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2016 SOUTHERN MINNESOTA REGIONAL RESEARCH & DEMONSTRATION SUMMARY

The University of Minnesota Extension, University of Minnesota Southern Research and Outreach Center (Waseca), University of Minnesota Southwest Research and Outreach Center (Lamberton), Minnesota Soybean Research & Promotion Council, and University Center Rochester, as well as many local cooperators and agribusinesses, collaborated to conduct field trials throughout southern Minnesota.

The majority of these projects are funded through grant dollars, entry fees, and support from our cooperators.

University of Minnesota is an equal opportunity educator and employer.

CROPS WEBSITE:

<http://www.extension.umn.edu/agriculture/crops/>

2016 Southern Minnesota Regional Research and Demonstration Summary

We want to thank our many partners in making this research report possible. University of Minnesota Extension and the research team including Faculty from Extension, the Research and Outreach Centers at Waseca, Lamberton and Rosemount, and the Campus, have worked to ensure these field research trials are directly applied and adapted to the local region and address the complex needs of Southern Minnesota production agriculture. The regional producers, industry sponsors and state and county partners who have provided land, financial contributions and expertise to make these research trials possible are very much appreciated.

Crop Management Tours, such as those conducted at Rochester and Waseca, provide hands-on events that bring meaning and an applied perspective to the crop trials. These tours give producers and industry professionals the opportunity to ask questions and have one-on-one time with University of Minnesota researchers and Extension Educators.

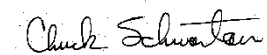
The many student interns involved in this important research are our workforce of the future! Their summer academic experience provides opportunities to accelerate their own professional careers and give them hands-on experiences working with Minnesota agriculture. We are actively promoting future projects and collaboration that will provide additional experiences with University of Minnesota Extension for students and future leaders of Minnesota.

Extension is committed to providing Minnesotans working in production agriculture with faster and more comprehensive access to the research and resources of the University through specialized educators at our Regional Offices.

This report is exemplary of the University's commitment of providing timely and relevant research results. Again, congratulations to all partners involved!

Together, you and Extension continue to make a difference in Minnesota.

Respectfully,



Chuck Schwartau
Regional Director – Southeast



Dr. LuAnn Hiniker
Regional Director - Southeast

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Extension and Research Team Members

Extension Specialists

Lisa Behnken	Extension Educator, Crops, Rochester
Fritz Breitenbach	Extension Integrated Pest Management Specialist, Southeast
Brad Carlson	Extension Educator, Crops, Mankato
Jeff Coulter	Extension Agronomist, Crops, St. Paul
Jeff Gunsolus	Extension Agronomist, Weed Scientist, St. Paul
Dan Kaiser	Extension Nutrient Management Specialist, St. Paul
Brad Kinkaid	Extension Weed Management Scientist, St. Paul
Robert Koch	Extension Entomologist, St. Paul
Dean Malvick	Research Plant Pathologist, St. Paul
Ryan Miller	Extension Educator, Crops, Rochester
Seth Naeve	Extension Agronomist, Soybean, St. Paul
Dave Nicolai	Extension Educator, Crops, Farmington
Ken Ostlie	Extension Entomologist, St. Paul
Craig Sheaffer	Research Agronomist, St. Paul
Lizabeth Stahl	Extension Educator, Crops, Worthington
Mary Jane Stearns	Executive Office & Administrative Specialist, Rochester
F. Scott Wells	Extension Forage Specialist, St. Paul
Jochum Wiersma	Extension Agronomist, Crookston

County Extension Educators

Michael Cruse	Fillmore and Houston Counties
Jake Overgaard	Winona County
Dan Martens	Benton, Morrison and Stearns Counties

SROC (Southern Research & Outreach Center – Waseca)

Matt Bickell	Assistant Scientist, Agronomy
Senyu Chen	Research Nematologist
Wayne Gottschalk	Senior Research Plot Technician
Tom Hoverstad	Scientist, Agronomy
Wade Ihlenfeld	Senior Research Plot Technician
Cathy Johnson	Senior Lab Technician
Gregg Johnson	Research Agronomist, Weed Management
Jeff Vetsch	Assistant Scientist, Soils

Agricultural Interns

Annette Kylo	Ag Intern, Rochester
Bill Kuisle	Operations Technician
Jared Liebenow	Ag Intern, Rochester
Reed Searcy	Ag Intern, Rochester

Check These Web Sites:

<http://www.extension.umn.edu>
<http://appliedweeds.cfans.umn.edu>
<http://sroc.cfans.umn.edu>
<http://www.soybeans.umn.edu>
<http://www.extension.umn.edu/forages>
<http://www.mnipm.umn.edu/BugWeb/>
<http://www.rctc.edu>

For More Information, Call or E-Mail:

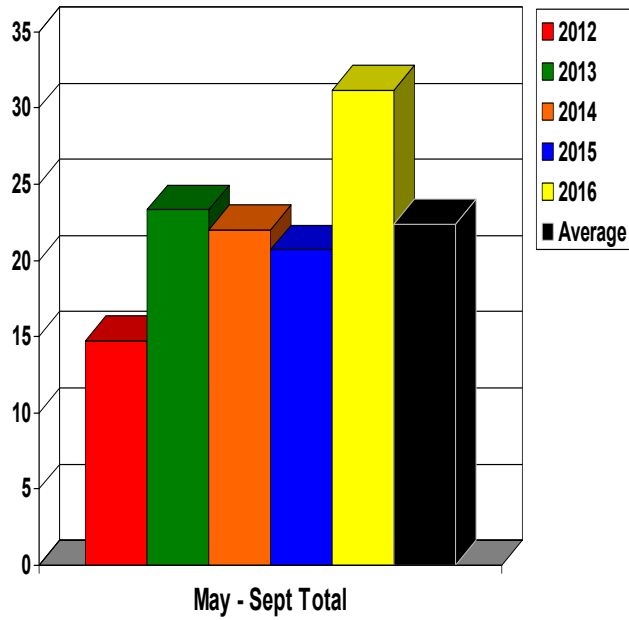
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Contact Fritz, Lisa, Ryan, or Mary Jane if interested in receiving the Crops Connection™ Newsletter sent via e-mail

NEW CROPS WEBSITE: www.extension.umn.edu/agriculture/crops/

Monthly Rainfall

At Rochester, MN
Season Totals (inches)
2012 - 2016

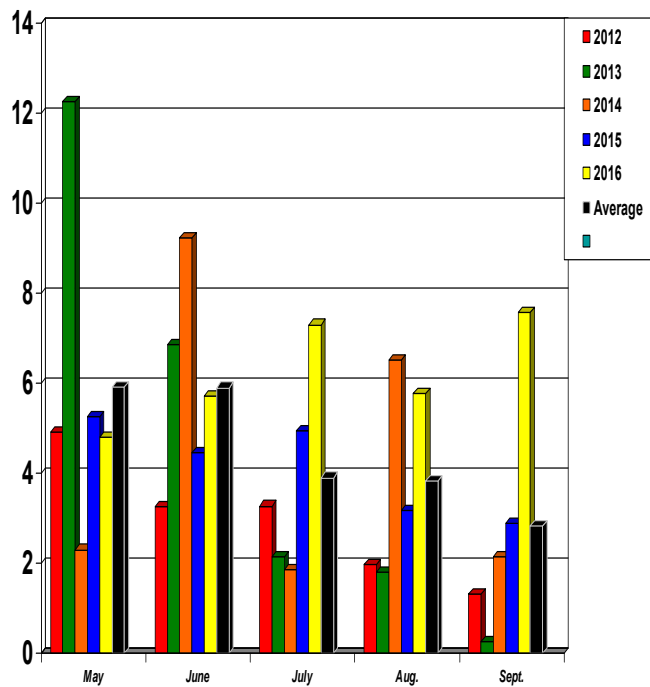


Rainfall totals are obtained from National Weather Service measurements at the Rochester International Airport.



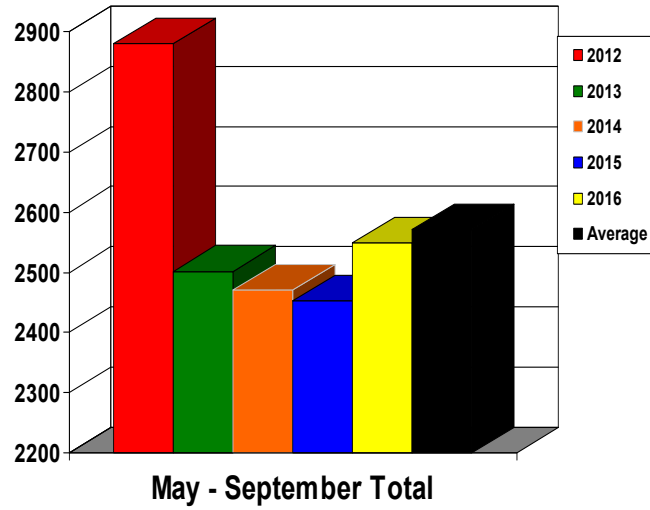
Monthly Rainfall Totals

At Rochester, MN
(inches)
Comparison by Month
2012 - 2016



Growing Degree Days

At Rochester, MN
Season Totals
2012 - 2016



A corn growing degree day (GDD) is an index used to express and track crop development through maturity. The index is calculated by subtracting a base temperature of 50°F from the average of the maximum and minimum temperatures for the day.

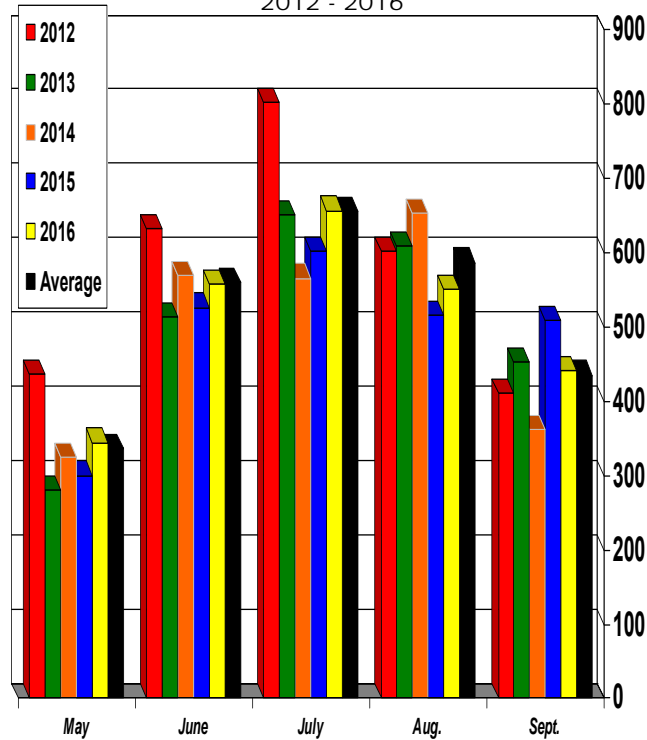
If the maximum temperature is greater than 86°F, then 86 is used in the equation. If the minimum temperature is less than 50°F, then 50 is used in the equation. These substitutions indicate that no appreciable growth takes place with temperatures greater than 86°F or lower than 50°F.

$$GDD = ((Maximum\ temp + Minimum\ temp) / 2) - 50$$



Growing Degree Days

At Rochester, MN
Comparison by Month
2012 - 2016

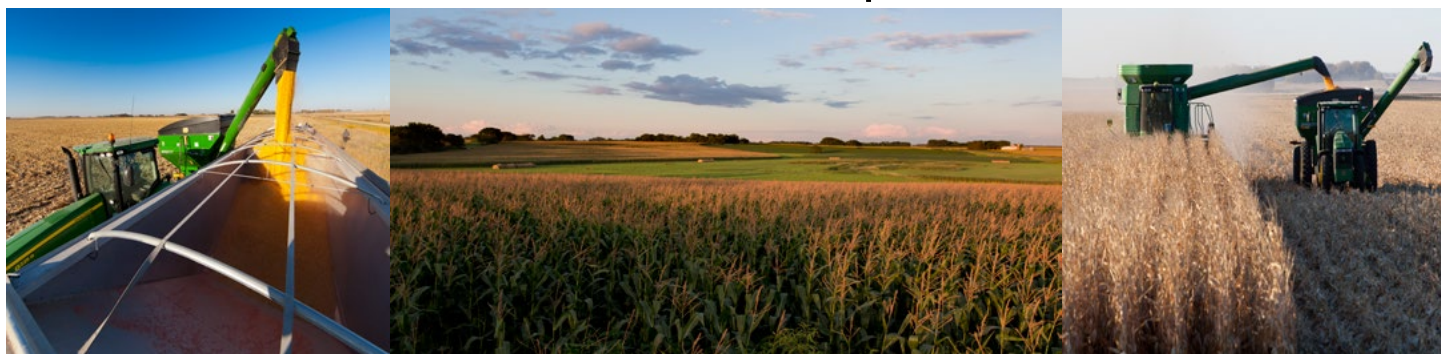


SECTION

A

CORN HYBRIDS

2016 Corn Grain Field Crop Trials Results



Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences

The Minnesota Corn Evaluation Program was conducted by the University of Minnesota Agricultural Experiment Station to provide unbiased information for use by corn growers when they choose which brand of corn to buy and grow. The program was financed in part by entry fees from private seed companies that chose to place their entries for testing.

Test Locations

Test zones, locations and maturities are as follows:

Southern Zone:

Lamberton, Rochester and Waseca

Early Maturity Trial - 103 Relative Maturity (RM) and earlier entries.

Late Maturity Trial - 104 RM and later entries.

Central Zone:

Hutchinson, Morris and Rosemount

Early Maturity Trial - 96 RM and earlier entries.

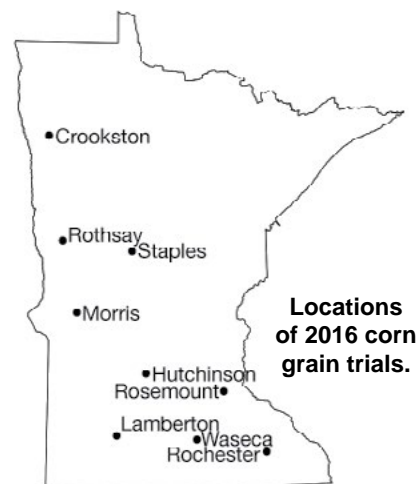
Late Maturity Trial - 97 RM and later entries.

Northern Zone:

Crookston, Rothsay and Staples

Testing Procedure

Entries: Seed corn companies choose their entries for each zone. Entries in each trial were based on the relative maturity (RM) provided by the company. The University of Minnesota Corn Testing Committee could also choose entries in each test. All locations tested three replications for each entry.



Locations of 2016 corn grain trials.

Corn Grain

Planting Rate and Date

Bushel Weight, Pounds.....56
 Planting Rate, Seeds/Acre.....35,000
 Planting Date.....April 26-May 12

Companies participating in the 2016 corn grain trials.

AgriGold Hybrids	5381 Akin Rd, St. Francisville, IL 62460	www.agrigold.com
Albert Lea Seed House (Viking Hybrids)	Box 127, 1414 W. Main St., Albert Lea, MN 56007	www.alseed.com
Albert Lea Seed House (NorthStar Genetics)	Box 127, 1414 W. Main St., Albert Lea, MN 56007	www.alseed.com
Anderson Seeds	37825 County Rd. 63, St. Peter, MN 56082	—
Dalman Seed Co.	73504 200th St., Dassel, MN 55325	www.dalmanseed.com
Dairyland Seed Co., Inc.	Box 958, West Bend, WI 53095	www.dairylandseed.com
Dekalb (Monsanto Co.)	102 W. Carol Ave., Courtland, IL 60112	www.dekalb.com
Federal Hybrids	209 3rd St. NE, West Bend, IA 50597	www.federalhybrids.com
Legacy Seeds Inc.	1937 Spindt Dr., Waupaca, WI 54981	www.legacyseeds.com
Masters Choice	305 W. Vienna St. Anna, IL 62906	seedcorn.com
Munson Hybrids	1262 Knox Rd 100E, Galesburg, IL 61401	www.munsonhybrids.com
NuTech Seed	2321 North Loop Drive, Suite 230; Ames, IA 50010	www.nutechseed.com
Peterson Farms Seed	3104 164th Ave. S.E., Harwood, ND 58092	www.petersonfarmsseed.com
REA Hybrids	826225 Ivan Trail, Park Rapids, MN 56470	www.rea-hybrids.com
Proseed	705 E Brewster St., Harvey, ND 58341	www.proseed.net
Titan Pro	1301 S. 24th St., Clear Lake, IA 50428	www.titanprosci.com
Tracy Seeds	1805 South State Rd. 140, Janesville, WI 53546	www.tracyseeds.com

Presentation of Data

Yields are given for individual locations along with yields and harvest moisture contents averaged across locations for 2016.

Reported yields are adjusted to 15.5% grain moisture. Entries are ranked within a maturity group by moisture content averaged across locations for 2016.

Identification of Traits

Genetic modifications of entries are identified using generic terms to describe the trait without identifying the specific event for genetic modification.

For example, Bt will identify genetic modification for corn borer resistance, but will not differentiate between the

Bt 11 event, the YieldGuard corn borer event, or the Herculex corn borer event.

Identifiers will be:

Bt = European corn borer resistance
CRW = Corn rootworm resistance
Gly = Glyphosate herbicide resistance
LL = Liberty herbicide resistance

Least Significant Difference

The LSD (Least Significant Difference) figures at the bottom of the yield columns in the tables are statistical measures of variability in the trials. These values may be used to determine whether the difference between any two entries is likely to be a real difference or just natural variation.

If the yield difference between two entries is equal to or greater than the LSD, then one can be confident that the two entries probably differ in yield potential. We show LSD values with a 0.2 alpha level, which means that when two entries differ in yield by the LSD value or more one can be 80% confident that the two entries differ in yield potential. The higher-yielding one is the better entry from the yield standpoint. If the yield difference between two entries is less than the LSD, the two entries probably do not differ significantly in yield potential.

Project Leaders

Tom Hoverstad.

Test Plot Managers

Tom Hoverstad, Wade Ihlenfeld, Jeff Coulter, Curt Reese, Steve Quiring and Mark Hanson.

Individual trial information, 2016.

Location	Cooperators	Previous Crop	Planting Date	Harvest Date
Lamberton	Steve Quiring	Soybean	May 5	October 13
Rochester	Fritz Brietenbach	Soybean	April 26	October 19
Waseca	Tom Hoverstad	Soybean	April 27	October 20
Hutchinson	Nathan Winter and Paul Wright	Soybean	May 4	October 24
Morris	Curt Reese	Soybean	May 10	October 19
Rosemount	Jerry Holz	Soybean	May 3	November 1
Crookston	Mark Hanson	Soybean	May 9	October 25
Rothsay	Troy Larson	Soybean	May 9	October 25
Staples	Ron Nelson	Soybean	May 12	October 27

Early maturity entries, southern locations, 2016.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at:			Average Across Locations	
				Lamberton	Rochester	Waseca	Bu/Acre	% Moisture
97 and earlier RM entries								
Anderson Seeds	795R	GLY	95	216	263	217	232	15.9
AgriGold	A6199STXRIB	GLY, Bt, LL, CRW	95	202	232	206	214	16.0
Anderson Seeds	7995	—	95	221	216	179	205	16.0
Federal Hybrids	4240 VT2P RIB	GLY, Bt	92	220	215	212	216	16.0
Federal Hybrids	4760 VT2P RIB	GLY, Bt	97	235	247	237	240	16.1
Anderson Seeds	669SRC	GLY, Bt, LL, CRW	97	220	242	229	230	16.2
Federal Hybrids	4770 CONV	—	97	236	253	197	229	16.4
Dekalb	DKC47-47RIB	GLY, Bt, LL, CRW	97	216	226	208	217	16.4
97 and earlier RM Averages:				221	237	211	223	16.1
98 to 101 RM entries								
AgriGold	A6237STX	GLY, Bt, LL, CRW	98	213	226	205	215	16.4
Dekalb	DKC49-72RIB	GLY, Bt, LL, CRW	99	229	246	224	233	16.4
Dairyland Seed	DS-9198RA	GLY, Bt, LL, CRW	98	211	222	194	209	16.6
AgriGold	A6257STXRIB	GLY, Bt, LL, CRW	100	209	233	205	216	16.8
Viking	O.35-99N	—	99	192	249	211	217	16.8
Titan Pro	TP 58-01 2P	GLY, Bt	101	214	257	220	231	16.8
NuTech\G2 Genetics	X5Y-9902	GLY, Bt, LL, CRW	99	198	202	198	199	16.8
Anderson Seeds	684R	GLY	98	227	229	219	225	16.9
NorthStar Genetics	NS 100-464	GLY, Bt, LL, CRW	100	222	232	220	224	16.9
Anderson Seeds	6284	—	98	210	249	211	223	16.9
Viking	58-98N	—	98	210	220	215	215	17.0
NuTech	X5V-9901	GLY, Bt, LL, CRW	99	223	237	222	227	17.0
Dekalb	DKC51-38RIB	GLY, Bt, LL, CRW	101	198	251	219	223	17.1
NorthStar Genetics	NS 101-314	GLY	101	209	216	240	222	17.2
Viking	57-01N	—	101	221	235	185	214	17.3
Dairyland Seed	DS-9701RA	GLY, Bt, LL, CRW	101	213	234	191	213	17.4
NuTech\G2 Genetics	5Z-601	GLY, Bt, LL	101	201	257	250	236	17.4
Anderson Seeds	6073	—	101	208	245	210	221	17.5
Dairyland Seed	DS-9599	GLY, Bt, LL, CRW	99	209	246	206	221	17.5
NuTech\G2 Genetics	5N-800	GLY, Bt, LL, CRW	100	235	233	243	237	17.7
Titan Pro	TP 31-01 3011A	GLY, Bt, LL, CRW	101	228	238	255	240	17.7
Anderson Seeds	511SRC	GLY, Bt, LL, CRW	101	211	241	213	221	17.7
NorthStar Genetics	NS 100-531	GLY, Bt, LL, CRW	100	210	237	241	229	17.8
Legacy Seeds	L-4315 GENSS	GLY, Bt, LL, CRW	101	214	233	228	225	18.0
98 to 101 RM Averages:				213	236	218	222	17.2
102 to 103 RM entries								
NorthStar Genetics	NS 102-168	GLY, Bt	102	223	250	230	234	16.9
Anderson Seeds	5303	—	103	232	232	217	227	17.1
Viking	40-03N	—	103	217	253	205	225	17.2
Anderson Seeds	533R	GLY	103	201	200	179	193	17.4
Dahlman	R52-328SSRIB	GLY, Bt, LL, CRW	103	212	259	227	233	17.4
Titan Pro	TP 67-02 SS	GLY, Bt, LL, CRW	102	201	246	250	232	17.6
Dekalb	DKC53-56RIB	GLY, Bt, LL, CRW	103	207	231	216	218	17.6
Dekalb	DKC52-84RIB	GLY, Bt, LL, CRW	102	234	245	214	231	17.7
AgriGold	A6267STXRIB	GLY, Bt, LL, CRW	102	230	264	236	243	17.8
NuTech\G2 Genetics	5L-702	GLY, Bt, LL, CRW	102	220	266	251	245	17.8
Titan Pro	TP 53-03 2P	GLY, Bt	103	268	264	229	254	17.9
Masters Choice	MCT 5371	GLY	103	223	249	249	240	18.0
NuTech\G2 Genetics	5Z-503	GLY, Bt, LL	103	245	280	268	264	18.0
Federal Hybrids	5245 VT2P	GLY, Bt	102	243	272	239	251	18.0
Dairyland Seed	DS-9802	GLY, Bt, LL, CRW	102	223	269	238	243	18.0
Federal Hybrids	5370 SSTAX	GLY, Bt, LL, CRW	103	233	265	251	250	18.3
AgriGold	A6355STXRIB	GLY, Bt, LL, CRW	103	237	259	242	246	18.3
Dairyland Seed	DS-9403	GLY, Bt, LL, CRW	103	233	239	243	238	18.5
Titan Pro	TP 40-03	—	103	241	249	237	242	18.6
Tracy Seeds	T102-26 3122 E-Z REFUGE	GLY, Bt, LL, CRW	102	215	246	222	228	18.7
102 to 103 RM averages:				227	252	232	237	17.8
Southern locations, early maturity averages:				220	242	222	228	17.3
LSD (0.20)				22	20	15	11	0.3

Late maturity entries, southern locations, 2016.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at:			Average Across Locations	
				Lamberton	Rochester	Waseca	Bu/Acre	% Moisture
104 RM and later entries								
Legacy Seeds	L-5516 GENSS	GLY, Bt, LL, CRW	105	244	235	232	237	16.6
Viking	73-07N	GLY, Bt, LL, CRW	107	245	259	235	247	17.5
Legacy Seeds	L-6025 GENSS	GLY, Bt, LL, CRW	107	249	239	240	242	17.6
Dahlman	R52-352SSRIB	GLY, Bt, LL, CRW	104	249	233	205	229	17.8
Masters Choice	MCT 5454	GLY, Bt, LL, CRW	104	244	219	226	230	17.9
NuTech\G2 Genetics	5F-504	GLY, Bt, LL	104	267	259	236	254	18.4
NorthStar Genetics	NS 104-167	GLY, Bt, LL, CRW	105	231	223	212	222	18.5
NuTech\G2 Genetics	5H-806	GLY, Bt, LL	106	272	249	257	259	18.6
Masters Choice	MCT 527	GLY	105	234	224	216	225	18.6
Dekalb	DKC54-38RIB	GLY, Bt, LL, CRW	104	239	230	220	230	18.6
Dairyland Seed	DS-9106	GLY, Bt, LL, CRW	106	242	244	226	238	19.0
Viking	63-05N	GLY, Bt, LL, CRW	105	263	240	238	247	19.1
Legacy Seeds	L-5914 GENSS	GLY, Bt, LL, CRW	106	243	243	210	232	19.3
Federal Hybrids	5550 SSTAX RIB	GLY, Bt, LL, CRW	105	226	236	235	232	19.4
Tracy Seeds	T108-26 3111 VIP	GLY, Bt, LL, CRW	108	252	237	237	242	19.4
Titan Pro	TP 59-08 SS	GLY, Bt, LL, CRW	108	229	235	239	234	19.5
AgriGold	A6346STX	GLY, Bt, LL, CRW	104	252	222	221	232	19.6
NuTech\G2 Genetics	5F-906	GLY, Bt, LL	106	271	240	261	257	19.6
Dairyland Seed	DS-9204	GLY, Bt, LL, CRW	104	250	234	216	233	19.7
NorthStar Genetics	NS 106-526	GLY, Bt, LL, CRW	106	246	217	217	226	19.8
AgriGold	A6413STXRIB	GLY, Bt, LL, CRW	107	241	251	248	247	19.8
AgriGold	A6441STXRIB	GLY, Bt, LL, CRW	108	235	256	247	246	19.8
Dekalb	DKC58-06RIB	GLY, Bt, LL, CRW	108	239	249	263	250	20.1
NuTech\G2 Genetics	5F-308	GLY, Bt, LL	108	282	284	263	276	20.4
AgriGold	A6462STXRIB	GLY, Bt, LL, CRW	110	274	254	237	255	20.6
Masters Choice	MCT 6153	GLY, Bt, LL, CRW	111	240	219	205	222	22.0
Southern locations, late maturity averages:				248	240	232	240	19.1
LSD (0.20)				15	17	15	9	0.3

Early maturity entries, central locations, 2016.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at:			Average Across Locations	
				Hutchinson	Morris	Rosemount	Bu/Acre	% Moisture
93 and earlier RM entries								
NorthStar Genetics	E88-90R	GLY, Bt	90	212	194	260	222	16.0
Proseed	1492	GLY, Bt, LL, CRW	92	212	175	228	205	16.1
Proseed	PX591	GLY, Bt	91	241	193	270	234	16.1
Legacy Seeds	L-3115 VT2PRO	GLY, Bt	92	218	187	248	218	16.3
Viking	42-92N	—	92	227	194	250	224	16.4
Dairyland Seed	DS-1091	—	91	213	186	243	214	16.5
Proseed	1191	GLY, Bt	91	195	192	231	206	16.5
Masters Choice	MCT 4211	GLY	92	209	195	250	218	16.5
Anderson Seeds	742R	GLY	92	240	219	244	234	16.7
Anderson Seeds	7422	—	92	234	214	262	237	16.8
Peterson Farms Seed	PFS76S92	GLY, Bt	92	220	185	235	213	16.9
Proseed	1392	GLY, Bt	92	207	206	229	214	16.9
93 RM and earlier averages:				219	195	246	220	16.5
94 to 96 RM entries								
Anderson Seeds	7995	—	95	221	195	246	220	16.2
NuTech\G2 Genetics	5F-894	GLY, Bt, LL	94	205	184	244	211	16.5
Munson	5639VT2P	GLY, Bt	96	229	202	235	222	16.5
Viking	34-94N	—	94	252	204	270	242	16.5
Titan Pro	TP 30-96	—	96	235	189	241	221	16.6
Peterson Farms Seed	PFS77P94	GLY, Bt	94	230	213	237	227	16.7
Dahlman	R47-24VT2PRIB	GLY, Bt	94	224	220	239	228	16.7
Tracy Seeds	T95-25 3000GT	GLY, Bt, LL, CRW	95	217	187	227	210	16.7
Viking	51-95N	—	95	227	197	250	224	16.8
Viking	O.24-95N	—	95	220	178	225	208	16.8
Anderson Seeds	795R	GLY	95	231	199	268	233	16.9
NuTech\G2 Genetics	X5Z-9501	GLY, Bt, LL	95	221	199	242	221	16.9
Dahlman	R48-301SSRIB	GLY, Bt, LL, CRW	95	205	190	221	205	16.9
Munson	5581VT3P	GLY, Bt, CRW	95	246	194	262	234	16.9
Peterson Farms Seed	PFS81W95	GLY, Bt, LL, CRW	95	210	204	245	220	17.0
Titan Pro	TP 50-94 A	—	94	237	204	246	229	17.2
Dairyland Seed	DS-7294	GLY, Bt, LL	94	230	215	266	237	17.2
Titan Pro	TP 58-95 SS	GLY, Bt, LL, CRW	95	217	195	256	223	17.4
Legacy Seeds	L-3715 GENSS	GLY, Bt, LL, CRW	96	201	194	260	218	17.4
NorthStar Genetics	NS 96-103	GLY, Bt, LL, CRW	96	235	216	254	235	17.4
Dekalb	DKC45-65RIB	GLY, Bt, LL, CRW	95	233	215	244	231	17.4
NuTech\G2 Genetics	5F-196	GLY, Bt, LL	96	229	203	291	241	17.4
Legacy Seeds	L-3845 GENSS	GLY, Bt, LL, CRW	96	239	200	265	235	17.5
Titan Pro	2M95-2P	GLY, Bt	95	231	194	272	232	17.5
Dekalb	DKC46-36RIB	GLY, Bt, LL, CRW	96	239	225	253	239	17.7
Masters Choice	MCT 4632	—	96	225	212	243	227	18.3
94 to 96 RM averages:				226	201	250	226	17.1
Central locations, early maturity averages:				224	199	249	224	16.9
LSD (0.20)				16	15	14	8	0.3

Late maturity entries, central locations, 2016.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at:			Average Across Locations	
				Hutchinson	Morris	Rosemount	Bu/Acre	% Moisture
99 RM and Earlier entries								
Munson	5896VT2P	GLY, Bt	98	224	189	240	218	16.9
Viking	58-98N	—	98	204	175	231	203	17.4
Titan Pro	TP 54-98 2P	GLY, Bt	98	241	201	240	227	17.4
Dairyland Seed	DS-9198RA	GLY, Bt, LL, CRW	98	197	214	212	208	17.5
Dahlman	R49-315SSRIB	GLY, Bt, LL, CRW	99	227	192	236	218	17.5
Dekalb	DKC49-72RIB	GLY, Bt, LL, CRW	99	227	205	244	225	17.5
Anderson Seeds	6284	—	98	235	174	250	220	17.5
Anderson Seeds	684R	GLY	98	209	177	258	215	17.5
NuTech	X5V-9901	GLY, Bt, LL, CRW	99	242	225	238	235	17.6
Viking	O.35-99N	—	99	242	178	236	219	17.6
Titan Pro	TP 68-98 SS	GLY, Bt, LL, CRW	98	199	183	228	204	17.7
Titan Pro	TP 50-99 A	—	99	239	213	252	235	17.8
Masters Choice	MCT 4884	—	98	226	216	227	223	17.8
Dahlman	R49-342SSRIB	GLY, Bt, LL, CRW	98	214	227	222	221	17.8
Dekalb	DKC47-47RIB	GLY, Bt, LL, CRW	97	224	190	244	219	17.9
Anderson Seeds	669SRC	GLY, Bt, LL, CRW	97	236	198	252	229	17.9
Viking	89-99N Art	—	99	214	220	225	220	18.1
NuTech\G2 Genetics	X5Y-9902	GLY, Bt, LL, CRW	99	223	168	228	207	18.2
Dairyland Seed	DS-9599	GLY, Bt, LL, CRW	99	234	237	232	234	18.2
Tracy Seeds	T098-26 3110VIP	GLY, Bt, LL	98	217	194	233	215	18.8
99 RM and earlier averages:				224	199	236	220	17.7
Later than 99 RM entries								
NorthStar Genetics	NS 102-168	GLY, Bt	102	226	191	249	222	17.8
Titan Pro	TP 65-00 2P	GLY, Bt	100	232	204	264	233	17.8
NuTech\G2 Genetics	5Z-601	GLY, Bt, LL	101	245	201	302	249	17.8
Titan Pro	TP 40-00	—	100	235	196	239	223	18.2
Tracy Seeds	T100-25 3000GT	GLY, Bt, LL, CRW	101	226	183	225	211	18.2
NuTech\G2 Genetics	5L-702	GLY, Bt, LL, CRW	102	258	233	270	254	18.2
Munson	6434VT2P	GLY, Bt	104	249	201	253	234	18.2
NorthStar Genetics	NS 101-314	GLY	101	229	200	255	228	18.2
Legacy Seeds	L-4315 GENSS	GLY, Bt, LL, CRW	101	245	194	244	228	18.3
Anderson Seeds	511SRC	GLY, Bt, LL, CRW	101	234	214	255	234	18.3
Anderson Seeds	5303	—	103	248	216	244	236	18.4
Dairyland Seed	DS-9701RA	GLY, Bt, LL, CRW	101	215	170	243	210	18.4
Viking	57-01N	—	101	223	192	238	217	18.4
NuTech\G2 Genetics	5Z-503	GLY, Bt, LL	103	269	238	285	264	18.4
Viking	40-03N	—	103	231	195	264	230	18.4
Anderson Seeds	6073	—	101	246	205	239	230	18.4
NuTech\G2 Genetics	5N-800	GLY, Bt, LL, CRW	100	239	201	272	237	18.5
Dahlman	R50-357SSRIB	GLY, Bt, LL, CRW	100	241	184	253	226	18.5
Munson	6048SS	GLY, Bt, LL, CRW	100	223	196	249	223	18.6
NorthStar Genetics	NS 100-531	GLY, Bt, LL, CRW	100	248	182	259	230	18.7
Dairyland Seed	DS-9802	GLY, Bt, LL, CRW	102	224	203	252	226	18.7
Anderson Seeds	533R	GLY	103	212	178	220	204	18.8
Dekalb	DKC51-38RIB	GLY, Bt, LL, CRW	101	235	181	250	222	19.0
Dekalb	DKC52-84RIB	GLY, Bt, LL, CRW	102	235	203	254	231	19.0
Dekalb	DKC53-56RIB	GLY, Bt, LL, CRW	103	223	200	245	223	19.0
Dekalb	DKC54-38RIB	GLY, Bt, LL, CRW	104	239	202	262	234	19.2
Dahlman	R52-328SSRIB	GLY, Bt, LL, CRW	103	252	186	254	231	19.3
Munson	6253SS	GLY, Bt, LL, CRW	102	232	191	246	223	19.3
Masters Choice	MCT 5371	GLY	103	233	212	229	224	19.5
Dairyland Seed	DS-9204	GLY, Bt, LL, CRW	104	235	203	247	228	19.9
Dairyland Seed	DS-9403	GLY, Bt, LL, CRW	103	250	196	238	228	20.1
Dekalb	DKC56-45RIB	GLY, Bt, LL, CRW	106	254	184	269	235	21.2
Later than 99 RM averages:				237	198	252	229	18.7
Central locations, late maturity averages:				232	198	246	225	18.3
LSD(0.20)				16	32	18	12	0.4

Northern locations, 2016.

Source	Entry	Traits	Relative Maturity	Yield, Bushels/Acre at:			Average Across Locations	
				Crookston	Rothsay	Staples	Bu/Acre	% Moisture
83 and earlier RM entries								
REA Hybrids	1B820-RIB	GLY, Bt	82	193	177	192	187	18.2
Proseed	1483	GLY, Bt	83	190	178	235	201	18.4
Proseed	1083	GLY, Bt, LL, CRW	83	200	172	202	191	18.4
Proseed	1283	GLY, Bt	83	179	164	175	173	18.6
Peterson Farms Seed	PFS79M83	GLY, Bt	83	203	164	207	192	18.9
NuTech	5N-183	GLY, Bt, LL, CRW	83	232	205	201	212	19.6
83 and earlier RM entry averages:				200	177	202	193	18.7
84 to 87 RM entries								
Dairyland Seed	DS-9787SSX	GLY, Bt, LL, CRW	87	200	188	215	201	18.3
Proseed	1384	GLY, Bt	84	197	163	180	180	18.8
REA Hybrids	2B860-RIB	GLY, Bt	86	218	191	193	201	18.9
Legacy Seeds	L-2516 VT2PRO	GLY, Bt	85	205	190	191	195	18.9
Proseed	1286	GLY, Bt	86	196	187	194	192	19.1
Proseed	1487	GLY, Bt	87	191	194	258	214	19.1
REA Hybrids	2B840-RIB	GLY, Bt	84	206	199	205	203	19.3
Proseed	1385	GLY, Bt	85	196	183	210	196	19.4
NuTech	5N-886	GLY, Bt, LL, CRW	86	229	182	254	222	19.7
Legacy Seeds	L-2546	—	86	214	184	214	204	19.8
Tracy Seeds	T086-26 3011A	GLY, Bt, LL, CRW	86	219	184	218	207	19.8
Dairyland Seed	DS-9686	GLY, Bt, LL, CRW	86	223	195	208	209	20.1
Peterson Farms Seed	PFS75K85	GLY, Bt	85	201	185	201	196	20.2
Dekalb	DKC36-28RIB	GLY, Bt, LL, CRW	86	203	177	185	188	20.4
REA Hybrids	2A871-RIB	GLY, Bt, LL, CRW	87	186	164	198	183	21.3
84 to 87 RM entry averages:				206	184	208	199	19.5
88 to 92 RM entries								
NuTech\G2 Genetics	5F-091	GLY, Bt, LL	91	212	181	220	204	19.5
Titan Pro	TP 65-90 2P	GLY, Bt	90	223	200	245	223	19.7
Tracy Seeds	T091-25 3000GT	GLY, Bt, LL, CRW	91	215	186	253	218	19.8
NuTech\G2 Genetics	X5Z-9103	GLY, Bt, LL	91	216	182	218	206	19.8
Legacy Seeds	L-2916 VT2PRO	GLY, Bt	88	222	194	233	216	19.8
Viking	E88-90R	GLY, Bt	90	233	192	224	216	20.0
Peterson Farms Seed	PFS74K89	GLY, Bt	89	231	202	219	217	20.2
REA Hybrids	3B330-RIB	GLY, Bt	90	235	196	220	217	20.3
NorthStar Genetics	E88-90R	—	92	220	197	218	211	20.4
Dekalb	DKC40-77RIB	GLY, Bt, LL, CRW	90	214	205	223	214	20.6
Dairyland Seed	DS-1091	—	91	215	205	221	214	20.6
Legacy Seeds	L-3115 VT2PRO	GLY, Bt	92	220	199	194	204	20.9
88 to 92 RM entry averages:				221	195	224	213	20.1
93 and later RM entries								
NuTech\G2 Genetics	X5Z-9501	GLY, Bt, LL	95	224	188	225	212	20.4
Dairyland Seed	DS-7294	GLY, Bt, LL	94	262	217	262	247	20.4
NuTech\G2 Genetics	5F-894	GLY, Bt, LL	94	227	202	235	221	20.9
Titan Pro	TP 48-93 2P	GLY, Bt	93	212	208	210	210	20.9
Tracy Seeds	T093-26 3110a VIP	GLY, Bt, LL	93	234	197	227	219	21.0
Viking	34-94N	—	94	251	206	229	229	21.3
REA Hybrids	4B931-RIB	GLY, Bt	93	216	218	217	217	21.5
NuTech	5B-293	GLY, Bt, LL	93	254	218	243	238	21.5
REA Hybrids	4B953-RIB	GLY, Bt	95	244	215	229	229	21.8
Viking	O.24-95N	—	95	216	196	220	211	22.1
Titan Pro	TP 50-94 A	—	94	217	220	193	210	22.8
Titan Pro	2M95-2P	GLY, Bt	95	238	215	246	233	23.1
Dekalb	DKC45-65RIB	GLY, Bt, LL, CRW	95	232	208	230	223	23.4
93 and Later RM entry averages:				233	208	228	223	21.6
Northern locations averages:				217	193	217	209	20.2
LSD(0.20)				13	13	16	8	0.4

2016 Corn Silage Field Crop Trials Results



Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences

The Minnesota Hybrid Corn Silage Evaluation Program evaluates the silage potential of corn hybrids in Minnesota. The goal of the program is to provide unbiased forage yield and forage quality information for educational and marketing programs.

The program is financed in part by entry fees from private seed companies that choose to enter hybrids for testing, which are listed below. Results are presented from the two corn silage performance trials, Southeast (SE) located in Rochester; and Central (CE) located in Hutchinson. Entries from the southeast and central sites are also evaluated at Waseca in trials designated as Waseca SE and Waseca CE. Trials at each location were split into early and late corn hybrid maturities, to facilitate harvesting the corn silage at 65% whole plant moisture.

Test Procedures

Plots were established at each test site in a randomized complete block design with four replications.

Planting and harvesting dates were:

Location	Planting Date	Early Harvest	Late Harvest
Rochester SE	April 26	Sept. 9	Sept. 20
Waseca SE	April 27	Sept. 2	Sept. 13
Hutchinson CE	May 4	Sept. 14	Sept. 14
Waseca CE	April 27	Sept. 1	Sept. 12

Hybrid entries were planted at 35,000 seeds per acre with 30-inch row spacing. Plant nutrients as manure or inorganic fertilizer and herbicides to control weeds were applied according to University of Minnesota recommendations.

