

Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control

Trial ID: 18-WIN-ToughTM Location: Winamac Trial Year: 2018
 Protocol ID: 18-WIN-ToughTM Investigator: Dr. Bryan Young
 Project ID: Study Director: Dr. Bryan Young
 Sponsor Contact: Dave Wright

General Trial Information

Study Director: Dr. Bryan Young **Title:** Professor
Investigator: Dr. Bryan Young **Title:** Professor

Discipline: H herbicide
Trial Status: E established
Initiation Date: May-1-2018
Completion Date: Aug-18-2018

Trial Location

City: Winamac **Country:** USA United States
State/Prov.: Indiana
Postal Code: 46996

Conducted Under GLP: No

Conducted Under GEP: No

Contacts

Study Director: Dr. Bryan Young **Title:** Professor
Organization: Purdue University
Address: 915 W. State Street
City+State/Prov: West Lafayette, IN
Postal Code: 47907 **E-mail:** BryanYoung@purdue.edu
Country: USA United States

Investigator: Dr. Bryan Young **Title:** Professor
Organization: Purdue University
Address: 915 W, State Street
City+State/Prov: West Lafayette
Postal Code: 47907 **E-mail:** BryanYoung@purdue.edu
Country: USA United States

Crop Description

Crop 1: C ZEAMD Zea mays indentata Dent corn
Variety: DKC62-52
Planting Date: May-16-2018 **Planting Rate:** 32000 S/A
Depth: 2 IN
Planting Method: SEEDED seeded
Row Spacing: 30 IN **Planting Equipment:** PP plot planter

Pest Description

Pest 1 Type: W **Code:** AMAPA *Amaranthus palmeri*
Common Name: Palmer amaranth
Attributes: glyphosate-resistant

Pest 2 Type: W **Code:** DIGSA *Digitaria sanguinalis*
Common Name: large crabgrass

Site and Design

Treated Plot Width: 6.67 FT **Site Type:** FIELD field
Treated Plot Length: 25 FT **Experimental Unit:** 1 PLOT plot
Treated Plot Area: 166.75 FT² **Treatments:** 13 **Tillage Type:** NOTILL no-till
Replications: 4 **Study Design:** RACOB� Randomized Complete Block (RCB)

Field Prep./Maintenance:

Gramoxone at 2 pt/A applied to entire plot area on 5/16/18. Super U polymer coated urea applied 5/16/18 to deliver 150 lb Nitrogen per acre.

Soil Description

Description Name: Winamac 17
% Sand: 83 **% OM:** 2.8 **Texture:** LS loamy sand
% Silt: 10 **pH:** 6.1
% Clay: 7 **CEC:** 9.4

Moisture and Weather Conditions

Overall Moisture Conditions: BELNOR below normal
Closest Weather Station: KGGP **Distance:** 26 MI

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Trial ID: 18-WIN-ToughTM Location: Winamac Trial Year: 2018
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No.	Date	Moisture Total	Unit	Type	Type Description
1.	May-1-2018	0.1	IN	RAIN	rain
2.	May-3-2018	0.31	IN	RAIN	rain
3.	May-9-2018	0.27	IN	RAIN	rain
4.	May-12-2018	0.02	IN	RAIN	rain
5.	May-15-2018	0.27	IN	RAIN	rain
6.	May-18-2018	0.17	IN	RAIN	rain
7.	May-19-2018	0.03	IN	RAIN	rain
8.	May-21-2018	0.05	IN	RAIN	rain
9.	May-26-2018	0.03	IN	RAIN	rain
10.	May-30-2018	0.35	IN	RAIN	rain
11.	May-31-2018	0.48	IN	RAIN	rain
12.	Jun-1-2018	0.52	IN	RAIN	rain
13.	Jun-5-2018	0.05	IN	RAIN	rain
14.	Jun-7-2018	0.35	IN	RAIN	rain
15.	Jun-9-2018	1.41	IN	RAIN	rain
16.	Jun-10-2018	0.51	IN	RAIN	rain
17.	Jun-13-2018	0.04	IN	RAIN	rain
18.	Jun-19-2018	0.23	IN	RAIN	rain
19.	Jun-21-2018	0.63	IN	RAIN	rain
20.	Jun-22-2018	1.52	IN	RAIN	rain
21.	Jun-23-2018	0.03	IN	RAIN	rain
22.	Jun-26-2018	0.33	IN	RAIN	rain
23.	Jul-2-2018	0.01	IN	RAIN	rain
24.	Jul-5-2018	0.7	IN	RAIN	rain
25.	Jul-10-2018	0.39	IN	RAIN	rain
26.	Jul-16-2018	0.33	IN	RAIN	rain
27.	Jul-20-2018	0.23	IN	RAIN	rain
28.	Jul-21-2018	0.67	IN	RAIN	rain

