb ai/a	1.5 pt/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
7	AUTHORITY MAXX	66	WG	0.206 lb ai/a	5 oz/a	PRE	A	13.6 a	52.9 a	45 cd
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
8	ROWEL FX	40.3	WG	0.0756 lb ai/a	3 oz/a	PRE	A	15.0 a	52.8 a	50 abc
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	WARRANT	3	CS	1.13 lb ai/a	3 pt/a	2-3T	E			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E			
9	BOUNDARY	6.5	EC	1.22 lb ai/a	1.5 pt/a	PRE	A	13.2 a	52.0 ab	57 a
	FLEXSTAR GT 3.5	2.82	SL	1.23 lb ae/a	3.5 pt/a	28DAP	D			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	28DAP	D			
10	ANTHEM MAXX	4.3	SC	0.134 lb ai/a	4 fl oz/a	PRE	A	13.2 a	53.2 a	56 ab
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A			
	MARVEL	3	SL	0.17 lb ai/a	7.25 fl oz/a	28DAP	D			
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	28DAP	D			
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	28DAP	D			

Means followed by same letter or symbol do not significantly differ (P=0.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Missing data estimates are included in columns: Average=7,8,9

Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

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Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
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Pest Code							GLXMA	GLXMA	GLXMA
Crop Code							10-7-16	10-7-16	10-7-16
Rating Date							Moisture	Test wt.	Yield
Rating Type							Percent	lb/bu	bu/A
Rating Unit									
Rating Timing									
Trt-Eval Interval									
Trt No.	Treatment Name	Form Conc	Form Type	Rate Rate	Other Rate	Other Rate	Growth Unit	Appl Stage	Code
11	NONTREATED								26 f
LSD P=.05							1.69	1.57	9.1
Standard Deviation							0.88	0.75	5.2
CV							6.49	1.43	11.72
Replicate F							1.483	0.127	1.335
Replicate Prob(F)							0.2904	0.8831	0.2946
Treatment F							1.740	5.672	8.928
Treatment Prob(F)							0.2398	0.0360	0.0002

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Pest Code						GLXMA	GLXMA	GLXMA	GLXMA
Crop Code						5-29-16	6-5-16	6-14-16	6-19-16
Rating Date						Injury	Injury	Injury	Injury
Rating Type						Percent	Percent	Percent	Percent
Rating Unit						7 DA-A	14 DA-A	0 DA-E	28 DA-A
Rating Timing									0 DA-D
Trt-Eval Interval									
Trt No.	Treatment Name	Form Type	Form Rate	Rate Unit	Other Rate	Other Rate Unit	Growth Stage	Appl Code	
1	MARVEL	3 SL	0.17 lb ai/a	7.25 fl oz/a	4"W-1	B			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	4"W-1	B			
	COC (PRIME OIL)	100 SL	0.5 % v/v	0.5 % v/v	4"W-1	B			
	COBRA	2 EC	0.156 lb ai/a	10 fl oz/a	4"W-2	C			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	4"W-2	C			
	COC (PRIME OIL)	100 SL	0.5 % v/v	0.5 % v/v	4"W-2	C			
2	AUTHORITY ELITE	7 SC	1.42 lb ai/a	26 fl oz/a	PRE	A	85 a	50 ab	37 b
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			40 ab
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
3	AUTHORITY ELITE	7 SC	1.42 lb ai/a	26 fl oz/a	PRE	A	75 a	48 ab	30 b
	SENCOR DF	75 DF	0.234 lb ai/a	5 oz/a	PRE	A			40 ab
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
4	AUTHORITY MTZ	45 WG	0.42 lb ai/a	15 oz/a	PRE	A	83 a	48 ab	40 b
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			38 b
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
5	AUTHORITY MTZ	45 WG	0.42 lb ai/a	15 oz/a	PRE	A	90 a	62 a	57 a
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	PRE	A			57 a
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
6	AUTHORITY MTZ	45 WG	0.42 lb ai/a	15 oz/a	PRE	A	80 a	35 b	28 b
	PROWL H2O	3.8 CS	0.71 lb ai/a	1.5 pt/a	PRE	A			38 b
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
7	AUTHORITY MAXX	66 WG	0.206 lb ai/a	5 oz/a	PRE	A	82 a	42 b	37 b
	SENCOR DF	75 DF	0.234 lb ai/a	5 oz/a	PRE	A			38 b
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
8	ROWEL FX	40.3 WG	0.0756 lb ai/a	3 oz/a	PRE	A	22 b	12 c	10 c
	SENCOR DF	75 DF	0.234 lb ai/a	5 oz/a	PRE	A			18 c
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	2-3T	E			
	WARRANT	3 CS	1.13 lb ai/a	3 pt/a	2-3T	E			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	2-3T	E			
9	BOUNDARY	6.5 EC	1.22 lb ai/a	1.5 pt/a	PRE	A	5 b	2 c	0 c
	FLEXSTAR GT 3.5	2.82 SL	1.23 lb ae/a	3.5 pt/a	28DAP	D			0 d
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	28DAP	D			
10	ANTHEM MAXX	4.3 SC	0.134 lb ai/a	4 fl oz/a	PRE	A	8 b	3 c	0 c
	SENCOR DF	75 DF	0.234 lb ai/a	5 oz/a	PRE	A			0 d
	MARVEL	3 SL	0.17 lb ai/a	7.25 fl oz/a	28DAP	D			
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a	32 fl oz/a	28DAP	D			
	N-PAK AMS	100 SL	2.5 % v/v	2.5 % v/v	28DAP	D			