Plots were harvested and whole-plant herbage sampled for determination of

dry matter content and forage quality. Test sites were normally harvested when the average whole-plant moisture across entries was estimated to be 65%.

Results Provided

Tables 1-8 summarize hybrid yield and forage quality results from Rochester, Hutchinson and Waseca. Moisture content, whole-plant dry matter (DM) yield, and silage yield at harvest moisture are listed. Hybrids are ranked in descending order of milk yield per acre (Milk Yield, lb. /acre). Genetic trait information is supplied by companies entered in the hybrid corn silage performance trials.

Whole-plant forage quality traits tested include crude protein (CP), neutral detergent fiber (NDF), 48-hour neutral detergent fiber digestibility (NDFD) and starch concentration. With the exception of NDFD, all forage qual-

Companies Participating in 2016 Hybrid Corn Silage Performance Trials

AgriGold Hybrids	www.agrigold.com
Anderson Seeds Channel	Kelsey Anderson - kelsey.anderson528@gmail.com www.channel.com
Dairyland Seed	www.dairylandseed.com
Dekalb	www.dekalb.com
Gold Country Seed	www.goldcountryseed.com
Golden Harvest	www.syngenta-us.com/corn/golden-harvest
Latham	www.lathamseeds.com
Legacy Seeds, Inc.	www.legacyseeds.com
Masters Choice	www.seedcorn.com
NuTech Seed LLC	www.nutechseed.com
Producers Hybrids	www.producershybrids.com
Tracy Seeds	www.tracyseeds.com
Viking Seed	www.alseed.com
Wensman Seed Company	www.wensmanseed.com



ity traits are expressed as a percent of dry matter. NDFD is expressed as a percent of NDF.

Milk production potential per ton (lb. milk/ ton forage) and per acre (lb. milk /acre) of forage was calculated using the MILK2006 spreadsheet developed by the University of Wisconsin. MILK2006 approximates animal performance based on a standard cow weight and milk production level (1,350 lb. body weight and 90 lb. / day at 3.8% fat).

Field values for moisture and DM yield at harvest; laboratory values for CP, NDF, NDFD, starch, oil and ash concentration; and book values for NDFCP (1.3%) were used for spreadsheet calculations. For MILK2006 predictions, we assumed that kernel processing occurred. Milk production (lb. milk / ton and lb. milk / acre) val-

ues can be used as a quick reference for relative comparison of hybrids within test locations.

How to Use Results

NDF is a negative indicator of forage intake potential; higher NDF concentration generally implies lower intake potential. NDFD estimates digestibility of the fiber fraction. Starch concentration is positively associated with digestibility because of its high digestibility. Relatively higher NDFD and / or starch concentrations generally imply greater animal performance potential. Milk yield per acre represents the combined effects of silage yield and quality.

Corn hybrids differed in yield, forage quality and milk production potential at all sites. Means and least significant difference (LSD) values at the 10% probability level are shown for

each parameter. Where the difference between two hybrids for a particular yield or quality trait is greater than the LSD value, there is a 90% probability that there is a statistically significant difference between the two hybrids for that parameter (i.e., moisture, yield, quality concentration or milk production). A difference less than the LSD value probably is due to environmental factors.

Figures 1-4 summarize the relationship between silage dry matter yield and milk per ton for test sites at Rochester, Waseca and Hutchinson. The figures also highlight those entries at each site that have a combination of high silage dry matter yields and milk production per ton.

Project Leaders

Craig Sheaffer, M. Scott Wells, Thomas Hoverstad and Joshua Larson.

Table 1. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for SE early corn hybrids planted at Rochester, MN (Olmsted County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/ton	lb/acre
27	Viking	O.51-04GS	—	104	63.0	13.7	36.9	5.9	41.5	40.7	44.2	2,509	34,468
13	DEKALB	DKC51-38RIB	GLY,Bt,LL,CRW	101	64.0	12.0	33.5	5.7	40.3	42.7	44.0	2,572	30,915
21	LEGACY SEEDS	L-6334 3111	GLY, BT, LL, CRW	107	65.5	12.4	36.0	6.1	39.9	39.2	44.7	2,483	30,774
23	Masters Choice	MCT 5454	GLY,Bt,LL,CRW	104	61.5	12.7	33.0	5.0	47.6	43.7	37.6	2,366	30,010
11	DAIRYLAND SEED	HiDF-3605RA	GLY,Bt,LL,CRW	105	67.2	12.5	38.5	6.2	45.1	39.6	38.2	2,340	29,322
8	DAIRYLAND SEED	HiDF-3702-9	GLY,Bt,LL,CRW	102	65.5	12.1	35.0	5.7	40.7	38.6	45.2	2,393	29,238
7	Channel	207-27STXRIB Brand Blend	GLY,Bt,LL,CRW	107	67.2	11.5	35.2	5.5	42.7	41.7	41.0	2,500	28,902
12	DAIRYLAND SEED	Exp-10707	GLY,Bt,LL,CRW	107	65.5	12.5	36.8	5.5	45.0	37.5	39.7	2,259	28,757
19	LEGACY SEEDS	L-5350 3122	GLY, BT, LL, CRW	104	64.2	12.1	34.1	5.7	43.3	39.5	41.6	2,371	28,596
26	NuTech\G2 Genetics	5H-806	GLY,BT,LL	106	67.5	11.7	36.1	6.1	42.1	38.9	41.7	2,412	28,220
1	AgriGold	A6267STXRIB	GLY,Bt,LL,CRW	102	63.2	11.4	31.1	5.0	44.2	42.1	41.0	2,444	27,736
25	NuTech\G2 Genetics	5F-906	GLY,BT,LL	106	68.2	12.7	39.6	7.0	46.5	37.1	38.1	2,179	27,615
5	AgriGold	A6416STXRIB	GLY,Bt,LL,CRW	107	65.0	12.5	36.0	6.4	45.9	37.0	39.2	2,184	27,376
22	Masters Choice	MCT 5371	GLY	103	63.0	12.0	32.4	5.9	45.5	38.8	40.1	2,264	27,029
18	Latham	LH 5715	—	107	64.7	11.3	32.2	5.6	46.1	41.8	38.4	2,385	26,996
3	AgriGold	A6358VT3PRIB	GLY,Bt,CRW	105	64.2	12.0	33.9	5.5	43.6	36.2	42.4	2,207	26,472
16	Gold Country Seed	HDS76-76RSS	GLY,Bt,LL,CRW	107	65.2	11.7	33.9	5.9	46.6	39.0	37.9	2,238	26,081
10	DAIRYLAND SEED	HiDF-3103-9	GLY,Bt,LL,CRW	103	66.7	11.7	35.1	5.1	49.2	39.8	35.2	2,193	25,880
9	DAIRYLAND SEED	DS-9403	GLY,Bt,LL,CRW	103	63.2	11.0	29.9	6.0	46.8	40.7	37.6	2,337	25,774
17	Golden Harvest	G07F23	GLY, BL,BT,LL,CRW	107	66.5	11.7	35.0	6.0	46.9	35.2	38.4	2,094	25,619
2	AgriGold	A6346STX	GLY,Bt,LL,CRW	104	65.2	10.7	30.9	5.7	44.9	40.6	39.0	2,358	25,432
4	AgriGold	A6413STXRIB	GLY,Bt,LL,CRW	107	68.7	11.0	35.4	5.7	45.4	38.3	40.0	2,266	24,971
20	LEGACY SEEDS	L-5810 GT	GLY, BT, LL, CRW	106	66.5	11.4	34.0	5.8	46.7	35.6	38.5	2,075	23,657
6	Channel	206-30STXRIB Brand Blend	GLY,Bt,LL,CRW	106	66.7	11.1	33.8	5.8	45.3	35.9	39.6	2,112	23,592
24	Masters Choice	MCT 527	GLY	105	64.5	10.3	29.1	5.9	49.5	40.3	36.0	2,176	22,467
Mean					65.3	11.8	34.3	5.8	44.8	39.3	40.0	2,311	27,438
LSD (0.10)					4.1	9.7	10.1	12.8	10.3	10.6	12.8	9.6	15.1
C.V.					1.0	0.5	1.3	0.3	2.2	2.0	2.5	99.1	1,817

¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Table 2. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for SE late corn hybrids planted at Rochester, MN (Olmsted County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
18	NuTech\G2 Genetics	5F-308	GLY,BT,LL	108	62.0	13.0	34.4	6.7	39.1	37.9	46.7	2,413	31,427
10	Golden Harvest	G09E98	GLY,Bt,LL,CRW,	109	59.8	12.5	31.5	6.2	37.6	38.7	47.1	2,478	31,143
19	NuTech\G2 Genetics	5F-709	GLY,BT,LL	109	60.3	13.0	32.5	6.1	39.8	37.2	45.7	2,375	30,951
8	DEKALB	DKC58-06RIB	GLY,Bt,LL,CRW	108	56.8	12.7	29.4	5.4	40.6	39.9	45.9	2,416	30,604
1	AgriGold	A6441STXRIB	GLY,Bt,LL,CRW	108	60.8	12.3	31.2	6.0	39.3	39.2	47.1	2,485	30,578
12	Golden Harvest	G10C45	GLY,BT,LL	110	55.3	13.0	28.9	5.7	40.2	37.6	46.2	2,361	30,547
13	Golden Harvest	G11F16	GLY, BL,BT,LL,CRW	111	60.3	13.0	32.8	6.0	43.7	38.6	42.2	2,339	30,475
11	Golden Harvest	G10T63	GLY,Bt,LL,CRW,	110	62.0	13.2	34.7	6.4	40.7	36.8	46.1	2,324	30,426
22	Producers Hybrids	6878STXRIB	GLY,Bt,LL,CRW	108	61.0	12.5	32.0	6.2	38.5	37.6	47.6	2,413	30,242
21	NuTech\G2 Genetics	X5Z-1001	GLY,BT,LL	110	61.3	12.5	32.1	6.0	42.6	38.4	42.8	2,356	29,631
23	Producers Hybrids	6968STXRIB	GLY,Bt,LL,CRW	109	61.5	11.6	30.1	5.9	36.7	38.9	49.3	2,537	29,357
14	Latham	LH 6175	—	111	59.3	12.7	31.2	5.6	41.9	36.8	43.6	2,279	29,140
24	Tracy Seeds	T108-26 3111 VIP	GLY,Bt,LL,CRW	108	57.3	12.1	28.3	5.7	42.4	37.5	44.4	2,317	29,073
16	Latham	LH Ex114	GLY,Bt,LL,CRW,	114	63.5	12.4	34.0	6.0	41.0	37.2	44.1	2,346	28,967
20	NuTech\G2 Genetics	5F-510	GLY,BT,LL	110	65.5	12.3	35.7	7.0	38.7	36.1	46.2	2,357	28,875
6	DAIRYLAND SEED	DS-9508RA	GLY,Bt,LL,CRW	108	64.3	11.8	33.0	5.8	39.2	36.7	45.7	2,350	27,832
25	Viking	O.73-08GS	—	108	62.5	12.1	32.2	5.8	43.2	37.4	42.6	2,288	27,574
9	Gold Country Seed	108-91RSS	GLY,Bt,LL,CRW	108	59.0	11.5	28.2	5.4	41.4	39.6	44.3	2,394	27,513
4	AgriGold	A6462STXRIB	GLY,Bt,LL,CRW	110	61.5	11.6	30.0	5.4	38.8	35.9	47.0	2,366	27,438
7	DAIRYLAND SEED	HiDF-3510SSX	GLY,Bt,LL,CRW	110	62.3	12.0	31.5	5.4	45.0	38.0	40.7	2,263	26,997
2	AgriGold	A6442STXRIB	GLY,Bt,LL,CRW	109	61.3	11.6	30.1	6.3	42.8	38.0	43.2	2,300	26,663
27	WENSMAN	W91073STXRIB	GLY,Bt,LL,CRW	107	61.2	11.5	29.8	6.0	42.9	38.1	41.1	2,263	26,188
17	Masters Choice	MCT 6153	GLY,Bt,LL,CRW	111	61.8	11.1	29.1	5.7	43.5	38.7	41.5	2,321	25,599
3	AgriGold	A6458VT3PRIB	GLY,Bt,CRW	110	62.3	11.3	30.2	6.8	43.0	36.4	42.3	2,215	25,153
5	DAIRYLAND SEED	HiDF-3808RA	GLY,Bt,LL,CRW	108	62.5	11.4	30.3	6.0	45.2	38.0	39.9	2,210	25,100
15	Latham	LH Ex114RRLFY	—	114	65.5	11.7	34.1	6.1	49.6	39.3	32.4	2,094	24,426
26	WENSMAN	W7473VT3PRIB	GLY,Bt,CRW	109	65.5	10.1	29.2	6.6	46.7	37.5	38.4	2,155	21,806
Mean					61.3	12.1	31.3	6.0	41.6	37.9	43.9	2,334	28,279
LSD (0.10)					5.1	11.4	11.6	10.7	10.9	5.2	12.1	7.2	15.3
C.V.					1.0	0.6	1.7	0.3	1.9	0.9	2.1	75.1	1,960

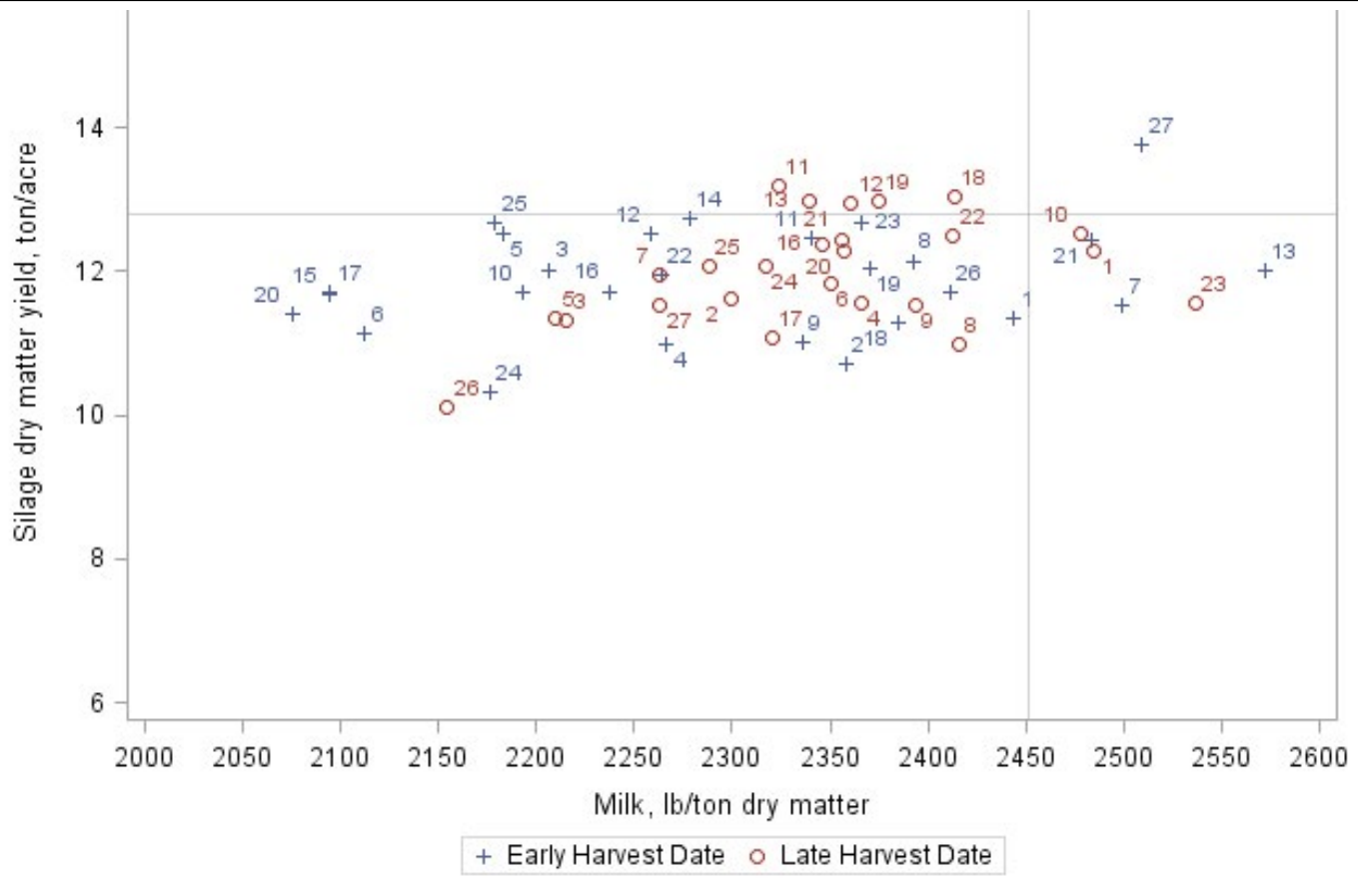
¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Figure 1. Relationship between silage dry matter yield and milk per ton for SE early and late corn hybrids planted at Rochester, MN (Olmsted County) in 2016.



1. Relationship between silage dry matter yield and milk per ton at Rochester (Olmsted County) in 2016. Silage dry matter yield values above the dashed line were among the highest in this trial at the 10% probability level.
2. Milk per ton values to the right of the dashed line were among the highest in this trial at the 10% probability level.
3. Entry numbers are shown for hybrids with silage dry matter yield and milk per ton values that were among the highest for both categories.

Table 3. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for SE early corn hybrids planted at Waseca, MN (Waseca County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
1	AgriGold	A6267STXRIB	GLY,Bt,LL,CRW	102	64.5	10.4	29.0	4.7	41.8	40.6	42.3	2,266	25,513
5	AgriGold	A6416STXRIB	GLY,Bt,LL,CRW	107	66.5	10.8	32.1	5.2	40.9	40.2	43.9	2,313	25,139
4	AgriGold	A6413STXRIB	GLY,Bt,LL,CRW	107	66.7	10.5	31.3	5.2	40.2	41.7	43.0	2,385	25,010
17	Golden Harvest	G07F23	GLY, BL,BT,LL,CRW	107	65.7	10.9	31.9	4.7	42.2	41.0	42.1	2,277	24,922
12	DAIRYLAND SEED	Exp-10707	GLY,Bt,LL,CRW	107	64.7	10.6	29.8	4.6	41.9	41.1	42.0	2,324	24,617
10	DAIRYLAND SEED	HiDF-3103-9	GLY,Bt,LL,CRW	103	64.0	10.2	28.4	4.5	40.2	41.1	44.2	2,365	24,139
20	LEGACY SEEDS	L-5810 GT	GLY, BT, LL, CRW	106	65.2	11.0	25.2	5.2	41.3	41.7	42.2	2,323	23,969
9	DAIRYLAND SEED	DS-9403	GLY,Bt,LL,CRW	103	63.2	9.9	25.1	4.9	39.3	40.1	45.3	2,359	23,782
7	Channel	207-27STXRIB Brand Blend	GLY,Bt,LL,CRW	107	66.7	9.9	29.6	4.8	38.9	40.8	45.8	2,373	23,601
23	Masters Choice	MCT 5454	GLY,Bt,LL,CRW	104	64.2	10.1	28.3	5.5	40.0	40.4	44.8	2,314	23,325
16	Gold Country Seed	HDS76-76RSS	GLY,Bt,LL,CRW	107	64.5	10.5	29.5	4.6	45.0	41.5	38.1	2,222	23,225
21	LEGACY SEEDS	L-6334 3111	GLY, BT, LL, CRW	107	66.0	10.3	30.5	5.2	42.5	40.1	40.8	2,236	23,031
19	LEGACY SEEDS	L-5350 3122	GLY, BT, LL, CRW	104	65.0	10.0	28.4	5.0	43.1	41.9	40.4	2,281	22,890
11	DAIRYLAND SEED	HiDF-3605RA	GLY,Bt,LL,CRW	105	66.2	10.3	30.1	4.2	43.8	40.2	39.9	2,215	22,699
2	AgriGold	A6346STX	GLY,Bt,LL,CRW	104	64.7	9.8	27.7	4.8	41.2	40.8	43.1	2,287	22,351
26	NuTech\G2 Genetics	5H-806	GLY,BT,LL	106	67.5	9.8	30.1	5.3	41.9	40.9	41.5	2,285	22,349
3	AgriGold	A6358VT3PRIB	GLY,Bt,CRW	105	65.0	9.2	26.2	4.7	40.0	41.6	44.3	2,371	21,898
6	Channel	206-30STXRIB Brand Blend	GLY,Bt,LL,CRW	106	66.0	9.7	28.4	5.5	42.9	41.4	40.2	2,248	21,809
18	Latham	LH 5715	—	107	64.0	9.3	25.8	4.3	41.1	41.0	43.2	2,317	21,607
27	Viking	O.51-04GS	—	104	64.3	9.2	25.4	4.0	42.6	42.0	41.2	2,303	21,284
25	NuTech\G2 Genetics	5F-906	GLY,BT,LL	106	68.7	9.3	29.7	5.2	44.0	40.5	40.3	2,194	20,436
22	Masters Choice	MCT 5371	GLY	103	64.2	8.7	24.7	4.3	42.7	43.3	41.4	2,322	20,286
8	DAIRYLAND SEED	HiDF-3702-9	GLY,Bt,LL,CRW	102	66.2	9.5	27.9	4.3	45.4	41.0	38.0	2,137	20,257
24	Masters Choice	MCT 527	GLY	105	65.7	9.1	26.7	4.8	45.2	41.7	38.1	2,187	20,010
13	DEKALB	DKC51-38RIB	GLY,Bt,LL,CRW	101	66.7	8.3	25.3	5.0	41.0	41.9	42.8	2,315	19,812
Mean					65.4	9.9	28.3	4.8	42.0	41.1	42.0	2,289	22,707
LSD (0.10)					0.9	0.6	1.6	0.3	1.6	0.9	1.9	54.5	1,731
C.V.					3.2	13.5	13.3	12.7	7.8	4.2	9.5	5.0	15.0

¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Table 4. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for SE late corn hybrids planted at Waseca, MN (Waseca County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
11	Golden Harvest	G10T63	GLY,Bt,LL,CRW,	110	55.3	13.4	30.0	4.3	43.5	39.1	43.0	2,296	30,728
20	NuTech\G2 Genetics	5F-510	GLY,BT,LL	110	56.8	13.0	29.7	5.8	37.3	36.3	50.6	2,381	30,663
12	Golden Harvest	G10C45	GLY,BT,LL	110	54.5	12.0	26.2	4.3	44.5	41.1	41.7	2,306	27,817
7	DAIRYLAND SEED	HiDF-3510SSX	GLY,Bt,LL,CRW	110	60.5	12.5	31.2	4.2	44.8	37.7	41.2	2,214	27,720
1	AgriGold	A6441STXRIB	GLY,Bt,LL,CRW	108	55.5	12.1	27.4	5.0	44.0	39.3	44.5	2,281	27,508
6	DAIRYLAND SEED	DS-9508RA	GLY,Bt,LL,CRW	108	56.0	12.0	26.9	4.7	40.6	37.8	44.4	2,314	27,476
18	NuTech\G2 Genetics	5F-308	GLY,BT,LL	108	62.3	12.1	31.8	5.5	44.0	38.6	41.4	2,255	27,289
2	AgriGold	A6442STXRIB	GLY,Bt,LL,CRW	109	53.8	12.3	26.6	4.6	44.3	37.7	42.6	2,216	27,196
13	Golden Harvest	G11F16	GLY, BL,BT,LL,CRW	111	59.5	11.9	29.1	5.0	48.2	39.6	38.6	2,208	26,356
24	Tracy Seeds	T108-26 3111 VIP	GLY,Bt,LL,CRW	108	55.5	11.8	26.6	4.4	47.6	38.6	40.3	2,203	25,897
25	Viking	O.73-08GS	—	108	61.8	10.8	28.3	4.4	41.4	39.6	44.0	2,376	25,701
8	DEKALB	DKC58-06RIB	GLY,Bt,LL,CRW	108	55.0	10.7	23.7	3.8	42.5	41.1	44.6	2,382	25,489
22	Producers Hybrids	6878STXRIB	GLY,Bt,LL,CRW	108	56.8	11.3	26.1	4.7	46.1	39.2	40.7	2,210	25,199
15	Latham	LH Ex114RRLFY	—	114	61.3	12.8	33.1	4.8	52.3	38.2	30.1	1,971	25,180
10	Golden Harvest	G09E98	GLY,Bt,LL,CRW,	109	60.5	11.4	28.7	5.3	43.4	37.7	43.4	2,222	25,166
21	NuTech\G2 Genetics	X5Z-1001	GLY,BT,LL	110	57.5	10.9	25.7	5.3	41.4	36.7	45.0	2,276	24,910
19	NuTech\G2 Genetics	5F-709	GLY,BT,LL	109	57.5	10.9	25.8	5.3	41.5	37.2	44.5	2,278	24,864
17	Masters Choice	MCT 6153	GLY,Bt,LL,CRW	111	59.8	10.7	26.6	4.7	45.4	41.1	41.7	2,424	24,574
26	WENSMAN	W7473VT3PRIB	GLY,Bt,CRW	109	59.3	10.4	25.4	5.1	44.3	39.7	42.8	2,322	24,408
4	AgriGold	A6462STXRIB	GLY,Bt,LL,CRW	110	60.5	10.6	26.9	4.2	44.1	40.0	41.9	2,293	24,268
27	WENSMAN	W91073STXRIB	GLY,Bt,LL,CRW	107	55.7	10.6	24.0	4.6	42.3	38.4	44.8	2,274	24,114
14	Latham	LH 6175	—	111	53.8	10.6	23.1	4.3	42.8	38.5	43.4	2,268	24,002
16	Latham	LH Ex114	GLY,Bt,LL,CRW,	114	61.3	10.2	26.6	4.2	45.6	38.5	41.2	2,217	22,688
23	Producers Hybrids	6968STXRIB	GLY,Bt,LL,CRW	109	61.8	9.9	25.8	4.5	45.6	39.2	40.9	2,240	22,319
5	DAIRYLAND SEED	HiDF-3808RA	GLY,Bt,LL,CRW	108	62.3	10.9	29.1	4.7	54.3	39.4	32.0	1,964	21,524
9	Gold Country Seed	108-91RSS	GLY,Bt,LL,CRW	108	58.8	9.1	22.3	4.3	42.4	39.0	45.7	2,320	21,205
3	AgriGold	A6458VT3PRIB	GLY,Bt,CRW	110	65.0	10.0	28.2	5.3	47.3	37.9	37.2	2,105	21,152
Mean					58.4	11.3	27.2	4.7	44.5	38.8	41.9	2,251	25,386
LSD (0.10)					1.6	0.8	1.4	0.4	2.6	1.2	2.6	63.3	2,109
C.V.					7.2	16.1	14.1	18.5	13.2	6.3	14.7	6.9	18.4

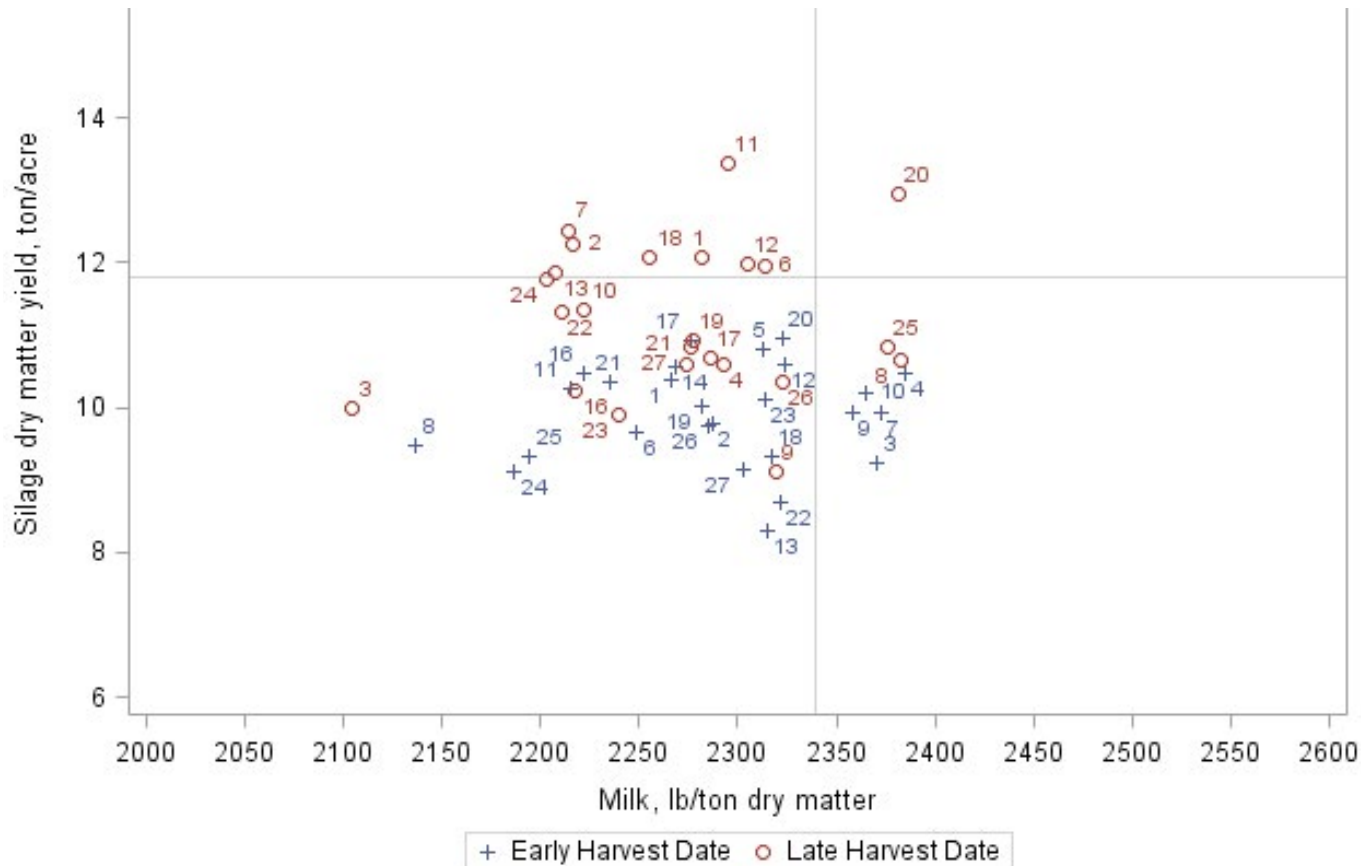
¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Figure 2. Relationship between silage dry matter yield and milk per ton for SE early and late corn hybrids planted at Waseca, MN (Waseca County) in 2016



1. Relationship between silage dry matter yield and milk per ton at Waseca (Waseca County) in 2016. Silage dry matter yield values above the dashed line were among the highest in this trial at the 10% probability level.
2. Milk per ton values to the right of the dashed line were among the highest in this trial at the 10% probability level.
3. Entry numbers are shown for hybrids with silage dry matter yield and milk per ton values that were among the highest for both categories.

Table 5. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for Central early corn hybrids planted at Hutchinson, MN (McLeod County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
20	Masters Choice	MCT 5371	GLY	103	58.3	11.6	27.7	5.7	38.9	35.4	48.3	2,323	26,857
23	NuTech\G2 Genetics	5F-701	GLY,BT,LL	101	56.5	11.2	25.7	5.3	39.2	34.7	48.2	2,288	25,662
12	Gold Country Seed	HDS76-26RSS	GLY,Bt,LL,CRW	102	63.0	10.7	28.8	5.7	39.8	36.6	44.5	2,313	24,776
19	Masters Choice	MCT 4884	GLY,Bt,LL,CRW	98	56.8	10.6	24.6	5.6	38.8	36.5	47.7	2,334	24,726
5	DAIRYLAND SEED	HiDF-3099-9	GLY,Bt,LL,CRW	99	59.3	10.7	26.4	6.1	40.1	34.8	48.1	2,257	24,158
9	DEKALB	DKC49-72RIB	GLY,Bt,LL,CRW	99	56.3	10.5	24.1	5.7	40.1	36.1	47.1	2,274	24,025
22	NuTech\G2 Genetics	5F-196	GLY,BT,LL	96	54.5	10.5	23.3	5.4	38.1	34.8	49.4	2,296	24,017
11	Gold Country Seed	102-88RSS	GLY,Bt,CRW	102	58.8	10.4	25.1	5.4	41.3	38.1	44.7	2,318	23,998
7	DAIRYLAND SEED	HiDF-3702-9	GLY,Bt,LL,CRW	102	61.3	11.0	28.2	5.2	41.6	33.7	45.8	2,165	23,814
24	NuTech\G2 Genetics	5H-502	GLY,BT,LL	102	61.5	10.5	27.3	6.1	39.4	34.0	47.1	2,252	23,673
6	DAIRYLAND SEED	HiDF-3700RA	GLY,Bt,LL,CRW	100	60.0	10.5	26.1	5.6	42.3	36.9	43.0	2,242	23,505
3	Channel	198-98STXRIB Brand Blend	GLY,Bt,LL,CRW	98	58.8	10.8	26.2	6.2	41.5	35.5	44.2	2,174	23,478
4	DAIRYLAND SEED	HiDF-3197RA	GLY,Bt,LL,CRW	97	58.8	10.6	25.7	5.9	41.6	34.6	45.2	2,200	23,382
33	WENSMAN	W9325STXRIB	—	102	58.0	10.4	24.9	5.4	40.4	34.8	47.6	2,228	23,174
14	Latham	LH 5215	—	102	59.8	10.5	25.8	6.0	41.2	33.5	45.8	2,192	22,988
31	WENSMAN	W90994STXRIB	—	99	59.8	10.2	25.2	6.0	41.5	35.6	45.2	2,220	22,856
13	Latham	LH 4529	—	95	53.5	10.0	21.6	6.2	39.6	35.3	47.7	2,267	22,702
1	Anderson Seeds	6073	—	101	51.5	10.1	20.9	5.2	41.0	36.0	46.1	2,248	22,676
32	WENSMAN	W91018STX	—	101	58.8	10.2	24.6	5.8	39.8	34.8	46.9	2,229	22,660
10	DEKALB	DKC51-38RIB	GLY,Bt,LL,CRW	101	59.8	10.6	26.3	6.3	43.4	34.8	42.7	2,117	22,472
30	WENSMAN	W9288STXRIB	—	98	58.3	9.9	23.7	5.7	42.3	37.7	44.2	2,256	22,365
25	Producers Hybrids	6108STXRIB	GLY,Bt,LL,CRW	101	58.3	9.8	23.4	5.6	39.4	35.5	48.6	2,274	22,299
17	Masters Choice	MCT 4572	GLY, BT, LL, BL	95	59.0	10.2	24.9	6.1	43.6	36.0	41.8	2,170	22,202
28	Viking	T51-01R	GLY	101	54.8	9.8	21.5	5.5	39.4	35.5	46.9	2,271	22,181
29	WENSMAN	W90962STXRIB	—	96	54.0	9.8	21.3	6.2	40.5	35.3	47.7	2,233	21,935
2	Channel	197-50STXRIB Brand Blend	GLY,Bt,LL,CRW	97	57.8	9.8	23.3	5.2	40.3	35.0	46.2	2,228	21,878
21	NuTech	5N-800	GLY,BT,LL,CRW	100	56.3	9.9	22.5	5.9	40.9	34.3	46.1	2,185	21,498
18	Masters Choice	MCT 4632	GLY, BT, LL, BL	96	56.3	9.3	21.3	6.8	38.4	36.0	47.6	2,282	21,231
26	Producers Hybrids	6318STXRIB	GLY,Bt,LL, CRW	103	59.8	9.9	24.6	5.6	43.5	35.8	42.5	2,146	21,198
27	Viking	42-92N	—	92	48.0	9.6	18.5	5.0	43.1	34.7	46.8	2,152	20,577
15	Masters Choice	MCT 3891	GLY	89	46.0	9.1	16.9	6.1	44.6	36.3	43.4	2,155	19,514
8	DEKALB	DKC46-79RIB	GLY,Bt,LL,CRW	96	54.4	8.9	20.9	5.1	40.6	34.8	46.1	2,213	19,500
16	Masters Choice	MCT 4211	GLY	92	48.3	9.2	17.9	5.0	43.9	33.3	43.8	2,082	19,121
	Mean				56.9	10.2	23.9	5.7	40.9	35.4	46.0	2,230	22,760
	LSD (0.10)				0.9	0.4	0.8	0.2	1.1	0.5	1.3	42.2	1,002
	C.V.				8.1	11.4	14.9	11.4	8.8	5.3	9.0	6.0	14.3

¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Table 6. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for Central late corn hybrids planted at Hutchinson, MN (McLeod County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
23	NuTech\G2 Genetics	5F-906	GLY,BT,LL	106	61.8	12.8	33.5	6.1	38.0	34.7	47.8	2,313	29,425
24	NuTech\G2 Genetics	5H-806	GLY,BT,LL	106	61.8	12.4	32.7	5.7	38.2	36.2	47.2	2,349	29,088
7	DAIRYLAND SEED	DS-9403	GLY,Bt,LL,CRW	103	55.8	12.0	27.0	5.8	38.7	36.8	47.8	2,379	28,602
6	DAHLMAN	R52-352SSRIB	GLY,Bt,LL,CRW	104	58.3	12.1	29.1	5.5	38.5	35.7	47.3	2,296	27,822
3	Channel	203-01STXRIB Brand Blend	GLY,Bt,LL,CRW	103	59.8	10.9	27.2	5.5	36.6	35.0	49.5	2,384	26,085
5	DAHLMAN	R52-328SSRIB	GLY,Bt,LL,CRW	103	56.5	11.1	25.2	6.0	38.3	36.1	48.1	2,364	26,023
22	NuTech\G2 Genetics	5F-504	GLY,BT,LL	104	61.3	11.4	29.3	5.7	40.3	36.2	45.2	2,271	25,846
10	DAIRYLAND SEED	Exp-10707	GLY,Bt,LL,CRW	107	62.8	11.2	29.9	5.3	39.3	34.6	45.9	2,301	25,828
11	DAIRYLAND SEED	HiDF-3808RA	GLY,Bt,LL,CRW	108	64.7	12.0	34.1	6.1	43.2	34.3	41.4	2,141	25,760
19	Latham	LH 5335	—	103	57.0	11.0	25.6	6.0	37.5	34.6	51.2	2,316	25,495
15	Gold Country Seed	HDS76-76RSS	GLY,Bt,LL,CRW	107	60.8	11.1	28.4	5.8	40.9	35.8	44.4	2,252	25,111
25	Tracy Seeds	T104-13 3000GT	GLY,Bt,LL,CRW	104	59.3	10.5	25.6	5.5	37.0	36.0	49.4	2,352	24,734
13	DEKALB	DKC56-45RIB	GLY,Bt,LL,CRW	106	61.3	10.3	26.4	5.3	38.8	38.2	46.9	2,388	24,591
21	NuTech	5N-406	GLY,BT,LL	106	63.0	10.8	29.1	5.6	40.6	37.2	44.7	2,275	24,564
17	Golden Harvest	G07F23	GLY, BL,BT,LL,CRW	107	63.3	11.2	30.4	6.0	42.0	34.6	42.8	2,193	24,461
27	Viking	O.51-04GS	—	104	60.0	10.7	25.5	5.5	39.3	34.4	48.1	2,289	24,450
14	DEKALB	DKC57-97RIB	GLY,Bt,LL,CRW	107	62.3	10.7	28.3	6.0	40.9	36.9	43.7	2,293	24,446
4	Channel	205-19STXRIB Brand Blend	GLY,Bt,LL,CRW	105	59.8	10.7	26.7	5.6	39.8	35.0	46.1	2,272	24,443
8	DAIRYLAND SEED	HiDF-3103-9	GLY,Bt,LL,CRW	103	60.8	10.9	28.1	5.9	41.6	34.6	44.8	2,194	24,013
16	Gold Country Seed	108-91RSS	GLY,Bt,LL,CRW	108	61.8	10.2	26.7	5.9	38.2	35.9	48.0	2,353	23,960
2	Anderson Seeds	533R	Roundup Ready 2	103	62.8	10.1	26.9	5.9	39.0	38.4	45.0	2,360	23,738
20	Latham	LH 5495	—	104	62.3	10.9	28.6	5.4	44.1	36.6	40.6	2,143	23,231
9	DAIRYLAND SEED	HiDF-3605RA	GLY,Bt,LL,CRW	105	64.3	10.7	29.8	6.8	43.3	33.9	41.3	2,133	22,863
12	DAIRYLAND SEED	DS-9508RA	GLY,Bt,LL,CRW	108	64.3	9.8	26.1	5.8	39.5	34.3	46.1	2,242	22,058
26	Viking	GT5781	GLY	104	59.8	10.1	25.1	5.1	44.6	35.9	40.5	2,118	21,563
18	Golden Harvest	G09E98	GLY,Bt,LL,CRW,	109	66.8	10.3	30.6	5.9	45.4	33.8	38.3	2,015	20,748
1	Anderson Seeds	5303	—	103	59.5	9.4	23.2	5.6	41.5	35.8	45.3	2,189	20,630
Mean					61.1	10.9	28.0	5.8	40.2	35.6	45.5	2,267	24,790
LSD (0.10)					0.9	0.5	1.4	0.3	1.4	0.8	1.6	54.5	1,517
C.V.					4.9	11.4	12.6	11.4	8.7	5.4	9.3	6.0	14.2

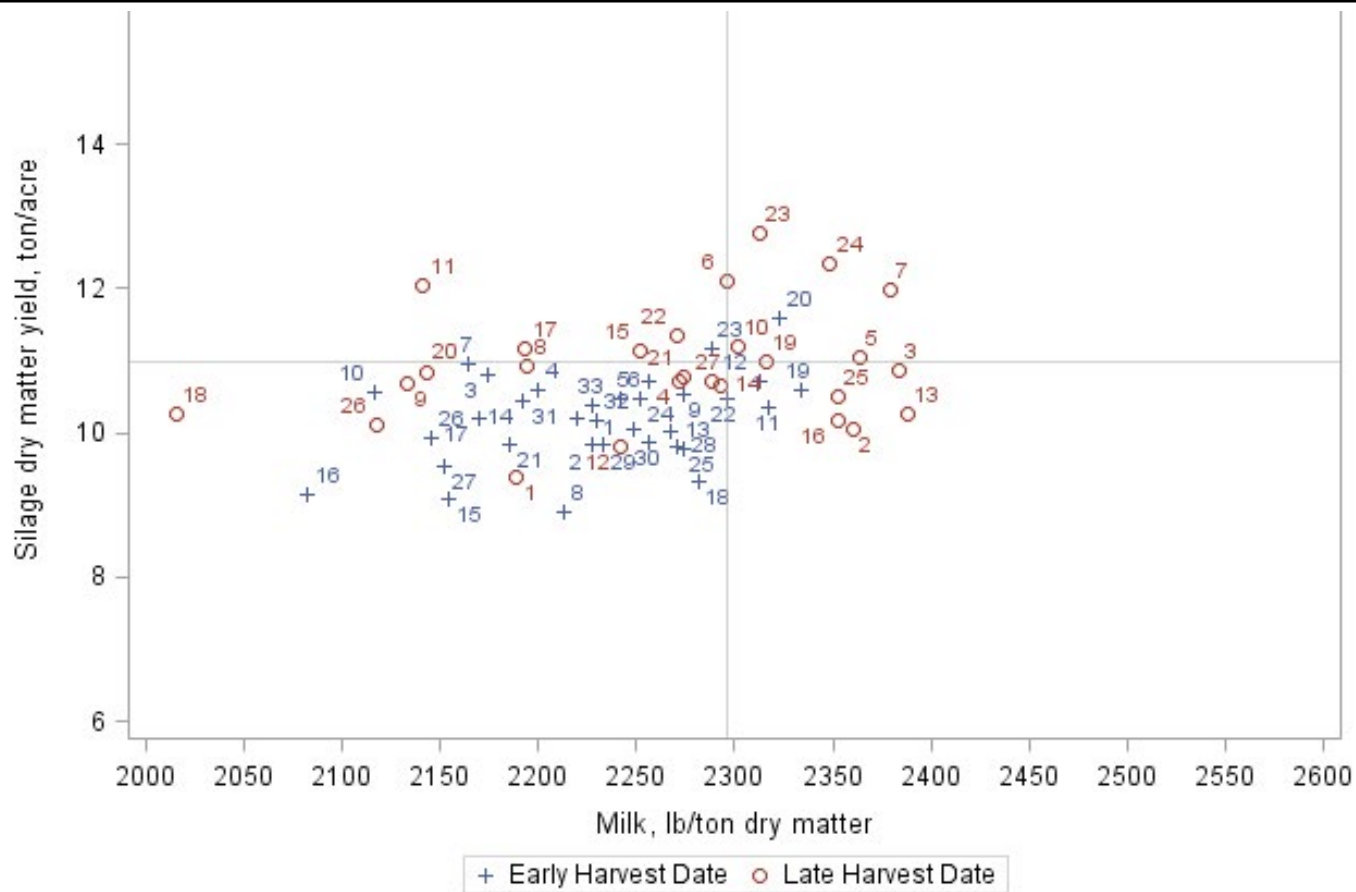
¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Figure 3. Relationship between silage dry matter yield and milk per ton for Central early and late corn hybrids planted at Hutchinson, MN (McLeod County) in 2016.