Application Description

	A	B
Application Date	May-16-2018	Jun-14-2018
Appl. Start Time	2:45 PM	8:50 AM
Appl. Stop Time	3:10 PM	9:30 AM
Application Method	SPRAY	SPRAY
Application Timing	PRE	V2-V4 CN
Application Placement	BROFOL	BROFOL
Applied By	BM	CH
Air Temperature Start, Stop	74 F	70.6 F
% Relative Humidity Start, Stop	45	70
Wind Velocity+Dir. Start	9.4 MPH NE	1 MPH S
Wet Leaves (Y/N)	N no	Y yes
Soil Temperature	75.4 F	67 F
Soil Moisture	NORMAL	SLIWET
% Cloud Cover	30	20

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Crop Stage At Each Application		
	A	B
Crop 1 Code, BBCH Scale	ZEAMD BCOR	ZEAMD BCOR
Stage Scale Used	BBCH	BBCH
Stage Majority, Percent	00	36
Stage Minimum, Percent		34
Stage Maximum, Percent		36
Height Average		23 IN
Height Minimum, Maximum		8 26

Pest Stage At Each Application		
	A	B
Pest 1 Code, Type, Scale	AMAPA W BBCH	AMAPA W BBCH
Stage Majority, Percent	00	17
Stage Minimum, Percent		14
Stage Maximum, Percent		19
Height Average		3 IN
Height Minimum, Maximum		1 6
Density Average		1 FT2
Pest 2 Code, Type, Scale	DIGSA W BBCH	DIGSA W BBCH
Stage Majority, Percent	00	16
Stage Minimum, Percent		12
Stage Maximum, Percent		19
Height Average		4 IN
Height Minimum, Maximum		0.5 6
Density Average		4 FT2

Application Equipment		
	A	B
Appl. Equipment	STD MEDIUM	STD MEDIUM
Equipment Type	BACSPR	BACSPR
Nozzle Type	FLAFXR	FLAFXR
Nozzle Size	8002	8002
Nozzle Spacing	20 IN	20 IN
Boom Length	6.67 FT	6.67 FT
Carrier	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC
Mix Size	0.2497 GAL	0.2497 GAL
Propellant	COMCO2	COMCO2