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Pest Code	GLXMA	GLXMA	GLXMA	GLXMA
Crop Code	5-29-16	6-5-16	6-14-16	6-19-16
Rating Date	Injury	Injury	Injury	Injury
Rating Type	Percent	Percent	Percent	Percent
Rating Unit	7 DA-A	14 DA-A	23 DA-A	28 DA-A
Rating Timing			0 DA-E	0 DA-D
Trt-Eval Interval				
Trt Treatment	Form	Form	Rate	Other
No. Name	Conc	Type	Rate	Unit
11 NONTREATED	0	0	0	0
LSD P=.05	18.3	16.7	14.2	17.0
Standard Deviation	10.6	9.6	8.2	9.8
CV	17.95	28.76	31.05	32.75
Replicate F	0.916	1.504	4.329	3.568
Replicate Prob(F)	0.4202	0.2520	0.0314	0.0523
Treatment F	34.608	16.037	16.596	11.871
Treatment Prob(F)	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
 Missing data estimates are included in columns: Average=7,8,9
 Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
Investigator: Karla L. Gage, Ph.D.

Pest Code						GLXMA	GLXMA	GLXMA				
Crop Code						6-21-16	6-28-16	7-12-16				
Rating Date						Injury	Injury	Injury				
Rating Type						Percent	Percent	Percent				
Rating Unit						7 DA-B	14 DA-B	13 DA-C				
Rating Timing						7 DA-E	14 DA-E	28 DA-E				
Trt-Eval Interval												
Trt No.	Treatment Name	Form Conc	Form Type	Rate	Rate Unit	Other Rate	Other Rate Unit	Growth Stage	Appl Code			
1	MARVEL	3	SL	0.17	lb ai/a	7.25	fl oz/a	4"W-1	B	11 c	5 d	17 b-e
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	4"W-1	B			
	COC (PRIME OIL)	100	SL	0.5	% v/v	0.5	% v/v	4"W-1	B			
	COBRA	2	EC	0.156	lb ai/a	10	fl oz/a	4"W-2	C			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	4"W-2	C			
	COC (PRIME OIL)	100	SL	0.5	% v/v	0.5	% v/v	4"W-2	C			
2	AUTHORITY ELITE	7	SC	1.42	lb ai/a	26	fl oz/a	PRE	A	40 ab	30 ab	28 ab
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
3	AUTHORITY ELITE	7	SC	1.42	lb ai/a	26	fl oz/a	PRE	A	40 ab	28 ab	27 abc
	SENCOR DF	75	DF	0.234	lb ai/a	5	oz/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
4	AUTHORITY MTZ	45	WG	0.42	lb ai/a	15	oz/a	PRE	A	38 b	27 bc	28 ab
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
5	AUTHORITY MTZ	45	WG	0.42	lb ai/a	15	oz/a	PRE	A	57 a	47 a	45 a
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
6	AUTHORITY MTZ	45	WG	0.42	lb ai/a	15	oz/a	PRE	A	38 b	30 ab	18 b-e
	PROWL H2O	3.8	CS	0.71	lb ai/a	1.5	pt/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
7	AUTHORITY MAXX	66	WG	0.206	lb ai/a	5	oz/a	PRE	A	38 b	23 bcd	25 bcd
	SENCOR DF	75	DF	0.234	lb ai/a	5	oz/a	PRE	A			
	ANTHEM MAXX	4.3	SC	0.084	lb ai/a	2.5	fl oz/a	2-3T	E			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
8	ROWEL FX	40.3	WG	0.0756	lb ai/a	3	oz/a	PRE	A	18 c	8 cd	7 de
	SENCOR DF	75	DF	0.234	lb ai/a	5	oz/a	PRE	A			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	2-3T	E			
	WARRANT	3	CS	1.13	lb ai/a	3	pt/a	2-3T	E			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	2-3T	E			
9	BOUNDARY	6.5	EC	1.22	lb ai/a	1.5	pt/a	PRE	A		7 d	3 e
	FLEXSTAR GT 3.5	2.82	SL	1.23	lb ae/a	3.5	pt/a	28DAP	D			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	28DAP	D			
10	ANTHEM MAXX	4.3	SC	0.134	lb ai/a	4	fl oz/a	PRE	A		15 bcd	8 cde
	SENCOR DF	75	DF	0.234	lb ai/a	5	oz/a	PRE	A			
	MARVEL	3	SL	0.17	lb ai/a	7.25	fl oz/a	28DAP	D			
	ROUNDUP POWERMAX	4.5	SL	1.13	lb ae/a	32	fl oz/a	28DAP	D			
	N-PAK AMS	100	SL	2.5	% v/v	2.5	% v/v	28DAP	D			