1. Relationship between silage dry matter yield and milk per ton at Hutchinson (McLeod County) in 2016. Silage dry matter yield values above the dashed line were among the highest in this trial at the 10% probability level.
2. Milk per ton values to the right of the dashed line were among the highest in this trial at the 10% probability level.
3. Entry numbers are shown for hybrids with silage dry matter yield and milk per ton values that were among the highest for both categories.

Table 7. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for Central early corn hybrids planted at Waseca, MN (Waseca County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
23	NuTech\G2 Genetics	5F-701	GLY,BT,LL	101	60.0	10.9	27.6	5.4	37.4	37.3	47.2	2,417	26,566
28	Viking	T51-01R	GLY	101	58.5	10.7	25.8	6.1	37.7	38.9	46.8	2,451	26,393
32	WENSMAN	W91018STX	—	101	61.3	10.4	26.8	5.3	36.1	38.1	49.4	2,472	25,793
16	Masters Choice	MCT 4211	GLY	92	54.3	10.1	22.2	5.6	34.4	38.7	52.0	2,538	25,662
4	DAIRYLAND SEED	HiDF-3197RA	GLY,Bt,LL,CRW	97	61.0	10.6	27.0	5.7	36.7	36.3	49.6	2,421	25,646
1	Anderson Seeds	6073	—	101	57.5	10.8	25.5	4.7	39.4	39.6	45.2	2,373	25,529
17	Masters Choice	MCT 4572	GLY, BT, LL, BL	95	61.0	10.4	26.6	6.3	38.5	39.0	47.2	2,431	25,205
24	NuTech\G2 Genetics	5H-502	GLY,BT,LL	102	62.8	10.3	27.7	6.0	38.0	37.9	47.1	2,438	25,146
5	DAIRYLAND SEED	HiDF-3099-9	GLY,Bt,LL,CRW	99	62.8	10.6	28.5	5.1	38.7	37.8	47.4	2,363	25,113
18	Masters Choice	MCT 4632	GLY, BT, LL, BL	96	59.0	10.3	25.3	5.8	36.5	37.9	49.5	2,428	24,985
22	NuTech\G2 Genetics	5F-196	GLY,BT,LL	96	58.0	11.1	26.4	5.8	39.5	36.0	47.4	2,313	24,982
7	DAIRYLAND SEED	HiDF-3702-9	GLY,Bt,LL,CRW	102	65.8	11.0	32.1	5.3	41.3	37.5	41.8	2,259	24,871
6	DAIRYLAND SEED	HiDF-3700RA	GLY,Bt,LL,CRW	100	63.0	10.5	28.4	5.3	41.2	39.0	43.1	2,371	24,863
19	Masters Choice	MCT 4884	GLY,Bt,LL,CRW	98	61.5	10.4	27.0	4.6	39.5	38.4	44.6	2,358	24,448
3	Channel	198-98STXRIB Brand Blend	GLY,Bt,LL,CRW	98	63.0	10.3	27.8	6.1	38.5	36.6	47.0	2,365	24,372
20	Masters Choice	MCT 5371	GLY	103	62.8	10.1	27.1	5.4	39.4	38.4	45.3	2,388	24,371
31	WENSMAN	W90994STXRIB	—	99	63.3	10.2	27.6	5.6	40.2	38.8	43.4	2,358	24,169
27	Viking	42-92N	—	92	57.8	9.9	23.3	4.7	37.1	40.2	49.2	2,421	24,018
21	NuTech	5N-800	GLY,Bt,LL,CRW	100	59.5	10.1	24.9	4.9	38.1	38.5	46.5	2,372	23,903
14	Latham	LH 5215	—	102	63.3	10.1	27.3	5.0	40.9	40.3	42.4	2,379	23,518
11	Gold Country Seed	102-88RSS	GLY,Bt,CRW	102	62.0	9.9	26.2	5.0	40.7	40.5	44.1	2,365	23,434
2	Channel	197-50STXRIB Brand Blend	GLY,Bt,LL,CRW	97	61.3	9.9	25.7	5.5	44.5	40.3	39.2	2,189	22,608
29	WENSMAN	W90962STXRIB	—	96	60.0	9.6	24.2	4.7	40.4	40.2	43.7	2,323	22,418
13	Latham	LH 4529	—	95	60.5	9.0	22.8	6.1	36.6	39.4	48.4	2,475	22,325
8	DEKALB	DKC46-79RIB	GLY,Bt,LL,CRW	96	60.5	9.3	23.3	5.9	38.3	38.7	46.7	2,395	22,254
33	WENSMAN	W9325STXRIB	—	102	64.3	9.6	26.5	5.3	40.9	37.4	44.2	2,298	22,054
26	Producers Hybrids	6318STXRIB	GLY,Bt,LL,CRW	103	62.3	9.3	24.8	6.0	40.9	38.8	44.4	2,334	21,784
25	Producers Hybrids	6108STXRIB	GLY,Bt,LL,CRW	101	64.3	9.3	25.9	5.0	41.6	39.9	42.9	2,328	21,744
15	Masters Choice	MCT 3891	GLY	89	52.0	9.3	19.3	5.3	41.8	39.5	43.8	2,334	21,578
12	Gold Country Seed	HDS76-26RSS	GLY,Bt,LL,CRW	102	66.3	9.0	27.4	4.4	46.4	39.4	36.3	2,159	21,577
30	WENSMAN	W9288STXRIB	—	98	62.5	8.9	23.7	5.6	39.3	38.9	46.7	2,411	21,493
9	DEKALB	DKC49-72RIB	GLY,Bt,LL,CRW	99	61.8	8.8	22.9	5.1	39.0	40.2	45.6	2,411	21,141
10	DEKALB	DKC51-38RIB	GLY,Bt,LL,CRW	101	65.0	8.4	24.3	5.4	40.6	39.7	41.9	2,346	19,761
	Mean				61.2	10.0	25.8	5.4	39.4	38.7	45.5	2,374	23,730
	LSD (0.10)				0.8	0.4	1.0	0.3	1.6	0.8	1.9	57.6	1,354
	C.V.				5.6	10.2	11.3	12.9	9.3	4.8	10.1	5.3	12.8

¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Table 8. Relative maturity (RM), whole-plant moisture (Moist), dry matter and silage yield, and quality traits for Central late corn hybrids planted at Waseca, MN (Waseca County) in 2016.

No.	Company	Entry	Traits ¹	RM	Moist, %	Yield, Tons/Acre ²		Quality (concentration), % ³				Milk Yield ⁴	
						DM	Silage	CP	NDF	NDFD	Starch	lb/Ton	lb/Acre
10	DAIRYLAND SEED	Exp-10707	GLY,Bt,LL,CRW	107	67.5	10.1	31.4	5.0	40.8	40.8	43.6	2,341	23,696
17	Golden Harvest	G07F23	GLY, BL,BT,LL,CRW	107	68.3	10.3	32.8	4.7	42.4	39.4	41.3	2,271	23,491
7	DAIRYLAND SEED	DS-9403	GLY,Bt,LL,CRW	103	65.3	9.9	28.5	4.2	40.6	38.1	44.5	2,277	22,839
4	Channel	205-19STXRIB Brand Blend	GLY,Bt,LL,CRW	105	65.8	9.7	28.2	5.0	39.5	38.5	45.7	2,327	22,610
22	NuTech\G2 Genetics	5F-504	GLY,BT,LL	104	66.5	9.6	28.5	4.9	40.4	40.8	44.8	2,324	22,241
18	Golden Harvest	G09E98	GLY,Bt,LL,CRW,	109	66.5	9.5	28.9	4.6	40.8	39.1	43.0	2,295	21,882
27	Viking	O.51-04GS	—	104	67.0	9.4	28.7	4.6	41.1	39.9	46.4	2,315	21,826
23	NuTech\G2 Genetics	5F-906	GLY,BT,LL	106	67.0	9.9	29.9	4.6	42.7	38.7	40.4	2,218	21,032
20	Latham	LH 5495	—	104	65.8	9.3	27.2	4.4	44.4	41.9	38.9	2,254	20,956
24	NuTech\G2 Genetics	5H-806	GLY,BT,LL	106	67.3	9.2	26.8	4.9	41.4	39.5	43.0	2,285	20,876
16	Gold Country Seed	108-91RSS	GLY,Bt,LL,CRW	108	67.5	9.0	27.5	4.4	40.1	39.5	44.3	2,327	20,849
9	DAIRYLAND SEED	HiDF-3605RA	GLY,Bt,LL,CRW	105	68.8	9.0	28.6	4.5	42.0	40.1	42.0	2,278	20,411
11	DAIRYLAND SEED	HiDF-3808RA	GLY,Bt,LL,CRW	108	70.3	9.2	31.0	4.6	43.8	40.1	39.3	2,227	20,347
19	Latham	LH 5335	—	103	65.8	8.8	25.8	4.3	41.1	39.7	43.9	2,300	20,303
8	DAIRYLAND SEED	HiDF-3103-9	GLY,Bt,LL,CRW	103	67.3	9.3	28.4	4.8	43.7	38.7	40.2	2,174	20,156
12	DAIRYLAND SEED	DS-9508RA	GLY,Bt,LL,CRW	108	67.8	8.6	26.6	4.5	40.4	39.9	44.0	2,338	19,980
21	NuTech	5N-406	GLY,BT,LL	106	67.3	8.8	26.7	4.3	42.6	40.6	41.6	2,255	19,922
15	Gold Country Seed	HDS76-76RSS	GLY,Bt,LL,CRW	107	71.0	8.8	30.0	4.8	43.8	40.0	40.0	2,188	19,226
3	Channel	203-01STXRIB Brand Blend	GLY,Bt,LL,CRW	103	68.8	8.1	25.8	5.2	42.2	40.0	41.9	2,256	18,288
1	Anderson Seeds	5303	—	103	67.8	8.3	26.0	4.9	43.4	39.5	41.5	2,200	18,279
26	Viking	GT5781	GLY	104	67.0	7.2	22.1	5.1	42.7	40.4	41.0	2,247	18,107
6	DAHLMAN	R52-352SSRIB	GLY,Bt,LL,CRW	104	64.8	9.3	26.2	4.2	43.0	39.5	43.2	2,170	17,532
25	Tracy Seeds	T104-13 3000GT	GLY,Bt,LL,CRW	104	69.8	7.8	25.5	4.8	43.2	40.7	41.0	2,232	17,369
5	DAHLMAN	R52-328SSRIB	GLY,Bt,LL,CRW	103	69.0	7.7	24.9	4.4	45.2	40.6	37.7	2,214	17,112
2	Anderson Seeds	533R	Roundup Ready 2	103	67.3	7.6	23.4	5.2	41.8	39.9	42.2	2,255	16,776
Mean					67.5	9.0	27.7	4.7	42.1	39.9	42.2	2,266	20,315
LSD (0.10)					1.0	0.4	1.2	0.3	1.6	0.6	1.8	49.5	1,145
C.V.					3.6	13.1	11.9	12.4	7.6	3.4	9.1	4.3	14.7

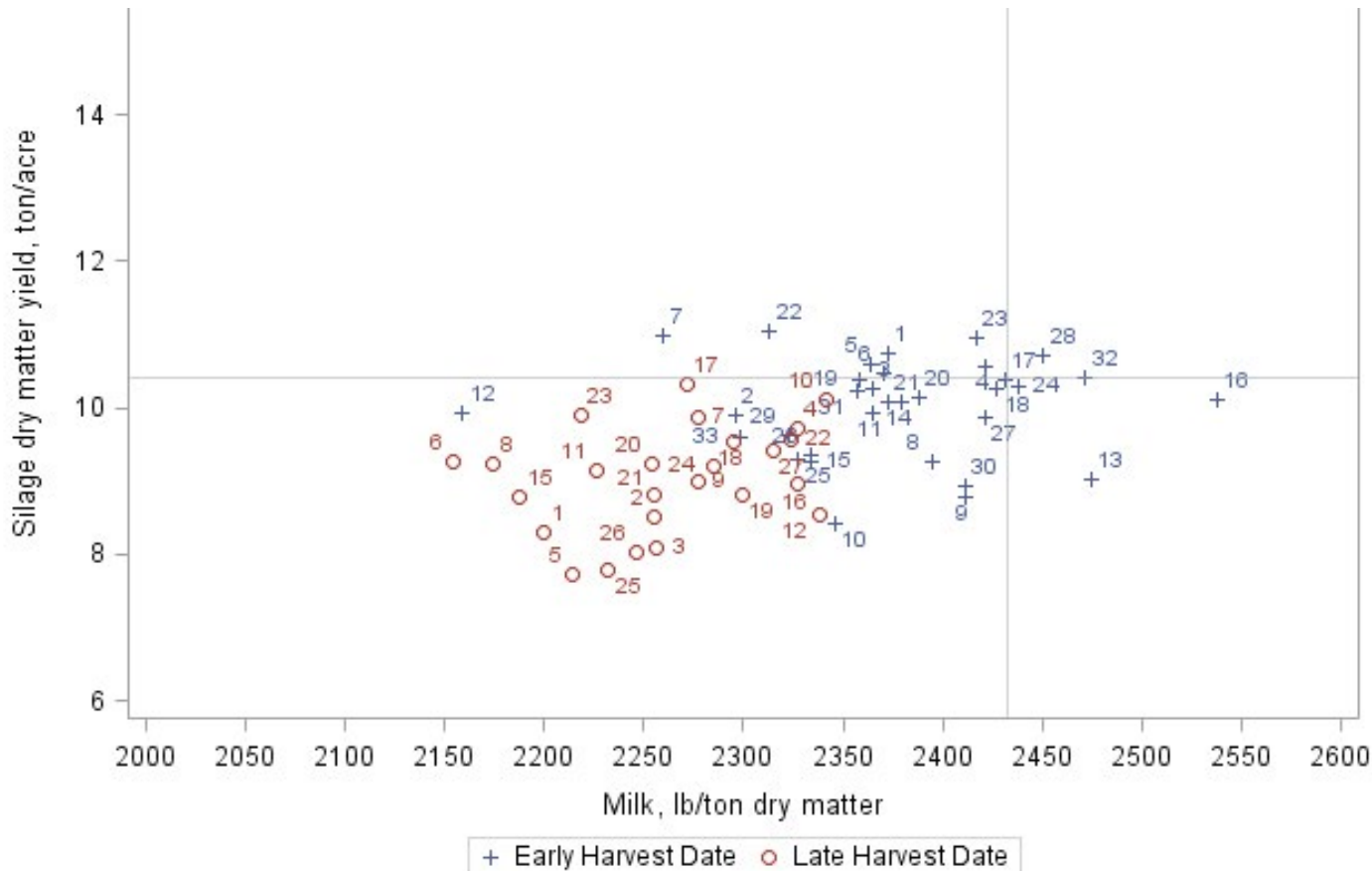
¹Bt, CRW, GLY, LL and Lf traits contain genes for European corn borer tolerance, corn rootworm tolerance, glyphosate herbicide tolerance, Liberty (glufosinate-ammonium) herbicide tolerance and leafy trait, respectively.

²DM yield is whole-plant corn yield at 100% dry matter; Silage yield is whole-plant corn yield at harvest moisture.

³Quality concentration expressed as a % of DM, except NDFD which is expressed as a % of NDF. Refer to Results Provided text for additional information.

⁴Milk production was estimated using spreadsheet MILK2006 developed at the University of Wisconsin. Refer to Results Provided text for additional information.

Figure 4. Relationship between silage dry matter yield and milk per ton for Central early and late corn hybrids planted at Waseca, MN (Waseca County) in 2016.



1. Relationship between silage dry matter yield and milk per ton at Waseca (Waseca County) in 2016. Silage dry matter yield values above the dashed line were among the highest in this trial at the 10% probability level.
2. Milk per ton values to the right of the dashed line were among the highest in this trial at the 10% probability level.
3. Entry numbers are shown for hybrids with silage dry matter yield and milk per ton values that were among the highest for both categories.

SECTION

B

CORN HERBICIDE EVALUATION

Evaluation of DiFlexx and DiFlexx Duo Herbicide Formulations for Weed Control and Crop Response in Field Corn at Rochester, Minnesota in 2016

Breitenbach, Fritz R., Lisa M. Behnken, Jared Liebenow and Annette Kylo

The objective of this trial was to evaluate DiFlexx and DiFlexx Duo herbicide formulations for weed control and crop response in field corn in southeastern Minnesota. The research site was a Lawler loam series with a pH of 6.4, O.M. 2.4%, and soil test P and K levels of 35 ppm and 165 ppm, respectively. Fertilizer was applied in the fall on November 5, 2015, at a rate of 0-46-180-0 lbs/A. Spring fertilizer was broadcast on April 16, 2016 ahead of planting at a rate of 115-0-0-24 (N-P-K-S). Additional nitrogen was applied on May 20, 2016 (25 lbs/A) and on June 10, 2016 (36 lbs/A). The field was disked and field cultivated once prior to planting. The previous crop was soybean. The corn hybrid, DeKalb Brand DKC49-72RIB, was planted April 25, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 32,000 seeds per acre. A randomized complete block design was used with three replications. Preemergence (PRE) and postemergence (POST) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI-11002 and TTIJ60-11002 spray tips, based on herbicide (systemic or contact). Evaluations of the plots were taken May 19, 24, 31, June 8, 13, and September 13. The center two rows of each plot were machine harvested on October 19, 2016. Application dates, environmental conditions and weed stages are reported in Table 1. Performance ratings for giant ragweed, common lambsquarters, common waterhemp and grass control can be found in Tables 2 through 5, respectively. No significant crop response was observed (data not shown).

DISCUSSION

DiFlexx is a dicamba-based herbicide for broadleaf control in corn. It is a combination of dicamba plus Crop Safety Innovation (CSI™). DiFlexx Duo is a premix of dicamba, tembotrione and CSI™. These herbicides may be applied postemergence up to V6 corn. In this trial, the PRE herbicide Zidua did not provide adequate control of giant ragweed, only 17-20 %, Table 2. The PRE Capreno applied at either 3.67 fl oz/a or 5.0 fl oz/a provided very good giant ragweed control, 81-85% and 82-89%, respectively, Table 2. PRE Capreno at 3.67 fl oz/a extended the window for post weed control up to 10 days, and at 5.0 fl oz/a up to 14 days. (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stage, environmental conditions

Date	4/26	5/23	6/2	6/6
Treatment	PRE (A)	POST I (B)	POST II (C)	POST III (D)
Temperature (F)				
Air	48	68	62	6
Soil	58.1	65.0	64.1	63.5
Relative Humidity (%)	82	48	69	52
Wind (mph)	16	20	10	15
Soil Moisture	Normal	Normal	Normal	Normal
Corn				
Stage		V3	V5	V5-V6
Height (inch)	0.0	3.5	10.0	15.0
Giant Ragweed				
Weed Density (ft ²)			16	16
Height (inch)	0.0	2.4	13.8	6.3
Common Waterhemp				
Weed Density (ft ²)			12.5	12.5
Height (inch)	0.0	0.2	2.8	1.9
Common Lambsquarters				
Weed Density (ft ²)			8.0	8.0
Height (inch)	0.0	0.9	3.1	2.6
Grass				
Weed Density (ft ²)			14.0	
Height (inch)	0.0	0.5	3.3	2.3
Rainfall after each application (inch)				
Week 1	0.77	1.91	0.9	0.3
Week 2	0.0	1.89	3.75	2.38
Week 3	1.43	1.37	0.3	1.01

Table 2. Evaluation of DiFlexx and DiFlexx Duo herbicides for giant ragweed control in field corn in Rochester, MN, 2016.											
Pest Code	AMBTR									YIELD @15%	
	Giant ragweed										
	Rating Date	Rate	Appl	May-19	May-24	May-31	Jun-8	Jun-13	Sep-13	BU/A	
Treatment	Rate	Appl	Percent Control (%)								
10 UNTREATED CHECK			0 c	0 e	0 g	0 h	0 f	0 g	6	h	
A/C = PRE 4/26/16 / POST II 6/2/16 (MIPOWE (V5) – 3 to 4 inch weeds)											
1 SOA 15 / 10, 27			17 b	18 c	17 f	94 abc	96 abc	97 bc	171	fg	
ZIDUA	2.0	oz wt/a	A								
LIBERTY 280	29	fl oz/a	C								
LAUDIS	3.0	fl oz/a	C								
Ammonium Sulfate	8.5	lb/100 gal	C								
2 SOA 15 / 10, 4			20 b	20 c	20 f	95 ab	97 ab	97 abc	184	b-f	
ZIDUA	2.0	oz wt/a	A								
LIBERTY 280	29	fl oz/a	C								
DIFLEXX	16	fl oz/a	C								
Ammonium Sulfate	8.5	lb/100 gal	C								
3 SOA 15, 10, 4, 27			18 b	20 c	20 f	95 ab	97 ab	97 abc	180	def	
ZIDUA	2.0	oz wt/a	A								
LIBERTY 280	29	fl oz/a	C								
DIFLEXX DUO	24	fl oz/a	C								
Ammonium Sulfate	8.5	lb/100 gal	C								
4 SOA 15 / 10, 5			20 b	20 c	17 f	87 fg	96 abc	97 bc	174	efg	
ZIDUA	2.0	oz wt/a	A								
LIBERTY 280	29	fl oz/a	C								
ATRAZINE	16	fl oz/a	C								
Ammonium Sulfate	8.5	lb/100 gal	C								
8 SOA 2, 27 / 10, 27			82 a	86 a	81 e	95 ab	98 a	99 a	187	a-e	
CAPRENO	3.67	fl oz/a	A								
LIBERTY 280	29	fl oz/a	C								
LAUDIS	3.0	fl oz/a	C								
Ammonium Sulfate	8.5	lb/100 gal	C								
9 SOA 2,27 / 10, 4, 27			82 a	85 a	81 e	97 a	98 a	99 ab	186	a-e	
CAPRENO	3.67	fl oz/a	A								
LIBERTY 280	29	fl oz/a	C								
DIFLEXX DUO	24	fl oz/a	C								
Ammonium Sulfate	8.5	lb/100 gal	C								
A/D = PRE 4/26/16 / POST III 6/6/16 (MIPOWE (V5-V6) 3 to 4 inch weeds)											
5 SOA 2, 27 / 10, 4			84 a	87 a	89 cd	91 cde	98 a	99 ab	199	a	
CAPRENO	5	fl oz/a	A								
LIBERTY 280	22	fl oz/a	D								
DIFLEXX	16	fl oz/a	D								
Ammonium Sulfate	8.5	lb/100 gal	D								
6 SOA 2, 27 / 10, 4			84 a	86 a	88 d	88 efg	98 ab	98 abc	195	abc	
CAPRENO	5	fl oz/a	A								
LIBERTY 280	29	fl oz/a	D								
DIFLEXX	16	fl oz/a	D								
Ammonium Sulfate	8.5	lb/100 gal	D								
7 SOA 2, 27 / 10, 5			82 a	84 a	86 d	87 g	96 abc	96 c	191	a-d	
CAPRENO	5	fl oz/a	A								
LIBERTY 280	29	fl oz/a	D								
ATRAZINE	16	fl oz/a	D								
Ammonium Sulfate	8.5	lb/100 gal	D								

Table 2 (continued). Evaluation of DiFlexx and DiFlexx Duo herbicides for giant ragweed control in field corn in Rochester, MN, 2016.

Pest Code	AMBTR											YIELD @15%				
	Giant ragweed															
Pest Name	May-19	May-24	May-31	Jun-8	Jun-13	Sep-13						BU/A				
Rating Date	Percent Control (%)															
Treatment	Rate	Appl														
B = POST I 5/23/16 (EAPOWE (V3) – 2 to 3 inch weeds)																
11	SOA 2,27, 9, 4		0	c	30	b	96	ab	95	ab	96	bc	96c	c	195	abc
	CAPRENO	3.0 fl oz/a	B													
	ROUNDUP	32 fl oz/a	B													
	POWERMAX	8 fl oz/a	B													
	DIFLEXX	8 fl oz/a	B													
	Ammonium Sulfate	8.5 lb/100 gal	B													
12	SOA 9, 4, 27, 15		0	c	30	b	97	a	94	ab	94	c	94	d	191	a-d
	ROUNDUP	32 fl oz/a	B													
	POWERMAX	24 fl oz/a	B													
	DIFLEX DUO	24 fl oz/a	B													
	ZIDUA	2.0 oz wt/a	B													
	Ammonium Sulfate	8.5 lb/100 gal	B													
13	SOA 9, 2, 27		0	c	30	b	96	ab	93	bcd	92	d	91	e	182	c-f
	ROUNDUP	32 fl oz/a	B													
	POWERMAX	24 fl oz/a	B													
	DIFLEX DUO	24 fl oz/a	B													
	Ammonium Sulfate	8.5 lb/100 gal	B													
14	SOA 15, 27, 9		0	c	10	d	95	ab	90	def	87	e	85	f	178	d-g
	ARMEZON PRO	18 fl oz/a	B													
	ROUNDUP	32 fl oz/a	B													
	POWERMAX	8.5 lb/100 gal	B													
	Ammonium Sulfate	8.5 lb/100 gal	B													
15	SOA 27, 4, 19, 9		0	c	30	b	93	bc	86	g	86	e	86f	f	163	g
	ARMEZON	0.75 fl oz/a	B													
	STATUS	3 oz wt/a	B													
	ROUNDUP	32 fl oz/a	B													
	POWERMAX	8.5 lb/100 gal	B													
	Ammonium Sulfate	8.5 lb/100 gal	B													
16	SOA 9, 15, 27, 2, 4		0	c	30	b	96	ab	96	ab	96	abc	96	c	197	ab
	HALEX GT	3.75 pt/a	B													
	NORTHSTAR	2.5 oz wt/a	B													
	NIS	0.25 % v/v	B													
	Ammonium Sulfate	8.5 lb/100 gal	B													
LSD P=.10			4		4		4		3		2		2		15.0	

Means followed by same letter do not significantly differ.

Table 3 (continued). Evaluation of DiFlexx and DiFlexx Duo herbicides for common lambsquarters control in field corn in Rochester, MN, 2016.											
Pest Code Pest Name Rating Date			CHEAL							YIELD	
			Common Lambsquarters							@15%	
Treatment			Rate	Appl	May-19	May-24	May-31	Jun-8	Jun-13	Sep-13	BU/A
			Percent Control (%)								
B = POST I 5/23/16 (EAPOWE (V3) – 2 to 3 inch weeds)											
11	SOA 2,27, 9, 4				0 c	30 d	99 ab	97 ab	98 ab	98 a	195 abc
	CAPRENO	3.0	fl oz/a	B							
	ROUNDUP										
	POWERMAX	32	fl oz/a	B							
	DIFLEXX	8	fl oz/a	B							
	Ammonium Sulfate	8.5	lb/100 gal	B							
12	SOA 9, 4, 27, 15				0 c	30 d	99 a	99 a	99 ab	98 ab	191 a-d
	ROUNDUP										
	POWERMAX	32	fl oz/a	B							
	DIFLEX DUO	24	fl oz/a	B							
	ZIDUA	2.0	oz wt/a	B							
	Ammonium Sulfate	8.5	lb/100 gal	B							
13	SOA 9, 2, 27				0 c	30 d	99 ab	97 ab	95 c	96 bc	182 c-f
	ROUNDUP										
	POWERMAX	32	fl oz/a	B							
	DIFLEX DUO	24	fl oz/a	B							
	Ammonium Sulfate	8.5	lb/100 gal	B							
14	SOA 15, 27, 9				0 c	10 e	98 abc	96 b	90 d	91 d	178 d-g
	ARMEZON PRO	18	fl oz/a	B							
	ROUNDUP										
	POWERMAX	32	fl oz/a	B							
	Ammonium Sulfate	8.5	lb/100 gal	B							
15	SOA 27, 4, 19, 9				0 c	30 d	97 de	92 c	89 d	90 d	163 g
	ARMEZON	0.75	fl oz/a	B							
	STATUS	3	oz wt/a	B							
	ROUNDUP										
	POWERMAX	32	fl oz/a	B							
	Ammonium Sulfate	8.5	lb/100 gal	B							
16	SOA 9, 15, 27, 2, 4				0 c	30 d	99 a	99 a	98 ab	98 a	197 ab
	HALEX GT	3.75	pt/a	B							
	NORTHSTAR	2.5	oz wt/a	B							
	NIS	0.25	% v/v	B							
	Ammonium Sulfate	8.5	lb/100 gal	B							
LSD P=.10					1	2	1	2	2	2	15.0

Means followed by same letter do not significantly differ.

Table 4. Evaluation of DiFlexx and DiFlexx Duo herbicides for common waterhemp control in field corn in Rochester, MN, 2016.

Pest Code	AMATA					YIELD		
	Common waterhemp							
Pest Name						@15%		
Rating Date	May-24	May-31	Jun-8	Jun-13	Sep-13	BU/A		
Treatment	Rate	Appl	Percent Control (%)					
10 UNTREATED CHECK			0 e	0 c	0 d	0 e	0 d	6 h
A/C = PRE 4/26/16 / POST II 6/2/16 (MIPOWE (V5) – 3 to 4 inch weeds)								
1 SOA 15 / 10, 27			99 a	98 a	99 a	99 ab	99a a	171 fg
ZIDUA	2.0	oz wt/a A						
LIBERTY 280	29	fl oz/a C						
LAUDIS	3.0	fl oz/a C						
Ammonium Sulfate	8.5	lb/100 gal C						
2 SOA 15 / 10, 4			99 a	97 a	99 a	99 a	97 a	184 b-f
ZIDUA	2.0	oz wt/a A						
LIBERTY 280	29	fl oz/a C						
DIFLEXX	16	fl oz/a C						
Ammonium Sulfate	8.5	lb/100 gal C						
3 SOA 15, 10, 4, 27			99 a	99 a	99 a	98 ab	97 a	180 def
ZIDUA	2.0	oz wt/a A						
LIBERTY 280	29	fl oz/a C						
DIFLEXX DUO	24	fl oz/a C						
Ammonium Sulfate	8.5	lb/100 gal C						
4 SOA 15 / 10, 5			99 a	98 a	99 a	98 ab	97 a	174 efg
ZIDUA	2.0	oz wt/a A						
LIBERTY 280	29	fl oz/a C						
ATRAZINE	16	fl oz/a C						
Ammonium Sulfate	8.5	lb/100 gal C						
8 SOA 2, 27 / 10, 27			99 a	98 a	99 a	99 a	97 a	187 a-e
CAPRENO	3.67	fl oz/a A						
LIBERTY 280	29	fl oz/a C						
LAUDIS	3.0	fl oz/a C						
Ammonium Sulfate	8.5	lb/100 gal C						
9 SOA 2,27 / 10, 4, 27			98 b	98 a	99 a	99 a	97 a	186 a-e
CAPRENO	3.67	fl oz/a A						
LIBERTY 280	29	fl oz/a C						
DIFLEXX DUO	24	fl oz/a C						
Ammonium Sulfate	8.5	lb/100 gal C						
A/D = PRE 4/26/16 / POST III 6/6/16 (MIPOWE (V5-V6) 3 to 4 inch weeds)								
5 SOA 2, 27 / 10, 4			99 a	99 a	99 a	99 ab	98 a	199 a
CAPRENO	5	fl oz/a A						
LIBERTY 280	22	fl oz/a D						
DIFLEXX	16	fl oz/a D						
Ammonium Sulfate	8.5	lb/100 gal D						
6 SOA 2, 27 / 10, 4			99 a	99 a	99 a	99 a	97 a	195 abc
CAPRENO	5	fl oz/a A						
LIBERTY 280	29	fl oz/a D						
DIFLEXX	16	fl oz/a D						
Ammonium Sulfate	8.5	lb/100 gal D						
7 SOA 2, 27 / 10, 5			99 a	99 a	99 a	99 ab	97 a	191 a-d
CAPRENO	5	fl oz/a A						
LIBERTY 280	29	fl oz/a D						
ATRAZINE	16	fl oz/a D						
Ammonium Sulfate	8.5	lb/100 gal D						

Table 4 (continued). Evaluation of DiFlexx and DiFlexx Duo herbicides for common waterhemp control in field corn in Rochester, MN, 2016.

Pest Code	AMATA					YIELD		
	Common waterhemp							
Pest Name						@15%		
Rating Date	May-24	May-31	Jun-8	Jun-13	Sep-13			
Treatment	Rate	Appl	Percent Control (%)			BU/A		
B = POST I 5/23/16 (EAPOWE (V3) – 2 to 3 inch weeds)								
11 SOA 2,27, 9, 4			30 c	98 a	95 b	85 c	87 b	195 abc
CAPRENO	3.0	fl oz/a	B					
ROUNDUP								
POWERMAX	32	fl oz/a	B					
DIFLEXX	8	fl oz/a	B					
Ammonium Sulfate	8.5	lb/100 gal	B					
12 SOA 9, 4, 27, 15			30 c	99 a	99 a	99 a	98 a	191 a-d
ROUNDUP								
POWERMAX	32	fl oz/a	B					
DIFLEX DUO	24	fl oz/a	B					
ZIDUA	2.0	oz wt/a	B					
Ammonium Sulfate	8.5	lb/100 gal	B					
13 SOA 9, 2, 27			30 c	97 a	93 c	83 c	85 b	182 c-f
ROUNDUP								
POWERMAX	32	fl oz/a	B					
DIFLEX DUO	24	fl oz/a	B					
Ammonium Sulfate	8.5	lb/100 gal	B					
14 SOA 15, 27, 9			10 d	99 a	98 a	96 b	97 s	178 d-g
ARMEZON PRO	18	fl oz/a	B					
ROUNDUP								
POWERMAX	32	fl oz/a	B					
Ammonium Sulfate	8.5	lb/100 gal	B					
15 SOA 27, 4, 19, 9			30 c	91 b	91 c	79 d	81 c	163 g
ARMEZON	0.75	fl oz/a	B					
STATUS	3	oz wt/a	B					
ROUNDUP								
POWERMAX	32	fl oz/a	B					
Ammonium Sulfate	8.5	lb/100 gal	B					
16 SOA 9, 15, 27, 2, 4			30 c	99 a	99 a	98 ab	97 a	197 ab
HALEX GT	3.75	pt/a	B					
NORTHSTAR	2.5	oz wt/a	B					
NIS	0.25	% v/v	B					
Ammonium Sulfate	8.5	lb/100 gal	B					
LSD P=.10			0.2	4	2	2	3	15.0

Means followed by same letter do not significantly differ.

Table 5 (continued). Evaluation of DiFlexx and DiFlexx Duo herbicides for grass control in field corn in Rochester, Minnesota, 2016.

Pest Code	GRASS							YIELD @15%								
	Grangea sp.															
Pest Name																
Rating Date	May-19	May-24	May-31	Jun-8	Jun-13	Sep-13										
Treatment	Rate	Appl	Percent Control (%)					BU/A								
B = POST I 5/23/16 (EAPOWE (V3) – 2 to 3 inch weeds)																
11 SOA 2,27, 9, 4			0	b	30	b	96	abc	93	b	92	b	89	b	195	abc
CAPRENO	3.0	fl oz/a	B													
ROUNDUP	32	fl oz/a	B													
POWERMAX																
DIFLEXX	8	fl oz/a	B													
Ammonium Sulfate	8.5	lb/100 gal	B													
12 SOA 9, 4, 27, 15			0	b	30	b	98	ab	99	a	98	a	98	a	191	a-d
ROUNDUP	32	fl oz/a	B													
POWERMAX																
DIFLEX DUO	24	fl oz/a	B													
ZIDUA	2.0	oz wt/a	B													
Ammonium Sulfate	8.5	lb/100 gal	B													
13 SOA 9, 2, 27			0	b	30	b	95	c	91	b	82	d	83	c	182	c-f
ROUNDUP	32	fl oz/a	B													
POWERMAX																
DIFLEX DUO	24	fl oz/a	B													
Ammonium Sulfate	8.5	lb/100 gal	B													
14 SOA 15, 27, 9			0	b	10	c	96	bc	99	a	99	a	98	a	178	d-g
ARMEZON PRO	18	fl oz/a	B													
ROUNDUP	32	fl oz/a	B													
POWERMAX																
Ammonium Sulfate	8.5	lb/100 gal	B													
15 SOA 27, 4, 19, 9			0	b	30	b	97	abc	93	b	85	c	86	bc	163	g
ARMEZON	0.75	fl oz/a	B													
STATUS	3	oz wt/a	B													
ROUNDUP	32	fl oz/a	B													
POWERMAX																
Ammonium Sulfate	8.5	lb/100 gal	B													
16 SOA 9, 15, 27, 2, 4			0	b	30	b	98	ab	99	a	97	a	95	a	197	ab
HALEX GT	3.75	pt/a	B													
NORTHSTAR	2.5	oz wt/a	B													
NIS	0.25	% v/v	B													
Ammonium Sulfate	8.5	lb/100 gal	B													
LSD P=10							3		2		4		4		15.0	

Means followed by same letter do not significantly differ.

2016 Evaluation of the Weed Spectrum and Duration of Control Achieved with Preemergence Applications of Acuron and Acuron Flexi in Field Corn at Rochester, MN.

Breitenbach, Fritz R., Lisa M. Behnken, Annette Kylo, and Reed Searcy

The objective of this trial was to evaluate the duration and spectrum of weed control achieved with preemergence applications of Acuron and Acuron Flexi compared to other standard preemergence programs in field corn in southeastern Minnesota. The research site was a Lawler loam series with a pH of 6.4, O.M. of 2.4%, and soil test P and K levels of 35 ppm and 165 ppm, respectively. Fertilizer was applied in the fall on November 5, 2015, at a rate of 0-46-180-0 lbs/A. In the spring, fertilizer was broadcast on April 16, 2016 ahead of planting at a rate of 115-0-0-24 (N-P-K-S) lbs/A. Additional nitrogen was applied on May (25 lbs/A) and on June (36 lbs/A). In the spring the field was disked and field cultivated once prior to planting. The previous crop was soybean. The corn hybrid, DEKALB DKC49-72RIB, was planted on April 25, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 32,000 seeds per acre. A randomized complete block design was used with four replications. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 40 psi using T-JET TTI 110015 spray tips. Evaluations of the plot were taken on May 19, 24, 31, June 6, 13, and September 13. The center two rows of each plot were machine harvested on October 19, 2016. Application dates, environmental conditions, and weed stages are in Table 1. Performance ratings for giant ragweed, common lambsquarter, common waterhemp, and grass control can be found in Tables 2 through 5, respectively. Crop injury was not observed.

SUMMARY

Acuron and Acuron Flexi performed very well in these trials. Over 90% control of giant ragweed, common lambsquarters, common waterhemp and grass was achieved through mid-September (last rating) with both herbicides. This is consistent with weed control evaluations of these herbicides in 2013, 2014 and 2015. University of Minnesota Extension Regional Office, Rochester.

Table 1. Application timing, plant stage, environmental conditions

Date	4/26
Treatment	PRE (A)
Temperature (F)	
Air	48.0
Soil	58.1
Relative Humidity (%)	82
Wind (mph)	East@16
Soil Moisture	Normal
Giant Ragweed	
Weed density (ft ²)	14.0
Common Lambsquarter	
Weed density (ft ²)	11.5
Common Waterhemp	
Weed density (ft ²)	28.5
Grass	
Weed density (ft ²)	13.0
Rainfall after each application (inch)	
Week 1	0.77
Week 2	0.87
Week 3	0.58

Table 2. Giant ragweed control with preemergence herbicides in field corn in Rochester, MN, 2016.