SE Definitions	
	1.
Crop Type, Code	C

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Trt No.	Treatment Type Name	Form Conc	Form Unit	Form Type	Rate Rate	Other Rate	Other Rate	Appl Unit	Appl Timing	Appl Code	Rep 1	2	3	4	Notes
1	CHK NONTREATED								PRE	A	101	213	304	412	
2	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	102	212	310	401	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
3	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	103	211	313	411	
	HERB TOUGH	5	LB/GAL	EC	0.312 lb ai/a		8 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
4	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	104	202	311	409	
	HERB TOUGH	5	LB/GAL	EC	0.39 lb ai/a		10 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
5	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	105	203	312	410	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB TOUGH	5	LB/GAL	EC	0.312 lb ai/a		8 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
6	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	106	204	309	406	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB TOUGH	5	LB/GAL	EC	0.39 lb ai/a		10 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
7	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	107	206	305	407	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB CALLISTO	4	LB/GAL	L	0.094 lb ai/a		3 fl oz/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
8	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	108	209	301	402	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB TOUGH	5	LB/GAL	EC	0.312 lb ai/a		8 fl oz/a		V2-V4	CN B					
	HERB CALLISTO	4	LB/GAL	L	0.094 lb ai/a		3 fl oz/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
9	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	109	201	307	408	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB TOUGH	5	LB/GAL	EC	0.39 lb ai/a		10 fl oz/a		V2-V4	CN B					
	HERB CALLISTO	4	LB/GAL	L	0.094 lb ai/a		3 fl oz/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
10	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	110	207	302	403	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB CALLISTO	4	LB/GAL	L	0.094 lb ai/a		3 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
11	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	111	210	306	413	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB TOUGH	5	LB/GAL	EC	0.312 lb ai/a		8 fl oz/a		V2-V4	CN B					
	HERB CALLISTO	4	LB/GAL	L	0.094 lb ai/a		3 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
12	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	112	208	303	405	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB BCP1016 H	3.25	LB/GAL	L	0.405 lb ai/a		16 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					
13	HERB DUAL II MAGNUM	7.64	LB/GAL	L	1.27 lb ai/a	1.33	pt/a		PRE	A	113	205	308	404	
	HERB ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	1.13 lb ae/a		32 fl oz/a		V2-V4	CN B					
	HERB TOUGH	5	LB/GAL	EC	0.39 lb ai/a		10 fl oz/a		V2-V4	CN B					
	HERB CALLISTO	4	LB/GAL	L	0.094 lb ai/a		3 fl oz/a		V2-V4	CN B					
	HERB AATREX	4	LB/GAL	L	1.2 lb ai/a		2.4 pt/a		V2-V4	CN B					
	ADJ N-PAK	3.4	LB/GAL	SL	2.5 % v/v		2.5 % v/v		V2-V4	CN B					

Sort Order: Replicate 1

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Protocol ID: 18-WIN-ToughTM		Investigator: Dr. Bryan Young		
Project ID:		Study Director: Dr. Bryan Young		
Sponsor Contact: Dave Wright				

						W Weed AMAPA amaranth, Palm> C -	W Weed DIGSA crabgrass, lar> C -	W Weed CHEAL lambquarters,> C -	C ZEAMD Dent corn Jun-21-2018 PHYGEN
						Jun-13-2018 CONTRO	Jun-13-2018 CONTRO	Jun-13-2018 CONTRO	Jun-21-2018 PHYGEN
						%	%	%	%
						1	1	1	1
						28 28	28 28	28 28	36 7
Trt No.	Treatment Name	Form Conc	Form Unit	Form Other Type	Other Rate	Other Rate	Appl Unit	Code	
1	NONTREATED						A		0.0
2	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		86.8 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		90.5 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		87.5 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 c
3	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		94.3 -
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		93.0 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		93.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 c
4	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		94.8 -
	TOUGH	5	LB/GAL	EC	10	fl oz/a	B		93.5 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		88.5 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 c
5	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		95.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		95.5 -
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		90.5 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		0.0 c
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
6	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		90.5 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		90.5 -
	TOUGH	5	LB/GAL	EC	10	fl oz/a	B		87.5 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		0.0 c
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
7	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		91.8 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		93.0 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		88.8 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		3.0 ab
8	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		94.8 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		92.5 -
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		86.0 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		0.0 c
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
9	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		94.8 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		93.0 -
	TOUGH	5	LB/GAL	EC	10	fl oz/a	B		90.0 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		2.3 b
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
10	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		93.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		93.8 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		83.8 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		0.0 c
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
11	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		94.3 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		93.3 -
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		90.5 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		3.3 a
	AATREX	4	LB/GAL	L	2.4	pt/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		

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.
 Untreated treatment(s) 1 excluded from analysis.
 * Adjusted means
 Could not calculate LSD (% mean diff) for columns 8,12,15,18 because error mean square = 0.