Means followed by same letter or symbol do not significantly differ (P=0.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Missing data estimates are included in columns: Average=7,8,9

Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
 Investigator: Karla L. Gage, Ph.D.

Pest Code							GLXMA	GLXMA	GLXMA	
Crop Code							6-21-16	6-28-16	7-12-16	
Rating Date							Injury	Injury	Injury	
Rating Type							Percent	Percent	Percent	
Rating Unit							7 DA-B	14 DA-B	13 DA-C	
Rating Timing							7 DA-E	14 DA-E	28 DA-E	
Trt-Eval Interval										
Trt No.	Treatment Name	Form Conc	Form Type	Rate Rate	Unit Unit	Other Rate	Other Rate	Growth Unit	Appl Stage	Code
11	NONTREATED									
							0	0	0	
	LSD P=.05						17.9	18.7	19.6	
	Standard Deviation						10.2	10.9	11.4	
	CV						29.16	49.5	55.31	
	Replicate F						3.679	2.803	2.991	
	Replicate Prob(F)						0.0520	0.0871	0.0756	
	Treatment F						5.824	4.384	3.660	
	Treatment Prob(F)						0.0026	0.0037	0.0092	

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
 Missing data estimates are included in columns: Average=7,8,9
 Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
Investigator: Karla L. Gage, Ph.D.

Pest Code						AMATA-HR	AMATA-HR	AMATA-HR
Crop Code						6-5-16	6-14-16	6-19-16
Rating Date						Control	Control	Control
Rating Type						Percent	Percent	Percent
Rating Unit						14 DA-A	23 DA-A	28 DA-A
Rating Timing						0 DA-E	0 DA-E	0 DA-D
Trt-Eval Interval								
Trt No.	Treatment Name	Form Type	Form Rate	Rate Unit	Other Rate	Other Rate Unit	Growth Stage	Appl Code
1	MARVEL	3 SL	0.17 lb ai/a		7.25 fl oz/a		4"W-1	B
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		4"W-1	B
	COC (PRIME OIL)	100 SL	0.5 % v/v		0.5 % v/v		4"W-1	B
	COBRA	2 EC	0.156 lb ai/a		10 fl oz/a		4"W-2	C
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		4"W-2	C
	COC (PRIME OIL)	100 SL	0.5 % v/v		0.5 % v/v		4"W-2	C
2	AUTHORITY ELITE	7 SC	1.42 lb ai/a		26 fl oz/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		2-3T	E
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
3	AUTHORITY ELITE	7 SC	1.42 lb ai/a		26 fl oz/a		PRE	A
	SENCOR DF	75 DF	0.234 lb ai/a		5 oz/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		2-3T	E
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
4	AUTHORITY MTZ	45 WG	0.42 lb ai/a		15 oz/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		2-3T	E
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
5	AUTHORITY MTZ	45 WG	0.42 lb ai/a		15 oz/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		2-3T	E
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
6	AUTHORITY MTZ	45 WG	0.42 lb ai/a		15 oz/a		PRE	A
	PROWL H2O	3.8 CS	0.71 lb ai/a		1.5 pt/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		2-3T	E
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
7	AUTHORITY MAXX	66 WG	0.206 lb ai/a		5 oz/a		PRE	A
	SENCOR DF	75 DF	0.234 lb ai/a		5 oz/a		PRE	A
	ANTHEM MAXX	4.3 SC	0.084 lb ai/a		2.5 fl oz/a		2-3T	E
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
8	ROWEL FX	40.3 WG	0.0756 lb ai/a		3 oz/a		PRE	A
	SENCOR DF	75 DF	0.234 lb ai/a		5 oz/a		PRE	A
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		2-3T	E
	WARRANT	3 CS	1.13 lb ai/a		3 pt/a		2-3T	E
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		2-3T	E
9	BOUNDARY	6.5 EC	1.22 lb ai/a		1.5 pt/a		PRE	A
	FLEXSTAR GT 3.5	2.82 SL	1.23 lb ae/a		3.5 pt/a		28DAP	D
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		28DAP	D
10	ANTHEM MAXX	4.3 SC	0.134 lb ai/a		4 fl oz/a		PRE	A
	SENCOR DF	75 DF	0.234 lb ai/a		5 oz/a		PRE	A
	MARVEL	3 SL	0.17 lb ai/a		7.25 fl oz/a		28DAP	D
	ROUNDUP POWERMAX	4.5 SL	1.13 lb ae/a		32 fl oz/a		28DAP	D
	N-PAK AMS	100 SL	2.5 % v/v		2.5 % v/v		28DAP	D