Pest Code				AMBTR						YIELD
Pest Name				Giant ragweed						
Rating Date				May-19	May-24	May-31	Jun-6	Jun-13	Sep-13	@15%
Trt	Treatment	Rate	Appl	(% Control)						(Bu/A)
1	UNTREATED CHECK			0 g	0 f	0 d	0 e	0	0 d	2 d
PRE 4/26/16										
2	SOA 15, 27 ACURON FLEXI	2.25 qt/a	A	85 de	93 bc	95 a	95 a	94 a	95 a	178 a
3	SOA 5,15, 27 ACURON	2.5 qt/a	A	92 bc	95 ab	96 a	97 a	96 a	97 a	178 a
4	SOA 4, 15, 27 RESICORE	2.5 qt/a	A	96 ab	97 a	96 a	96 a	95 a	94 a	167 ab
5	SOA 2, 27 CORVUS	5.6 fl oz/a	A	81 ef	90 cd	95 a	91 b	89 b	87 b	121 abc
6	SOA 2, 4, 15 SURESTART II	2.5 pt/a	A	89 cd	89 d	90 b	82 cd	78 cd	75 c	79 c
7	SOA 2, 27 INSTIGATE	5.25 oz wt/a	A	77 f	83 e	83 c	79 d	75 d	77 c	88 c
8	SOA 14, 15 VERDICT	14 fl oz/a	A	97 a	93 bcd	90 b	84 c	81 c	81 bc	111 bc
LSD P=.10				5	3	3	4	5	7	58.2

Table 3. Common lambsquarters control with preemergence herbicide in field corn in Rochester, MN, 2016.

Pest Code				CHEAL						YIELD
Pest Name				Common lambsquarters						
Rating Date				May 19	May 24	May 31	June 6	June 13	Sep-13	@15%
Trt	Treatment	Rate	Appl	(% Control)						(Bu/A)
1	UNTREATED CHECK			0 b	0 c	0 b	0 c	0 c	0 c	2 d
PRE 4/26/16										
2	SOA 15,27 ACURON FLEXI	2.25 qt/a	A	99 a	99 a	99 a	99 a	99 a	99 a	178 a
3	SOA 5,15, 27 ACURON	2.5 qt/a	A	99 a	99 a	99 a	99 a	99 a	99 a	178 a
4	SOA 4,15,27 REICORE	2.5 qt/a	A	99 a	99 a	99 a	99 a	99 a	99 a	167 ab
5	SOA 2,27 CORVUS	5.6 fl oz/a	A	99 a	99 a	99 a	99 a	99 a	99 a	121 abc
6	SOA 2, 4,15 SURESTART II	2.5 pt/a	A	99 a	99 a	99 a	99 b	98 ab	98 ab	79 c
7	SOA 2,27 INSTIGATE	5.25 oz wt/a	A	99 a	99 a	99 a	99 a	99 a	99 a	88 c
8	SOA 14,15 VERDICT	14 fl oz/a	A	99 a	99 b	99 a	99 a	97 b	97 b	111 bc
LSD P=.10 for weed ratings					0.3		0.3	1	1	58.2

Table 4. Common waterhemp control with preemergence herbicides in field corn in Rochester, MN, 2016.

Pest Code				AMATA						YIELD @15%			
				Common waterhemp									
Rating Date				May 24	May 31	June 6	June 13	Sep-13					
Trt	Treatment	Rate	Appl	(% Control)						BU/A			
1	UNTREATED CHECK			0	b	0	c	0	b	0	c	2	d
PRE 4/26/16													
2	SOA 15,27 ACURON FLEXI	2.25 qt/a	A	99	a	99	a	99	a	99	a	178	a
3	SOA 5,15, 27 ACURON	2.5 qt/a	A	99	a	99	a	99	a	99	a	178	a
4	SOA 4,15,27 REICORE	2.5 qt/a	A	99	a	99	a	99	a	98	ab	167	ab
5	SOA 2,27 CORVUS	5.6 fl oz/a	A	99	a	99	a	99	a	99	a	97b	b
6	SOA 2, 4,15 SURESTART II	2.5 pt/a	A	99	a	99	a	99	a	99	a	79	c
7	SOA 2,27 INSTIGATE	5.25 oz wt/a	A	99	a	99	a	99	a	98	a	99	ab
8	SOA 14,15 VERDICT	14 fl oz/a	A	99	a	99	b	99	a	98	a	98	ab
LSD P=.10 for weed ratings				0.3		1.0		1.7		58.2			

Table 5. Grass control with preemergence herbicides in field corn in Rochester, MN, 2016.

Pest Code				GRASS						YIELD @15%					
				May 19	May 24	May 31	June 6	June 13	Sept 13						
Rating Date				(% Control)						BU/A					
Trt	Treatment	Rate	Appl												
1	UNTREATED CHECK			0	b	0	b	0	b	0	c	0	c	2	d
PRE 4/26/16															
2	SOA 15,27 ACURON FLEXI	2.25 qt/a	A	99	a	99	a	99	a	99	a	99	a	178	a
3	SOA 5,15, 27 ACURON	2.5 qt/a	A	99	a	99	a	99	a	99	a	99	a	178	a
4	SOA 4,15,27 REICORE	2.5 qt/a	A	99	a	99	a	99	a	99	a	97	ab	167	ab
5	SOA 2,27 CORVUS	5.6 fl oz/a	A	99	a	99	a	99	a	99	a	98	a	121	abc
6	SOA 2, 4,15 SURESTART II	2.5 pt/a	A	99	a	99	a	99	a	99	a	99	a	79	c
7	SOA 2,27 INSTIGATE	5.25 oz wt/a	A	99	a	99	a	99	a	98	b	93	b	95	b
8	SOA 14,15 VERDICT	14 fl oz/a	A	99	a	99	a	99	a	99	a	99	a	111	bc
LSD P=.10 for weed ratings						1		3		3		58.2			

Comparisons of PRE/POST Weed Control Programs in Field Corn at Rochester, MN in 2016

Behnken, Lisa M., Fritz R. Breitenbach, Reed Searcy, and Jared Liebenow

The objective of this trial was to evaluate PRE/POST programs for weed control and crop response in field corn in southeastern Minnesota. The research site was a Lawler loam series with a pH of 6.4, O.M. of 2.4%, and soil test P and K levels of 35 ppm and 165 ppm, respectively. Fertilizer was applied in the fall on November 5, 2015, at a rate of 0-46-180-0 lbs/A. Spring fertilizer was broadcast ahead of planting on April 16, 2016 at a rate of 115-0-0-25 (N-P-K-S). The field was spring disked and field cultivated once prior to planting. The previous crop was soybean. The corn hybrid, DEKALB DKC49-72RIB, was planted April 25, 2016 at a depth of 1.5 inches in 30 inch rows at a rate of 32,000 seeds per acre. A randomized complete block design was used with three replications. Preemergence (PRE) and postemergence (POST) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI 11002 spray tips. Evaluations of the plots were taken May 19, 24, 31, June 6, 13 and September 13, 2016. The center two rows of each plot were machine harvested on October 19, 2016. Application dates, environmental conditions and weed stages can be found in Table 1. Performance ratings for control of giant ragweed, common lambsquarter, common waterhemp, and grass, plus crop response ratings are found in Tables 2 through 6, respectively. (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stage, environmental conditions

Date	4/26	5/20	5/24	6/2
Treatment	PRE (A)	POST I (B)	POST II (C)	POST III (D)
Temperature (F)				
Air	49	68	75	64
Soil	58.3	71.0	72.6	64.1
Relative Humidity (%)	80	38	68	64
Wind (mph)	16	15	9	8
Soil Moisture	Normal	Normal	Normal	Normal
Corn				
Stage		2-collar	3-collar	5-collar
Height (inch)		2.8	4.3	10.8
Giant Ragweed				
Weed Density (ft ²)				21
Height (inch)		1.3	2.0	5.0
Common Waterhemp				
Weed Density (ft ²)				9.0
Height (inch)		0.4	0.4	1.7
Common Lambsquarter				
Weed Density (ft ²)				5
Height (inch)		0.8	1.3	1.6
Grass				
Weed Density (ft ²)				49
Height (inch)		0.3	0.4	2.3
Rainfall after each application (inch)				
Week 1	0.77	2.12	2.79	0.9
Week 2	0.00	0.99	1.22	3.75
Week 3	1.43	2.27	2.66	0.30

Table 2. Comparisons of PRE/POST programs for control of giant ragweed in field corn at Rochester Minnesota, in 2016.

Pest Code			AMBTR						YIELD		
Pest Name			Giant ragweed						@15% BU/A		
Rating Date			May-19	May-24	May-31	Jun-6	Jun-13	Sep-13			
Trt	Treatment	Rate	Appl	Percent Control (%)							
12	UNTREATED CHECK			0 e	0 h	0 e	0 e	0 h	0 g	2	e
A = PRE 4-26-16											
1	SOA 14, 15, 27, 5			85 c	88 cd	86 c	83 d	82 g	82 f	100	d
	ANTHEM MAX	4 fl oz/a	A								
	BALANCE FLEX	2 fl oz/a	A								
	ATRAZINE	1 qt/a	A								
2	SOA 5, 15, 27,			92 ab	95 ab	94 ab	96 b	95 cd	95 bc	187	ab
	ACURON	2.5 qt/a	A								
3	SOA 2, 27			82 c	93 ab	92 abc	91 c	89 f	89 e	158	c
	CORVUS	5.6 fl oz/a	A								
A/C = PRE 4-26-16 / POST II 5-24-16 (EAPOWE – 2 inch weeds)											
5	SOA 14, 15, 5 / 14, 27, 5, 9			82 c	85 de	97 a	98 a	98 a	97 ab	199	ab
	ANTHEM MAX	4.5 fl oz/a	A								
	ATRAZINE	1 qt/a	A								
	SOLSTICE	2.5 fl oz/a	C								
	ATRAZINE	1 pt/a	C								
	ROUNDUP POWERMAX	32 fl oz/a	C								
	Ammonium Sulfate	3.3 lb/100 gal	C								
6	SOA 14, 15 / 14, 27, 9			28 d	22 g	97 a	96 ab	95 d	94 cd	195	ab
	ANTHEM MAX	4.5 fl oz/a	A								
	SOLSTICE	2.5 fl oz/a	C								
	ROUNDUP POWERMAX	32 fl oz/a	C								
	Ammonium Sulfate	3.3 lb/100 gal	C								
AD = /PRE 4-26-16 / POST III 6-2-16 (MIPOWE – 2 to 3 inch weeds)											
4	SOA 14, 15 / 9			96 a	96 a	89 bc	96 ab	97 a-d	96 bc	194	ab
	ANTHEM MAX	5 fl oz/a	A								
	SHARPEN	2 fl oz/a	A								
	ROUNDUP POWERMAX	32 fl oz/a	D								
	Ammonium Sulfate	3.3 lb/100 gal	D								
7	SOA 14, 5 / 14, 15, 9			93 ab	94 ab	91 abc	96 ab	96 a-d	96 bc	202	ab
	SHARPEN	2 fl oz/a	A								
	ATRAZINE	1 qt/a	A								
	ANTHEM MAX	4 fl oz/a	D								
	ROUNDUP POWERMAX	32 fl oz/a	D								
	Ammonium Sulfate	3.3 lb/100 gal	D								
8	SOA 2,4,15 / 9			91 b	91 bc	77 d	95 b	95 bcd	94 cd	202	ab
	SURESTART II	2 pt/a	A								
	ROUNDUP POWERMAX	32 fl oz/a	D								
	Ammonium Sulfate	3.3 lb/100 gal	D								
B = POST I 5-20-16 (EAPOWE –1-2 inch weeds)											
9	SOA 15, 27, 9			0 e	33 f	97 a	97 ab	97 abc	99 a	188	ab
	ACURON FLEXI	2.25 qt/a	B								
	ROUNDUP POWERMAX	32 fl oz/a	B								
	Ammonium Sulfate	3.3 lb/100 gal	B								
10	SOA 14, 15, 27, 5, 9			0 e	82 e	97 a	98 a	97 ab	98 ab	206	a
	ANTHEM MAX	2 fl oz/a	B								
	SOLSTICE	2.5 fl oz/a	B								
	ATRAZINE	1 qt/a	B								
	ROUNDUP POWERMAX	32 fl oz/a	B								
	Ammonium Sulfate	3.3 lb/100 gal	B								
11	SOA 9, 15, 27			0 e	30 f	92 abc	93 c	92 e	92 d	186	b
	HALEX GT	3.6 pt/a	B								
	Ammonium Sulfate	3.3 lb/100 gal	B								
	NIS	0.25 % v/v	B								
LSD P=.10				5	5	7	2	2	3	18.9	

Means followed by same letter do not significantly differ.

Table 3. Comparisons of PRE/POST programs for control of common lambsquarters in field corn at Rochester, MN in 2016.

Pest Code	CHEAL										YIELD @15%					
	Common lambsquarters															
Rating Date			May-19	May-24	May-31	Jun-6	Jun-13	Sep-13								
Trt Treatment	Rate	Appl	Percent Control (%)										BU/A			
12 UNTREATED CHECK			0	b	0	e	0	b	0	b	0	b	0	c	2	e
A = PRE 4-26-16																
1 SOA 14, 15, 27, 5			99	a	99	a	99	a	99	a	99	a	99	a	100	d
ANTHEM MAX	4 fl oz/a	A														
BALANCE FLEX	2 fl oz/a	A														
ATRAZINE	1 qt/a	A														
2 SOA 5, 15, 27, ACURON	2.5 qt/a	A	99	a	99	a	99	a	99	a	99	a	99	a	187	ab
3 SOA 2, 27 CORVUS	5.6 fl oz/a	A	99	a	99	a	99	a	99	a	99	a	99	a	158	c
A/C = PRE 4-26-16 / POST II 5-24-16 (EAPOWE - 2 inch weeds)																
5 SOA 14, 15, 5 / 14, 27, 5, 9			99	a	99	a	99	a	99	a	99	a	99	a	199	ab
ANTHEM MAX	4.5 fl oz/a	A														
ATRAZINE	1 qt/a	A														
SOLSTICE	2.5 fl oz/a	C														
ATRAZINE	1 pt/a	C														
ROUNDUP POWERMAX	32 fl oz/a	C														
Ammonium Sulfate	3.3 lb/100 gal	C														
6 SOA 14, 15 / 14, 27, 9			99	a	98	ab	99	a	99	a	99	a	99	a	195	ab
ANTHEM MAX	4.5 fl oz/a	A														
SOLSTICE	2.5 fl oz/a	C														
ROUNDUP POWERMAX	32 fl oz/a	C														
Ammonium Sulfate	3.3 lb/100 gal	C														
A/D = PRE 4-26-16 / POST III 6-2-16 (MIPOWE - 2 to 3 inch weeds)																
4 SOA 14, 15 / 9			99	a	99	a	99	a	99	a	99	a	97	b	194	ab
ANTHEM MAX	5 fl oz/a	A														
SHARPEN	2 fl oz/a	A														
ROUNDUP POWERMAX	32 fl oz/a	D														
Ammonium Sulfate	3.3 lb/100 gal	D														
7 SOA 14, 5 / 14, 15, 9			99	a	99	a	99	a	99	a	99	a	99	a	202	ab
SHARPEN	2 fl oz/a	A														
ATRAZINE	1 qt/a	A														
ANTHEM MAX	4 fl oz/a	D														
ROUNDUP POWERMAX	32 fl oz/a	D														
Ammonium Sulfate	3.3 lb/100 gal	D														
8 SOA 2,4,15 / 9			99	a	99	a	99	a	99	a	99	a	98	a	202	ab
SURESTART II	2 pt/a	A														
ROUNDUP POWERMAX	32 fl oz/a	D														
Ammonium Sulfate	3.3 lb/100 gal	D														
(B =)POST I 5-20-16 (EAPOWE -1-2 inch weeds)																
9 SOA 15, 27, 9			0	b	35	c	99	a	99	a	99	a	99	a	188	ab
ACURON FLEXI	2.25 qt/a	B														
ROUNDUP POWERMAX	32 fl oz/a	B														
Ammonium Sulfate	3.3 lb/100 gal	B														
10 SOA 14, 15, 27, 5, 9			0	b	96	b	99	a	99	a	99	a	99	a	206	a
ANTHEM MAX	2 fl oz/a	B														
SOLSTICE	2.5 fl oz/a	B														
ATRAZINE	1 qt/a	B														
ROUNDUP POWERMAX	32 fl oz/a	B														
Ammonium Sulfate	3.3 lb/100 gal	B														
11 SOA 9, 15, 27			0	b	30	d	99	a	99	a	99	a	99	a	186	b
HALEX GT	3.6 pt/a	B														
Ammonium Sulfate	3.3 lb/100 gal	B														
NIS	0.25 % v/v	B														
LSD P=.10					2								1		18.9	

Means followed by same letter do not significantly differ.

Table 4. Comparisons of PRE/POST programs for control of common waterhemp in field corn at Rochester, MN in 2016.

Pest Code	AMATA					YIELD									
	Common waterhemp														
Pest Name						@15%									
Rating Date	May-24	May-31	Jun-6	Jun-13	Sep-13										
Trt Treatment	Rate	Appl	Percent Control (%)			BUu/A									
12 UNTREATED CHECK	0	e	0	c	0	b	0	d	0	c	2	e			
A = PRE 4-26-16															
1 SOA 14, 15, 27, 5			99	a	99	a	99	a	99	a	99	a	100	d	
ANTHEM MAX	4	fl oz/a	A												
BALANCE FLEX	2	fl oz/a	A												
ATRAZINE	1	qt/a	A												
2 SOA 5, 15, 27, ACURON	2.5	qt/a	A	99	a	99	a	99	a	99	a	187	ab		
3 SOA 2, 27 CORVUS	5.6	fl oz/a	A	99	a	99	a	99	a	97	c	95b	b	158	c
A/C = PRE 4-26-16 / POST II 5-24-16 (EAPOWE – 2 inch weeds)															
5 SOA 14, 15, 5 / 14, 27, 5, 9			99	a	99	a	99	a	99	a	99	a	199	ab	
ANTHEM MAX	4.5	fl oz/a	A												
ATRAZINE	1	qt/a	A												
SOLSTICE	2.5	fl oz/a	C												
ATRAZINE	1	pt/a	C												
ROUNDUP POWERMAX	32	fl oz/a	C												
Ammonium Sulfate	3.3	lb/100 gal	C												
6 SOA 14, 15 / 14, 27, 9			99	a	99	a	99	a	99	a	99	a	195	ab	
ANTHEM MAX	4.5	fl oz/a	A												
SOLSTICE	2.5	fl oz/a	C												
ROUNDUP POWERMAX	32	fl oz/a	C												
Ammonium Sulfate	3.3	lb/100 gal	C												
A/D = PRE 4-26-16 / POST III 6-2-16 (MPOWE – 2 to 3 inch weeds)															
4 SOA 14, 15 / 9			99	a	99	a	99	a	99	a	99	a	194	ab	
ANTHEM MAX	5	fl oz/a	A												
SHARPEN	2	fl oz/a	A												
ROUNDUP POWERMAX	32	fl oz/a	D												
Ammonium Sulfate	3.3	lb/100 gal	D												
7 SOA 14, 5 / 14, 15, 9			98	ab	98	b	99	a	99	a	99	a	202	ab	
SHARPEN	2	fl oz/a	A												
ATRAZINE	1	qt/a	A												
ANTHEM MAX	4	fl oz/a	D												
ROUNDUP POWERMAX	32	fl oz/a	D												
Ammonium Sulfate	3.3	lb/100 gal	D												
8 SOA 2, 4, 15 / 9			99	a	99	a	99	a	99	a	99	a	202	ab	
SURESTART II	2	pt/a	A												
ROUNDUP POWERMAX	32	fl oz/a	D												
Ammonium Sulfate	3.3	lb/100 gal	D												
B = POST I 5-20-16 (EAPOWE –1-2 inch weeds)															
9 SOA 15, 27, 9			35	c	99	a	99	a	99	a	99	a	188	ab	
ACURON FLEXI	2.25	qt/a	B												
ROUNDUP POWERMAX	32	fl oz/a	B												
Ammonium Sulfate	3.3	lb/100 gal	B												
10 SOA 14, 15, 27, 5, 9			96	b	99	a	99	a	99	a	99	a	206	a	
ANTHEM MAX	2	fl oz/a	B												
SOLSTICE	2.5	fl oz/a	B												
ATRAZINE	1	qt/a	B												
ROUNDUP POWERMAX	32	fl oz/a	B												
Ammonium Sulfate	3.3	lb/100 gal	B												
11 SOA 9, 15, 27			30	d	99	a	99	a	98	b	99	a	186	b	
HALEX GT	3.6	pt/a	B												
Ammonium Sulfate	3.3	lb/100 gal	B												
NIS	0.25	% v/v	B												
LSD P=.10			2		1		.		1		0.4		18.9		

Means followed by same letter do not significantly differ

Table 5. Comparisons of PRE/POST programs for control of grass species in field corn at Rochester, MN in 2016.

Pest Code	GRASS								YIELD
	Grangea sp.								
Pest Name									@15%
Rating Date	May-19	May-24	May-31	Jun-6	Jun-13	Sep-13			
Trt Treatment	Rate	Appl	Percent Control (%)						Bu/A
12 UNTREATED CHECK			0 b	0 e	0 c	0 c	0 c	0 d	2 e
A = PRE 4-26-16									
1 SOA 14, 15, 27, 5			99 a	99 a	99 a	99 a	99 a	99 a	100 d
ANTHEM MAX	4 fl oz/a	A							
BALANCE FLEX	2 fl oz/a	A							
ATRAZINE	1 qt/a	A							
2 SOA 5, 15, 27, ACURON	2.5 qt/a	A	99 a	99 a	99 a	99 a	99 a	99 a	187 ab
3 SOA 2, 27 CORVUS	5.6 fl oz/a	A	99 a	99 a	99 a	99 a	98 a	98 ab	158 c
A/C = PRE 4-26-16 / POST II 5-24-16 (EAPOWE - 2 inch weeds)									
5 SOA 14, 15, 5 / 14, 27, 5, 9			99 a	99 a	99 a	99 a	99 a	99 a	199 ab
ANTHEM MAX	4.5 fl oz/a	A							
ATRAZINE	1 qt/a	A							
SOLSTICE	2.5 fl oz/a	C							
ATRAZINE	1 pt/a	C							
ROUNDUP POWERMAX	32 fl oz/a	C							
Ammonium Sulfate	3.3 lb/100 gal	C							
6 SOA 14, 15 / 14, 27, 9			99 a	99 a	99 a	99 a	99 a	99 a	195 ab
ANTHEM MAX	4.5 fl oz/a	A							
SOLSTICE	2.5 fl oz/a	C							
ROUNDUP POWERMAX	32 fl oz/a	C							
Ammonium Sulfate	3.3 lb/100 gal	C							
A/D = PRE 4-26-16 / POST III 6-2-16 (MIPOWE - 2 to 3 inch weeds)									
4 SOA 14, 15 / 9			99 a	99 a	99 a	99 a	98 a	99 a	194 ab
ANTHEM MAX	5 fl oz/a	A							
SHARPEN	2 fl oz/a	A							
ROUNDUP POWERMAX	32 fl oz/a	D							
Ammonium Sulfate	3.3 lb/100 gal	D							
7 SOA 14, 5 / 14, 15, 9			99 a	93 b	83 b	97 b	95 b	97 bc	202 ab
SHARPEN	2 fl oz/a	A							
ATRAZINE	1 qt/a	A							
ANTHEM MAX	4 fl oz/a	D							
ROUNDUP POWERMAX	32 fl oz/a	D							
Ammonium Sulfate	3.3 lb/100 gal	D							
8 SOA 2,4,15 / 9			99 a	99 a	99 a	99 a	99 a	98 ab	202 ab
SURESTART II	2 pt/a	A							
ROUNDUP POWERMAX	32 fl oz/a	D							
Ammonium Sulfate	3.3 lb/100 gal	D							
B = POST I 5-20-16 (EAPOWE -1-2 inch weeds)									
9 SOA 15, 27, 9			0 b	33 c	99 a	99 a	99 a	99 a	188 ab
ACURON FLEXI	2.25 qt/a	B							
ROUNDUP POWERMAX	32 fl oz/a	B							
Ammonium Sulfate	3.3 lb/100 gal	B							
10 SOA 14, 15, 27, 5, 9			0 b	93 b	98 a	98 a	96 b	96 c	206 a
ANTHEM MAX	2 fl oz/a	B							
SOLSTICE	2.5 fl oz/a	B							
ATRAZINE	1 qt/a	B							
ROUNDUP POWERMAX	32 fl oz/a	B							
Ammonium Sulfate	3.3 lb/100 gal	B							
11 SOA 9, 15, 27			0 b	30 d	99 a	99 a	98 a	98 a	186 b
HALEX GT	3.6 pt/a	B							
Ammonium Sulfate	3.3 lb/100 gal	B							
NIS	0.25 % v/v	B							
LSD P=.10			.	3	3	1	2	2	18.9

Means followed by same letter do not significantly differ.

Table 6. Corn response to PRE/POST weed control programs at Rochester, MN, in 2016.

Pest Name				INJURY				YIELD				
Rating Date				May-19	May-24	May-31	Jun-6	@15%				
Trt	Treatment	Rate	Appl	Percent Injury (%)				BU/A				
12	UNTREATED CHECK			0	0	b	0	c	0	b	2	e
A = PRE 4-26-16												
1	SOA 14, 15, 27, 5			0	0	b	0	c	0	b	100	d
	ANTHEM MAX	4 fl oz/a	A									
	BALANCE FLEX	2 fl oz/a	A									
	ATRAZINE	1 qt/a	A									
2	SOA 5, 15, 27,			0	0	b	0	c	0	b	187	ab
	ACURON	2.5 qt/a	A									
3	SOA 2, 27			0	0	b	0	c	0	b	158	c
	CORVUS	5.6 fl oz/a	A									
A/C = PRE 4-26-16 / POST II 5-24-16 (EAPOWE - 2 inch weeds)												
5	SOA 14, 15, 5 / 14, 27, 5, 9			0	0	b	2	b	2	b	199	ab
	ANTHEM MAX	4.5 fl oz/a	A									
	ATRAZINE	1 qt/a	A									
	SOLSTICE	2.5 fl oz/a	C									
	ATRAZINE	1 pt/a	C									
	ROUNDUP POWERMAX	32 fl oz/a	C									
	Ammonium Sulfate	3.3 lb/100 gal	C									
6	SOA 14, 15 / 14, 27, 9			0	0	b	0	c	0	b	195	ab
	ANTHEM MAX	4.5 fl oz/a	A									
	SOLSTICE	2.5 fl oz/a	C									
	ROUNDUP POWERMAX	32 fl oz/a	C									
	Ammonium Sulfate	3.3 lb/100 gal	C									
A/D = PRE 4-26-16 / POST III 6-2-16 (MPOWE - 2 to 3 inch weeds)												
4	SOA 14, 15 / 9			0	0	b	0	c	0	b	194	ab
	ANTHEM MAX	5 fl oz/a	A									
	SHARPEN	2 fl oz/a	A									
	ROUNDUP POWERMAX	32 fl oz/a	D									
	Ammonium Sulfate	3.3 lb/100 gal	D									
7	SOA 14, 5 / 14, 15, 9			0	0	b	0	c	7	a	202	ab
	SHARPEN	2 fl oz/a	A									
	ATRAZINE	1 qt/a	A									
	ANTHEM MAX	4 fl oz/a	D									
	ROUNDUP POWERMAX	32 fl oz/a	D									
	Ammonium Sulfate	3.3 lb/100 gal	D									
8	SOA 2,4,15 / 9			0	0	b	0	c	0	b	202	ab
	SURESTART II	2 pt/a	A									
	ROUNDUP POWERMAX	32 fl oz/a	D									
	Ammonium Sulfate	3.3 lb/100 gal	D									
B = POST I 5-20-16 (EAPOWE -1-2 inch weeds)												
9	SOA 15, 27, 9			0	0	b	0	c	0	b	188	ab
	ACURON FLEXI	2.25 qt/a	B									
	ROUNDUP POWERMAX	32 fl oz/a	B									
	Ammonium Sulfate	3.3 lb/100 gal	B									
10	SOA 14, 15, 27, 5, 9			0	13	a	5	a	0	b	206	a
	ANTHEM MAX	2 fl oz/a	B									
	SOLSTICE	2.5 fl oz/a	B									
	ATRAZINE	1 qt/a	B									
	ROUNDUP POWERMAX	32 fl oz/a	B									
	Ammonium Sulfate	3.3 lb/100 gal	B									
11	SOA 9, 15, 27			0	0	b	5	a	0	b	186	b
	HALEX GT	3.6 pt/a	B									
	Ammonium Sulfate	3.3 lb/100 gal	B									
	NIS	0.25 % v/v	B									
LSD P=.10					1		1		3		18.9	

Means followed by same letter do not significantly differ.

Comparisons of Herbicide Systems for Weed Control in Field Corn at Rochester, MN in 2016

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The objective of this trial was to evaluate herbicide systems in field corn in southeastern Minnesota. The research site was a loamy sand series with a pH of 6.7, O.M. of 2.1%, and soil test P and K levels of 29 ppm and 167 ppm, respectively. Fall fertilizer was broadcast on November 5, 2015 at a rate of 0-46-180-0 lbs/A. Fertilizer was also applied in the spring, ahead of a planting, on April 16, 2016 at a rate of 115-0-0-24 (N-P-K-S) lbs/A. Additional nitrogen was applied on May (25 lbs/A) and on June (36 lbs/A). The field was disked and field cultivated once prior to planting. The previous crop was soybean. The corn hybrid, DEKALB DKC49-72RIB, was planted April 25, 2016 at a depth of 1.5 inches in 30 inch rows at a rate of 32,000 seeds per acre. A randomized complete block design was used with four replications. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI-11002 tips. Postemergence (POST) were applied at 15 gpa and 30 PSI using TTI 11002 tips for systemic materials and TTI J60 - 11002 tips for contact herbicides. Evaluations of the plots were taken May 19, May 24, May 31, June 6, June 15, and September 15. The center two rows of each plot were machine harvested on October 19, 2016. Application dates, environmental conditions and weed stages can be found in Table 1. Performance ratings for giant ragweed, common lambsquarters, common waterhemp and grass control can be found in Tables 2 through 5 respectively. Minor crop injury (speckling) was only observed immediately after application in two postemergence treatments, 19 and 21 (data not shown). (University of Minnesota Extension Regional Office, Rochester.)

DISCUSSION

Twenty of the twenty-two or (91%) of the treatments had a PRE herbicide component. Four of them (23%) included atrazine (SOA 5). There were eight different SOAs (2, 4, 5, 9, 10, 14, 15 and 27) included in this trial. Three of the soil applied programs provided 93-96% control of giant ragweed, Acuron, Corvus and Resicore. Six of the soil applied programs provided 89-92% control of giant ragweed, full rates of Surestart and Verdict, split rates of Acuron Flexi and Resicore, and a tankmix of Breakfree NXT Lite + Instigate. 95% of the herbicide programs provided excellent control of the small seeded broadleaf weeds, waterhemp and common lambsquarters. Grass control was 98 – 99% for twenty of the herbicide programs.

One of the key values of using a preemergence herbicide is to extend the window of opportunity to make the postemergence herbicide applications. In regards to giant ragweed, if no PRE was used, the POST herbicides needed to be applied 25 days after planting for effective control. If the PRE herbicide was weak on Giant ragweed, (%) control, the post herbicide was applied 29 days after planting. If the PRE herbicide provided very good to excellent control of giant ragweed (85-98%?), the window widened to 37 to 43 days after planting before the POST herbicide needed to be applied to control later emerging weeds. The use of a robust PRE expanded the window to apply the POST herbicide by an additional 12 to 18 days compared to the programs not using a PRE herbicide.

Table 1. Application timing, plant stage, environmental conditions.

Date	4/25	5/20	5/24	6/2	6/8
Treatment	PRE (A)	POST I (B)	POST II (C)	POST III (D)	POST IV (E)
Temperature (F)					
Air	69	68	75	64	65
Soil	62.8	69.1	71.3	64.9	65.3
Relative Humidity (%)	62	38	68	64	56
Wind (mph)	10	15	9	8	5
Soil Moisture	Normal	Normal	Normal	Normal	Normal
Corn					
Stage		2-collar	3-collar	5-collar	V6
Height (in)		2.5	3.7	10.0	12.8
Giant Ragweed					
Weed Density (ft ²)				15.3	
Height (in)	0.0	1.0	2.5	3.9	4.6
Common Waterhemp					
Weed Density (ft ²)				12.0	
Height (in)	0.0	0.3	0.6	1.4	1.6
Common Lambsquarter					
Weed Density (ft ²)				12.0	
Height (in)	0.0	0.7	1.3	1.9	2.8
Grass					
Weed Density (ft ²)				16.3	
Height (in)	0.0	0.0	0.5	1.6	2.8
Rainfall after each application (inch)					
Week 1	0.77	0	2.79	0.90	2.66
Week 2	0		0.32		1.39
Week 3	1.45				0.71

Table 2 (continued). Giant ragweed control in herbicide systems for field corn at Rochester MN in 2016.

Pest Code	Pest Name	Rating	Date	Trt	Treatment	Rate	Growth	Appl	AMBTR						YIELD @15% Bu/A							
									Giant ragweed													
									May-19	May-24	May-31	Jun-6	Jun-15	Sept 15								
									Percent Control (%)													
A/E = PRE 4-25-16 / POST IV 6-8-16 (MIPOWE 4 inch weeds)																						
5	SOA 2, 5, 10, 27								87	de	93	bcd	94	de	94	f	98	b	98	ab	220	ab
	CORVUS	5.6	fl oz/a	PRE	A																	
	LIBERTY 280	29	fl oz/a	4" weeds	E																	
	ATRAZINE	16	fl oz/a	4" weeds	E																	
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																	
8	SOA 2, 5, 9, 15, 27								89	cd	89	de	90	g	90	ghi	97	b	98	ab	220	ab
	BREAKFREE NXT	1.75	qt/a	PRE	A																	
	LITE																					
	INSTIGATE	5.25	oz/a		A																	
	- rimsulfuron	0.875	oz wt/a	PRE	A																	
	- mesotrione	4.375	oz wt/a	PRE	A																	
	ABUNDIT EXTRA	32	fl oz/a	4" weeds	E																	
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																	
13	SOA 4, 9, 15, 27								97	a	96	b	97	bc	96	b-e	98	b	99	ab	226	a
	RESICORE	3	qt/a	PRE	A																	
	DURANGO DMA	32	fl oz/a	4" weeds	E																	
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																	
14	SOA 4, 9, 15, 27								87	def	91	d	91	fg	88	i	97	b	99	ab	219	abc
	RESICORE	1.25	qt/a	PRE	A																	
	RESICORE	1.25	qt/a	4" weeds	E																	
	DURANGO DMA	32	fl oz/a	4" weeds	E																	
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																	
18	SOA 4, 9, 14, 15								94	b	92	cd	92	fg	89	hi	97	b	98	ab	211	bcd
	VERDICT	16	fl oz/a	PRE	A																	
	ROUNDUP	32	fl oz/a	4" weeds	E																	
	POWERMAX																					
	STATUS	5	oz wt/a	4" weeds	E																	
	NIS	0.25	% v/v	4" weeds	E																	
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																	
B = POST I 5-20-16 (EAPOWE 2 inch weeds)																						
21	SOA 9, 14, 15, 27								0	k	85	fg	96	bc	95	c-f	93	c	94	d	211	bcd
	SOLSTICE	2.5	fl oz/a	2" weeds	B																	
	ANTHEM MAX	2	fl oz/a	2" weeds	B																	
	ROUNDUP	32	fl oz/a	2" weeds	B																	
	POWERMAX																					
	Atrazine	16	fl oz/a	2" weeds	B																	
	NIS	0.25	% v/v	2" weeds	B																	
	N-Pa-K AMS	1.5	qt/a	2" weeds	B																	
22	SOA 2, 9, 15, 27								0	k	65	h	92	ef	90	gh	90	de	88	f	180	f
	REALM Q - 4 oz/A			2" weeds	B																	
	- rimsulfuron	1.2	oz wt/a	2" weeds	B																	
	- mesotrione	2.5	oz wt/a	2" weeds	B																	
	- isoxadifen-ethyl	0.3	oz wt/a	2" weeds	B																	
	ABUNDIT EXTRA	32	fl oz/a	2" weeds	B																	
	NIS	0.25	% v/v	2" weeds	B																	
	N-Pa-K AMS	1.5	qt/a	2" weeds	B																	
24	Weed - Free								100	a	100	a	100	a	100	a	100	a	100	a	204	de
LSD P=.10									4		4		2		2		2		3		12.9	

Table 3 (continued). Common lambsquarters control with different herbicide systems in corn at Rochester, MN in 2016.

Pest Code	Pest Name	Rating Date	Trt	Treatment	Rate	Growth	Appl	CHEAL						YIELD @15%							
								Common Lambsquarter							Bu/A						
								May-19	May-24	May-31	Jun-6	Jun-15	Sept 15								
A/E = PRE 4-25-16 / POST IV 6-8-16 (MIPOWE 4 inch weeds)																					
5	SOA 2, 5, 10, 27							99	b	99	ab	99	b	99	b	99	b	220	ab		
	CORVUS	5.6	fl oz/a	PRE	A																
	LIBERTY 280	29	fl oz/a	4" weeds	E																
	ATRAZINE	16	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
8	SOA 2, 5, 9, 15, 27							99	b	99	ab	99	b	99	b	99	b	220	ab		
	BREAKFREE NXT	1.75	qt/a	PRE	A																
	LITE																				
	INSTIGATE	5.25	oz/a		A																
	- rimsulfuron	0.875	oz wt/a	PRE	A																
	- mesotrione	4.375	oz wt/a	PRE	A																
	ABUNDIT EXTRA	32	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
13	SOA 4, 9, 15, 27							99	b	99	ab	99	b	99	b	99	b	226	a		
	RESICORE	3	qt/a	PRE	A																
	DURANGO DMA	32	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
14	SOA 4, 9, 15, 27							99	b	98	b	99	b	99	b	99	b	219	abc		
	RESICORE	1.25	qt/a	PRE	A																
	RESICORE	1.25	qt/a	4" weeds	E																
	DURANGO DMA	32	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
18	SOA 4, 9, 14, 15							99	b	99	ab	99	b	99	b	99	b	98	de	211	bcd
	VERDICT	16	fl oz/a	PRE	A																
	ROUNDUP	32	fl oz/a	4" weeds	E																
	POWERMAX																				
	STATUS	5	oz wt/a	4" weeds	E																
	NIS	0.25	% v/v	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
B = POST I 5-20-16 (EAPOWE 2 inch weeds)																					
21	SOA 9, 14, 15, 27							0	c	99	ab	99	b	99	b	99	b	99	bc	211	bcd
	SOLSTICE	2.5	fl oz/a	2" weeds	B																
	ANTHEM MAX	2	fl oz/a	2" weeds	B																
	ROUNDUP	32	fl oz/a	2" weeds	B																
	POWERMAX																				
	Atrazine	16	fl oz/a	2" weeds	B																
	NIS	0.25	% v/v	2" weeds	B																
	N-Pa-K AMS	1.5	qt/a	2" weeds	B																
22	SOA 2, 9, 15, 27							0	c	65	d	98	c	98	c	97	d	98	ef	180	f
	REALM Q - 4 oz/A			2" weeds	B																
	- rimsulfuron	1.2	oz wt/a	2" weeds	B																
	- mesotrione	2.5	oz wt/a	2" weeds	B																
	- isoxadifen-ethyl	0.3	oz wt/a	2" weeds	B																
	ABUNDIT EXTRA	32	fl oz/a	2" weeds	B																
	NIS	0.25	% v/v	2" weeds	B																
	N-Pa-K AMS	1.5	qt/a	2" weeds	B																
24	Weed - Free				E			100	a	100	a	100	a	100	a	100	a	100	a	204	de
LSD P=.10																					
								.		1		0.4		0.5		1		1		12.9	

Table 4 (continued). Common waterhemp control with different herbicide systems in corn at Rochester, MN in 2016.

Pest Code	Pest Name	Rating Date	Trt Treatment	Rate	Growth	Appl	AMATA					YIELD @15% Bu/A						
							Common waterhemp											
							May-24	May-31	Jun-6	Jun-15	Sept 15							
Percent Control (%)																		
A/E = PRE 4-25-16 / POST IV 6-8-16 (MIPOWE 4 inch weeds)6																		
5	SOA 2, 5, 10, 27						99	b	99	b	99	a	99	ab	97c	c	220	ab
	CORVUS	5.6	fl oz/a	PRE	A													
	LIBERTY 280	29	fl oz/a	4" weeds	E													
	ATRAZINE	16	fl oz/a	4" weeds	E													
	N-Pa-K AMS	1.5	qt/a	4" weeds	E													
8	SOA 2, 5, 9, 15, 27						99	b	99	b	99	a	99	ab	99	ab	220	ab
	BREAKFREE NXT	1.75	qt/a	PRE	A													
	LITE																	
	INSTIGATE	5.25	oz a		A													
	- rimsulfuron	0.875	oz wt/a	PRE	A													
	- mesotrione	4.375	oz wt/a	PRE	A													
	ABUNDIT EXTRA	32	fl oz/a	4" weeds	E													
	N-Pa-K AMS	1.5	qt/a	4" weeds	E													
13	SOA 4, 9, 15, 27						99	b	99	b	99	a	99	ab	99	ab	226	a
	RESICORE	3	qt/a	PRE	A													
	DURANGO DMA	32	fl oz/a	4" weeds	E													
	N-Pa-K AMS	1.5	qt/a	4" weeds	E													
14	SOA 4, 9, 15, 27						98	c	99	b	99	a	99	ab	99	ab	219	abc
	RESICORE	1.25	qt/a	PRE	A													
	RESICORE	1.25	qt/a	4" weeds	E													
	DURANGO DMA	32	fl oz/a	4" weeds	E													
	N-Pa-K AMS	1.5	qt/a	4" weeds	E													
18	SOA 4, 9, 14, 15						99	b	99	b	99	a	99	ab	99	abc	211	bcd
	VERDICT	16	fl oz/a	PRE	A													
	ROUNDUP	32	fl oz/a	4" weeds	E													
	POWERMAX																	
	STATUS	5	oz wt/a	4" weeds	E													
	NIS	0.25	% v/v	4" weeds	E													
	N-Pa-K AMS	1.5	qt/a	4" weeds	E													
B = POST I 5-20-16 (EAPOWE 2 inch weeds)																		
21	SOA 9, 14, 15, 27						99	b	99	b	99	a	99	ab	98	bc	211	bcd
	SOLSTICE	2.5	fl oz/a	2" weeds	B													
	ANTHEM MAX	2	fl oz/a	2" weeds	B													
	ROUNDUP	32	fl oz/a	2" weeds	B													
	POWERMAX																	
	Atrazine	16	fl oz/a	2" weeds	B													
	NIS	0.25	% v/v	2" weeds	B													
	N-Pa-K AMS	1.5	qt/a	2" weeds	B													
22	SOA 2, 9, 15, 27						65	d	97	c	94	b	94	c	94	d	180	f
	REALM Q - 4 oz/A			2" weeds	B													
	- rimsulfuron	1.2	oz wt/a	2" weeds	B													
	- mesotrione	2.5	oz wt/a	2" weeds	B													
	- isoxadifen-ethyl	0.3	oz wt/a	2" weeds	B													
	ABUNDIT EXTRA	32	fl oz/a	2" weeds	B													
	NIS	0.25	% v/v	2" weeds	B													
	N-Pa-K AMS	1.5	qt/a	2" weeds	B													
24 Weed - Free							100	a	100	a	100	a	100	a	100	a	204	de
LSD P=.10							0.5		1		2		2		2		12.9	

Table 5. Grass control with different herbicide systems in corn at Rochester, MN in 2016.