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Pest Type	W Weed	W Weed	W Weed	
Pest Code	AMAPA	DIGSA	CHEAL	
Pest Name	amaranth, Palm>	crabgrass, lar>	lambsquarters,>	
Crop Type, Code	C -	C -	C -	C ZEAMD
Crop Name				Dent corn
Rating Date	Jun-13-2018	Jun-13-2018	Jun-13-2018	Jun-21-2018
Rating Type	CONTRO	CONTRO	CONTRO	PHYGEN
Rating Unit	%	%	%	%
Number of Subsamples	1	1	1	1
Days After First/Last Applic.	28 28	28 28	28 28	36 7
Trt Treatment	Form	Form	Form	Other
No. Name	Conc Unit	Type Rate	Rate Unit	Code
12 DUAL II MAGNUM	7.64 LB/GAL	L	1.33 pt/a	A
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL	32 fl oz/a	B
BCP1016 H	3.25 LB/GAL	L	16 fl oz/a	B
AATREX	4 LB/GAL	L	2.4 pt/a	B
N-PAK	3.4 LB/GAL	SL	2.5 % v/v	B
13 DUAL II MAGNUM	7.64 LB/GAL	L	1.33 pt/a	A
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL	32 fl oz/a	B
TOUGH	5 LB/GAL	EC	10 fl oz/a	B
CALLISTO	4 LB/GAL	L	3 fl oz/a	B
AATREX	4 LB/GAL	L	2.4 pt/a	B
N-PAK	3.4 LB/GAL	SL	2.5 % v/v	B
LSD P=.05	6.07	6.42	8.43	0.82
Standard Deviation	4.22	4.47	5.86	0.57
CV	4.54	4.81	6.66	60.7
Levene's F	0.938	0.243	1.643	1.191
Levene's Prob(F)	0.517	0.992	0.128	0.328
Skewness	-1.4808*	-0.9996*	-0.8101*	1.0745*
Kurtosis	1.7372*	-0.3132	1.6283*	-0.3707
Replicate F	3.411	0.268	2.579	1.608
Replicate Prob(F)	0.0287	0.8477	0.0702	0.2062
Treatment F	1.295	0.395	1.176	24.298
Treatment Prob(F)	0.2701	0.9485	0.3401	0.0001

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 * Adjusted means
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						W Weed AMAPA amaranth, Palm> C -	W Weed DIGSA crabgrass, lar> C -	W Weed CHEAL lambquarters,> C -	C ZEAMD Dent corn Jun-28-2018 PHYGEN	
						Jun-21-2018 CONTRO %	Jun-21-2018 CONTRO %	Jun-21-2018 CONTRO %	Jun-28-2018 PHYGEN %	
						1 36 7	1 36 7	1 36 7	1 43 14	
Trt No.	Treatment Name	Form Conc	Form Unit	Form Other Type	Other Rate	Appl Unit Code	5*	6*	7*	8*
1	NONTREATED					A	0.0	0.0	0.0	0.0
2	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	95.0 -	93.0 -	99.0 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
3	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	97.5 -	94.3 -	99.0 -	0.0 -
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
4	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	97.8 -	91.8 -	98.8 -	0.0 -
	TOUGH	5	LB/GAL	EC	10 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
5	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.8 -	96.0 -	99.0 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
6	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.5 -	94.5 -	98.3 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	TOUGH	5	LB/GAL	EC	10 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
7	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	95.0 -	95.0 -	98.0 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
8	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.5 -	96.3 -	99.0 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B				
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
9	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.3 -	96.5 -	99.0 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	TOUGH	5	LB/GAL	EC	10 fl oz/a	B				
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
10	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	97.8 -	97.0 -	98.5 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				
11	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.8 -	97.8 -	99.0 -	0.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B				
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B				
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B				
	AATREX	4	LB/GAL	L	2.4 pt/a	B				
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B				

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 Untreated treatment(s) 1 excluded from analysis.
 * Adjusted means
 Could not calculate LSD (% mean diff) for columns 8,12,15,18 because error mean square = 0.

Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control				
Trial ID: 18-WIN-ToughTM		Location: Winamac		Trial Year: 2018
Protocol ID: 18-WIN-ToughTM		Investigator: Dr. Bryan Young		
Project ID:		Study Director: Dr. Bryan Young		
Sponsor Contact: Dave Wright				