Means followed by same letter or symbol do not significantly differ (P=0.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Missing data estimates are included in columns: Average=7,8,9

Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
 Investigator: Karla L. Gage, Ph.D.

								AMATA-HR	AMATA-HR	AMATA-HR
Pest Code								6-5-16	6-14-16	6-19-16
Crop Code								Control	Control	Control
Rating Date								Percent	Percent	Percent
Rating Type								23 DA-A	28 DA-A	28 DA-A
Rating Unit								14 DA-A	0 DA-E	0 DA-D
Rating Timing										
Trt-Eval Interval										
Trt No.	Treatment Name	Form Conc	Form Type	Rate Rate	Unit	Other Rate	Other Rate	Growth Unit	Appl Stage	Code
11	NONTREATED									
LSD P=.05								.	.	.
Standard Deviation								0.0	0.0	0.0
CV								0.0	0.0	0.0
Replicate F								0.000	0.000	0.000
Replicate Prob(F)								1.0000	1.0000	1.0000
Treatment F								0.000	0.000	0.000
Treatment Prob(F)								1.0000	1.0000	1.0000

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
 Missing data estimates are included in columns: Average=7,8,9
 Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
Investigator: Karla L. Gage, Ph.D.

Pest Code						AMATA-HR	AMATA-HR	AMATA-HR
Crop Code						6-28-16	7-17-16	8-14-16
Rating Date						Control	Control	Control
Rating Type						Percent	Percent	Percent
Rating Unit						14 DA-B	18 DA-C	46 DA-C
Rating Timing						14 DA-E	56 DA-A	84 DA-A
Trt-Eval Interval								
Trt No.	Treatment Name	Form Conc	Form Type	Rate Rate Unit	Other Rate Rate Unit	Growth Stage	Appl Code	
1	MARVEL	3	SL	0.17 lb ai/a	7.25 fl oz/a	4"W-1	B	63 b
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	4"W-1	B	47 b
	COC (PRIME OIL)	100	SL	0.5 % v/v	0.5 % v/v	4"W-1	B	37 b
	COBRA	2	EC	0.156 lb ai/a	10 fl oz/a	4"W-2	C	
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	4"W-2	C	
	COC (PRIME OIL)	100	SL	0.5 % v/v	0.5 % v/v	4"W-2	C	
2	AUTHORITY ELITE	7	SC	1.42 lb ai/a	26 fl oz/a	PRE	A	98 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E	98 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	97 a
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
3	AUTHORITY ELITE	7	SC	1.42 lb ai/a	26 fl oz/a	PRE	A	98 a
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A	97 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E	95 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
4	AUTHORITY MTZ	45	WG	0.42 lb ai/a	15 oz/a	PRE	A	97 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E	94 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	91 a
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
5	AUTHORITY MTZ	45	WG	0.42 lb ai/a	15 oz/a	PRE	A	99 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	PRE	A	99 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E	99 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
6	AUTHORITY MTZ	45	WG	0.42 lb ai/a	15 oz/a	PRE	A	97 a
	PROWL H2O	3.8	CS	0.71 lb ai/a	1.5 pt/a	PRE	A	97 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E	97 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
7	AUTHORITY MAXX	66	WG	0.206 lb ai/a	5 oz/a	PRE	A	99 a
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A	98 a
	ANTHEM MAXX	4.3	SC	0.084 lb ai/a	2.5 fl oz/a	2-3T	E	98 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
8	ROWEL FX	40.3	WG	0.0756 lb ai/a	3 oz/a	PRE	A	98 a
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A	97 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	2-3T	E	96 a
	WARRANT	3	CS	1.13 lb ai/a	3 pt/a	2-3T	E	
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	2-3T	E	
9	BOUNDARY	6.5	EC	1.22 lb ai/a	1.5 pt/a	PRE	A	99 a
	FLEXSTAR GT 3.5	2.82	SL	1.23 lb ae/a	3.5 pt/a	28DAP	D	96 a
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	28DAP	D	93 a
10	ANTHEM MAXX	4.3	SC	0.134 lb ai/a	4 fl oz/a	PRE	A	99 a
	SENCOR DF	75	DF	0.234 lb ai/a	5 oz/a	PRE	A	99 a
	MARVEL	3	SL	0.17 lb ai/a	7.25 fl oz/a	28DAP	D	99 a
	ROUNDUP POWERMAX	4.5	SL	1.13 lb ae/a	32 fl oz/a	28DAP	D	
	N-PAK AMS	100	SL	2.5 % v/v	2.5 % v/v	28DAP	D	