Pest Code		GRASS										YIELD @15%						
Pest Name		Grangea sp.																
Rating Date		May-19	May-24	May-31	Jun-6	Jun-15	Sep 15											
Trt	Treatment	Rate	Growth	Appl	Percent Control (%)										Bu/A			
23	Weedy				0	c	0	e	0	e	0	d	0	f	0	f	3	g
A = PRE 4-25-16																		
1	SOA 5, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	218	abc
	ACURON	3 qt/a	PRE	A														
A/C = PRE 4-25-16 / POST II 5-24-16 (MIPOWE 3-4 inch weeds)																		
4	SOA 4, 9, 15				99	b	99	b	99	ab	99	b	98	bc	98	bc	206	cde
	HARNESS	1.25 pt/a	PRE	A														
	DIFLEXX	10 fl oz/a	4" weeds	C														
	ROUNDUP POWERMAX	28 fl oz/a	4" weeds	C														
	Destiny HC	0.5 % v/v	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
6	SOA 4, 9, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	206	cde
	HARNESS	1.25 pt/a	PRE	A														
	DIFLEXX DUO	24 fl oz/a	4" weeds	C														
	ROUNDUP POWERMAX	28 fl oz/a	4" weeds	C														
	Destiny HC	0.5 % v/v	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
7	SOA 2, 5, 9, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	217	abc
	BREAKFREE NXT	2 pt/a	PRE	A														
	REALM Q - 4 oz/A			C														
	- rimsulfuron	1.2 oz wt/a	4" weeds	C														
	- mesotrione	2.5 oz wt/a	4" weeds	C														
	- Isoxadifen-ethyl	0.3 oz wt/a	4" weeds	C														
	ABUNDIT EXTRA	32 fl oz/a	4" weeds	C														
	Atrazine	12 fl oz/a	4" weeds	C														
	NIS	0.25 % v/v	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
10	SOA 9, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	198	e
	HARNESS	2.25 pt/a	PRE	A														
	IMPACT	0.75 fl oz/a	4" weeds	C														
	ROUNDUP POWERMAX	32 fl oz/a	4" weeds	C														
	MSO	1 % v/v	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
12	SOA 4, 9, 15				99	b	99	b	99	ab	99	b	99	ab	99	ab	210	b-e
	HARNESS	2.25 pt/a	PRE	A														
	ROUNDUP POWERMAX	32 fl oz/a	4" weeds	C														
	STATUS	5 oz/a	4" weeds	C														
	NIS	0.25 % v/v	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
19	SOA 9, 14, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	abc	220	ab
	ANTHEM MAX	4 fl oz/a	PRE	A														
	SOLSTICE	3 fl oz/a	4" weeds	C														
	ROUNDUP POWERMAX	32 fl oz/a	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
20	SOA 2, 4, 9, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	213	a-d
	HARNESS	2.25 pt/a	PRE	A														
	IMPACT	0.75 fl oz/a	4" weeds	C														
	Atrazine	16 fl oz/a	4" weeds	C														
	Destiny HC	1 % v/v	4" weeds	C														
	N-Pa-K AMS	1.5 qt/a	4" weeds	C														
A/D = PRE 4-25/16 / POST III 6-2-16 (MIPOWE 2-4 inch weeds)																		
2	SOA 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	219	abc
	ACURON FLEXI	1.12 qt/a	PRE	A														
	ACURON FLEXI	1.12 qt/a	2" weeds	D														
	NIS	0.25 % v/v	2" weeds	D														
	N-Pa-K AMS	1.5 qt/a	2" weeds	D														
3	SOA 9, 15, 27				99	b	99	b	99	ab	99	b	99	ab	97	cd	222	ab
	ACURON FLEXI	1.12 qt/a	PRE	A														
	HALEX GT	3.6 pt/a	2-4" weeds	D														
	NIS	0.25 % v/v	2-4" weeds	D														
	N-Pa-K AMS	1.5 qt/a	2-4" weeds	D														
9	SOA 2, 4, 9, 15, 27				99	b	99	b	99	ab	99	b	99	b	99	ab	218	abc
	TRIPLEFLEX II	2 pt/a	PRE	A														
	ROUNDUP POWERMAX	32 fl oz/a	4" weeds	D														
	IMPACT	0.75 fl oz/a	4" weeds	D														
	MSO	1 % v/v	4" weeds	D														
	N-Pa-K AMS	1.5 qt/a	4" weeds	D														
11	SOA 2, 4, 9, 15				99	b	99	b	99	ab	99	b	99	ab	98	bc	222	ab
	TRIPLEFLEX II	2 pt/a	PRE	A														
	STATUS	5 oz/a	4" weeds	D														
	ROUNDUP POWERMAX	32 fl oz/a	4" weeds	D														
	NIS	0.25 % v/v	4" weeds	D														
	N-Pa-K AMS	1.5 qt/a	4" weeds	D														
15	SOA 2, 4, 9, 15				99	b	99	b	99	ab	99	b	99	ab	99	ab	218	abc
	SURESTART II	2.5 pt/a	PRE	A														
	DURANGO DMA	32 fl oz/a	4" weeds	D														
	N-Pa-K AMS	1.5 qt/a	4" weeds	D														
16	SOA 2, 4, 9, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	221	ab
	SURESTART II	2 pt/a	PRE	A														
	RESICORE	1.25 qt/a	4" weeds	D														
	DURANGO DMA	32 fl oz/a	4" weeds	D														
	N-Pa-K AMS	1.5 qt/a	4" weeds	D														
17	SOA 5, 9, 14, 15, 27				99	b	99	b	99	ab	99	b	99	ab	99	ab	220	ab
	VERDICT	10 oz/a	PRE	A														
	ARMEZON PRO	16 fl oz/a	4" weeds	D														
	Atrazine	16 fl oz/a	4" weeds	D														
	ROUNDUP POWERMAX	32 fl oz/a	4" weeds	D														
	COC	1 pt/a	4" weeds	D														
	N-Pa-K AMS	1.5 qt/a	4" weeds	D														

Table 5 (continued). Grass control with different herbicide systems in corn at Rochester, MN in 2016.

Pest Code	Pest Name	Rating	Date	Treatment	Rate	Growth	Appl	GRASS						YIELD @15% Bu/A							
								Grangea sp.													
								May-19	May-24	May-31	Jun-6	Jun-15	Sep 15								
Percent Control (%)																					
A/E = PRE 4-25-16 / POST IV 6-8-16 (MIPOWE 4 inch weeds)																					
5	SOA 2, 5, 10, 27							99	b	99	b	95	c	99	b	98	c	98	bc	220	ab
	CORVUS	5.6	fl oz/a	PRE	A																
	LIBERTY 280	29	fl oz/a	4" weeds	E																
	ATRAZINE	16	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
8	SOA 2, 5, 9, 15, 27							99	b	99	b	99	ab	99	b	99	b	99	ab	220	ab
	BREAKFREE NXT LITE	1.75	qt/a	PRE	A																
	INSTIGATE	5.25	oz/a		A																
	- rimsulfuron	0.875	oz wt/a	PRE	A																
	- mesotrione	4.375	oz wt/a	PRE	A																
	ABUNDIT EXTRA	32	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
13	SOA 4, 9, 15, 27							99	b	99	b	99	ab	99	b	99	ab	99	ab	226	a
	RESICORE	3	qt/a	PRE	A																
	DURANGO DMA	32	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
14	SOA 4, 9, 15, 27							99	b	98	c	99	ab	99	b	99	ab	99	ab	219	abc
	RESICORE	1.25	qt/a	PRE	A																
	RESICORE	1.25	qt/a	4" weeds	E																
	DURANGO DMA	32	fl oz/a	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
18	SOA 4, 9, 14, 15							99	b	99	b	99	ab	99	b	99	ab	99	ab	211	bcd
	VERDICT	16	fl oz/a	PRE	A																
	ROUNDUP POWERMAX	32	fl oz/a	4" weeds	E																
	STATUS	5	oz wt/a	4" weeds	E																
	NIS	0.25	% v/v	4" weeds	E																
	N-Pa-K AMS	1.5	qt/a	4" weeds	E																
B = POST I 5-20-16 (EAPOWE 2 inch weeds)																					
21	SOA 9, 14, 15, 27							0	c	99	b	98	b	99	b	96	d	96	d	211	bcd
	SOLSTICE	2.5	fl oz/a	2" weeds	B																
	ANTHEM MAX	2	fl oz/a	2" weeds	B																
	ROUNDUP POWERMAX	32	fl oz/a	2" weeds	B																
	Atrazine	16	fl oz/a	2" weeds	B																
	NIS	0.25	% v/v	2" weeds	B																
	N-Pa-K AMS	1.5	qt/a	2" weeds	B																
22	SOA 2, 9, 15, 27							0	c	65	d	90	d	91	c	88	e	88	e	180	f
	REALM Q - 4 oz/A			2" weeds	B																
	- rimsulfuron	1.2	oz wt/a	2" weeds	B																
	- mesotrione	2.5	oz wt/a	2" weeds	B																
	- isoxadifen-ethyl	0.3	oz wt/a	2" weeds	B																
	ABUNDIT EXTRA	32	fl oz/a	2" weeds	B																
	NIS	0.25	% v/v	2" weeds	B																
	N-Pa-K AMS	1.5	qt/a	2" weeds	B																
24 Weed - Free								100	a	100	a	100	a	100	a	100	a	100	a	204	de
LSD P=.10								.		0.5		1		1		1		1.5		12.9	

Corn Herbicide Evaluation

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SECTION

C

SOYBEAN

VARIETY

University of Minnesota Extension

2016 SE Minnesota Regional Performance of Early (1.3-1.8) and Late (1.9-2.4) Maturity Glyphosate Tolerant (GT) Roundup Ready® (RR) Soybean Varieties at Rochester, MN.

The objective of these studies was to compare the performance of early (1.3-1.8) and late (1.9-2.4) maturity GT/RR® soybean in southeastern Minnesota. The research site was a Port Byron silt loam, located near Rochester, MN (Lawler site). Trials were planted on May 5, 2016 with a 4-row John Deere 7000 planter equipped with cone units. The seeding rate was 150,000 seeds per acre with seed planted at a depth of 1.5 inches in 30 inch rows. Plots were four rows wide by 22 feet in length. A randomized complete block design was implemented and replicated four times. The center two rows of each plot were machine harvested on October 4, 2016. Tables 1 and 2 provide the yield for the early maturity entries at 13% moisture by entry and yield rank, respectfully. Early maturity soybean yield average was **76.3 bu/a with a range of 71.4-81.0 bu/a**. Tables 3 and 4 provide the yield for the late maturity entries at 13% moisture by entry and yield rank, respectfully. Late maturity soybean yield average was **77.4 bu/a with a range of 64.1-83.4 bu/a**.

What do the letters mean in the tables?

The power of our research is that we replicate the trial to help take out effects due to variability across the field (e.g., soil type, drainage, topography, etc.). So we randomly place varieties in the plots, planting them in blocks (replications). Four replications are considered the standard for field research. Moisture and yield results followed by the same letter are not statistically different.

That means, if I planted varieties followed by the same letter, I would not expect to see a difference in yield in the field. Even though the average yield for a couple of varieties may be numerically different by a few bushels, there was enough variability in the yields across replications that no real trend could be found. Consider a comparison between variety x vs y. If variety x yielded more than y in two plots, and y more than x in the others, these likely would come out statistically the same. In another example, variety x may outyield y in one replication by quite a bit, but then yield less than y in the other 3 replications, so here again, likely these would not be statistically different although the average yields may come out numerically different.

The LSD is the "least significant difference" or the minimum difference in yield we need to see before we can say with confidence that there is a true difference in yield between a pair of varieties. When there is more variability in yield across a plot, the LSD value will go up. The p value (P in the tables below) indicates the probability or confidence we have that two entries differ in yield when the difference is equal to or greater than the LSD. When the P = 0.10, this indicates that we can be 90% confident that variety x performs better than variety y if the yield difference is equal to or greater than the LSD. Likewise, if P = .20, we have 80% confidence that two varieties differ in yield when the yield difference is equal to or greater than the LSD. For variety trials, a P value of .10 or .20 are considered standards

Note in Table 2: The highest yielding entries have the letter "a" after the yield value. RENK RS153NR2 has a yield of 81.0 bu/a followed by the letter "a". All other entries with the letter "a" after the yield value are statistically the same as RENK RS153NR2.

Some entries have more than one letter, like "ab or a-d". **What does this mean?** Entries with the same letter (s) following the yield are not statistically different from each other. For example, STINE 14RD62 has a yield of 77.9 followed by the letters "a-d". This means that the STINE 14RD62 yield of 77.9 is statistically the same as the RENK RS153 NR2 with 81.0 bu/A (both have the letter "a" after the yield). It also means that the STINE 14RD62 yield of 77.9 is not statistically different from all entries followed by a "a, b, c, or d", therefore not statistically than LEGEND 17R654N at 74.1 bu/A followed by letters "def" because both yields values are followed by the letter "d".

Many of the entries/varieties performed very well and there are not big differences. **Yield is** one of the primary things to consider when choosing a variety. However, take time to evaluate other replicated, reliable trial results for consistency of a variety's performance and also consider other key agronomic traits such as maturity, SCN, disease scores, etc. when choosing varieties for your farm. Stay tuned for more updates. (University of Minnesota Extension Regional Office, Rochester, and Southern Research and Outreach Center, Waseca, MN).

Table 1. Early maturity (1.3-1.8) Soybean yield results by entry number from Lawler farm, Rochester, MN, 2016.

Harvest Date			Oct-4-2016 MOISTURE percent		Oct-4-2016 YIELD 13%	
No.	Entry Name	Maturity	(%)		(BU/A)	
1	ASGROW AG1636	1.6	12.9	ab	76.1	b-f
2	ASGROW AG1733	1.7	12.5	cd	75.4	c-f
3	BAYER CZ1787RY	1.7	12.5	c	75.6	b-f
4	CROPLAN R2C1572	1.5	12.6	c	77.9	a-d
5	DAHLMAN 5215NRR2Y	1.5	12.6	bc	76.8	a-e
6	DAIRYLAND DSR-1526/R2Y	1.5	12.5	c	75.4	c-f
7	DAIRYLAND DSR-1870/R2Y	1.8	12.6	c	77.7	a-d
8	GOLD COUNTRY 1814	1.8	12.5	c	79.7	abc
9	LEGEND 13R700N	1.3	12.6	c	75.3	c-f
10	LEGEND 17R654N	1.7	12.3	d	74.1	def
11	MYCOGEN SEEDS 5N145R2	1.4	12.7	abc	72.3	ef
12	MYCOGEN SEEDS 5N182R2	1.8	12.6	bc	75.0	c-f
13	NK BRAND 13H5	1.3	12.7	bc	75.2	c-f
14	NK BRAND S14A6	1.4	12.7	bc	79.7	abc
15	PIONEER BRAND 15T46R2	1.5	12.7	bc	71.4	f
16	PIONEER BRAND 18T26R2	1.8	12.6	c	75.7	b-f
17	PRAIRIE BRAND PB-1376R2	1.3	12.7	abc	72.5	ef
18	PRAIRIE BRAND PB-1787R2	1.7	12.5	cd	78.8	a-d
19	RENK RS153NR2	1.5	12.6	c	81.0	a
20	RENK RS175NR2	1.7	12.9	a	75.2	c-f
21	STINE 14RD62	1.4	12.5	c	77.9	a-d
22	STINE 17RF26	1.7	12.9	a	74.2	def
23	NORTHSTAR GENETICS NS 1528NR2	1.5	12.6	c	80.2	ab
24	NORTHSTAR GENETICS NS 1776NR	1.7	12.5	c	77.3	a-d
LSD P=.10			0.2		4.7	
Grand Mean			12.6		76.3	

Table 2. Early maturity (1.3-1.8) Soybean yield results ranked from Lawler farm, Rochester, MN, 2016.

Harvest Date			Oct-4-2016 MOISTURE percent		Oct-4-2016 YIELD 13%	
No.	Entry Name	Maturity	(%)		(BU/A)	
19	RENK RS153NR2	1.5	12.6	c	81.0	a
23	NORTHSTAR GENETICS NS 1528NR2	1.5	12.6	c	80.2	ab
8	GOLD COUNTRY 1814	1.8	12.5	c	79.7	abc
14	NK BRAND S14A6	1.4	12.7	bc	79.7	abc
18	PRAIRIE BRAND PB-1787R2	1.7	12.5	cd	78.8	a-d
4	CROPLAN R2C1572	1.5	12.6	c	77.9	a-d
21	STINE 14RD62	1.4	12.5	c	77.9	a-d
7	DAIRYLAND DSR-1870/R2Y	1.8	12.6	c	77.7	a-d
24	NORTHSTAR GENETICS NS 1776NR	1.7	12.5	c	77.3	a-d
5	DAHLMAN 5215NRR2Y	1.5	12.6	bc	76.8	a-e
1	ASGROW AG1636	1.6	12.9	ab	76.1	b-f
16	PIONEER BRAND 18T26R2	1.8	12.6	c	75.7	b-f
3	BAYER CZ1787RY	1.7	12.5	c	75.6	b-f
2	ASGROW AG1733	1.7	12.5	cd	75.4	c-f
6	DAIRYLAND DSR-1526/R2Y	1.5	12.5	c	75.4	c-f
9	LEGEND 13R700N	1.3	12.6	c	75.3	c-f
13	NK BRAND 13H5	1.3	12.7	bc	75.2	c-f
20	RENK RS175NR2	1.7	12.9	a	75.2	c-f
12	MYCOGEN SEEDS 5N182R2	1.8	12.6	bc	75.0	c-f
22	STINE 17RF26	1.7	12.9	a	74.2	def
10	LEGEND 17R654N	1.7	12.3	d	74.1	def
17	PRAIRIE BRAND PB-1376R2	1.3	12.7	abc	72.5	ef
11	MYCOGEN SEEDS 5N145R2	1.4	12.7	abc	72.3	ef
15	PIONEER BRAND 15T46R2	1.5	12.7	bc	71.4	f
LSD P=.10			0.2		4.7	
Grand Mean			12.6		76.3	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD).

Table 3. Late maturity (1.9-2.4) Soybean yield results by entry number from Lawler farm, Rochester, MN, 2016.

Harvest Date Rating Data Type Rating Unit			Oct-4-2016 MOISTURE percent		Oct-4-2016 YIELD 13%	
No.	Entry Name	Maturity	(%)		(BU/A)	
1	ASGROW AG1935	1.9	12.3	d-i	74.9	def
2	ASGROW AG2035	2.0	12.3	b-i	78.5	a-f
3	BAYER CZ2474RY	2.4	12.7	a	64.1	g
4	CROPLAN R2C1950	1.9	12.3	b-h	81.7	ab
5	DAIRYLAND DSR-2110/R2Y	2.1	12.4	bcd	73.6	f
6	DAIRYLAND DSR-2330/R2Y	2.3	12.3	b-g	80.1	abc
7	GOLD COUNTRY 2114	2.1	12.2	f-i	77.7	b-f
8	LEGEND 20R524N	2.0	12.3	b-i	80.1	abc
9	LEGEND 21R635N	2.1	12.4	bc	75.7	c-f
10	MYCOGEN SEEDS 5N194R2	1.9	12.4	b-f	77.4	b-f
11	MYCOGEN SEEDS 5N206R2	2.0	12.5	b	74.7	ef
12	NK BRAND S20T6	2.0	12.0	j	83.2	a
13	NK BRAND S21M7	2.1	12.0	j	75.5	c-f
14	PIONEER BRAND 19T39R2	1.9	12.4	b-e	74.1	f
15	PIONEER BRAND 22T73	2.2	12.4	c-i	77.2	b-f
16	PRAIRIE BRAND PB-1956R2	1.9	12.4	d-i	77.8	b-f
17	PRAIRIE BRAND PB-2197R2	2.1	12.3	ghi	78.6	a-f
18	PRODUCERS HYBRIDS 1905NR2	1.9	12.3	c-i	83.4	a
19	PRODUCERS HYBRIDS 2204NR2	2.2	12.2	ghi	80.0	a-d
20	RENK RS195NR2	1.9	12.2	e-i	79.7	a-e
21	RENK RS213NR2	2.1	12.1	ij	76.8	b-f
22	STINE 19RF32	1.9	12.3	b-h	79.5	a-e
23	STINE 20RD20	2.0	12.2	hij	76.0	c-f
24	NORTHSTAR GENETICS NS 2031NR2	2.0	12.3	b-g	79.9	a-d
25	NORTHSTAR GENETICS NS 2362NR2	2.3	12.4	bcd	75.3	c-f
LSD P=.10			0.2		5.2	
Grand Mean			12.3		77.4	

Table 4. Late maturity (1.9-2.4) Soybean yield results by entry number from Lawler farm, Rochester, MN, 2016

Harvest Date			Oct-4-2016 MOISTURE percent		Oct-4-2016 YIELD 13%	
No.	Entry Name	Maturity	(%)		(BU/A)	
18	PRODUCERS HYBRIDS 1905NR2	1.9	12.3	c-i	83.4	a
12	NK BRAND S20T6	2.0	12.0	j	83.2	a
4	CROPLAN R2C1950	1.9	12.3	b-h	81.7	ab
6	DAIRYLAND DSR-2330/R2Y	2.3	12.3	b-g	80.1	abc
8	LEGEND 20R524N	2.0	12.3	b-i	80.1	abc
19	PRODUCERS HYBRIDS 2204NR2	2.2	12.2	ghi	80.0	a-d
24	NORTHSTAR GENETICS NS 2031NR2	2.0	12.3	b-g	79.9	a-d
20	RENK RS195NR2	1.9	12.2	e-i	79.7	a-e
22	STINE 19RF32	1.9	12.3	b-h	79.5	a-e
17	PRAIRIE BRAND PB-2197R2	2.1	12.2	ghi	78.6	a-f
2	ASGROW AG2035	2.0	12.3	b-i	78.5	a-f
16	PRAIRIE BRAND PB-1956R2	1.9	12.3	d-i	77.8	b-f
7	GOLD COUNTRY 2114	2.1	12.2	f-i	77.7	b-f
10	MYCOGEN SEEDS 5N194R2	1.9	12.4	b-f	77.4	b-f
15	PIONEER BRAND 22T73	2.2	12.3	c-i	77.2	b-f
21	RENK RS213NR2	2.1	12.1	ij	76.8	b-f
23	STINE 20RD20	2.0	12.2	hij	76.0	c-f
9	LEGEND 21R635N	2.1	12.4	bc	75.7	c-f
13	NK BRAND S21M7	2.1	12.0	j	75.5	c-f
25	NORTHSTAR GENETICS NS 2362NR2	2.3	12.4	bcd	75.3	c-f
1	ASGROW AG1935	1.9	12.3	d-i	74.9	def
11	MYCOGEN SEEDS 5N206R2	2.0	12.5	b	74.7	ef
14	PIONEER BRAND 19T39R2	1.9	12.4	b-e	74.1	f
5	DAIRYLAND DSR-2110/R2Y	2.1	12.4	bcd	73.6	f
3	BAYER CZ2474RY	2.4	12.7	a	64.1	g
LSD P=.10			0.2		5.2	
Grand Mean			12.3		77.4	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD).

University of Minnesota Extension

U of M SE Minnesota dicamba-tolerant soybean yield results now available

by Lisa Behnken, Extension Educator, Fritz Breitenbach, IPM Specialist SE Minnesota, Lizabeth Stahl, Extension Educator, Jeff Gunsolus, Extension Agronomist, Weed Science, Phyllis Bongard, Content Development and Communications Specialist, and Jeffrey Vetsch, Soil Science Researcher, SROC, University of Minnesota

Farmer's interest in planting dicamba-tolerant soybeans continues. There are a number of reasons a farmer may choose to plant dicamba-tolerant soybeans, but a primary one is to potentially be part of their 2017 weed management plan to help in the control of glyphosate-resistant weeds. However, a word of caution, dicamba is currently NOT labeled for application to soybeans at planting or postemergence (read more below).

While a number of dicamba-tolerant soybean varieties will be offered for the 2017 planting season, a limited amount of agronomic information may be available about these varieties. Regardless of the herbicide-resistance trait, growers should consider yield, disease tolerance, and other agronomic traits needed specifically for their farms when choosing a good variety.

In an effort to help answer some of these questions, a yield performance trial was planted near Rochester, MN, on a Port Byron silt loam. The study included 14 dicamba-tolerant entries and four glyphosate-tolerant standards for comparison. Trials were planted on May 5, 2016 with a 4-row John Deere 7000 planter equipped with cone units. The seeding rate was 150,000 seeds per acre with seed planted at a depth of 1.5 inches in 30 inch rows. Plots were four rows wide by 22 feet in length and the center two rows of each plot were machine harvested on October 4, 2016.

Soybean yield results

Tables 1 and 2 provide the yield for the dicamba-tolerant soybeans entries at 13% moisture by entry and yield rank, respectively. The dicamba-tolerant soybean entries averaged 72.8 bu/a, ranging from 64.4 – 80.2 bu/a, while the glyphosate-tolerant entries averaged 75.1 bu/a, ranging from 70.0 – 80.8 bu/a.

Considerations when planting dicamba tolerant soybeans in 2017:

Label concerns: Monsanto's Roundup Ready 2 Xtend™ soybean seed, which is tolerant to both glyphosate and dicamba, is currently available for purchase. While this technology will eventually offer another option for controlling glyphosate-resistant and other tough-to-control weeds, there are still herbicide label concerns for the 2017 growing season.

Dicamba is NOT currently labeled for application on these soybeans at-planting or postemergence. Dicamba is currently labeled ONLY for burndown applications prior to planting, with a required wait time of 14 to 30 days before planting, even if the variety is dicamba-tolerant. Any other applications to soybean are in violation of federal and state law and may result in enforcement actions, and additional liability to the producer for off-target movement. One only needs to look at what happened in more southern states during the 2016 growing season, where older formulations of dicamba were illegally applied to dicamba-tolerant soybeans, and drift onto non-tolerant crops occurred. Thousands of acres have been affected, leading to litigation, fines, and proposals for further regulation.

Low-volatility dicamba formulations developed for use with tolerant soybeans are still awaiting approval. It is unknown when this label will be granted approval and if it will be granted in time for the 2017 growing season.

Use an integrated approach and start with a solid foundation: Due to uncertainty with the herbicide labeling, growers planning to utilize the dicamba system in the control of glyphosate-resistant weeds in soybean might want to consider alternative strategies. Options might include rotating to a different crop or planting a LibertyLink variety and applying glufosinate to control the problem weeds.

The solid foundation required for all soybean systems, regardless of trait, is to start with a preemergence herbicide. Using a preemergence herbicide that provides residual control of the weeds on your farm is essential due to the widespread presence of early and late emerging weeds and the increase in waterhemp populations that are resistant to multiple classes of herbicides.

As always, an integrated approach that includes both chemical and non-chemical strategies is essential for managing difficult weeds, seedbanks and herbicide resistance. A diversified program is also a key component of an effective weed management program – overreliance on any one technology is never recommended for effective, long-term weed control. (University of Minnesota Extension Regional Office, Rochester, and Southern Research and Outreach Center, Waseca, MN).

Table 1. Soybean yield by entry of dicamba tolerant compared to glyphosate tolerant standards at Lawler farm, Rochester, MN, 2016.

Harvest Date			Oct-4-2016 MOISTURE Percent		Oct-4-2016 YIELD 13%	
No.	Name	MATURITY	(%)		(BU/A)	
1	ASGROW AG12X6	1.2	12.1	cd	72.8	b-e
2	ASGROW AG17X6	1.7	12.0	efg	64.4	f
3	ASGROW AG20X7	2.0	12.0	efg	70.3	cde
4	ASGROW AG21X7	2.1	11.9	fg	80.2	a
5	CROPLAN RX1466	1.4	12.1	c-f	68.4	ef
6	CROPLAN RX1836	1.8	12.0	c-g	73.3	bcd
7	DAHLMAN 6713XN	1.3	12.0	efg	71.4	cde
8	DAHLMAN 6717XN	1.7	12.0	c-g	70.8	cde
9	DAHLMAN 6721XN	2.1	12.0	efg	76.7	ab
10	GOLD COUNTRY 2026X	2.0	11.9	g	77.4	ab
11	PIONEER P19T55X	1.9	12.3	ab	74.2	bcd
12	PIONEER P21T89X	2.1	12.1	c-f	73.8	bcd
13	PIONEER P22T24X	2.2	12.3	a	73.4	bcd
14	PRODUCERS HYBRIDS 2115NRX	2.1	12.0	efg	71.8	cde
15	CROPLAN R2C1950	1.9 STANDARD	12.1	cde	80.8	a
16	ASGROW AG1733	1.7 STANDARD	11.9	fg	74.9	bc
17	PIONEER P15T46R2	1.5 STANDARD	12.2	bc	70.0	de
18	STINE 20RD20	2.0 STANDARD	12.0	d-g	74.8	bc
LSD P=.10			0.1		4.6	
Mean yield dicamba entries (1-14)			12.1		72.8	
Mean yield glyphosate tolerant entries (15-18, standard)			12.1		75.1	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 2. Ranked soybean yield of dicamba tolerant compared to glyphosate tolerant standards at Lawler farm, Rochester, MN, 2016.

Harvest Date			Oct-4-2016 MOISTURE percent		Oct-4-2016 YIELD 13%	
No.	Name	MATURITY	(%)		(BU/A)	
4	ASGROW AG21X7	2.1	11.9	fg	80.2	a
10	GOLD COUNTRY 2026X	2.0	11.9	g	77.4	ab
9	DAHLMAN 6721XN	2.1	12.0	efg	76.7	ab
11	PIONEER P19T55X	1.9	12.3	ab	74.2	bcd
12	PIONEER P21T89X	2.1	12.1	c-f	73.8	bcd
13	PIONEER P22T24X	2.2	12.3	a	73.4	bcd
6	CROPLAN RX1836	1.8	12.0	c-g	73.3	bcd
1	ASGROW AG12X6	1.2	12.1	cd	72.8	b-e
14	PRODUCERS HYBRIDS 2115NRX	2.1	12.0	efg	71.8	cde
7	DAHLMAN 6713XN	1.3	12.0	efg	71.4	cde
8	DAHLMAN 6717XN	1.7	12.0	c-g	70.8	cde
3	ASGROW AG20X7	2.0	12.0	efg	70.3	cde
5	CROPLAN RX1466	1.4	12.1	c-f	68.4	ef
2	ASGROW AG17X6	1.7	12.0	efg	64.4	f
15	CROPLAN R2C1950	1.9 STANDARD	12.1	cde	80.8	a
18	STINE 20RD20	2.0 STANDARD	12.0	d-g	74.8	bc
16	ASGROW AG1733	1.7 STANDARD	11.9	fg	74.9	bc
17	PIONEER P15T46R2	1.5 STANDARD	12.2	bc	70.0	de
LSD P=.10			0.1		4.6	
Mean yield dicamba entries (1-14)			12.1		72.8	
Mean yield glyphosate tolerant entries (15-18, standard)			12.1		75.1	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

SECTION

D

SOYBEAN HERBICIDE EVALUATION

2016 Evaluation of Enlist Duo for control of broadleaf weeds in soybeans at Rochester, MN.

Behnken, Lisa B., Fritz R. Breitenbach, Jared Liebenow and Annette Kylo

The objective of this trial was to evaluate the performance of Enlist Duo herbicide and compare herbicide systems for weed control in soybeans in southeastern, MN. The research site was a loamy sand series with a pH of 6.6, O.M. of 2.1%, and soil test P and K levels of 49 ppm and 137 ppm, respectively. Fall fertilizer was applied on November 5, 2015 at a rate of 0-46-180-0 lbs/A (N-P-K-S). The field was field cultivated prior to planting in the spring. The Dow AgroSciences soybean variety 12R15X1 Enlist RR2Y was planted on May 9, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 150,000 seeds per acre. A randomized complete block design was used with four replications. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI-11002 nozzles. Postemergence (POST) treatments using systemic herbicides were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI-11002 nozzles. POST contact herbicide treatments were applied with TTIJ60-11002 nozzles. Evaluations of the plot were taken on June 3, 6, 15, 27, and July 11. The crop was destroyed on July 28, 2016. Application dates, environmental conditions, and weed stages can be found in Table 1. Performance ratings for control of giant ragweed, common lambsquarters, common waterhemp and grass, and crop response can be found in Tables 2 through 6 respectively. (University of Minnesota Extension Regional Office, Rochester.)

SUMMARY:

Glyphosate systems using Enlist Duo applied POST at 56 or 75 fl oz/A provided satisfactory control of giant ragweed, 96% and 97%, respectively, compared to the Durango system which achieved only 86% control. Glufosinate systems using 2,4-D Choline at 24 or 32 fl oz/A also provided satisfactory giant ragweed control, 96% and 97%, respectively, compared to the Liberty system which achieved 87% control. Common lambsquarters and common waterhemp control was satisfactory, 98-99%, with all systems except POST only Durango at 89% and 10%, respectively (July 11 rating).

Table 1. Application timing, plant stage, environmental conditions.

Date	5/9	6/3	6/8
Treatment	PRE (A)	POST I (B)	POST II (C)
Temperature (F)			
Air	59	79	67
Soil	61.7	70.7	68.5
Relative Humidity (%)	72	50	54
Wind (mph)	24	14	3
Soil Moisture	Normal	Normal	Normal
Soybean			
Stage		V1	V2
Height (inch)		3.0	4.4
Giant Ragweed			
Weed density (ft ²)			14
Height (inch)		6.3	3.9
Common Lambsquarters			
Weed density (ft ²)			1.8
Height (inch)		2.9	2.3
Common Waterhemp			
Weed density (ft ²)			5.5
Height (inch)		1.6	0.9
Grass			
Weed density (ft ²)			6.5
Height (inch)		2.5	1.7
Rainfall after each application (inch)			
Week 1	1.43	2.27	3.75
Week 2	0.02	2.38	0.30
Week 3	0.21	0.41	0.71

Table 2. Giant ragweed control with herbicide systems that include Enlist Duo in soybean in Rochester, MN, 2016

Pest Code						AMBTR									
Pest Name						Giant ragweed									
Rating Date						June-3		June-6		June-15		June-27		July-11	
Trt	Treatment	Rate	Stage	Appl		Percent Control (%)									
1	UNTREATED CHECK					0	d	0	d	0	d	0	e	0	d
<i>A/C = PRE 5/9/16 / POST II 6/8/16 - (MIDPOWE - less than 4 inch weeds)</i>															
2	SOA 2,14 / 9					84	ab	79	ab	91	c	85	c	86	b
	SONIC	4.5	oz wt/a	PREPRE	A										
	DURANGO	32	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
3	SOA 2,14 / 4,9					85	a	80	a	97	a	97	a	96	a
	SONIC	4.5	oz wt/a	PREPRE	A										
	ENLIST DUO	56	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
4	SOA 2,14 / 4,9					83	abc	78	ab	98	a	98	a	97	a
	SONIC	4.5	oz wt/a	PREPRE	A										
	ENLIST DUO	75	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
5	SOA 2, 14 / 4, 9					82	c	76	abc	97	a	98	a	97	a
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	24	fl oz/a	MIDPOWE	C										
	DURANGO	24	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
6	SOA 2,14 / 4, 9					84	ab	79	ab	98	a	97	a	97	a
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	32	fl oz/a	MIDPOWE	C										
	DURANGO	32	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
7	SOA 2,14 / 10					82	c	75	bc	95	b	88	b	87	b
	SONIC	4.5	oz wt/a	PREPRE	A										
	LIBERTY 280	29	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
8	SOA 2,14 / 4, 10					82	bc	73	c	98	a	97	a	96	a
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	24	fl oz/a	MIDPOWE	C										
	LIBERTY 280	29	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
9	SOA 2,14 / 4, 10					83	abc	75	bc	99	a	98	a	97	a
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	32	fl oz/a	MIDPOWE	C										
	LIBERTY 280	29	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
<i>B = POST I 6/3/16 - (MIDPOWE - less than 4 inch weeds)</i>															
10	SOA 9 CHECK					0	d	80	a	90	c	81	d	81	c
	DURANGO	32	fl oz/a	MIDPOWE	B										
	N-PAK AMS	2.5	% v/v	MIDPOWE	B										
LSD P=.10						3		5		2		2		2	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 3. Common lambsquarters control with herbicide systems that include Enlist Duo herbicide in soybean in Rochester, MN, 2016.

Pest Code					CHEAL									
Pest Name					Common lambsquarters									
Rating Date					June 3		June 6		June-15		June-27		July-11	
Trt	Treatment	Rate	Stage	Appl	Percent Control (%)									
1	UNTREATED CHECK				0	c	0	e	0	c	0	c	0	c
<i>A/C = PRE 5/9/16 / POST II 6/8/16 – (MIDPOWE – less than 4 inch weeds)</i>														
2	SOA 2,14 / 9				99	ab	99	ab	98	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	DURANGO	32 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
3	SOA 2,14 / 4,9				99	ab	99	a	99	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	ENLIST DUO	56 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
4	SOA 2,14 / 4,9				98	b	99	bc	98	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	ENLIST DUO	75 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
5	SOA 2, 14 / 4, 9				99	ab	99	a	99	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	24 fl oz/a	MIDPOWE	C										
	DURANGO	24 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
6	SOA 2,14 / 4, 9				99	ab	99	a	99	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	32 fl oz/a	MIDPOWE	C										
	DURANGO	32 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
7	SOA 2,14 / 10				99	ab	98	c	99	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	LIBERTY 280	29 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
8	SOA 2,14 / 4, 10				99	ab	99	a	99	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	24 fl oz/a	MIDPOWE	C										
	LIBERTY 280	29 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
9	SOA 2,14 / 4, 10				99	a	99	ab	99	a	99	a	99	a
	SONIC	4.5 oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	32 fl oz/a	MIDPOWE	C										
	LIBERTY 280	29 fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5 % v/v	MIDPOWE	C										
<i>B = POST I 6/3/16 – (MIDPOWE – less than 4 inch weeds)</i>														
10	SOA 9				0	c	80	d	89	b	89	b	89	b
	GLYPHOSATE CHECK													
	DURANGO	32 fl oz/a	MIDPOWE	B										
	N-PAK AMS	2.5 % v/v	MIDPOWE	B										
LSD P=.10					0.5		0.5		0.4		0.4		0.3	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 4. Common waterhemp control with herbicide systems that include Enlist Duo in soybean in Rochester, MN, 2016.

Pest Code Pest Name Rating Date Trt Treatment Rate Growth Appl					AMATA									
					Common waterhemp									
					June 3		June 6		June 15		June 27		July 11	
					Percent Control (%)									
1 UNTREATED CHECK					0	c	0	d	0	c	0	d	0	c
A/B = PRE 5/9/16 / POST II 6/8/16 – (MIDPOWE – less than 4 inch weeds)														
2 SOA 2,14 / 9					99	a	99	a	99	a	99	b	99	a
SONIC 4.5 oz wt/a PREPRE A														
DURANGO 32 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
3 SOA 2,14 / 4,9					99	a	99	a	99	a	99	ab	99	a
SONIC 4.5 oz wt/a PREPRE A														
ENLIST DUO 56 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
4 SOA 2,14 / 4,9					99	a	99	a	99	a	99	ab	99	a
SONIC 4.5 oz wt/a PREPRE A														
ENLIST DUO 75 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
5 SOA 2, 14 / 4, 9					99	b	99	a	99	a	99	a	98	a
SONIC 4.5 oz wt/a PREPRE A														
2,4-D CHOLINE SALT 24 fl oz/a MIDPOWE C														
DURANGO 24 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
6 SOA 2,14 / 4, 9					99	a	99	b	99	a	99	a	99	a
SONIC 4.5 oz wt/a PREPRE A														
2,4-D CHOLINE SALT 32 fl oz/a MIDPOWE C														
DURANGO 32 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
7 SOA 2,14 / 10					99	a	99	a	99	a	99	b	98	a
SONIC 4.5 oz wt/a PREPRE A														
LIBERTY 280 29 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
8 SOA 2,14 / 4, 10					99	a	99	a	99	a	99	ab	98	a
SONIC 4.5 oz wt/a PREPRE A														
2,4-D CHOLINE SALT 24 fl oz/a MIDPOWE C														
LIBERTY 280 29 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
9 SOA 2,14 / 4, 10					99	a	99	a	99	a	99	a	98	a
SONIC 4.5 oz wt/a PREPRE A														
2,4-D CHOLINE SALT 32 fl oz/a MIDPOWE C														
LIBERTY 280 29 fl oz/a MIDPOWE C														
N-PAK AMS 2.5 % v/v MIDPOWE C														
B = POST I 6/3/16 – (MIDPOWE – less than 4 inch weeds)														
10 SOA 9					0	c	90	c	73	b	10	c	10	b
GLYPHOSATE CHECK														
DURANGO 32 fl oz/a MIDPOWE B														
N-PAK AMS 2.5 % v/v MIDPOWE B														
LSD P=.10					0.2		0.2		2		0.5		1	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 5. Grass control with herbicide systems that include Enlist Duo in soybean in Rochester, MN, 2016.