Pest Type	W Weed	W Weed	W Weed	
Pest Code	AMAPA	DIGSA	CHEAL	
Pest Name	amaranth, Palm>	crabgrass, lar>	lambsquarters,>	
Crop Type, Code	C -	C -	C -	C ZEAMD
Crop Name				Dent corn
Rating Date	Jun-21-2018	Jun-21-2018	Jun-21-2018	Jun-28-2018
Rating Type	CONTRO	CONTRO	CONTRO	PHYGEN
Rating Unit	%	%	%	%
Number of Subsamples	1	1	1	1
Days After First/Last Applic.	36 7	36 7	36 7	43 14
Trt Treatment	Form	Form	Form	Other
No. Name	Conc Unit	Type Rate	Type Rate	Rate Unit Code
				5*
12 DUAL II MAGNUM	7.64 LB/GAL	L	1.33 pt/a	A
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL	32 fl oz/a	B
BCP1016 H	3.25 LB/GAL	L	16 fl oz/a	B
AATREX	4 LB/GAL	L	2.4 pt/a	B
N-PAK	3.4 LB/GAL	SL	2.5 % v/v	B
				98.0 -
13 DUAL II MAGNUM	7.64 LB/GAL	L	1.33 pt/a	A
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL	32 fl oz/a	B
TOUGH	5 LB/GAL	EC	10 fl oz/a	B
CALLISTO	4 LB/GAL	L	3 fl oz/a	B
AATREX	4 LB/GAL	L	2.4 pt/a	B
N-PAK	3.4 LB/GAL	SL	2.5 % v/v	B
				98.5 -
LSD P=.05	4.16	4.47	0.95	.
Standard Deviation	2.89	3.10	0.66	0.00
CV	2.96	3.25	0.67	0.0
Levene's F	0.939	0.895	3.636	0.00
Levene's Prob(F)	0.516	0.554	0.002*	.
Skewness	-3.8638*	-1.519*	-1.6386*	.
Kurtosis	15.6021*	1.9858*	0.9994	.
Replicate F	1.242	0.994	1.208	0.000
Replicate Prob(F)	0.3101	0.4079	0.3221	1.0000
Treatment F	0.831	1.365	1.925	0.000
Treatment Prob(F)	0.6116	0.2350	0.0721	1.0000

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 Could not calculate LSD (% mean diff) for columns 8,12,15,18 because error mean square = 0.

Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control				
Trial ID: 18-WIN-ToughTM		Location: Winamac		Trial Year: 2018
Protocol ID: 18-WIN-ToughTM		Investigator: Dr. Bryan Young		
Project ID:		Study Director: Dr. Bryan Young		
Sponsor Contact: Dave Wright				

						W Weed AMAPA amaranth, Palm> C -	W Weed DIGSA crabgrass, lar> C -	W Weed CHEAL lambquarters,> C -	C ZEAMD Dent corn Jul-12-2018 PHYGEN
						Jun-28-2018 CONTRO %	Jun-28-2018 CONTRO %	Jun-28-2018 CONTRO %	1 %
						1 43 14	1 43 14	1 43 14	1 57 28
Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Other Rate	Other Rate	Appl Unit	Code	
						9*	10*	11*	12*
1	NONTREATED						A		0.0
2	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		98.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		98.3 a
	AATREX	4	LB/GAL	L	2.4	pt/a	B		99.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 -
3	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		98.3 -
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		93.0 b
	AATREX	4	LB/GAL	L	2.4	pt/a	B		99.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 -
4	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		97.5 -
	TOUGH	5	LB/GAL	EC	10	fl oz/a	B		87.0 c
	AATREX	4	LB/GAL	L	2.4	pt/a	B		98.8 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 -
5	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		98.3 a
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		99.0 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		0.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
6	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		98.0 a
	TOUGH	5	LB/GAL	EC	10	fl oz/a	B		99.0 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		0.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
7	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		98.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		97.8 a
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		99.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		0.0 -
8	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		98.5 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		98.5 a
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		99.0 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		0.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
9	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		98.3 a
	TOUGH	5	LB/GAL	EC	10	fl oz/a	B		99.0 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		0.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
10	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		98.3 a
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		99.0 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		0.0 -
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		
11	DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B		97.8 a
	TOUGH	5	LB/GAL	EC	8	fl oz/a	B		99.0 -
	CALLISTO	4	LB/GAL	L	3	fl oz/a	B		0.0 -
	AATREX	4	LB/GAL	L	2.4	pt/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B		