Means followed by same letter or symbol do not significantly differ (P=0.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Missing data estimates are included in columns: Average=7,8,9

Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
 Investigator: Karla L. Gage, Ph.D.

Pest Code		AMATA-HR	AMATA-HR	AMATA-HR
Crop Code				
Rating Date		6-28-16	7-17-16	8-14-16
Rating Type		Control	Control	Control
Rating Unit		Percent	Percent	Percent
Rating Timing		14 DA-B	18 DA-C	46 DA-C
Trt-Eval Interval		14 DA-E	56 DA-A	84 DA-A
Trt Treatment	Form Form	Rate	Other Other	Growth Appl
No. Name	Conc Type Rate	Unit	Rate Rate	Unit Stage Code
11 NONTREATED				
		0	0	0
LSD P=.05		16.0	16.0	22.6
Standard Deviation		9.4	9.3	13.2
CV		9.86	10.13	14.63
Replicate F		0.915	1.171	1.380
Replicate Prob(F)		0.4185	0.3326	0.2770
Treatment F		4.225	8.866	6.214
Treatment Prob(F)		0.0045	0.0001	0.0005

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
 Missing data estimates are included in columns: Average=7,8,9
 Could not calculate LSD (% mean diff) for columns 12,14,16 because error mean square = 0.

PPO-Resistant Waterhemp Strategies in Roundup Ready Soybean.

Trial ID: 16-PPO-RR-SB Location: Carlyle, IL Trial Year: 2016
Investigator: Karla L. Gage, Ph.D.

Trial Comments

1. Protocol: FMC (PPO in RR SB).
2. Ratings:
CI 7, 14, and 28 DA-A; and 7, 14, and 28 DA-E.
WC 14, 28, 56, and 84 DA-A, but rate PREs prior to POST applications D+E.
Rate all plots each time.
3. Yield if possible.
4. Blanket to start clean if needed (was not needed, used tillage).
Blanket Select Max after PRE and before POST if needed.
5. Target waterhemp and rate other weeds.
6. Application E, 2-3T = 2-3 soybean trifoliate.
7. Photos of PREs prior to POSTs.
8. Rainfall following the PRE application A was 0.89 inch over 2 days beginning 5 days later.
Rainfall following the 4"W-1 application B was 0.48 inch over 2 days beginning 17 days later.
Rainfall following the 4"W-2 application C was 0.48 inch over 2 days beginning 2 days later.
Rainfall following the 28DAP application D was 0.48 inch over 2 days beginning 12 days later.
Rainfall following the 2-3T application E was 0.48 inch over 2 days beginning 17 days later.
9. AMATA-HR = Herbicide-resistant waterhemp (PPO).
10. Regarding soybean injury;

At 7 DA-A there was severe sulfentrazone damage, few soybeans in these treatments were fully emerged, and if emerged there was severe injury on the hypocotyl and cotyledons.

Injury in Rowel FX plots was less severe. Boundary and Anthem Maxx plus Sencor had only a slight delay in emergence compared to the nontreated plots.

Plots in replication 1 had more severe injury probably due to poorer drainage compared to the rest of the field. These fields are very flat and perhaps it took an extended period of time for them to drain.

At 14 DA-A soybean injury was stunt and stand reduction in treatments 2-8 and slight stunt in treatments 9 and 10.

11. Harvested 10-7-16, (2) 30 inch rows by 27 ft.
Missing yield data was due to equipment malfunction.