Pest Name						Grass species									
Rating Date						June 3		June 6		June 15		June 27		July 11	
Trt	Treatment	Rate	Growth	Appl	Percent control (%)										
1	UNTREATED CHECK					0	d	0	e	0	c	0	c	0	d
<i>A/B = PRE 5/9/16 / POST II 6/8/16 - (MIDPOWE - less than 4 inch weeds)</i>															
2	SOA 2,14 / 9				98	bc	97	c	99	a	97	a	97	a	
	SONIC	4.5	oz wt/a	PREPRE	A										
	DURANGO	32	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
3	SOA 2,14 / 4,9				99	a	99	a	99	a	97	a	97	a	
	SONIC	4.5	oz wt/a	PREPRE	A										
	ENLIST DUO	56	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
4	SOA 2,14 / 4,9				98	c	97	c	99	a	97	a	95	b	
	SONIC	4.5	oz wt/a	PREPRE	A										
	ENLIST DUO	75	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
5	SOA 2, 14 / 4, 9				99	ab	99	a	99	a	95	a	94	b	
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	24	fl oz/a	MIDPOWE	C										
	DURANGO	24	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
6	SOA 2,14 / 4, 9				99	a	99	a	99	a	98	a	97	a	
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	32	fl oz/a	MIDPOWE	C										
	DURANGO	32	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
7	SOA 2,14 / 10				99	ab	99	a	99	a	98	a	97	a	
	SONIC	4.5	oz wt/a	PREPRE	A										
	LIBERTY 280	29	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
8	SOA 2,14 / 4, 10				99	ab	99	ab	99	a	98	a	97	a	
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	24	fl oz/a	MIDPOWE	C										
	LIBERTY 280	29	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
9	SOA 2,14 / 4, 10				98	c	98	bc	99	a	96	a	95	b	
	SONIC	4.5	oz wt/a	PREPRE	A										
	2,4-D CHOLINE SALT	32	fl oz/a	MIDPOWE	C										
	LIBERTY 280	29	fl oz/a	MIDPOWE	C										
	N-PAK AMS	2.5	% v/v	MIDPOWE	C										
<i>B = POST I 6/3/16 - (MIDPOWE - less than 4 inch weeds)</i>															
10	SOA 9				0	d	90	d	86	b	90	b	80	c	
	GLYPHOSATE CHECK														
	DURANGO	32	fl oz/a	MIDPOWE	B										
	N-PAK AMS	2.5	% v/v	MIDPOWE	B										
LSD P=.10						0.6		2		2		3		2	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 6. Soybean response to herbicide systems that include Enlist Duo in Rochester, MN, 2016.

					Crop Response						
Rating Date					June 3	June 15	June 27				
No.	Name	Rate	Unit	Stage	Code	Percent Injury (%)					
1	UNTREATED CHECK					0	-	0	c	0	-
A/B = PRE 5/9/16 / POST II 6/8/16 - (MIDPOWE - less than 4 inch weeds)											
2	SOA 2,14 / 9					0	-	0	c	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	DURANGO	32	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
3	SOA 2,14 / 4,9					0	-	10	b	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	ENLIST DUO	56	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
4	SOA 2,14 / 4,9					0	-	11	b	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	ENLIST DUO	75	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
5	SOA 2, 14 / 4, 9					0	-	10	b	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	2,4-D CHOLINE SALT	24	fl oz/a	MIDPOWE	C						
	DURANGO	24	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
6	SOA 2,14 / 4, 9					0	-	11	b	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	2,4-D CHOLINE SALT	32	fl oz/a	MIDPOWE	C						
	DURANGO	32	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
7	SOA 2,14 / 10					0	-	11	b	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	LIBERTY 280	29	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
8	SOA 2,14 / 4, 10					0	-	18	a	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	2,4-D CHOLINE SALT	24	fl oz/a	MIDPOWE	C						
	LIBERTY 280	29	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
9	SOA 2,14 / 4, 10					0	-	20	a	0	-
	SONIC	4.5	oz wt/a	PREPRE	A						
	2,4-D CHOLINE SALT	32	fl oz/a	MIDPOWE	C						
	LIBERTY 280	29	fl oz/a	MIDPOWE	C						
	N-PAK AMS	2.5	% v/v	MIDPOWE	C						
B = POST I 6/3/16 - (MIDPOWE - less than 4 inch weeds)											
10	SOA 9					0	-	0	c	0	-
	GLYPHOSATE CHECK										
	DURANGO	32	fl oz/a	MIDPOWE	B						
	N-PAK AMS	2.5	% v/v	MIDPOWE	B						
LSD P=.10						.		3		.	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Evaluation of Difficult to Control Broadleaf Weeds with an HPPD Herbicide Based Program in Soybean in SE Minnesota in 2016.

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The objective of this trial was to evaluate weed control systems and crop response in soybeans that are tolerant to HPPD herbicides in southeastern Minnesota. The research site was a Lawler loam series with pH of 7.0, O.M. 2.2% and soil test P and K levels of 26 ppm and 132 ppm, respectively. In the spring the field was disked and field cultivated once prior to planting. The previous crop was corn. The soybean variety was an HPPD herbicide tolerant variety and was planted May 6, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 129,000 seeds per acre. A randomized complete block design was used with three replications. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI 11002 spray tips. Postemergence (POST) applications were applied at 15 gpa and 30 psi using TTI 11002 spray tips for systemic herbicides and TTIJ60 11002 spray tips for contact herbicides. Evaluations of the plots were made on June 6, 13, 20, 27 and July 8. Application dates, environmental conditions, and weed stages can be found in Table 1. Performance ratings for giant ragweed, common lambsquarters, and common waterhemp control and crop response can be found in Tables 2 through 6, respectively. Common lambsquarters, common waterhemp and grass control was excellent for all systems. Giant ragweed control was excellent for all systems except for Boundary preemergence, which provided 20% control. Crop response was observed with Flexstar GT at 40% (Treatment 8, June 20) and 60% (Treatment 3, June 27). Some crop response, 15%, occurred with A21472 (s-metolachlor and dicamba premix) (Treatment 5), June 27. Crop was destroyed on July 19, 2016 to comply with protocol requirements. *Note: Treatments included in this trial contain unregistered products.* (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stage, and environmental conditions

Date	5/6	6/17	6/24
Treatment	PRE	POST I	POST II
Temperature (F)			
Air	87.9	72	69
Soil	66.4	73.4	65.1
Relative Humidity (%)	20	78	78
Wind (mph)	20	10	6
Soil Moisture	Normal	Normal	Normal
Soybean			
Stage		V4	V5
Height (inch)		9.0	10.8
Giant Ragweed			
Weed Density (ft ²)		0	
Height (inch)		7.6	2.4
Common Lambsquarter			
Weed Density (ft ²)		2.4	
Height (inch)		12.5	0
Common Waterhemp			
Weed Density (ft ²)		3.1	0.6
Height (inch)		9.5	
Grass			
Weed Density (ft ²)		10	3.8
Height (inch)		5.8	
Rainfall after each application (inch)			
Week 1	1.13	0.41	0.70
Week 2	0.32	0.7	1.61
Week 3	0.21	1.61	0.82

Table 2. Giant ragweed control with HPPD (SOA 27) herbicide systems in HPPD tolerant soybean at Rochester, MN in 2016										
Pest Code Pest Name Rating Date				AMBTR						
				Giant ragweed						
No. Name				Rate	Appl	June 6	June 13	June 20	June 27	July 8
				Percent Control (%)						
1 UNTREATED CHECK						0 c	0 c	0 c	0 d	0 b
PRE 5/6/16 / POST I 6/17/16 (POSPOS - 2 to 3 inch weeds)										
8	SOA 5, 15 / 9, 14					17 b	20 b	94 b	99 a	99 a
	BOUNDARY	1.8	pt/a	A						
	N-PAK AMS	2.5	% v/v	B						
	FLEXSTAR GT	3.5	pt/a	B						
	MSO	1.0	% v/v	B						
PRE 5/6/16 / POST II 6/24/16 (POSPOS - 2 inch weeds)										
2	SOA 27, 15 / 9					98 a	97 a	98 a	98 bc	99 a
	CALLISTO	5	fl oz/a	A						
	DUAL MAGNUM	1.67	pt/a	A						
	N-PAK AMS	2.5	% v/v	C						
	ROUNDUP POWERMAX	26.6	fl oz/a	C						
3	SOA 27, 15 / 9, 14					98 a	97 a	98 a	99 a	99 a
	CALLISTO	5	fl oz/a	A						
	DUAL MAGNUM	1.67	pt/a	A						
	N-PAK AMS	2.5	% v/v	C						
	FLEXSTAR GT	3.5	pt/a	C						
	MSO	1.0	% v/v	C						
4	SOA 27, 15 / 9, 4					98 a	97 a	98 a	98 c	99 a
	CALLISTO	5	fl oz/a	A						
	DUAL MAGNUM	1.67	pt/a	A						
	AG13063	1.0	% v/v	C						
	ROUNDUP POWERMAX	26.6	fl oz/a	C						
	CLARITY	16	fl oz/a	C						
5	SOA 27, 15 / 9, 4, 15					98 a	98 a	98 a	99 ab	99 a
	CALLISTO	5	fl oz/a	A						
	DUAL MAGNUM	1.67	pt/a	A						
	AG13063	1.0	% v/v	C						
	ROUNDUP POWERMAX	26.6	fl oz/a	C						
	A21472	3.53	pt/a	C						
6	SOA 27, 15, 14 / 9					98 a	98 a	98 a	99 ab	99 a
	CALLISTO	5	fl oz/a	A						
	DUAL MAGNUM	1.67	pt/a	A						
	REFLEX	16	fl oz/a	A						
	N-PAK AMS	2.5	% v/v	C						
	ROUNDUP POWERMAX	26.6	fl oz/a	C						
7	SOA 27, 15, 5 / 9					98 a	97 a	97 a	98 bc	99 a
	CALLISTO	5	fl oz/a	A						
	DUAL MAGNUM	1.67	pt/a	A						
	TRICOR	5.3	oz wt/a	A						
	N-PAK AMS	2.5	% v/v	C						
	ROUNDUP POWERMAX	26.6	fl oz/a	C						
LSD P=.10						10	9	2	1	.

Table 3. Common lambsquarters control with HPPD (SOA 27) herbicide systems in HPPD tolerant soybean at Rochester, MN in 2016.

Pest Code				CHEAL									
				Common lambsquarters									
Pest Name													
Rating Date				June-6		June-13		June-20		June-27		July-8	
No. Name	Rate	Appl		Percent Control (%)									
1	UNTREATED CHECK			0	c	0	c	0	c	0	b	0	c
PRE 5/6/16 / POST I 6/17/16 (POSPOS - 2 to 3 inch weeds)													
8	SOA 5, 15 / 9, 14			98	b	89	b	98	b	99	a	99	a
	BOUNDARY	1.8	pt/a	A									
	N-PAK AMS	2.5	% v/v	B									
	FLEXSTAR GT	3.5	pt/a	B									
	MSO	1.0	% v/v	B									
PRE 5/6/16 / POST II 6/24/16 (POSPOS - 2 inch weeds)													
2	SOA 27, 15 / 9			99	a	99	a	99	a	99	a	99	b
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	N-PAK AMS	2.5	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
3	SOA 27, 15 / 9, 14			99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	N-PAK AMS	2.5	% v/v	C									
	FLEXSTAR GT	3.5	pt/a	C									
	MSO	1.0	% v/v	C									
4	SOA 27, 15 / 9, 4			99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	AG13063	1.0	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
	CLARITY	16	fl oz/a	C									
5	SOA 27, 15 / 9, 4, 15			99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	AG13063	1.0	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
	A21472	3.53	pt/a	C									
6	SOA 27, 15, 14 / 9			99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	REFLEX	16	fl oz/a	A									
	N-PAK AMS	2.5	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
7	SOA 27, 15, 5 / 9			99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	TRICOR	5.3	oz wt/a	A									
	N-PAK AMS	2.5	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
LSD P=.10				0.5		5		1		.		0.3	

Table 4. Common waterhemp control with HPPD (SOA 27) herbicide systems in HPPD tolerant soybean at Rochester, MN in 2016.													
Pest Code Pest Name Rating Date				AMATA									
				Common waterhemp									
No. Name				June-6		June 13		June-20		June-27		July-8	
Rate				Appl		Percent Control (%)							
1 UNTREATED CHECK				0	c	0	c	0	c	0	b	0	c
PRE 5/6/16 / POST I 6/17/16 (POSPOS – 2 to 3 inch weeds)													
8 SOA 5, 15 / 9, 14				98	b	90	b	99	a	99	a	99	a
BOUNDARY 1.8 pt/a A													
N-PAK AMS 2.5 % v/v B													
FLEXSTAR GT 3.5 pt/a B													
MSO 1.0 % v/v B													
PRE 5/6/16 / POST II 6/24/16 (POSPOS - 2 inch weeds)													
2 SOA 27, 15 / 9				99	a	99	a	99	a	99	a	99	a
CALLISTO 5 fl oz/a A													
DUAL MAGNUM 1.67 pt/a A													
N-PAK AMS 2.5 % v/v C													
ROUNDUP POWERMAX 26.6 fl oz/a C													
3 SOA 27, 15 / 9, 14				99	a	99	a	99	ab	99	a	99	a
CALLISTO 5 fl oz/a A													
DUAL MAGNUM 1.67 pt/a A													
N-PAK AMS 2.5 % v/v C													
FLEXSTAR GT 3.5 pt/a C													
MSO 1.0 % v/v C													
4 SOA 27, 15 / 9, 4				99	a	99	a	98	b	99	a	99	a
CALLISTO 5 fl oz/a A													
DUAL MAGNUM 1.67 pt/a A													
AG13063 1.0 % v/v C													
ROUNDUP POWERMAX 26.6 fl oz/a C													
CLARITY 16 fl oz/a C													
5 SOA 27, 15 / 9, 4, 15				99	a	99	a	99	a	99	a	99	a
CALLISTO 5 fl oz/a A													
DUAL MAGNUM 1.67 pt/a A													
AG13063 1.0 % v/v C													
ROUNDUP POWERMAX 26.6 fl oz/a C													
A21472 3.53 pt/a C													
6 SOA 27, 15, 14 / 9				99	a	99	a	99	a	99	a	99	a
CALLISTO 5 fl oz/a A													
DUAL MAGNUM 1.67 pt/a A													
REFLEX 16 fl oz/a A													
N-PAK AMS 2.5 % v/v C													
ROUNDUP POWERMAX 26.6 fl oz/a C													
7 SOA 27, 15, 5 / 9				99	a	99	a	99	a	99	a	99	b
CALLISTO 5 fl oz/a A													
DUAL MAGNUM 1.67 pt/a A													
TRICOR 5.3 oz wt/a A													
N-PAK AMS 2.5 % v/v C													
ROUNDUP POWERMAX 26.6 fl oz/a C													
LSD P=.10				1		4		0.4				0.3	

Table 5. Grass control with HPPD (SOA 27) herbicide systems in HPPD tolerant soybean at Rochester, MN in 2016.

Pest Name					Grass species									
					June-6		June 13		June-20		June-27		July-8	
Rating Date					Percent Control (%)									
No.	Name	Rate		Appl	0	c	0	d	0	c	0	b	0	c
1 UNTREATED CHECK					0	c	0	d	0	c	0	b	0	c
PRE 5/6/16 / POST I 6/17/16 (POSPOS - 2 to 3 inch weeds)														
8	SOA 5, 15 / 9, 14				99	a	93	bc	99	a	99	a	98	b
	BOUNDARY	1.8	pt/a	A										
	N-PAK AMS	2.5	% v/v	B										
	FLEXSTAR GT	3.5	pt/a	B										
	MSO	1.0	% v/v	B										
PRE 5/6/16 / POST II 6/24/16 (POSPOS - 2 inch weeds)														
2	SOA 27, 15 / 9				96	b	93	c	86	b	98	a	99	a
	CALLISTO	5	fl oz/a	A										
	DUAL MAGNUM	1.67	pt/a	A										
	N-PAK AMS	2.5	% v/v	C										
	ROUNDUP POWERMAX	26.6	fl oz/a	C										
3	SOA 27, 15 / 9, 14				99	a	99	ab	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A										
	DUAL MAGNUM	1.67	pt/a	A										
	N-PAK AMS	2.5	% v/v	C										
	FLEXSTAR GT	3.5	pt/a	C										
	MSO	1.0	% v/v	C										
4	SOA 27, 15 / 9, 4				99	a	99	ab	98	a	99	a	99	a
	CALLISTO	5	fl oz/a	A										
	DUAL MAGNUM	1.67	pt/a	A										
	AG13063	1.0	% v/v	C										
	ROUNDUP POWERMAX	26.6	fl oz/a	C										
	CLARITY	16	fl oz/a	C										
5	SOA 27, 15 / 9, 4, 15				99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A										
	DUAL MAGNUM	1.67	pt/a	A										
	AG13063	1.0	% v/v	C										
	ROUNDUP POWERMAX	26.6	fl oz/a	C										
	A21472	3.53	pt/a	C										
6	SOA 27, 15, 14 / 9				99	a	99	a	99	a	99	a	99	a
	CALLISTO	5	fl oz/a	A										
	DUAL MAGNUM	1.67	pt/a	A										
	REFLEX	16	fl oz/a	A										
	N-PAK AMS	2.5	% v/v	C										
	ROUNDUP POWERMAX	26.6	fl oz/a	C										
7	SOA 27, 15, 5 / 9				98	ab	98	abc	98	a	99	a	99	a
	CALLISTO	5	fl oz/a	A										
	DUAL MAGNUM	1.67	pt/a	A										
	TRICOR	5.3	oz wt/a	A										
	N-PAK AMS	2.5	% v/v	C										
	ROUNDUP POWERMAX	26.6	fl oz/a	C										
LSD P=.10					3		6		11		1		1	

Table 6. HPPD tolerant soybean response to HPPD (SOA 27) herbicide systems at Rochester, MN in 2016.													
Rating Date				Crop Response									
				June-6		June-13		June-20		June-27		July-8	
No.	Name	Rate	Appl	Percent Injury(%)									
1	UNTREATED CHECK			0	b	0	-	0	b	0	e	0	c
PRE 5/6/16 / POST I 6/17/16 (POSPOS - 2 to 3 inch weeds)													
8	SOA 5, 15 / 9, 14			10	a	0	-	40	a	27	b	7	b
	BOUNDARY	1.8	pt/a	A									
	N-PAK AMS	2.5	% v/v	B									
	FLEXSTAR GT	3.5	pt/a	B									
	MSO	1.0	% v/v	B									
PRE 5/6/16 / POST II 6/24/16 (POSPOS - 2 inch weeds)s													
2	SOA 27, 15 / 9			10	a	0	-	0	b	0	e	0	c
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	N-PAK AMS	2.5	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
3	SOA 27, 15 / 9, 14			10	a	0	-	0	b	60	a	20	a
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	N-PAK AMS	2.5	% v/v	C									
	FLEXSTAR GT	3.5	pt/a	C									
	MSO	1.0	% v/v	C									
4	SOA 27, 15 / 9, 4			10	a	0	-	0	b	7	d	0	c
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	AG13063	1.0	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
	CLARITY	16	fl oz/a	C									
5	SOA 27, 15 / 9, 4, 15			10	a	0	-	0	b	15	c	8	b
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	AG13063	1.0	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
	A21472	3.53	pt/a	C									
6	SOA 27, 15, 14 / 9			10	a	0	-	0	b	0	e	0	c
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	REFLEX	16	fl oz/a	A									
	N-PAK AMS	2.5	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
7	SOA 27, 15, 5 / 9			10	a	0	-	0	b	0	e	0	c
	CALLISTO	5	fl oz/a	A									
	DUAL MAGNUM	1.67	pt/a	A									
	TRICOR	5.3	oz wt/a	A									
	N-PAK AMS	2.5	% v/v	C									
	ROUNDUP POWERMAX	26.6	fl oz/a	C									
LSD P=.10										2		3	

Evaluation of A21472 for weed control in RR2-XTEND soybeans at Rochester, MN in 2016.

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The objective of this trial was to evaluate weed control and crop response in RR2-XTEND soybeans with A21472 (s-metolachlor + dicamba premix) applied with additive AG13063 and in tank mixes with glyphosate and fomesafen. The research site was a Loamy sand with a pH of 7.0, O.M. of 2.2%, and soil test P and K levels of 26 ppm and 132 ppm, respectively. The field was cultivated prior to planting. Resource S20-J5X, RR2-XTEND soybean was planted May 6, 2016 at 1.5 inches deep in 30-inch rows at 129,000 seeds per acre. A randomized complete block design was used with four replications. Postemergence (POST) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 40 psi using TTI-110015 nozzles. Evaluations were taken on June 10, 13, 20, 28 and July 11. Application dates, environmental conditions, and weed stages are in Table 1. Performance ratings for control of giant ragweed, common lambsquarters, common waterhemp and grass and crop response are in Tables 2-ough 6, respectively. Common waterhemp population at this site is Group-9 and Group-14 susceptible.

SUMMARY

Giant ragweed density in this trial was low, 2.0 plants/ft² and control was excellent for all systems evaluated. A21472 plus AG13063 with or without NIS provided 99% control of common lambsquarters. Control of lambsquarters remained excellent, 98 and 99%, when A21472 was applied with either Roundup PowerMax or Flexstar + Roundup PowerMax, respectively. Common waterhemp control with A21472 was only 64% and improved significantly when applied with Roundup PowerMax or with Flexstar plus Roundup PowerMax, from 84% to 97%, respectively. Also, adding A21472 to Flexstar + Roundup PowerMax gave a 7% increase in common waterhemp control, from 90% to 97%. Crop response was observed with all herbicide systems. The greatest occurred when Flexstar was included in the programs, 41-49%, (June 10). Crop response to A21472 with AG13063 or with NIS was 19 and 23%, respectively (June 13). *Note: Treatments included in this trial contain unregistered products.* (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stage, environmental conditions.

Date	June 6
Treatment	POST I
Temperature (F)	
Air	67.0
Soil	65.7
Relative Humidity (%)	56%
Wind (mph)	15
Soil Moisture	normal
Soybean	
Stage	V1-V2
Height (inch)	4.7
Giant Ragweed	
Weed density (ft ²)	2.0
Height (inch)	3.8
Common Lambsquarters	
Weed density (ft ²)	22.0
Height (inch)	1.6
Common Waterhemp	
Weed density (ft ²)	14.5
Height (inch)	2.0
Grass species	
Weed density (ft ²)	11.0
Height (inch)	2.0
Rainfall after each application (inch)	
Week 1	1.66
Week 2	1.39
Week 3	0.71

Table 2. Evaluation of A21472 for giant ragweed control in dicamba tolerant soybean at Rochester, MN in 2016.										
Pest Code Pest Name Rating Date					AMBTR					
					Giant ragweed					
Treatment					June-13	June-20	June-28	July-11		
Rate	Application				Percent Control (%)					
1 UNTREATED CHECK					0	d	0	b	0	b
<i>POST 1 6/6/16 (4-6 inch weeds)</i>										
2 SOA 4,15					98	c	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	A21472	3.53	pt/a	MIPOWE A						
3 SOA 4,15					98	bc	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	A21472	3.53	pt/a	MIPOWE A						
	NIS	0.25	% v/v	MIPOWE A						
4 SOA 4,15,9					99	ab	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	A21472	3.53	pt/a	MIPOWE A						
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A						
5 SOA 14, 4,15, 9					99	ab	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	FLEXSTAR	1.0	pt/a	MIPOWE A						
	A21472	3.53	pt/a	MIPOWE A						
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A						
6 SOA 14, 9					99	a	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	FLEXSTAR	1.0	pt/a	MIPOWE A						
	ROUNDUP POWERMAX	26.6	fl oz/a	MIPOWE A						
	MSO	1.0	% v/v	MIPOWE A						
7 SOA 4,9					98	bc	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	CLARITY	1.0	pt/a	MIPOWE A						
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A						
8 SOA 14, 15, 4, 9					99	ab	99	a	99	a
	AG13063	1	% v/v	MIPOWE A						
	WARRANT ULTRA	50.0	fl oz/a	MIPOWE A						
	CLARITY	1.0	pt/a	MIPOWE A						
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A						
LSD P=.10					0.6		0.3		0.4	0.5

Table 3. Evaluation of A21472 for common lambsquarters control in dicamba tolerant soybean at Rochester, MN in 2016.													
Pest Code					CHEAL								
Pest Name					Common lambsquarters								
Rating Date					June-13		June-20		June-28		July-11		
Treatment		Rate		Application		Percent Control (%)							
1 UNTREATED CHECK						0	c	0	c	0	c	0	c
<i>POST 1 6/6/16 (2-4 inch weeds)</i>													
2 SOA 4,15						97	b	99	a	99	a	99	a
AG13063		1	% v/v	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
3 SOA 4,15						97	b	99	a	99	a	99	a
AG13063		1	% v/v	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
NIS		0.25	% v/v	MIPOWE	A								
4 SOA 4,15,9						99	a	99	a	99	a	98	a
AG13063		1	% v/v	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
5 SOA 14, 4,15, 9						99	a	99	a	99	a	99	a
AG13063		1	% v/v	MIPOWE	A								
FLEXSTAR		1.0	pt/a	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
6 SOA 14, 9						99	a	98	b	92	b	87	b
AG13063		1	% v/v	MIPOWE	A								
FLEXSTAR		1.0	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		26.6	fl oz/a	MIPOWE	A								
MSO		1.0	% v/v	MIPOWE	A								
7 SOA 4,9						99	a	99	a	99	a	97	a
AG13063		1	% v/v	MIPOWE	A								
CLARITY		1.0	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
8 SOA 14, 15, 4, 9						99	a	99	a	99	a	99	a
AG13063		1	% v/v	MIPOWE	A								
WARRANT ULTRA		50.0	fl oz/a	MIPOWE	A								
CLARITY		1.0	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
LSD P=.10						1		1		1		2	

Table 4. Evaluation of A21472 common waterhemp control in dicamba tolerant soybean at Rochester, MN in 2016.												
Pest Code					AMATA							
Pest Name					Common waterhemp							
Rating Date					June 13		June 20		June 28		July 11	
Treatment	Rate	Application										
1	UNTREATED CHECK				0	c	0	e	0	f	0	f
<i>POST 1 (6/6/16) 2-4 inch weeds</i>												
2	SOA 4,15				92	b	76	d	66	e	64	e
	AG13063	1	% v/v	MIPOWE A								
	A21472	3.53	pt/a	MIPOWE A								
3	SOA 4,15				92	b	79	d	66	e	65	e
	AG13063	1	% v/v	MIPOWE A								
	A21472	3.53	pt/a	MIPOWE A								
	NIS	0.25	% v/v	MIPOWE A								
4	SOA 4,15,9				98	a	93	b	86	c	84	c
	AG13063	1	% v/v	MIPOWE A								
	A21472	3.53	pt/a	MIPOWE A								
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A								
5	SOA 14, 4,15, 9				99	a	99	a	98	a	97	a
	AG13063	1	% v/v	MIPOWE A								
	FLEXSTAR	1.0	pt/a	MIPOWE A								
	A21472	3.53	pt/a	MIPOWE A								
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A								
6	SOA 14, 9				98	a	97	a	93	b	90	b
	AG13063	1	% v/v	MIPOWE A								
	FLEXSTAR	1.0	pt/a	MIPOWE A								
	ROUNDUP POWERMAX	26.6	fl oz/a	MIPOWE A								
	MSO	1.0	% v/v	MIPOWE A								
7	SOA 4,9				97	a	88	c	77	d	72	d
	AG13063	1	% v/v	MIPOWE A								
	CLARITY	1.0	pt/a	MIPOWE A								
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A								
8	SOA 14, 15, 4, 9				99	a	98	a	97	a	95	a
	AG13063	1	% v/v	MIPOWE A								
	WARRANT ULTRA	50.0	fl oz/a	MIPOWE A								
	CLARITY	1.0	pt/a	MIPOWE A								
	ROUNDUP POWERMAX	28.4	fl oz/a	MIPOWE A								
LSD P=.10					2		4		2		4	

Table 5. Evaluation of A21472 for grass control in dicamba tolerant soybean at Rochester, MN in 2016.													
Pest Code						Grass Species							
Rating Date						June 13		June-20		June-28		July-11	
Treatment		Rate		Application									
1 UNTREATED CHECK						0	e	0	d	0	e	0	d
<i>POST 1 (6/6/16) 2-4 inch weeds</i>													
2 SOA 4,15						50	d	34	c	69	d	66	c
AG13063		1	% v/v	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
3 SOA 4,15						50	d	31	c	70	d	64	c
AG13063		1	% v/v	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
NIS		0.25	% v/v	MIPOWE	A								
4 SOA 4,15,9						98	b	97	a	97	a	94	a
AG13063		1	% v/v	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
5 SOA 14, 4,15, 9						99	a	97	a	97	a	95	a
AG13063		1	% v/v	MIPOWE	A								
FLEXSTAR		1.0	pt/a	MIPOWE	A								
A21472		3.53	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
6 SOA 14, 9						98	b	96	a	93	b	91	a
AG13063		1	% v/v	MIPOWE	A								
FLEXSTAR		1.0	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		26.6	fl oz/a	MIPOWE	A								
MSO		1.0	% v/v	MIPOWE	A								
7 SOA 4,9						97	c	92	b	83	c	80	b
AG13063		1	% v/v	MIPOWE	A								
CLARITY		1.0	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
8 SOA 14, 15, 4, 9						99	a	98	a	97	a	94	a
AG13063		1	% v/v	MIPOWE	A								
WARRANT ULTRA		50.0	fl oz/a	MIPOWE	A								
CLARITY		1.0	pt/a	MIPOWE	A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE	A								
LSD P=.10						0.5		3		3		4	

Table 6. Dicamba tolerant soybean response to A21472 herbicide systems at Rochester, MN in 2016.												
Crop Response					CROP RESPONSE							
Rating Date					June-10		June-13		June-20			
Treatment		Rate	Application									
1 UNTREATED CHECK					0	g	0	f	0	e	0	c
<i>POST 1 (6/6/16) 2-4 inch weeds</i>												
2 SOA 4,15					7	f	19	de	9	cd	0	c
AG13063		1	% v/v	MIPOWE A								
A21472		3.53	pt/a	MIPOWE A								
3 SOA 4,15					13	e	23	cd	10	c	0	c
AG13063		1	% v/v	MIPOWE A								
A21472		3.53	pt/a	MIPOWE A								
NIS		0.25	% v/v	MIPOWE A								
4 SOA 4,15,9					20	d	25	c	9	cd	0	c
AG13063		1	% v/v	MIPOWE A								
A21472		3.53	pt/a	MIPOWE A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE A								
5 SOA 14, 4,15, 9					41	b	34	ab	21	a	10	a
AG13063		1	% v/v	MIPOWE A								
FLEXSTAR		1.0	pt/a	MIPOWE A								
A21472		3.53	pt/a	MIPOWE A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE A								
6 SOA 14, 9					49	a	38	a	21	ab	10	a
AG13063		1	% v/v	MIPOWE A								
FLEXSTAR		1.0	pt/a	MIPOWE A								
ROUNDUP POWERMAX		26.6	fl oz/a	MIPOWE A								
MSO		1.0	% v/v	MIPOWE A								
7 SOA 4,9					8	f	16	e	5	d	0	c
AG13063		1	% v/v	MIPOWE A								
CLARITY		1.0	pt/a	MIPOWE A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE A								
8 SOA 14, 15, 4, 9					30	c	33	b	17	b	5	b
AG13063		1	% v/v	MIPOWE A								
WARRANT ULTRA		50.0	fl oz/a	MIPOWE A								
CLARITY		1.0	pt/a	MIPOWE A								
ROUNDUP POWERMAX		28.4	fl oz/a	MIPOWE A								
LSD P=.10					3		5		4		.	

Managing Glyphosate (Group-9) and ALS (Group-2) Resistant Common Waterhemp with Different Systems and Herbicide Rates in LibertyLink Soybean in SE Minnesota in 2016.

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The objective of this trial was to evaluate systems for controlling glyphosate (Group-9) and ALS (Group-2) resistant waterhemp in southeastern Minnesota. The research site was a Lawler loam series with pH of 6.1, O.M. 2.4 % and soil test P and K levels of 41 ppm and 137 ppm, respectively. In the spring the field was disked and field cultivated once prior to planting. The previous crop was alfalfa/fallow/soybean. The soybean variety was Stine 23LF32 (LibertyLink) and was planted on May 4, 2016 at a depth of 1.5 inches in 30 inch rows at a rate of 165,000 seeds per acre. A randomized complete block design was used with three replications. Preemergence (PRE) treatments and postemergence (POST) for systemic herbicides were applied with a tractor mounted sprayer delivering 15 gpa at 30 psi using TTI 11002 spray tips. POST applications for contact herbicides were made using TTI J60 11002 spray tips delivering 15 gpa at 30 psi. Evaluations were taken May 24 and 31, June 10, 17, 21, and 27, July 8 and September 19. The center two rows of each plot were machine harvested on October 13, 2016. Application dates, environmental conditions, and weed stages can be found in Table 1. Performance ratings for common waterhemp, common lambsquarters, and grass control and crop injury can be found in Tables 2 through 5, respectively.

Discussion

All of the PRE/POST systems in this trial provided very good to excellent (89 to 99%) control of common waterhemp, September 19 rating date. Two total POST systems were evaluated, Liberty at 29 fl oz/a + Prefix at 2 pt/a / Liberty at 29 fl oz/a + Warrant at 3 pt/a, and Liberty at 29 fl oz/a + Outlook at 10 fl oz/a / Liberty at 29 fl oz/a + Warrant at 3 pt/a. The first post application was made on June 2 (V2 soybean and 1-3 inch weeds), which was 6 days earlier than the first POST treatments that included a PRE. Both systems provided 96-99% waterhemp control by the final rating, September 19. However, soybean response to the POST I applications of Liberty + Prefix was 60% injury compared to the Liberty + Outlook at 27% injury, Figures 1 and 2. Even though soybeans recovered, injury resulting from the POST I Liberty + Prefix appeared to impact final yield, Liberty + Prefix, 50.9 bu/a compared to Liberty + Outlook, 56.8 bu/a, Table 1.

As herbicide resistant waterhemp populations become more widespread, there is a need and an interest to include non-chemical control options such as in-season cultivation to control waterhemp. In 2016, a comparison of Boundary at 1.95 pts/a followed by either Liberty at 29 fl oz/a or a mechanical cultivation was evaluated. Final waterhemp control achieved by the Boundary/cultivation was significantly better, 98%, compared to the Boundary/Liberty program at 89%, Table 2. Interesting to note, the soybean canopy closed sooner where cultivation occurred and any waterhemp that germinated under the canopy in July did not survive, Table 2., July 8 and Sept 19 rating dates. In addition, soybean yield of each treatment was similar and equal to the top yielding treatment in this trial. The Boundary / cultivation treatment was evaluated in 2015 with similar results for weed control, canopy closure and final yield. (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stage, environmental conditions.						
Date	5/4	6/2	6/8	6/17	6/21	6/24
Treatment	PRE (A)	POST I (B)	POST II (C)	POST III (D)	POST IV (E)	POST V (F)
Temperature (F)						
Air	59	69	70	72	71	64
Soil	56.0	69.5	73.9	68.5	69.2	65.3
Relative Humidity (%)	40	46	40	78	47	90
Wind (mph)	12	7	3	10	10	7
Soil Moisture	Normal	Normal	Normal	Normal	Normal	Normal
Soybean						
Stage		V2	V2-V3	V5	V6	V6-V7
Height (inch)		4.9	5.8	11.1	14.0	14.6
Common Lambsquarter						
Weed Density (ft ²)				5.5		
Height (inch)		2.5	2.4	6.3	9.3	7.3
Common Waterhemp						
Weed Density (ft ²)				40.5		
Height (inch)		1.5	2.9	5.5	8.0	3.4
Grass						
Weed Density (ft ²)				75.5		
Height (inch)		2.6	2.7	6.3	8.8	5.6
Rainfall after each application (inch)						
Week 1	0.87	0.9	2.66	0.41	0.71	0.65
Week 2	0.58	3.75	1.39	0.65	0.1	1.66
Week 3	0.21	0.3	0.71	1.66	2.07	0.78



Figure 1. Liberty 280 @ 29 fl oz/a + Prefix @2 pt/a
POST on June 2, 2016
60% Injury
50.9 bu/a

Figure 2. Liberty 280 @ 29 fl oz/a + Outlook @10 fl oz/a
POST on June 2, 2016
27% Injury
56.8 bu/a

Table 2. Common waterhemp control with herbicide systems in Liberty Link soybean at Rochester, MN in 2016.

Pest Code	AMATA											YIELD			
	Common Waterhemp											Oct-13-2016			
Pest Name															
Rating Date	May-24	May-31	June-10	June-17	June-21	June-27	July-8	Sept-19							
No. Treatment	Rate	Appl	Percent Control (%)											BU/A	
16 UNTREATED CHECK			0 d	0 e	0 f	0 i	0 e	0 e	0 g	0 f			28.5	d	
A/C = PRE 5/4/16 / POST II 6-8-16 (MIDPOWE 1-3 inch weeds)															
9 SOA 14, 15 / 10			99 a	97 b	96 ab	99 a	98 ab	86 d	85 f	92 de			59.9	a	
VERDICT	5 fl oz/a	A													
OUTLOOK	10 fl oz/a	A													
LIBERTY 280	29 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
10 SOA 14, 15 / 10, 15			95 c	95 d	91 de	99 ab	97 bc	97 abc	95 cd	95 bc			57.1	ab	
VERDICT	5 fl oz/a	A													
LIBERTY 280	29 fl oz/a	C													
OUTLOOK	8 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
11 SOA 14, 15 / 10, 15			97 b	95 d	92 cde	98 ab	97 abc	94 bc	93 d	93 cd			52.9	bc	
VERDICT	5 fl oz/a	A													
LIBERTY 280	32 fl oz/a	C													
OUTLOOK	8 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
12 SOA 5,15 / 10			99 a	98 ab	99 a	99 ab	97 ab	94 c	89 e	89 e			57.3	ab	
BOUNDARY	1.95 pt/a	A													
LIBERTY 280	29 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
A/D = PRE 5/4/16 / POST III 6-17-16 (MIDPOWE 1-3 inch weeds)															
1 SOA 2, 14 / 10			99 a	97 b	94 bcd	94 f	98 ab	99 a	99 ab	98 a			57.7	ab	
AUTHORITY FIRST	4 oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
4 SOA 2, 14 / 14, 15, 10			99 a	96 c	89 e	90 g	97 ab	99 a	99 ab	98 a			59.3	a	
AUTHORITY FIRST	4 oz/a	A													
ANTHEM MAX	2.5 fl oz/a	D													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
5 SOA 14, 15 / 10			99 a	98 ab	96 ab	97 bcd	99 ab	99 a	99 a	99 a			61.0	a	
AUTHORITY ELITE	32 fl oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
6 SOA 14, 15 / 10			99 a	98 ab	95 abc	94 ef	99 a	99 a	98 abc	99 a			60.8	a	
AUTHORITY ELITE	24 fl oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
7 SOA 14, 15 / 10			99 a	99 a	99 a	99 a	99 a	99 a	99 ab	99 a			60.4	a	
FIERCE	3.5 oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
8 SOA 2, 14, 15 / 10			99 a	97 b	97 ab	96 cde	99 ab	97 ab	95 bcd	95 bc			58.2	a	
OPTILL PRO															
OPTILL	2 oz/a	A													
OUTLOOK	10 fl oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
A/E = PRE 5/4/16 / POST IV 6-21-16 (LAPOWE, Before R1, 1-3 inch weeds)															
13 SOA 5,15			99 a	98 ab	97 ab	99 ab	99 a	99 a	95 bcd	98 a			58.1	a	
BOUNDARY	1.95 pt/a	A													
CULTIVATION		E													
A/F = PRE 5/4/16 / POST V 6-24-16 (LAPOWE, Before R1, 1-3 inch weeds)															
2 SOA 2, 14 / 10			99 a	97 b	94 bcd	95 def	95 c	99 a	99 ab	99 a			60.4	a	
AUTHORITY FIRST	6.5 oz/a	A													
LIBERTY 280	29 fl oz/a	F													
AMS	8.5 lb/100 gal	F													
3 SOA 2, 14 / 10			99 a	98 ab	97 ab	97 abc	97 abc	99 a	99 ab	99 a			56.9	ab	
AUTHORITY FIRST	8 oz/a	A													
LIBERTY 280	29 fl oz/a	F													
AMS	8.5 lb/100 gal	F													
B/F = POST I 6-2-16 (EAPOWE 1-3 inch weeds) / POST V 6/24/16 (LAPOWE, Before R1, 1-3 inch weeds)															
14 SOA 10, 14, 15 / 10, 15			0 d	0 e	99 a	99 a	97 ab	99 a	99 ab	99 a			50.9	c	
LIBERTY 280	29 fl oz/a	B													
PREFIX	2 pt/a	B													
AMS	8.5 lb/100 gal	B													
LIBERTY 280	29 fl oz/a	F													
WARRANT	3 pt/a	F													
AMS	8.5 lb/100 gal	F													
15 SOA 10, 15 / 10, 15			0 d	0 e	88 e	80 h	76 d	98 a	96 a-d	96 b			56.8	ab	
LIBERTY 280	29 fl oz/a	B													
OUTLOOK	10 fl oz/a	B													
AMS	8.5 lb/100 gal	B													
LIBERTY 280	29 fl oz/a	F													
WARRANT	3 pt/a	F													
AMS	8.5 lb/100 gal	F													
LSD P=.10			1	1	4	2	2	3	3	3			4.8		

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 3. Common lambsquarters control with herbicide systems in liberty Link soybeans at Rochester, MN in 2016.