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Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control				
Trial ID: 18-WIN-ToughTM	Location: Winamac	Trial Year: 2018		
Protocol ID: 18-WIN-ToughTM	Investigator: Dr. Bryan Young			
Project ID:	Study Director: Dr. Bryan Young			
Sponsor Contact: Dave Wright				

Pest Type	W Weed	W Weed	W Weed	
Pest Code	AMAPA	DIGSA	CHEAL	
Pest Name	amaranth, Palm>	crabgrass, lar>	lambsquarters,>	
Crop Type, Code	C -	C -	C -	C ZEAMD
Crop Name				Dent corn
Rating Date	Jun-28-2018	Jun-28-2018	Jun-28-2018	Jul-12-2018
Rating Type	CONTRO	CONTRO	CONTRO	PHYGEN
Rating Unit	%	%	%	%
Number of Subsamples	1	1	1	1
Days After First/Last Applic.	43 14	43 14	43 14	57 28
Trt Treatment	Form	Form	Form	Other
No. Name	Conc Unit	Type Rate	Rate Unit	Code
12 DUAL II MAGNUM	7.64 LB/GAL	L	1.33 pt/a	A
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL	32 fl oz/a	B
BCP1016 H	3.25 LB/GAL	L	16 fl oz/a	B
AATREX	4 LB/GAL	L	2.4 pt/a	B
N-PAK	3.4 LB/GAL	SL	2.5 % v/v	B
13 DUAL II MAGNUM	7.64 LB/GAL	L	1.33 pt/a	A
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL	32 fl oz/a	B
TOUGH	5 LB/GAL	EC	10 fl oz/a	B
CALLISTO	4 LB/GAL	L	3 fl oz/a	B
AATREX	4 LB/GAL	L	2.4 pt/a	B
N-PAK	3.4 LB/GAL	SL	2.5 % v/v	B
LSD P=.05	1.36	4.32	0.21	.
Standard Deviation	0.95	3.00	0.14	0.00
CV	0.96	3.1	0.15	0.0
Levene's F	0.753	0.90	1.00	0.00
Levene's Prob(F)	0.682	0.55	0.465	.
Skewness	-2.5526*	-3.6226*	-6.9282*	.
Kurtosis	6.4758*	15.444*	48.0*	.
Replicate F	0.949	1.163	1.000	0.000
Replicate Prob(F)	0.4280	0.3385	0.4051	1.0000
Treatment F	1.168	5.225	1.000	0.000
Treatment Prob(F)	0.3451	0.0001	0.4671	1.0000

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Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control				
Trial ID: 18-WIN-ToughTM	Location: Winamac	Trial Year: 2018		
Protocol ID: 18-WIN-ToughTM	Investigator: Dr. Bryan Young			
Project ID:	Study Director: Dr. Bryan Young			
Sponsor Contact: Dave Wright				

Pest Type	W Weed	W Weed	W Weed	W Weed
Pest Code	AMAPA	DIGSA	CHEAL	AMAPA
Pest Name	amaranth, Palm>	crabgrass, lar>	lambquarters,>	amaranth, Palm>
Crop Type, Code	C -	C -	C -	C -
Crop Name				
Rating Date	Jul-12-2018	Jul-12-2018	Jul-12-2018	Jul-26-2018
Rating Type	CONTRO	CONTRO	CONTRO	CONTRO
Rating Unit	%	%	%	%
Number of Subsamples	1	1	1	1
Days After First/Last Applic.	57 28	57 28	57 28	71 42
Trt Treatment	Form	Form	Form	Other
No. Name	Conc	Unit	Type	Rate
				Rate
				Unit
				Code
1 NONTREATED				A
2 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
3 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
TOUGH	5	LB/GAL	EC	8 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
4 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
TOUGH	5	LB/GAL	EC	10 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
5 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
TOUGH	5	LB/GAL	EC	8 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
6 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
TOUGH	5	LB/GAL	EC	10 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
7 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
CALLISTO	4	LB/GAL	L	3 fl oz/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
8 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
TOUGH	5	LB/GAL	EC	8 fl oz/a
CALLISTO	4	LB/GAL	L	3 fl oz/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
9 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
TOUGH	5	LB/GAL	EC	10 fl oz/a
CALLISTO	4	LB/GAL	L	3 fl oz/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
10 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
CALLISTO	4	LB/GAL	L	3 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v
11 DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a
TOUGH	5	LB/GAL	EC	8 fl oz/a
CALLISTO	4	LB/GAL	L	3 fl oz/a
AATREX	4	LB/GAL	L	2.4 pt/a
N-PAK	3.4	LB/GAL	SL	2.5 % v/v

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Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control											
Trial ID: 18-WIN-ToughTM		Location: Winamac			Trial Year: 2018						
Protocol ID: 18-WIN-ToughTM		Investigator: Dr. Bryan Young									
Project ID:		Study Director: Dr. Bryan Young									
		Sponsor Contact: Dave Wright									
Pest Type	W Weed	W Weed	W Weed	W Weed							
Pest Code	AMAPA	DIGSA	CHEAL	AMAPA							
Pest Name	amaranth, Palm>	crabgrass, lar>	lambsquarters,>	amaranth, Palm>							
Crop Type, Code	C -	C -	C -	C -							
Crop Name											
Rating Date	Jul-12-2018	Jul-12-2018	Jul-12-2018	Jul-26-2018							
Rating Type	CONTRO	CONTRO	CONTRO	CONTRO							
Rating Unit	%	%	%	%							
Number of Subsamples	1	1	1	1							
Days After First/Last Applic.	57 28	57 28	57 28	71 42							
Trt Treatment	Form	Form	Form	Other	Other	Appl					
No. Name	Conc	Unit	Type	Rate	Rate	Unit	Code	13*	14*	15*	16*
12 DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		99.0 a	99.0 a	99.0 -	99.0 -
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B					
BCP1016 H	3.25	LB/GAL	L	16	fl oz/a	B					
AATREX	4	LB/GAL	L	2.4	pt/a	B					
N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B					
13 DUAL II MAGNUM	7.64	LB/GAL	L	1.33	pt/a	A		98.8 ab	99.0 a	99.0 -	98.5 -
ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32	fl oz/a	B					
TOUGH	5	LB/GAL	EC	10	fl oz/a	B					
CALLISTO	4	LB/GAL	L	3	fl oz/a	B					
AATREX	4	LB/GAL	L	2.4	pt/a	B					
N-PAK	3.4	LB/GAL	SL	2.5	% v/v	B					
LSD P=.05	1.41			3.32				.			2.14
Standard Deviation	0.98			2.31				0.00			1.49
CV	1.0			2.41				0.0			1.52
Levene's F	1.147			1.278				0.00			1.698
Levene's Prob(F)	0.356			0.276				.			0.114
Skewness	-2.0928*			-2.2269*				.			-3.5536*
Kurtosis	3.1943*			4.0591*				.			15.4996*
Replicate F	1.345			2.294				0.000			0.775
Replicate Prob(F)	0.2765			0.0961				1.0000			0.5163
Treatment F	3.208			37.248				0.000			1.725
Treatment Prob(F)	0.0046			0.0001				1.0000			0.1109

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 * Adjusted means
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Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control			
Trial ID: 18-WIN-ToughTM	Location: Winamac	Trial Year: 2018	
Protocol ID: 18-WIN-ToughTM	Investigator: Dr. Bryan Young		
Project ID:	Study Director: Dr. Bryan Young		
Sponsor Contact: Dave Wright			