Pest Code	CHEAL											YIELD			
	Common Lambsquarters											Oct-13-2016			
Pest Name															
Rating Date	May-24	May-31	June-10	June-17	June-21	June-27	July-8	Sept-19							
No. Treatment	Rate	Appl	Percent Control (%)											BU/A	
16 UNTREATED CHECK			0 d	0 d	0 f	0 d	0 f	0 e	0 f	0 e	0 e	0 e	28.5	d	
A/C = PRE 5/4/16 / POST II 6-8-16 (MIDPOWE 1-3 inch weeds)															
9 SOA 14, 15 / 10			91 c	85 c	94 a-d	93 ab	90 e	87 d	86 de	90 c			59.9	a	
VERDICT	5 fl oz/a	A													
OUTLOOK	10 fl oz/a	A													
LIBERTY 280	29 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
10 SOA 14, 15 / 10, 15			88 c	86 c	92 cde	96 ab	90 e	89.7 cd	88 cd	91 bc			57.1	ab	
VERDICT	5 fl oz/a	A													
LIBERTY 280	29 fl oz/a	C													
OUTLOOK	8 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
11 SOA 14, 15 / 10, 15			88 c	86 c	93 a-d	98 a	92 de	93 bc	90 bc	90 bc			52.9	bc	
VERDICT	5 fl oz/a	A													
LIBERTY 280	32 fl oz/a	C													
OUTLOOK	8 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
12 SOA 5,15 / 10			95 b	90 bc	94 a-d	94 ab	93 cde	88 d	83 e	83 d			57.3	ab	
BOUNDARY	1.95 pt/a	A													
LIBERTY 280	29 fl oz/a	C													
AMS	8.5 lb/100 gal	C													
A/D = PRE 5/4/16 / POST III 6-17-16 (MIDPOWE 1-3 inch weeds)															
1 SOA 2, 14 / 10			97 ab	98 a	97 ab	96 a	98 a	99 a	99 a	99 a			57.7	ab	
AUTHORITY FIRST	4 oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
4 SOA 2, 14 / 14, 15, 10			97 ab	97 a	93 a-d	94 ab	99 a	99 a	99 a	99 a			59.3	a	
AUTHORITY FIRST	4 oz/a	A													
ANTHEM MAX	2.5 fl oz/a	D													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
5 SOA 14, 15 / 10			98 a	98 a	96 abc	96 a	99 a	99 a	99 a	99 a			61.0	a	
AUTHORITY ELITE	32 fl oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
6 SOA 14, 15 / 10			97 ab	97 a	95 abc	94 ab	98 ab	99 a	99 a	99 a			60.8	a	
AUTHORITY ELITE	24 fl oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
7 SOA 14, 15 / 10			96 ab	94 ab	92 b-e	90 bc	97 ab	98 a	97 a	98 a			60.4	a	
FIERCE	3.5 oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
8 SOA 2, 14, 15 / 10			98 ab	96 a	88 e	88 c	97 abc	98 a	98 a	98 a			58.2	a	
OPTILL PRO															
OPTILL	2 oz/a	A													
OUTLOOK	10 fl oz/a	A													
LIBERTY 280	29 fl oz/a	D													
AMS	8.5 lb/100 gal	D													
A/E = PRE 5/4/16 / POST IV 6-21-16 (LAPOWE, Before R1, 1-3 inch weeds)															
13 SOA 5,15			97 ab	95 ab	90 de	87 c	96 a-d	93 b	93 b	93 b			58.1	a	
BOUNDARY	1.95 pt/a	A													
CULTIVATION		E													
A/F = PRE 5/4/16 / POST V 6-24-16 (LAPOWE, Before R1, 1-3 inch weeds)															
2 SOA 2, 14 / 10			98 ab	97 a	97 ab	95 ab	97 abc	99 a	99 a	99 a			60.4	a	
AUTHORITY FIRST	6.5 oz/a	A													
LIBERTY 280	29 fl oz/a	F													
AMS	8.5 lb/100 gal	F													
3 SOA 2, 14 / 10			98 ab	98 a	96 abc	97 a	97 ab	98 a	98 a	99 a			56.9	ab	
AUTHORITY FIRST	8 oz/a	A													
LIBERTY 280	29 fl oz/a	F													
AMS	8.5 lb/100 gal	F													
B/F = POST I 6-2-16 (EAPOWE 1-3 inch weeds) / POST V 6/24/16 (LAPOWE, Before R1, 1-3 inch weeds)															
14 SOA 10, 14, 15 / 10, 15			0 d	0 d	97 a	96 a	94 b-e	99 a	99 a	98 a			50.9	c	
LIBERTY 280	29 fl oz/a	B													
PREFIX	2 pt/a	B													
AMS	8.5 lb/100 gal	B													
LIBERTY 280	29 fl oz/a	F													
WARRANT	3 pt/a	F													
AMS	8.5 lb/100 gal	F													
15 SOA 10, 15 / 10, 15			0 d	0 d	96 abc	97 a	90 e	99 a	97 a	97 a			56.8	ab	
LIBERTY 280	29 fl oz/a	B													
OUTLOOK	10 fl oz/a	B													
AMS	8.5 lb/100 gal	B													
LIBERTY 280	29 fl oz/a	F													
WARRANT	3 pt/a	F													
AMS	8.5 lb/100 gal	F													
LSD P=.10			3	6	5	5	4	3	3	3			4.8		

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 4. Grass control with herbicide systems in LibertyLink soybeans at Rochester, MN in 2016.

Pest Code	Rating Date	GRASS species								YIELD									
		May-31	June-10	June-17	June-21	June-27	July 8	Sept-19	Oct-13-2016	BU/A									
No.	Treatment	Rate	Appl	Percent Control (%)															
16	UNTREATED CHECK			0	d	0	e	0	f	0	e	0	c	0	f	0	c	28.5	d
A/C = PRE 5/4/16 / POST II 6-8-16 (MIDPOWE 1-3 inch weeds)																			
9	SOA 14, 15 / 10			99	a	97	abc	99	a	99	a	99	a	99	a	99	a	59.9	a
	VERDICT	5	fl oz/a																
	OUTLOOK	10	fl oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
10	SOA 14, 15 / 10, 15			97	c	93	d	98	ab	98	ab	98	b	97	e	97	b	57.1	ab
	VERDICT	5	fl oz/a																
	LIBERTY 280	29	fl oz/a																
	OUTLOOK	8	fl oz/a																
	AMS	8.5	lb/100 gal																
11	SOA 14, 15 / 10, 15			98	b	94	cd	99	ab	99	ab	99	ab	98	cd	98	a	52.9	bc
	VERDICT	5	fl oz/a																
	LIBERTY 280	32	fl oz/a																
	OUTLOOK	8	fl oz/a																
	AMS	8.5	lb/100 gal																
12	SOA 5,15 / 10			99	a	99	a	99	a	99	a	99	a	99	a	99	a	57.3	ab
	BOUNDARY	1.95	pt/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
A/D = PRE 5/4/16 / POST III 6-17-16 (MIDPOWE 1-3 inch weeds)																			
1	SOA 2, 14 / 10			97	c	94	cd	91.3	e	98	ab	99	a	99	a	99	a	57.7	ab
	AUTHORITY FIRST	4	oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
4	SOA 2, 14 / 14, 15, 10			97	c	96	bc	90	e	98	ab	99	a	97	d	98	a	59.3	a
	AUTHORITY FIRST	4	oz/a																
	ANTHEM MAX	2.5	fl oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
5	SOA 14, 15 / 10			99	a	99	ab	99	a	99	a	99	a	99	a	99	a	61.0	a
	AUTHORITY ELITE	32	fl oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
6	SOA 14, 15 / 10			99	a	99	a	99	ab	99	a	99	a	99	a	99	a	60.8	a
	AUTHORITY ELITE	24	fl oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
7	SOA 14, 15 / 10			99	a	98	ab	97	ab	99	ab	99	a	99	a	99	a	60.4	a
	FIERCE	3.5	oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
8	SOA 2, 14, 15 / 10			99	a	99	a	99	ab	99	a	99	a	99	ab	99	a	58.2	a
	OPTILL PRO																		
	OPTILL	2	oz/a																
	OUTLOOK	10	fl oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
A/E = PRE 5/4/16 / POST IV 6-21-16 (LAPOWE, Before R1, 1-3 inch weeds)																			
13	SOA 5,15			99	a	99	a	99	a	99	a	99	a	99	a	99	a	58.1	a
	BOUNDARY	1.95	pt/a																
	CULTIVATION																		
A/F = PRE 5/4/16 / POST V 6-24-16 (LAPOWE, Before R1, 1-3 inch weeds)																			
2	SOA 2, 14 / 10			97	bc	97	ab	95	c	95	c	99	a	99	a	99	a	60.4	a
	AUTHORITY FIRST	6.5	oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
3	SOA 2, 14 / 10			98	b	96	abc	93	d	92.3	d	99	a	99	a	99	a	56.9	ab
	AUTHORITY FIRST	8	oz/a																
	LIBERTY 280	29	fl oz/a																
	AMS	8.5	lb/100 gal																
B/F = POST I 6-2-16 (EAPOWE, 1-3 inch weeds) / POST V 6/24/16 (LAPOWE, Before R1, 1-3 inch weeds)																			
14	SOA 10, 14, 15 / 10, 15			0	d	98	ab	97	b	96	c	99	a	98	bc	98	a	50.9	c
	LIBERTY 280	29	fl oz/a																
	PREFIX	2	pt/a																
	AMS	8.5	lb/100 gal																
	LIBERTY 280	29	fl oz/a																
	WARRANT	3	pt/a																
	AMS	8.5	lb/100 gal																
15	SOA 10, 15 / 10, 15			0	d	97	abc	99	a	97	bc	99	a	99	ab	99	a	56.8	ab
	LIBERTY 280	29	fl oz/a																
	OUTLOOK	10	fl oz/a																
	AMS	8.5	lb/100 gal																
	LIBERTY 280	29	fl oz/a																
	WARRANT	3	pt/a																
	AMS	8.5	lb/100 gal																
LSD P=.10				1	3	2	2	0.5	1	1	1	4.8							

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 5. Crop response to herbicide systems to control SOA 9- and SOA 2- resistant common waterhemp in LibertyLink soybeans at Rochester, MN in 2016.

Pest Code	Rating Date	Crop Response									YIELD Oct-13 BU/A		
		May-24	May-31	June-10	June-17	June-21	June-27	July-8	Percent Injury (%)				
No.	Treatment	Rate	Appl	Percent Injury (%)									BU/A
16	UNTREATED CHECK			3 e	0 -	0 d	0 b	0 d	0 c	0 -	28.5 d		
A/C = PRE 5/4/16 / POST II 6-8-16 (MIDPOWE 1-3 inch weeds)													
9	SOA 14, 15 / 10			13 ab	0 -	20 c	0 b	0 d	0 c	0 -	59.9 a		
	VERDICT	5 fl oz/a	A										
	OUTLOOK	10 fl oz/a	A										
	LIBERTY 280	29 fl oz/a	C										
	AMS	8.5 lb/100 gal	C										
10	SOA 14, 15 / 10, 15			12 abc	0 -	22 c	0 b	0 d	0 c	0 -	57.1 ab		
	VERDICT	5 fl oz/a	A										
	LIBERTY 280	29 fl oz/a	C										
	OUTLOOK	8 fl oz/a	C										
	AMS	8.5 lb/100 gal	C										
11	SOA 14, 15 / 10, 15			13 ab	0 -	20 c	0 b	0 d	0 c	0 -	52.9 bc		
	VERDICT	5 fl oz/a	A										
	LIBERTY 280	32 fl oz/a	C										
	OUTLOOK	8 fl oz/a	C										
	AMS	8.5 lb/100 gal	C										
12	SOA 5,15 / 10			15 a	0 -	20 c	0 b	0 d	0 c	0 -	57.3 ab		
	BOUNDARY	1.95 pt/a	A										
	LIBERTY 280	29 fl oz/a	C										
	AMS	8.5 lb/100 gal	C										
A/D = PRE 5/4/16 / POST III 6-17-16 (MIDPOWE 1-3 inch weeds)													
1	SOA 2, 14 / 10			8 b-e	0 -	0 d	0 b	15 b	0 c	0 -	57.7 ab		
	AUTHORITY FIRST	4 oz/a	A										
	LIBERTY 280	29 fl oz/a	D										
	AMS	8.5 lb/100 gal	D										
4	SOA 2, 14 / 14, 15, 10			7 cde	0 -	0 d	0 b	30 a	15 b	2 -	59.3 a		
	AUTHORITY FIRST	4 oz/a	A										
	ANTHEM MAX	2.5 fl oz/a	D										
	LIBERTY 280	29 fl oz/a	D										
	AMS	8.5 lb/100 gal	D										
5	SOA 14, 15 / 10			15 a	0 -	0 d	0 b	15 b	0 c	0 -	61.0 a		
	AUTHORITY ELITE	32 fl oz/a	A										
	LIBERTY 280	29 fl oz/a	D										
	AMS	8.5 lb/100 gal	D										
6	SOA 14, 15 / 10			13 ab	0 -	0 d	0 b	15 b	0 c	0 -	60.8 a		
	AUTHORITY ELITE	24 fl oz/a	A										
	LIBERTY 280	29 fl oz/a	D										
	AMS	8.5 lb/100 gal	D										
7	SOA 14, 15 / 10			10 a-d	0 -	0 d	0 b	15 b	0 c	0 -	60.4 a		
	FIERCE	3.5 oz/a	A										
	LIBERTY 280	29 fl oz/a	D										
	AMS	8.5 lb/100 gal	D										
8	SOA 2, 14, 15 / 10			12 abc	0 -	0 d	0 b	15 b	0 c	0 -	58.2 a		
	OPTILL PRO												
	OPTILL	2 oz/a	A										
	OUTLOOK	10 fl oz/a	A										
	LIBERTY 280	29 fl oz/a	D										
	AMS	8.5 lb/100 gal	D										
A/E = PRE 5/4/16 / POST IV 6-21-16 (LAPOWE, Before R1, 1-3 inch weeds)													
13	SOA 5,15			12 abc	0 -	0 d	0 b	2 c	0 c	0 -	58.1 a		
	BOUNDARY	1.95 pt/a	A										
	CULTIVATION		E										
A/F = PRE 5/4/16 / POST V 6-24-16 (LAPOWE, Before R1, 1-3 inch weeds)													
2	SOA 2, 14 / 10			9 bcd	0 -	0 d	0 b	0 d	15 b	0 -	60.4 a		
	AUTHORITY FIRST	6.5 oz/a	A										
	LIBERTY 280	29 fl oz/a	F										
	AMS	8.5 lb/100 gal	F										
3	SOA 2, 14 / 10			8 b-e	0 -	0 d	0 b	0 d	15 b	0 -	56.9 ab		
	AUTHORITY FIRST	8 oz/a	A										
	LIBERTY 280	29 fl oz/a	F										
	AMS	8.5 lb/100 gal	F										
B/F = POST I 6-2-16 (EAPOWE 1-3 inch weeds) / POST V 6/24/16 (LAPOWE, Before R1, 1-3 inch weeds)													
14	SOA 10, 14, 15 / 10, 15			5 de	0 -	60 a	20 a	0 d	20 a	0 -	50.9 c		
	LIBERTY 280	29 fl oz/a	B										
	PREFIX	2 pt/a	B										
	AMS	8.5 lb/100 gal	B										
	LIBERTY 280	29 fl oz/a	F										
	WARRANT	3 pt/a	F										
	AMS	8.5 lb/100 gal	F										
15	SOA 10, 15 / 10, 15			3 e	0 -	27 b	0 b	0 d	20 a	0 -	56.8 ab		
	LIBERTY 280	29 fl oz/a	B										
	OUTLOOK	10 fl oz/a	B										
	AMS	8.5 lb/100 gal	B										
	LIBERTY 280	29 fl oz/a	F										
	WARRANT	3 pt/a	F										
	AMS	8.5 lb/100 gal	F										
LSD P=.10				6	.	2	.	1	.	1	4.8		

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Managing Waterhemp in Soybean with Layered Residual Herbicides - A Strategy for Controlling ALS and Glyphosate Resistant Waterhemp in Minnesota, 2015 and 2016.

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Tall waterhemp (*Amaranthus tuberculatus*) is expanding its reach across Minnesota and herbicide resistant populations are becoming more commonplace. Most waterhemp populations in Minnesota are resistant to ALS (Group-2) herbicides. In 2007, waterhemp populations resistant to glyphosate (Group-9) were reported and in 2015 and 2016, populations in southern Minnesota were confirmed resistant to PPO herbicides (Group-14), with some populations resistant to all three herbicide groups, Group-2, Group-9 and Group-14¹. New management strategies to control waterhemp are needed. Waterhemp seedlings emerge over an extended period, frequently outlasting the residual control achieved by herbicides applied before or at crop planting. One strategy for dealing with glyphosate-, PPO- and ALS- resistant waterhemp is to layer Group-15 soil residual herbicides, preemergence (PRE) followed by additional Group-15 residual herbicide at early postemergence (POST), about 30 days after planting, Figure 1. Several residual herbicides may be applied postemergence to the crop alone or in combination with other post-emergent herbicides. When activated by rainfall, these post-applied residual herbicides can extend the duration of waterhemp seedling control. The objective of this trial was to evaluate and demonstrate the effectiveness of layering soil residual herbicides for control of common waterhemp in soybeans in southeastern Minnesota.

Materials and Methods:

Three Group-15 herbicides were evaluated in this study, 1) Dual II Magnum (s-metolachlor) at 1.5 pts/A PRE only or 1.5 pt/A PRE followed by 1.0 pt/A POST, 2) Outlook (dimethenamid-P) at 18 fl oz/A PRE only or 14 fl oz/A PRE followed by 10 fl oz/A POST, and 3) Warrant (acetochlor) at 1.6 qt/A PRE only or 1.6 qt/A PRE followed by 1.6 qt/A POST. Additional treatments were included in 2016 to evaluate the 1) optimum time for POST layered application to be made, (20, 29 or 44 days after PRE or DAP), 2) effect of layering two different Group-15 herbicides, used at maximum labelled rates, and 3) effectiveness of layering multiple residual SOAs, Group-14 Valor SX (flumioxazin) followed by a Group-15 Dual II Magnum.

Herbicide selection was based on their known effectiveness for controlling common waterhemp and their flexibility of application timing. Rates used were based on soil type and seasonal limits. The waterhemp population at Rochester is ALS-resistant. Pursuit (imazethapyr) in 2015 and FirstRate (chloransulam) in 2016 were used preemergence to assist in controlling other broadleaf weeds present in this study. The research site was a Lawler loam series that was fall chisel plowed, spring disked and field cultivated prior to planting. Stine 22LD23 (LibertyLink) soybean was planted May 5, 2015 in 30-inch rows at 135,000 seeds per acre. Stine 23LF32 (LibertyLink) was planted on May 4, 2016 in 30-inch rows at 165,000 seeds per acre. A randomized complete block was used with three replications. Preemergence treatments were applied immediately after planting. Layered soil residuals herbicides were applied POST 34 days (2015) and 22, 29 or 44 days (2016) after PRE herbicides were applied. Evaluations were taken from May through September. The center two rows of each plot were machine harvested on October 13, 2015 and 2016. Application dates, environmental conditions, and weed stages can be found in Table 1. Performance ratings for common waterhemp, common lambsquarters and grass control and crop response are in Tables 2 - 8.

Discussion

1. In 2015, layered or sequential applications of Dual II Magnum, Outlook or Warrant herbicides provided significantly better (95, 94 and 90%, respectively) season-long control of waterhemp compared to their PRE only treatments (81, 71, and 62%, respectively), 9/29/15 rating, Table 2. The results were similar in 2016, with the layered herbicides providing significantly better (94, 95 and 91%, respectively) season long control compared to their PRE only treatments (76, 79, and 79%, respectively), 9/26/16 rating, Table 3. The two-year average waterhemp control achieved with layering herbicides in this study was 20% greater than PRE only, Figure 2. An open soybean canopy well into July allowed waterhemp to continue to emerge and compete with the crop, Figure 3.

- Layering two different Group-15 herbicides, Zidua (pyroxasulfone) at 2.5 oz/A PRE followed by Outlook at 18 fl oz/A POST, (maximum labelled rates), provided satisfactory control, 93%, 9/26/ 26 rating.
- These data show the optimum time for applying the POST layered residual Group-15 herbicide was about 30 DAP, Table 4. The 20 DAP and 29 DAP provided 92 to 98% season-long control with minimal waterhemp escapes, which was significantly better than the later application at 44 DAP, which resulted in escapes by the June 27 rating, 85% control. This correlates with their average half-life² (~30 days) as control starts to diminish about 30 days after PRE application, Table 4. This shows that when the second residual application is delayed, it would be necessary to include a postemergence herbicide that effectively controls emerged waterhemp and other weeds, as Group-15 herbicides do not control emerged waterhemp.
- Layering effective residual, SOA's is a good strategy for controlling waterhemp populations. Group-14 Valor SX applied PRE followed by Group-15 Dual II Magnum applied POST provided very good season long waterhemp control, Table 5. When compared to the layered Group-15 herbicide programs, the Valor SX followed by Dual II Magnum provided excellent control (98%), which was similar to the layered Dual II Magnum (94%) and Outlook (95%) and significantly better than the Warrant (91%) control, Table 5. However, because populations of PPO-resistant waterhemp have been increasing in Minnesota, the effectiveness of a PRE Group-14 herbicide may be diminished and/or provide a shorter duration of control. Layering an effective residual Group-15 herbicide would make this a more durable system.

This trial demonstrates that layering of effective residual herbicides is a strategy that could provide season long control of waterhemp. However, as waterhemp populations become resistant to multiple herbicides, the need for new weed management strategies, including non-chemical options, must be implemented. (University of Minnesota Extension Regional Office, Rochester).

- Heap, I. The International Survey of Herbicide Resistant Weeds. Online. November, 2016 . Available www.weedscience.org
- National Pesticide Information Center, <http://npic.orst.edu/HPT/index.html>.

Table 1. Application timing, plant stages, environmental conditions in 2016.

Date	5/4	5/24	6/2	6/17
Treatment	PRE	POST I	POST II	POST III
Temperature (F)				
Air	59.0	76.0	68.0	72.0
Soil	56.3	71.3	69.5	68.5
Relative Humidity (%)	40	64	56	78
Wind (mph)	12	5	9	10
Soil Moisture	Normal	Normal	Normal	Normal
Soybean				
Stage		VC	V2	V5
Height (inch)		2.0	4.4	11.2
Common Waterhemp				
Density (ft ²)				40.5
Height (inch)			1.2	4.9
Rainfall after each application				
Week 1	0.87	2.79	0.9	0.41
Week 2	0.58	1.22	3.75	0.65
Week 3	0.21	2.66	0.3	1.66

Figure 1. Concept of layering soil residual herbicide (PRE / POST) to control waterhemp populations in soybean.

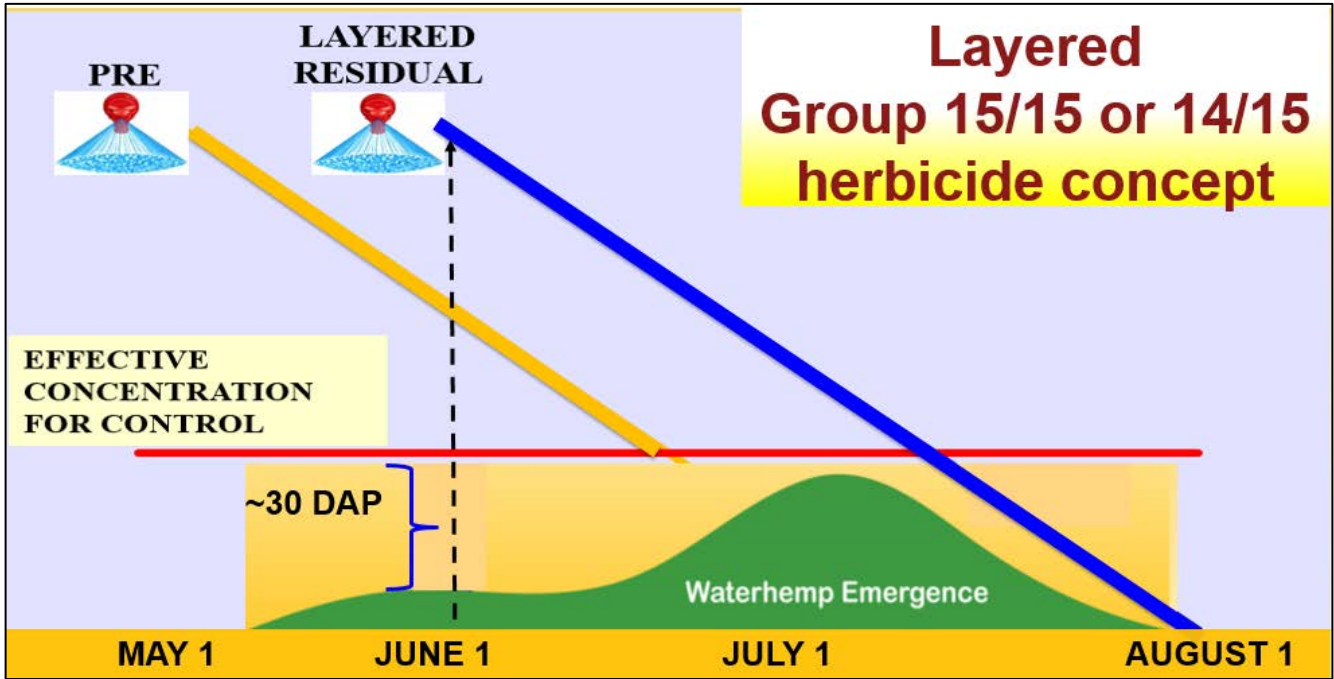


Figure 2. Average control of 2015 and 2016 of layered (PRE/POST) residual herbicides compared to preemergence (PRE) application only.

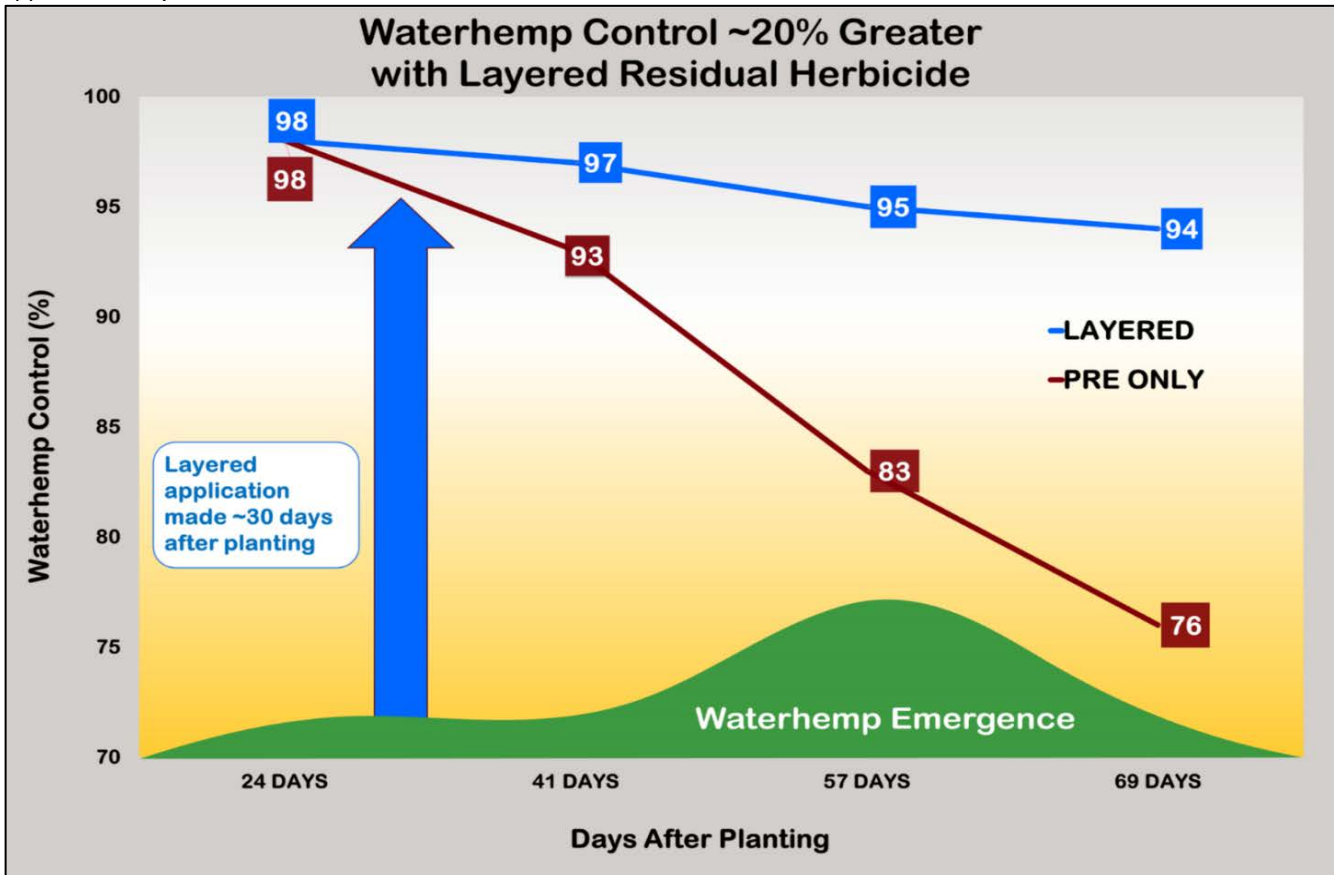




Figure 3. Comparison of weed control in soybean with a single preemergence, May 5, application of Outlook (left and layered applications of Outlook on May 5 and June 8 (right). Top photos taken on July 14, 2015. Bottom photos taken three weeks later on August 6, 2015.

Table 2. Waterhemp and common lambsquarters control and soybean yield with residual herbicides applied either PRE (A) only or layered PRE/POST (A/B) at Rochester, MN in 2015.

Pest Name					Common waterhemp		Common lambsquarters		YIELD 13%	
Rating Date					Sep-29-2015				Oct-13-2015	
No.	Name	Rate	Unit	Code Description	(%) CONTROL				YIELD (bu/A)	
1	SOA 2, 15 DUAL II MAGNUM PURSUIT	1.5 4	pt/a fl oz/a	A A	81	b	92	c	43.1	cd
2	SOA 2, 15 / 15 DUAL II MAGNUM PURSUIT DUAL II MAGNUM	1.5 4 1.0	pt/a fl oz/a pt/a	A A B +/- 30 DAP	95	a	97	ab	48.9	ab
3	SOA 2, 15 OUTLOOK PURSUIT	18 4	fl oz/a fl oz/a	A A	71	c	98	ab	40.3	d
4	SOA 2, 15 / 15 OUTLOOK PURSUIT OUTLOOK	14 4 10	fl oz/a fl oz/a fl oz/a	A A B +/- 30 DAP	94	a	98	ab	51.4	a
5	SOA 2, 15 WARRANT PURSUIT	1.6 4	qt/a fl oz/a	A A	62	d	97	b	32.3	e
6	SOA 2, 15 / 15 WARRANT PURSUIT WARRANT	1.6 4 1.6	qt/a fl oz/a qt/a	A A B +/- 30 DAP	90	a	99	a	46.1	bc
LSD P=.10					6.9		2.3		4.1	

Table 3. Waterhemp and common lambsquarters control and soybean yield with residual herbicides applied either PRE (A) only or layered PRE/POST (A/C) at Rochester, MN in 2016.

Pest Name						Common waterhemp		Common lambsquarters		YIELD @13%	
Rating Date						Sep-26-2016				Oct-14-2016	
No.	Name	Rate	Unit	Code	Description	(%) CONTROL					
										(bu/A)	
1	SOA 15, 2 DUAL II MAGNUM FIRSTRATE	1.5 0.6	pt/a oz/a	A A		76	b	86	ab	45.7	bc
2	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 0.6 1.0	pt/a oz/a pt/a	A A C	+/- 30 DAP	94	a	92	a	47.7	abc
3	SOA 15, 2 OUTLOOK FIRSTRATE	18 0.6	fl oz/a oz/a	A A		79	b	82	b	50.3	ab
4	SOA 15, 2 / 15 OUTLOOK FIRSTRATE OUTLOOK	14 0.6 10	fl oz/a oz/a fl oz/a	A A C	+/- 30 DAP	95	a	83	b	51.8	ab
5	SOA 15, 2 WARRANT FIRSTRATE	1.6 0.6	qt/a oz/a	A A		79	b	81	b	42.2	c
6	SOA 15, 2 / 15 WARRANT FIRSTRATE WARRANT	1.6 0.6 1.6	qt/a oz/a qt/a	A A C	+/- 30 DAP	91	a	87	ab	52.9	a
LSD P=.10 for weed control, LSD P=.20 for yield						7.0		6.5		4.95	

Table 4. Comparison of a PRE Group-15 herbicide followed by three different POST Group-15 application timings (20 DAP, 29 DAP and 44 DAP) for waterhemp control in soybeans at Rochester, MN in 2016.

Pest						Waterhemp species									
Rating Date						Jun-1-2016	Jun-10-2016	Jun-27-2016	Jul-8-2016	Sep-26-2016					
No.	Name	Rate	Unit	Code	Description	(%) CONTROL									
A/B = PRE / POST I 5-4-16 / 5-24-16															
11	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 0.6 1.0	pt/a oz/a pt/a	A A B	+ 20 DAP	98	a	98	a	94	a	93	a	93	a
A/C = PRE / POST II 5-4-16 / 6-2-16															
2	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 0.6 1.0	pt/a oz/a pt/a	A A C	+ 29 DAP	97	b	96	a	93	a	92	a	94	a
A/D = PRE / POST III 5-4-16 / 6-17-16															
12	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 0.6 1.0	pt/a oz/a pt/a	A A D	+ 44 DAP	97	b	93	b	85	b	83	b	83	b
LSD P=.10 for weed ratings						0.9		2.6		2.2		3.5		6.2	

Table 5. Common waterhemp control with preemergence compared to preemergence followed by postemergence herbicides in soybeans in SE MN in 2016.

Pest Code	AMATA						YIELD @13% October 13 (bu/A)		
	Common waterhemp								
Pest Name	May-24	June-1	June-10	June-27	July-8	Sept-26			
Rating Date	($)$ CONTROL								
Treatment	Rate	Appl							
9 SOA 2 CHECK FIRSTRATE	0.6 oz/a	A	0 c	0 f	0 g	0 g	0 g	0 e	28.3 e
A = PRE 5-4-16									
1 SOA 15, 2 DUAL II MAGNUM FIRSTRATE	1.5 pt/a 0.6 oz/a	A A	98 ab	97 bc	90 e	78 f	72 f	76 d	45.7 cd
3 SOA 15, 2 OUTLOOK FIRSTRATE	18 fl oz/a 0.6 oz/a	A A	98 ab	98 a	98 ab	80 f	72 f	79 cd	50.3 abc
5 SOA 15, 2 WARRANT FIRSTRATE	1.6 qt/a 0.6 oz/a	A A	97 ab	95 de	85 f	80 f	80 e	79 cd	42.2 d
7 SOA 14, 2 VALOR SX FIRSTRATE	3 oz/a 0.6 oz/a	A A	99 a	99 a	99 a	98 a	97 ab	98 a	51.8 ab
A/B = PRE / POST I 5-4-16 / 5-24-16 (20 DAP)									
11 SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A B	98 ab	98 ab	98 ab	94 bcd	93 bcd	93 b	51.6 ab
A/C = PRE / POST II 5-4-16 / 6-2-16 (29 DAP)									
2 SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A C	99 a	97 c	96 c	93 cd	92 cd	94 ab	47.7 bcd
4 SOA 15, 2 / 15 OUTLOOK FIRSTRATE OUTLOOK	14 fl oz/a 0.6 oz/a 10 fl oz/a	A A C	98 ab	97 c	98 abc	96 abc	95 abc	95 ab	51.8 ab
6 SOA 15, 2 / 15 WARRANT FIRSTRATE WARRANT	1.6 qt/a 0.6 oz/a 1.6 qt/a	A A C	97 b	95 e	97 bc	91 d	91 d	91 b	52.9 ab
8 SOA 14, 2 / 15 VALOR SX FIRSTRATE DUAL II MAGNUM	3 oz/a 0.6 oz/a 1.0 pt/a	A A C	98 ab	99 a	99 a	97 ab	98 a	98 a	53. a
10 SOA 15, 2 / 15 ZIDUA FIRSTRATE OUTLOOK	2.5 oz/a 0.6 oz/a 18 fl oz/a	A A C	98 ab	96 cd	99 a	94 bcd	93 bcd	93 b	50.6 abc
A/C = PRE / POST III 5-4-16 / 6-17-16 (44 DAP)									
12 SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A D	99 a	97 bc	93 d	85 e	83 e	83 c	48.2 abc
LSD P=.10 for weed ratings, LSD P=.20 for yield			2	1	2	4	4	5	5.8

Table 6. Common lambsquarters control with preemergence compared to preemergence followed by postemergence herbicides in soybeans in SE MN in 2016.

Pest Code Pest Name Rating Date				CHEAL							YIELD @13% October 13 (bu/A)	
				Common lambsquarter								
Trt Treatment Rate Appl				May-24	Jun-1	Jun 10	Jun-27	Jul-8	Sept 26			
				(%) CONTROL								
9	SOA 2 CHECK FIRSTRATE	0.6 oz/a	A	0 b	0 c	0 d	0 e	0 f	0 e	28.3	e	
A = PRE 5-4-16												
1	SOA 15, 2 DUAL II MAGNUM FIRSTRATE	1.5 pt/a 0.6 oz/a	A A	94 a	95 ab	90 bc	86 bc	86 d	86 cd	45.7	cd	
3	SOA 15, 2 OUTLOOK FIRSTRATE	18 fl oz/a 0.6 oz/a	A A	93 a	96 ab	93 ab	88 bc	86 d	82 d	50.3	abc	
5	SOA 15, 2 WARRANT FIRSTRATE	1.6 qt/a 0.6 oz/a	A A	94 a	95 b	86 c	80 d	80 e	81 d	42.2	c	
7	SOA 14, 2 VALOR SX FIRSTRATE	3 oz/a 0.6 oz/a	A A	95 a	97 a	97 a	95 a	95 a	96a a	51.8	ab	
A/B = PRE / POST I 5-4-16 / 5-24-16 (20 DAP)												
11	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A B	94 a	96 ab	93 ab	89 bc	87 cd	87 bcd	51.6	ab	
A/C = PRE / POST II 5-4-16 / 6-2-16 (29 DAP)												
2	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A C	93 a	97 ab	94 ab	92 ab	92 abc	92 abc	47.7	bcd	
4	SOA 15, 2 / 15 OUTLOOK FIRSTRATE OUTLOOK	14 fl oz/a 0.6 oz/a 10 fl oz/a	A A C	93 a	95 ab	90 bc	84 cd	83 de	83 d	51.8	ab	
6	SOA 15, 2 / 15 WARRANT FIRSTRATE WARRANT	1.6 qt/a 0.6 oz/a 1.6 qt/a	A A C	92 a	95 b	91 bc	88 bc	87 bcd	87 bcd	52.9	ab	
8	SOA 14, 2 / 15 VALOR SX FIRSTRATE DUAL II MAGNUM	3 oz/a 0.6 oz/a 1.0 pt/a	A A C	95 a	97 ab	95 ab	92 ab	93 ab	93 ab	53.7	a	
10	SOA 15, 2 / 15 ZIDUA FIRSTRATE OUTLOOK	2.5 oz/a 0.6 oz/a 18 fl oz/a	A A C	92 a	95 ab	90 bc	87 bc	87 cd	87 cd	50.6	abc	
A/D = PRE / POST III 5-4-16 / 6-17-16 (44 DAP)												
12	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A D	94 a	95 ab	92 ab	88 bc	85 de	85 d	48.2	abc	
LSD P=.10 for weed ratings, LSD P=.20 for yield				5	2	6	6	6	6	5.8		

Table 7. Grass control with preemergence compared to preemergence followed by postemergence herbicides in soybeans in SE MN in 2016.

Pest Code				GRASS						YIELD					
Pest Name				Grangea sp.						@13%					
Rating Date				Jun-1		October 13		Jun-27		Jul-8		Sep-26		October 13	
Trt	Treatment	Rate	Appl	(% CONTROL)										(bu/A)	
9	SOA 2 CHECK FIRSTRATE	0.6 oz/a	A	0	c	0	c	0	f	0	e	0	d	28.3	e
A = PRE 5/4/16															
1	SOA 15, 2 DUAL II MAGNUM FIRSTRATE	1.5 pt/a 0.6 oz/a	A A	99	ab	99	a	97	abc	97	ab	97	a	45.7	cd
3	SOA 15, 2 OUTLOOK FIRSTRATE	18 fl oz/a 0.6 oz/a	A A	99	a	99	a	98	ab	98	a	98	a	50.3	abc
5	SOA 15, 2 WARRANT FIRSTRATE	1.6 qt/a 0.6 oz/a	A A	97	b	93	b	91	e	91	d	90	c	42.2	d
7	SOA 14, 2 VALOR SX FIRSTRATE	3 oz/a 0.6 oz/a	A A	97	ab	96	a	92	de	91	d	91	c	51.8	ab
A/B = PRE/POST I 5/4/16 / 5/24/16 (20 DAP)															
11	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A B	99	a	99	a	99	a	99	a	98	a	51.6	ab
A/C = PRE/ POST II 5/4/16 / 6/2/16 (29 DAP)															
2	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A C	99	a	99	a	97	abc	97	ab	96	ab	47.7	bcd
4	SOA 15, 2 / 15 OUTLOOK FIRSTRATE OUTLOOK	14 fl oz/a 0.6 oz/a 10 fl oz/a	A A C	99	a	98	a	98	ab	97	ab	97	a	51.8	ab
6	SOA 15, 2 / 15 WARRANT FIRSTRATE WARRANT	1.6 qt/a 0.6 oz/a 1.6 qt/a	A A C	99	a	98	a	95	bcd	95	bc	93	bc	52.9	ab
8	SOA 14, 2 / 15 VALOR SX FIRSTRATE DUAL II MAGNUM	3 oz/a 0.6 oz/a 1.0 pt/a	A A C	98	ab	97	a	94	cde	93	cd	93	bc	53.7	a
10	SOA 15, 2 / 15 ZIDUA FIRSTRATE OUTLOOK	2.5 oz/a 0.6 oz/a 18 fl oz/a	A A C	99	a	99	a	98	ab	98	a	97	a	50.6	abc
A/D = PRE/POST III 5/4/16 / 6/17/16 (44 DAP)															
12	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A D	99	a	99	a	98	ab	98	a	98	a	48.2	abc
LSD P=.10 for weed ratings, LSD P=.20 for yield				1.8		3.1		3.2		3.0		3.7		5.8	

Table 8. Crop response to layered PRE/POST herbicide programs used to control waterhemp in soybeans in SE MN in 2016.