						W Weed DIGSA crabgrass, lar> C -	W Weed CHEAL lambsquarters,> C -	
						Jul-26-2018 CONTRO % 1	Jul-26-2018 CONTRO % 1	
						71 42	71 42	
Trt No.	Treatment Name	Form Conc	Form Unit	Form Other Type	Other Rate	Appl Unit Code		
1	NONTREATED					A	17* 0.0	18* 0.0
2	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	96.8 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B		
3	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	82.8 b	99.0 -
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B		
4	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	78.3 c	99.0 -
	TOUGH	5	LB/GAL	EC	10 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B		
5	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.0 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
6	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.0 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	TOUGH	5	LB/GAL	EC	10 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
7	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	99.0 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B		
8	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.5 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B		
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B		
9	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	97.8 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	TOUGH	5	LB/GAL	EC	10 fl oz/a	B		
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B		
10	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	97.5 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
11	DUAL II MAGNUM	7.64	LB/GAL	L	1.33 pt/a	A	98.3 a	99.0 -
	ROUNDUP POWERMAX	4.5	LBAE/GAL	SL	32 fl oz/a	B		
	TOUGH	5	LB/GAL	EC	8 fl oz/a	B		
	CALLISTO	4	LB/GAL	L	3 fl oz/a	B		
	AATREX	4	LB/GAL	L	2.4 pt/a	B		
	N-PAK	3.4	LB/GAL	SL	2.5 % v/v	B		

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.
 Untreated treatment(s) 1 excluded from analysis.
 * Adjusted means
 Could not calculate LSD (% mean diff) for columns 8,12,15,18 because error mean square = 0.

Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control		
Trial ID: 18-WIN-ToughTM	Location: Winamac	Trial Year: 2018
Protocol ID: 18-WIN-ToughTM	Investigator: Dr. Bryan Young	
Project ID:	Study Director: Dr. Bryan Young	
	Sponsor Contact: Dave Wright	

	W Weed DIGSA crabgrass, lar> C -	W Weed CHEAL lambsquarters,> C -
Pest Type		
Pest Code		
Pest Name		
Crop Type, Code		
Crop Name		
Rating Date	Jul-26-2018	Jul-26-2018
Rating Type	CONTRO	CONTRO
Rating Unit	%	%
Number of Subsamples	1	1
Days After First/Last Applic.	71 42	71 42
Trt Treatment No. Name	Form Form Conc Unit	Form Other Other Type Rate Rate Unit Code
12 DUAL II MAGNUM	7.64 LB/GAL	L 1.33 pt/a
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL 32 fl oz/a
BCP1016 H	3.25 LB/GAL	L 16 fl oz/a
AATREX	4 LB/GAL	L 2.4 pt/a
N-PAK	3.4 LB/GAL	SL 2.5 % v/v
13 DUAL II MAGNUM	7.64 LB/GAL	L 1.33 pt/a
ROUNDUP POWERMAX	4.5 LBAE/GAL	SL 32 fl oz/a
TOUGH	5 LB/GAL	EC 10 fl oz/a
CALLISTO	4 LB/GAL	L 3 fl oz/a
AATREX	4 LB/GAL	L 2.4 pt/a
N-PAK	3.4 LB/GAL	SL 2.5 % v/v
LSD P=.05	4.19	.
Standard Deviation	2.91	0.00
CV	3.06	0.0
Levene's F	1.878	0.00
Levene's Prob(F)	0.076	.
Skewness	-2.5221*	.
Kurtosis	6.3607*	.
Replicate F	4.272	0.000
Replicate Prob(F)	0.0118	1.0000
Treatment F	22.751	0.000
Treatment Prob(F)	0.0001	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.
 Untreated treatment(s) 1 excluded from analysis.
 * Adjusted means
 Could not calculate LSD (% mean diff) for columns 8,12,15,18 because error mean square = 0.

Purdue University Weed Science

Evaluation of Tough in common tank mixtures for glyphosate-resistant Palmer amaranth control

Trial ID: 18-WIN-ToughTM Location: Winamac Trial Year: 2018
Protocol ID: 18-WIN-ToughTM Investigator: Dr. Bryan Young
Project ID: Study Director: Dr. Bryan Young
Sponsor Contact: Dave Wright

Pest Type

W, Weed, G-BYRW7, G-WedStg = Weed or volunteer crop

Pest Code

AMAPA, Amaranthus palmeri, amaranth, Palmer = US

DIGSA, Digitaria sanguinalis, crabgrass, large = US

CHEAL, Chenopodium album, lambsquarters, common = US

Crop Type, Code

C, G-ByrC7 = EPPO species (Bayer) codes

ZEAMD, BCOR, Zea mays indentata, Dent corn = US

Rating Type

CONTRO = control / burndown or knockdown

PHYGEN = phytotoxicity - general / injury

Rating Unit

% = percent