Pest Code				INJURY				YIELD	
Rating Date				May-24	Jun-1	Jun-10	Jun-27	@13% October 13	
Trt	Treatment	Rate	Appl	Percent Injury (%)				(bu/A)	
9	SOA 2 CHECK FIRSTRATE	0.6 oz/a	A	7	0 b	0 e	0 b	28.3	e
<i>A = PRE 5/4/16</i>									
1	SOA 15, 2 DUAL II MAGNUM FIRSTRATE	1.5 pt/a 0.6 oz/a	A A	10	0 b	0 e	0 b	45.7	cd
3	SOA 15, 2 OUTLOOK FIRSTRATE	18 fl oz/a 0.6 oz/a	A A	12	0 b	0 e	0 b	50.3	abc
5	SOA 15, 2 WARRANT FIRSTRATE	1.6 qt/a 0.6 oz/a	A A	11	0 b	0 e	0 b	42.2	d
7	SOA 14, 2 VALOR SX FIRSTRATE	3 oz/a 0.6 oz/a	A A	10	0 b	0 e	0 b	51.8	ab
<i>A/B = PRE/POST I 5/4/16 / 5/24/16 (20 DAP)</i>									
11	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A B	12	7 a	27 b	0 b	51.6	ab
<i>A/C = PRE/POST II 5/4/16 / 6/2/16 (29 DAP)</i>									
2	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A C	5	0 b	27 b	0 b	47.7	bcd
4	SOA 15, 2 / 15 OUTLOOK FIRSTRATE OUTLOOK	14 fl oz/a 0.6 oz/a 10 fl oz/a	A A C	12	0 b	15 d	0 b	51.8	ab
6	SOA 15, 2 / 15 WARRANT FIRSTRATE WARRANT	1.6 qt/a 0.6 oz/a 1.6 qt/a	A A C	15	0 b	15 d	0 b	52.9	ab
8	SOA 14, 2 / 15 VALOR SX FIRSTRATE DUAL II MAGNUM	3 oz/a 0.6 oz/a 1.0 pt/a	A A C	12	0 b	32 a	0 b	53.7	a
10	SOA 15, 2 / 15 ZIDUA FIRSTRATE OUTLOOK	2.5 oz/a 0.6 oz/a 18 fl oz/a	A A C	10	0 b	18 c	0 b	50.6	abc
<i>A/D = PRE/POST III 5/4/16 / 6/17/16 (44 DAP)</i>									
12	SOA 15, 2 / 15 DUAL II MAGNUM FIRSTRATE DUAL II MAGNUM	1.5 pt/a 0.6 oz/a 1.0 pt/a	A A D	12	0 b	0 e	5 a	48.2	abc
LSD P=.10 for weed ratings, LSD P=.20 for yield				NS	1.2	3.2		5.8	

Introduction

Tall waterhemp (*Amaranthus tuberculatus*) is becoming more widespread throughout Minnesota. Most waterhemp populations in Minnesota are resistant to ALS (Group-2) herbicides. In 2007, waterhemp populations resistant to glyphosate (Group-9) were reported and in 2015 and 2016, populations in southern Minnesota were confirmed resistant to PPO herbicides (Group-14), with some populations resistant to both Group-9 and Group-14¹. New management strategies to control waterhemp are needed. One strategy for dealing with glyphosate-, PPO- and ALS- resistant waterhemp is to layer soil residual herbicides (Group-15), preemergence (PRE) followed by additional residual herbicide (Group-15) at early postemergence (POST), about 30 days after planting. Waterhemp seedlings emerge over an extended period of time, frequently outlasting the residual control achieved by herbicides applied before or at crop planting. Several residual herbicides may be applied postemergence to the crop alone or in combination with other post-emergent herbicides. When activated by rainfall, these post-applied residual herbicides can extend the duration of waterhemp seedling control. The objective of this trial was to evaluate and demonstrate the effectiveness of layering soil residual herbicides for control of common waterhemp in soybeans in southeastern Minnesota.

Materials and Methods

Three herbicides were evaluated in this study, 1) Dual II Magnum (s-metolachlor) at 1.5 pts/A PRE only or 1.5 pt/A PRE followed by 1.0 pt/A POST, 2) Outlook (dimethenamid-P) at 18 fl oz/A PRE only or 14 fl oz/A PRE followed by 10 fl oz/A POST, and 3) Warrant (acetochlor) at 1.6 qt/A PRE only or 1.6 qt/A PRE followed by 1.6 qt/A POST. Herbicide selection was based on their known effectiveness for controlling common waterhemp and their flexibility of application timing. Rates used were based on soil type and seasonal limits. The waterhemp population at Rochester is ALS-resistant. Pursuit (imazethapyr) in 2015 and FirstRate (chloransulam) in 2016 were used preemergence to assist in controlling other broadleaf weeds present in this study. The research site was a Lawler loam series with a pH of 6.7, O.M. 2.8% and soil test P and K levels of 34 ppm and 175 ppm, respectively. The field was fall chisel plowed, spring disked and field cultivated prior to planting. Stine 22LD23 (LibertyLink) soybean was planted May 5, 2015 in 30 inch rows at 135,000 seeds per acre. Stine 23LF32 (LibertyLink) was planted on May 4, 2016 in 30 inch rows at 165,000 seeds per acre. A randomized complete block was used with three replications. Preemergence treatments were applied immediately after planting. Layered soil residuals herbicides were applied POST 34 days (2015) and 29 days (2016) after PRE herbicides were applied. Evaluations were taken from May through September. The center two rows of each plot were machine harvested on October 13, 2015 and 2016.

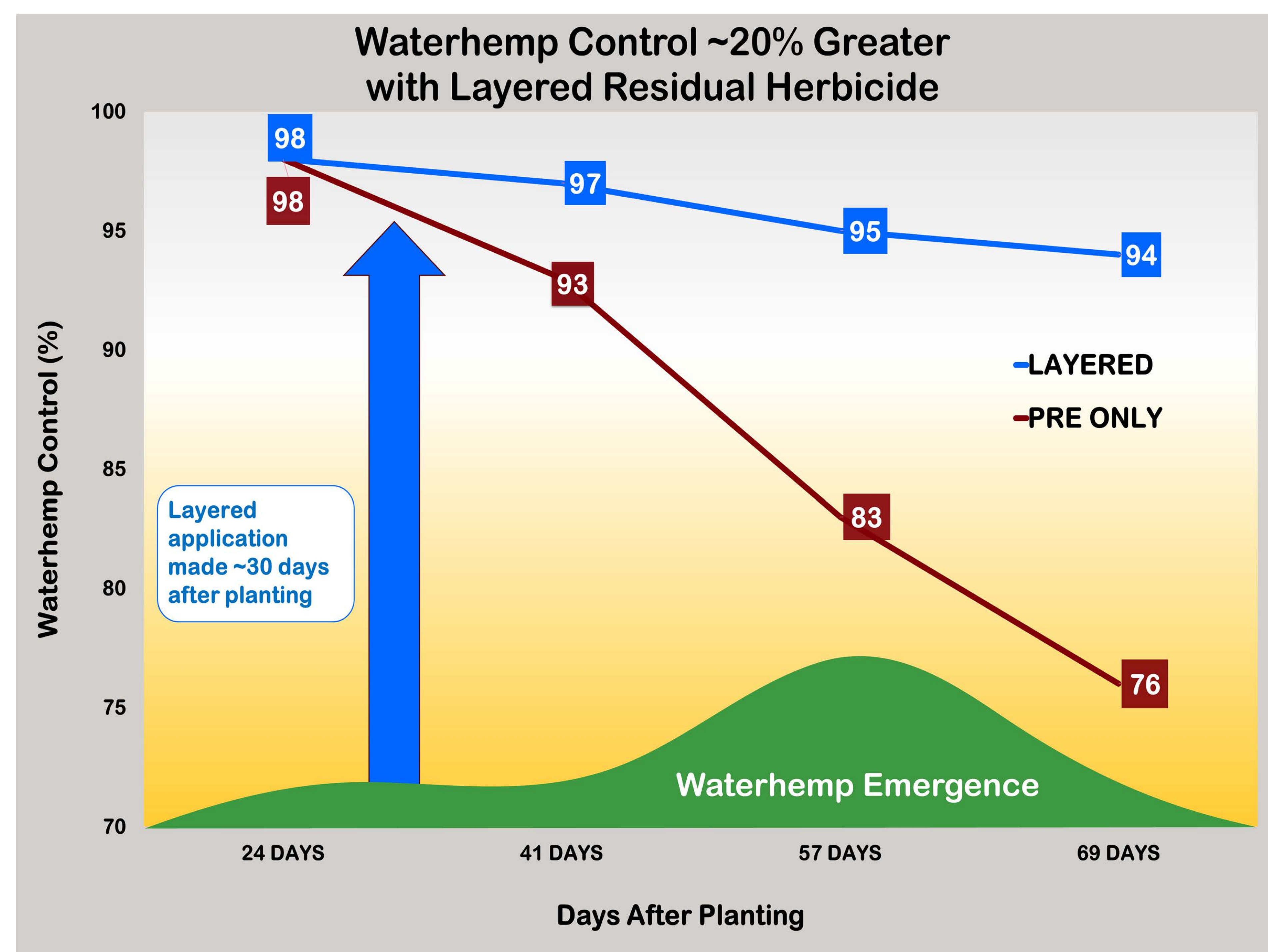
Discussion

Layered or sequential applications of Dual II Magnum, Outlook or Warrant herbicides provided significantly better (95,94 and 90%, respectively) season-long control of waterhemp compared to their PRE only treatments (81, 71, and 62%, respectively), 9/29/15 rating. The results were similar in 2016, with the layered applications of Dual II Magnum, Outlook or Warrant herbicides providing significantly better (94,95 and 91%, respectively) season long control compared to their PRE only treatments (76, 79, and 79%, respectively), 9/26/16 rating (Figure 2.). In addition, an open soybean canopy well into July allowed waterhemp to continue to emerge and compete with the crop (Figure 1). The performance of these herbicides applied PRE also correlates with their average half-life² (~30 days) as control starts to diminish about 30 days after PRE application. This trial

Figure 1. Comparison of weed control in soybean with a single preemergence, May 5, application of dimethenamid-P (left) and layered applications of dimethenamid-P on May 5 and June 8 (right). Photos taken on July 14, 2015.



Figure 2. Average control (2015 and 2016) of layered (PRE/POST) residual herbicides compared to preemergence (PRE) application only.



1. Heap, I. The International Survey of Herbicide Resistant Weeds. Online. November, 2016 . Available www.weedscience.org
 2. National Pesticide Information Center, <http://npic.orst.edu/HPT/index.html>.

Giant Ragweed Control in Soybean - Demonstration of the Advantages of a Full Spectrum Residual Herbicide Program in Soybean at Rochester, Minnesota in 2016.

Breitenbach, Fritz R., Lisa M. Behnken, Annette Kyllö and Reed Searcy

The objective of this trial was to evaluate herbicide programs for giant ragweed control in soybeans in southeastern Minnesota in 2016. The research site was a loamy sand series with pH of 6.4, O.M. 2.2% and soil test P and K levels of 31 ppm and 123 ppm, respectively. The field was disked and field cultivated once in the spring prior to planting. The previous crop was corn. The soybean variety NK Brand S20-T6 was planted May 18, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 165,000 seeds per acre. A randomized complete block design with four replications was used. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI 11002 spray tips. POST applications were made using TTI 11002 spray tips for systemic herbicides and TTIJ60 11002 spray tips for contact herbicides. Evaluations of this plot were taken June 8, 16, 20, 28, July 11 and September 27. The center two rows of each plot were machine harvested on October 1, 2016. Application dates, environmental conditions, and weed stages are in Table 1. Performance ratings for control of giant ragweed, common lambsquarters, common waterhemp, and grass, plus crop response can be found in Tables 2 through 6 respectively.

Discussion

Authority First at either 6.4 or 8.0 oz/a provided the highest preemergence giant ragweed control (94%) and the longest duration of control, an additional 4 to 10 days, before postemergence herbicides were applied, June 16 rating, Table 2. Zidua Pro at 6 fl oz/a plus Tricor at 6 oz wt/ac provided 89% control of giant ragweed and POST herbicides were applied 4 days earlier (June 20 compared to June 24) than the 6.4 or 8.0 oz/a Authority First treatments. Verdict at 5 fl oz/a + Outlook at 10 fl oz/a + Tricor at 6 oz wt/a gave slightly less control at 85-87% control and POST programs were also applied on June 20. The addition of Tricor at 6 oz wt/a to preemergence ZiduaPro or Verdict gave a 4-7% increase in giant ragweed control in this trial, Table 2. (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stages, environmental conditions.

Date	5/19	6/14	6/17	6/20	6/24
Treatment	PRE (A)	POST I (B)	POST II (C)	POST III (D)	POST IV (E)
Temperature (F)					
Air	64	73	72	76	69
Soil	57.6	73.9	73.9	78.4	65
Relative Humidity (%)	38	81	78	49	78
Wind (mph)	16	14	10	16	6
Soil Moisture	Normal	Normal	Normal	Normal	Normal
Soybean					
Stage		V2	V3	V4	V4-V5
Height (inch)		6.9	8.8	9.4	11.2
Giant Ragweed					
Weed Density (ft ²)				5.5	
Height (inch)		4	5.3	8.1	6.5
Common Lambsquarter					
Weed Density (ft ²)				8	
Height (inch)		1.4	1.8		1.5
Common Waterhemp					
Weed Density (ft ²)				15.5	
Height (inch)		1.5	2.1		2.0
Grass					
Weed Density (ft ²)				21.5	
Height (inch)		2.8	3.9	3.3	2.1
Rainfall after each application (inch)					
Week 1	2.12	2.68	0.41	0.71	0.70
Week 2	0.99	0.71	0.70	0.10	1.61
Week 3	2.27	1.0	1.61	2.07	0.82
Week 4	2.38	1.45	0.82	2.32	1.96

Table 2. Evaluation of herbicide systems to control giant ragweed in soybeans at Rochester, MN in 2016.																					
Pest Code	Pest Name	Rating Date	No.	Name	Rate	Unit	Application	AMBTR								YIELD @13% Oct-11 BU/A					
								Giant ragweed													
								June-8		June-16		June-20		June-28			July-11		Sept-27		
Percent Control (%)																					
6	UNTREATED CHECK							0	h	0	g	0	h	0	g	0	i	0	h	16.5	h
A/B = PRE 5/19/16 / POST I 6/14/16 (EAPOWE - 2-4 inch weeds)																					
1	SOA 2, 14 / 14, 9							76	f	82	ef	92	bc	93	cd	91	efg	92	d-g	54.2	b-f
	AUTHORITY ASSIST	9		fl oz/a		A															
	MARVEL	7.25		fl oz/a		B															
	ROUNDUP POWERMAX	32		fl oz/a		B															
	Ammonium Sulfate	3.3		lb/100 gal		B															
2	SOA 2,14 / 14, 9							81	e	84	de	94	abc	95	bc	93	cde	96	a-d	53.5	c-f
	AUTHORITY ASSIST	12		fl oz/a		A															
	MARVEL	7.25		fl oz/a		B															
	ROUNDUP POWERMAX	32		fl oz/a		B															
	Ammonium Sulfate	3.3		lb/100 gal		B															
7	SOA 5, 15 / 14, 9							33	g	96	a	99	a	98	ab	97	ab	97	ab	54.3	b-e
	BOUNDARY	1.5		pt/a		A															
	FLEXSTAR GT 3.5	3.5		pt/a		B															
	MSO	1		% v/v		B															
	Ammonium Sulfate	3.3		lb/100 gal		B															
8	SOA 5, 15 / 14, 9, 15							33	g	96	a	99	a	98	ab	97	a	97	a	52.1	d-g
	BOUNDARY	1.5		pt/a		A															
	FLEXSTAR GT 3.5	3.5		pt/a		B															
	DUAL II MAGNUM	1		pt/a		B															
	MSO	1		% v/v		B															
	Ammonium Sulfate	3.3		lb/100 gal		B															
9	SOA 14, 15 / 14, 9							31	g	96	a	97	ab	98	a	97	a	96	abc	52.1	d-g
	BROADAXE	25		fl oz/a		A															
	FLEXSTAR GT 3.5	3.5		pt/a		B															
	MSO	1		% v/v		B															
	Ammonium Sulfate	3.3		lb/100 gal		B															
10	SOA 14, 15 / 14, 9, 15							33	g	97	a	99	a	99	a	98	a	99	a	50.7	efg
	BROADAXE	25		fl oz/a		A															
	FLEXSTAR GT 3.5	3.5		pt/a		B															
	DUAL II MAGNUM	1		pt/a		B															
	MSO	1		% v/v		B															
	Ammonium Sulfate	3.3		lb/100 gal		B															
A/C = PRE 5/19/16 / POST II 6/17/16 (MIDPOWE - 2-4 inch weeds)																					
16	SOA 14, 15, 5 / 14							93	b	87	bc	97	ab	97	ab	92	def	90	fg	50.7	fg
	VERDICT	5		fl oz/a		A															
	OUTLOOK	10		fl oz/a		A															
	TRICOR	6		oz wt/a		A															
	COBRA	8		fl oz/a		C															
	COC	1		pt/a		C															
	N-Pa-K AMS	3		qt/a		C															
17	SOA 14, 15, 5 / 14, 15							93	b	85	cde	98	a	97	ab	94	b-e	92	efg	49.5	g
	VERDICT	5		fl oz/a		A															
	OUTLOOK	10		fl oz/a		A															
	TRICOR	6		oz wt/a		A															
	COBRA	8		fl oz/a		C															
	OUTLOOK	10		fl oz/a		C															
	COC	1		pt/a		C															
	N-Pa-K AMS	3		qt/a		C															
A/D = PRE 5/19/16 / POST III 6/20/16 (MIDPOWE - 2-4 inch weeds)																					
11	SOA 2, 14, 15 / 9							87	d	85	cde	59	f	90	d	88	gh	94	c-f	56.9	abc
	ZIDUA PRO	6		fl oz/a		A															
	ROUNDUP POWERMAX	32		fl oz/a		D															
12	SOA 2, 14, 15, 5 / 9							93	b	89	b	71	e	96	ab	97	abc	96	abc	58.1	a
	ZIDUA PRO	6		fl oz/a		A															
	TRICOR	6		oz wt/a		A															
	ROUNDUP POWERMAX	32		fl oz/a		D															
13	SOA 14, 15							86	d	81	f	51	g	83	f	85	h	90	g	55.5	a-d
	VERDICT	5		fl oz/a		A															
	OUTLOOK	10		fl oz/a		A															
	ROUNDUP POWERMAX	32		fl oz/a		D															
14	SOA 14, 15, 5							89	cd	85	cd	60	f	87	e	88	gh	93	d-g	57.9	a
	VERDICT	5		fl oz/a		A															
	TRICOR	6		oz wt/a		A															
	ROUNDUP POWERMAX	32		fl oz/a		D															
15	SOA 14, 15, 5							92	bc	87	bcd	69	e	91	d	89	fg	94	b-e	54.8	a-d
	VERDICT	5		fl oz/a		A															
	OUTLOOK	10		fl oz/a		A															
	TRICOR	6		oz wt/a		A															
	ROUNDUP POWERMAX	32		fl oz/a		D															
A/E = PRE 5/19/16 / POST IV 6/24/16 (MIDPOWE - 2-4 inch weeds)																					
3	SOA 2,14 / 14, 9							88	cd	87	bc	86	d	96	ab	97	abc	97	a	57.6	ab
	AUTHORITY FIRST	4		oz/a		A															
	MARVEL	7.25		fl oz/a		E															
	ROUNDUP POWERMAX	32		fl oz/a		E															
	Ammonium Sulfate	3.3		lb/100 gal		E															
4	SOA 2,14 / 14, 9							95	ab	94	a	90	cd	96	ab	97	a	98	a	55.5	a-d
	AUTHORITY FIRST	6.4		oz/a		A															
	MARVEL	7.25		fl oz/a		E															
	ROUNDUP POWERMAX	32		fl oz/a		E															
	Ammonium Sulfate	3.3		lb/100 gal		E															
5	SOA 2,14 / 14, 9							97	a	94	a	90	cd	97	ab	98	ab	97	a	54.7	a-d
	AUTHORITY FIRST	8.0		oz/a		A															
	MARVEL	7.25		fl oz/a		E															
	ROUNDUP POWERMAX	32		fl oz/a		E															
	Ammonium Sulfate	3.3		lb/100 gal		E															
C = POST II 6/17/16 (4 inch weeds)																					
18	SOA 9							0	h	0	g	71	e	95	bc	95	a-d	96	a-d	56.7	abc
	ROUNDUP POWERMAX	32		fl oz/a		C															
LSD P=.10								4		3		6		3							

Table 3. Evaluation of herbicide systems to control common lambsquarters in soybeans at Rochester, MN in 2016.

Pest Code	Pest Name	Rating Date	No.	Name	Rate	Unit	Application	CHEAL								YIELD @13% Oct-11 BU/A					
								Common lambsquarters													
								June-8		June-16		June-20		June-28			July-11		Sept-27		
								Percent Control (%)													
6	UNTREATED CHECK							0	c	0	c	0	c	0	c	0	c	16.5	h		
A/B = PRE 5/19/16 / POST I 6/14/16 (EAPOWE - 2-4 inch weeds)																					
1	SOA 2, 14 / 14, 9							99	b	99	a	99	a	99	a	99	a	54.2	b-f		
	AUTHORITY ASSIST	9	fl oz/a	A																	
	MARVEL	7.25	fl oz/a	B																	
	ROUNDUP POWERMAX	32	fl oz/a	B																	
	Ammonium Sulfate	3.3	lb/100 gal	B																	
2	SOA 2,14 / 14, 9							99	a	99	a	99	a	99	a	99	a	53.5	c-f		
	AUTHORITY ASSIST	12	fl oz/a	A																	
	MARVEL	7.25	fl oz/a	B																	
	ROUNDUP POWERMAX	32	fl oz/a	B																	
	Ammonium Sulfate	3.3	lb/100 gal	B																	
7	SOA 5, 15 / 14, 9							99	a	99	a	99	a	99	b	99	a	99	b	54.3	b-e
	BOUNDARY	1.5	pt/a	A																	
	FLEXSTAR GT 3.5	3.5	pt/a	B																	
	MSO	1	% v/v	B																	
	Ammonium Sulfate	3.3	lb/100 gal	B																	
8	SOA 5, 15 / 14, 9, 15							99	a	99	b	99	a	99	a	99	a	99	a	52.1	d-g
	BOUNDARY	1.5	pt/a	A																	
	FLEXSTAR GT 3.5	3.5	pt/a	B																	
	DUAL II MAGNUM	1	pt/a	B																	
	MSO	1	% v/v	B																	
	Ammonium Sulfate	3.3	lb/100 gal	B																	
9	SOA 14, 15 / 14, 9							99	a	99	a	99	a	99	a	99	a	99	a	52.1	d-g
	BROADAXE	25	fl oz/a	A																	
	FLEXSTAR GT 3.5	3.5	pt/a	B																	
	MSO	1	% v/v	B																	
	Ammonium Sulfate	3.3	lb/100 gal	B																	
10	SOA 14, 15 / 14, 9, 15							99	a	99	a	99	a	99	a	99	a	99	a	50.7	efg
	BROADAXE	25	fl oz/a	A																	
	FLEXSTAR GT 3.5	3.5	pt/a	B																	
	DUAL II MAGNUM	1	pt/a	B																	
	MSO	1	% v/v	B																	
	Ammonium Sulfate	3.3	lb/100 gal	B																	
A/C = PRE 5/19/16 / POST II 6/17/16 (MIDPOWE - 2-4 inch weeds)																					
16	SOA 14, 15, 5 / 14							99	a	99	a	99	a	99	a	99	a	99	a	50.7	fg
	VERDICT	5	fl oz/a	A																	
	OUTLOOK	10	fl oz/a	A																	
	TRICOR	6	oz wt/a	A																	
	COBRA	8	fl oz/a	C																	
	COC	1	pt/a	C																	
	N-Pa-K AMS	3	qt/a	C																	
17	SOA 14, 15, 5 / 14, 15							99	a	99	a	99	a	99	a	99	a	99	a	49.5	g
	VERDICT	5	fl oz/a	A																	
	OUTLOOK	10	fl oz/a	A																	
	TRICOR	6	oz wt/a	A																	
	COBRA	8	fl oz/a	C																	
	OUTLOOK	10	fl oz/a	C																	
	COC	1	pt/a	C																	
	N-Pa-K AMS	3	qt/a	C																	
A/D = PRE 5/19/16 / POST III 6/20/16 (MIDPOWE - 2-4 inch weeds)																					
11	SOA 2, 14, 15 / 9							99	a	99	a	99	a	99	a	99	a	99	a	56.9	abc
	ZIDUA PRO	6	fl oz/a	A																	
	ROUNDUP POWERMAX	32	fl oz/a	D																	
12	SOA 2, 14, 15, 5 / 9							99	a	99	a	99	a	99	a	99	a	99	a	58.1	a
	ZIDUA PRO	6	fl oz/a	A																	
	TRICOR	6	oz wt/a	A																	
	ROUNDUP POWERMAX	32	fl oz/a	D																	
13	SOA 14, 15							99	a	99	a	99	a	99	a	99	a	99	a	55.5	a-d
	VERDICT	5	fl oz/a	A																	
	OUTLOOK	10	fl oz/a	A																	
	ROUNDUP POWERMAX	32	fl oz/a	D																	
14	SOA 14, 15, 5							99	a	99	a	99	a	99	a	99	a	99	a	57.9	a
	VERDICT	5	fl oz/a	A																	
	TRICOR	6	oz wt/a	A																	
	ROUNDUP POWERMAX	32	fl oz/a	D																	
15	SOA 14, 15, 5							99	a	99	a	99	a	99	a	98	a	99	b	54.8	a-d
	VERDICT	5	fl oz/a	A																	
	OUTLOOK	10	fl oz/a	A																	
	TRICOR	6	oz wt/a	A																	
	ROUNDUP POWERMAX	32	fl oz/a	D																	
A/E = PRE 5/19/16 / POST IV 6/24/16 (MIDPOWE - 2-4 inch weeds)																					
3	SOA 2,14 / 14, 9							99	a	99	a	99	a	99	a	99	a	99	a	57.6	ab
	AUTHORITY FIRST	4	oz/a	A																	
	MARVEL	7.25	fl oz/a	E																	
	ROUNDUP POWERMAX	32	fl oz/a	E																	
	Ammonium Sulfate	3.3	lb/100 gal	E																	
4	SOA 2,14 / 14, 9							99	a	99	a	99	a	99	a	99	a	99	a	55.5	a-d
	AUTHORITY FIRST	6.4	oz/a	A																	
	MARVEL	7.25	fl oz/a	E																	
	ROUNDUP POWERMAX	32	fl oz/a	E																	
	Ammonium Sulfate	3.3	lb/100 gal	E																	
5	SOA 2,14 / 14, 9							99	a	99	a	99	a	99	a	99	a	99	a	54.7	a-d
	AUTHORITY FIRST	8.0	oz/a	A																	
	MARVEL	7.25	fl oz/a	E																	
	ROUNDUP POWERMAX	32	fl oz/a	E																	
	Ammonium Sulfate	3.3	lb/100 gal	E																	
C = POST II 6/17/16 (4 inch weeds)																					
18	SOA 9							0	c	0	c	79	b	99	a	97	b	98	b	56.7	abc
	ROUNDUP POWERMAX	32	fl oz/a	C																	
LSD P=.10								0.3		0.1		1		0.1		1.0		0.4		3.6	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 4. Evaluation of herbicide systems to control common waterhemp in soybeans at Rochester, MN in 2016.

Pest Code	AMATA										YIELD @13%						
	Common Waterhemp																
	Rating Date	June-8	June-16	June-20	June-28	July-11	Sept-27	Oct-11	BU/A								
No. Treatment	Rate	Unit	Application	Percent Control (%)													
6	UNTREATED CHECK			0	b	0	c	0	e	0	c	0	d	0	e	16.5	h
A/B = PRE 5/19/16 / POST I 6/14/16 (EAPOWE - 2-4 inch weeds)																	
1	SOA 2, 14 / 14, 9			99	a	99	a	99	a	99	a	99	a	99	a	54.2	b-f
	AUTHORITY ASSIST	9	fl oz/a														
	MARVEL	7.25	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	Ammonium Sulfate	3.3	lb/100 gal														
2	SOA 2,14 / 14, 9			99	a	99	a	99	a	99	a	99	abc	99	abc	53.5	c-f
	AUTHORITY ASSIST	12	fl oz/a														
	MARVEL	7.25	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	Ammonium Sulfate	3.3	lb/100 gal														
7	SOA 5, 15 / 14, 9			99	a	99	a	99	a	99	a	99	a	99	a	54.3	b-e
	BOUNDARY	1.5	pt/a														
	FLEXSTAR GT 3.5	3.5	pt/a														
	MSO	1	% v/v														
	Ammonium Sulfate	3.3	lb/100 gal														
8	SOA 5, 15 / 14, 9, 15			99	a	99	a	99	a	99	a	99	a	99	a	52.1	d-g
	BOUNDARY	1.5	pt/a														
	FLEXSTAR GT 3.5	3.5	pt/a														
	DUAL II MAGNUM	1	pt/a														
	MSO	1	% v/v														
	Ammonium Sulfate	3.3	lb/100 gal														
9	SOA 14, 15 / 14, 9			99	a	99	a	99	a	99	a	99	a	99	a	52.1	d-g
	BROADAXE	25	fl oz/a														
	FLEXSTAR GT 3.5	3.5	pt/a														
	MSO	1	% v/v														
	Ammonium Sulfate	3.3	lb/100 gal														
10	SOA 14, 15 / 14, 9, 15			99	a	99	a	99	a	99	a	99	ab	99	ab	50.7	efg
	BROADAXE	25	fl oz/a														
	FLEXSTAR GT 3.5	3.5	pt/a														
	DUAL II MAGNUM	1	pt/a														
	MSO	1	% v/v														
	Ammonium Sulfate	3.3	lb/100 gal														
A/C = PRE 5/19/16 / POST II 6/17/16 (MIDPOWE - 2-4 inch weeds)																	
16	SOA 14, 15, 5 / 14			99	a	99	a	99	a	99	a	99	a	99	a	50.7	fg
	VERDICT	5	fl oz/a														
	OUTLOOK	10	fl oz/a														
	TRICOR	6	oz wt/a														
	COBRA	8	fl oz/a														
	COC	1	pt/a														
	N-Pa-K AMS	3	qt/a														
17	SOA 14, 15, 5 / 14, 15			99	a	99	a	99	a	99	a	99	a	99	a	49.5	g
	VERDICT	5	fl oz/a														
	OUTLOOK	10	fl oz/a														
	TRICOR	6	oz wt/a														
	COBRA	8	fl oz/a														
	OUTLOOK	10	fl oz/a														
	COC	1	pt/a														
	N-Pa-K AMS	3	qt/a														
A/D = PRE 5/19/16 / POST III 6/20/16 (MIDPOWE - 2-4 inch weeds)																	
11	SOA 2, 14, 15 / 9			99	a	99	a	99	a	99	a	99	abc	99	abc	56.9	abc
	ZIDUA PRO	6	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
12	SOA 2, 14, 15, 5 / 9			99	a	99	a	99	a	99	a	99	ab	99	ab	58.1	a
	ZIDUA PRO	6	fl oz/a														
	TRICOR	6	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
13	SOA 14, 15			99	a	99	a	99	a	99	a	99	a	98	c	55.5	a-d
	VERDICT	5	fl oz/a														
	OUTLOOK	10	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
14	SOA 14, 15, 5			99	a	99	b	99	a	99	a	97	b	98	bc	57.9	a
	VERDICT	5	fl oz/a														
	TRICOR	6	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
15	SOA 14, 15, 5			99	a	99	a	99	a	99	a	99	abc	99	abc	54.8	a-d
	VERDICT	5	fl oz/a														
	OUTLOOK	10	fl oz/a														
	TRICOR	6	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
A/E = PRE 5/19/16 / POST IV 6/24/16 (MIDPOWE - 2-4 inch weeds)																	
3	SOA 2,14 / 14, 9			99	a	99	a	98	c	99	a	99	a	99	a	57.6	ab
	AUTHORITY FIRST	4	oz/a														
	MARVEL	7.25	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	Ammonium Sulfate	3.3	lb/100 gal														
4	SOA 2,14 / 14, 9			99	a	99	b	99	b	99	a	99	a	99	a	55.5	a-d
	AUTHORITY FIRST	6.4	oz/a														
	MARVEL	7.25	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	Ammonium Sulfate	3.3	lb/100 gal														
5	SOA 2,14 / 14, 9			99	a	99	a	99	a	99	a	99	a	99	a	54.7	a-d
	AUTHORITY FIRST	8.0	oz/a														
	MARVEL	7.25	fl oz/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	Ammonium Sulfate	3.3	lb/100 gal														
C = POST II 6/17/16 (4 inch weeds)																	
18	SOA 9			0	b	0	c	75	d	85	b	78	c	76	d	56.7	abc
	ROUNDUP POWERMAX	32	fl oz/a														
LSD P=.10						0.3		0.5		1		1		1		3.6	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

Table 5. Evaluation of herbicide systems to control grasses in soybeans at Rochester, MN in 2016.

Pest Code	Rating Date	No.	Name	Rate	Unit	Application	Grass species.								YIELD Oct-11 BU/A					
							June-8		June-16		June-20		June-28				July-11		Sept-27	
							0	b	0	d	0	f	0	d	0	f	0	d	16.5	h
6 UNTREATED CHECK																				
A/B = PRE 5/19/16 / POST I 6/14/16 (EAPOWE - 2-4 inch weeds)																				
1	SOA 2, 14 / 14, 9						99	a	98	ab	99	a	99	ab	98	ab	99	ab	54.2	b-f
	AUTHORITY ASSIST	9	fl oz/a			A														
	MARVEL	7.25	fl oz/a			B														
	ROUNDUP POWERMAX	32	fl oz/a			B														
	Ammonium Sulfate	3.3	lb/100 gal			B														
2	SOA 2,14 / 14, 9						99	a	99	a	99	a	99	ab	99	a	99	ab	53.5	c-f
	AUTHORITY ASSIST	12	fl oz/a			A														
	MARVEL	7.25	fl oz/a			B														
	ROUNDUP POWERMAX	32	fl oz/a			B														
	Ammonium Sulfate	3.3	lb/100 gal			B														
7	SOA 5, 15 / 14, 9						99	a	99	a	99	a	99	a	99	a	99	ab	54.3	b-e
	BOUNDARY	1.5	pt/a			A														
	FLEXSTAR GT 3.5	3.5	pt/a			B														
	MSO	1	% v/v			B														
	Ammonium Sulfate	3.3	lb/100 gal			B														
8	SOA 5, 15 / 14, 9, 15						99	a	99	a	99	a	99	a	99	a	99	a	52.1	d-g
	BOUNDARY	1.5	pt/a			A														
	FLEXSTAR GT 3.5	3.5	pt/a			B														
	DUAL II MAGNUM	1	pt/a			B														
	MSO	1	% v/v			B														
	Ammonium Sulfate	3.3	lb/100 gal			B														
9	SOA 14, 15 / 14, 9						99	a	99	a	99	a	99	a	99	a	99	ab	52.1	d-g
	BROADAXE	25	fl oz/a			A														
	FLEXSTAR GT 3.5	3.5	pt/a			B														
	MSO	1	% v/v			B														
	Ammonium Sulfate	3.3	lb/100 gal			B														
10	SOA 14, 15 / 14, 9, 15						99	a	99	a	99	a	99	a	99	a	99	a	50.7	efg
	BROADAXE	25	fl oz/a			A														
	FLEXSTAR GT 3.5	3.5	pt/a			B														
	DUAL II MAGNUM	1	pt/a			B														
	MSO	1	% v/v			B														
	Ammonium Sulfate	3.3	lb/100 gal			B														
A/C = PRE 5/19/16 / POST II 6/17/16 (MIDPOWE - 2-4 inch weeds)																				
16	SOA 14, 15, 5 / 14						99	a	99	a	99	a	99	b	97	cd	98	ab	50.7	fg
	VERDICT	5	fl oz/a			A														
	OUTLOOK	10	fl oz/a			A														
	TRICOR	6	oz wt/a			A														
	COBRA	8	fl oz/a			C														
	COC	1	pt/a			C														
	N-Pa-K AMS	3	qt/a			C														
17	SOA 14, 15, 5 / 14, 15						99	a	99	a	99	a	99	b	98	abc	98	ab	49.5	g
	VERDICT	5	fl oz/a			A														
	OUTLOOK	10	fl oz/a			A														
	TRICOR	6	oz wt/a			A														
	COBRA	8	fl oz/a			C														
	OUTLOOK	10	fl oz/a			C														
	COC	1	pt/a			C														
	N-Pa-K AMS	3	qt/a			C														
A/D = PRE 5/19/16 / POST III 6/20/16 (MIDPOWE - 2-4 inch weeds)																				
11	SOA 2, 14, 15 / 9						99	a	99	a	99	a	99	a	99	a	99	ab	56.9	abc
	ZIDUA PRO	6	fl oz/a			A														
	ROUNDUP POWERMAX	32	fl oz/a			D														
12	SOA 2, 14, 15, 5 / 9						99	a	99	a	99	ab	99	a	98	ab	99	ab	58.1	a
	ZIDUA PRO	6	fl oz/a			A														
	TRICOR	6	oz wt/a			A														
	ROUNDUP POWERMAX	32	fl oz/a			D														
13	SOA 14, 15						99	a	99	a	99	ab	99	a	97	bcd	97	b	55.5	a-d
	VERDICT	5	fl oz/a			A														
	OUTLOOK	10	fl oz/a			A														
	ROUNDUP POWERMAX	32	fl oz/a			D														
14	SOA 14, 15, 5						99	a	94	c	95	d	99	a	96	d	98	ab	57.9	a
	VERDICT	5	fl oz/a			A														
	TRICOR	6	oz wt/a			A														
	ROUNDUP POWERMAX	32	fl oz/a			D														
15	SOA 14, 15, 5						99	a	99	a	99	a	99	a	97	cd	97	b	54.8	a-d
	VERDICT	5	fl oz/a			A														
	OUTLOOK	10	fl oz/a			A														
	TRICOR	6	oz wt/a			A														
	ROUNDUP POWERMAX	32	fl oz/a			D														
A/E = PRE 5/19/16 / POST IV 6/24/16 (MIDPOWE - 2-4 inch weeds)																				
3	SOA 2,14 / 14, 9						99	a	93	c	91	e	99	ab	99	a	99	a	57.6	ab
	AUTHORITY FIRST	4	oz/a			A														
	MARVEL	7.25	fl oz/a			E														
	ROUNDUP POWERMAX	32	fl oz/a			E														
	Ammonium Sulfate	3.3	lb/100 gal			E														
4	SOA 2,14 / 14, 9						99	a	97	b	97	c	99	a	99	a	99	a	55.5	a-d
	AUTHORITY FIRST	6.4	oz/a			A														
	MARVEL	7.25	fl oz/a			E														
	ROUNDUP POWERMAX	32	fl oz/a			E														
	Ammonium Sulfate	3.3	lb/100 gal			E														
5	SOA 2,14 / 14, 9						99	a	97	b	98	bc	99	a	99	a	99	a	54.7	a-d
	AUTHORITY FIRST	8.0	oz/a			A														
	MARVEL	7.25	fl oz/a			E														
	ROUNDUP POWERMAX	32	fl oz/a			E														
	Ammonium Sulfate	3.3	lb/100 gal			E														
C = POST II 6/17/16 (4 inch weeds)																				
18	SOA 9						0	b	0	d	90	e	91	c	81	e	80	c	56.7	abc
	ROUNDUP POWERMAX	32	fl oz/a			C														
LSD P=.10									2		1		0.5		1		2		3.6	

Means followed by same letter or symbol do not significantly differ (P=.10, LSD)

2016 Demonstration of the herbicide components in dicamba soybean, PRE plus POST and POST only applied at 3 and 6 inch weed at Rochester, MN.

Behnken, Lisa B., Fritz R. Breitenbach, Jared Liebenow and Annette Kylo

The objectives of this demonstration were to show the 1) value of a preemergence (PRE) herbicide in a dicamba soybean system, 2) weeds controlled with each component (PRE (ZiduaPRO), POST (Engenia, glyphosate, or Engenia plus glyphosate) and 3) impact of POST timing, 3 or 6 inch weeds in dicamba tolerant soybeans. The research site was a loamy sand series with a pH of 7.0, O.M. of 2.2%, and soil test P and K levels of 26 ppm and 132 ppm, respectively. Fall fertilizer was applied on November 5, 2015 at a rate of 0-46-180-0 lbs/A (N-P-K-S). The field was field cultivated prior to planting in the spring. Croplan RX1836 soybean was planted on May 6, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 165,000 seeds per acre. A randomized complete block design was used with four replications. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI-11002 nozzles. Postemergence (POST) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi using TTI-11002 nozzles. Evaluations of the plot were taken on June 6, 20, 28, and July 8, 2016. The crop was destroyed before harvest. Application dates, environmental conditions, and weed stages can be found in Table 1. Performance ratings for control of giant ragweed, common lambsquarters, common waterhemp and grass, and crop response can be found in Tables 2 through 6 respectively. (University of Minnesota Extension Regional Office, Rochester.)

SUMMARY: A preemergence, residual herbicide is recommended for full season, robust weed control in a dicamba soybean system, Figures 1 and 2. This demonstration shows the advantage of using the PRE residual herbicide, Zidua Pro, and what each POST component controls when applied with or without a PRE on 3- and 6-inch weeds. Engenia (dicamba) provides excellent control of giant ragweed, however giant ragweed is an early emerging weed, later April to early June, and control remained excellent after the POST applications. However, Engenia and glyphosate do not provide residual control, thus weeds emerging after application, common waterhemp and grasses were problematic later in the season. This demonstration also illustrated the best POST control was achieved when Engenia was applied to small, 3-inch, broadleaf weeds.

Table 1. Application timing, plant stage, environmental conditions.

Date	5/6	6/6	6/14	6/21
Treatment	PRE (A)	POST I (B)	POST II (C)	POST III (D)
Temperature (F)				
Air	89	67	76	75
Soil	66.4	64.6	74.4	69.9
Relative Humidity (%)	20	56	79	46
Wind (mph)	20	15	13	10
Soil Moisture	Slightly dry	Normal	Normal	Normal
Soybean				
Stage		V1-V2	V3	V5
Height (inch)		4.8	9.1	12.0
Giant Ragweed				
Weed density (ft ²)			2.5	
Height (inch)		4.0	5.9	2.5
Common Lambsquarters				
Weed density (ft ²)			24	
Height (inch)		1.8	5.1	--
Common Waterhemp				
Weed density (ft ²)			8.0	
Height (inch)		2.4	5.9	--
Grass				
Weed density (ft ²)			102	
Height (inch)		1.6	5.1	2.0
Rainfall after each application (inch)				
Week 1	1.13	2.27	1.39	0.71
Week 2	0.32	2.38	0.71	0.10
Week 3	2.12	1.01	0.10	2.07

Table 2. Giant ragweed control in PRE/POST or POST only systems in dicamba soybeans at Rochester, MN in 2016.

Pest Code					AMBTR							
Pest Name					Giant ragweed							
Rating Date					Jun-6-2016	Jun-20-2016	Jun-28-2016	Jul-8-2016				
No.	Name	Rate	Unit	Code	Description	(%) Control						
1	SOA 2, 14, 15 / 4					88	80	c	95	c	98	ab
	ZIDUA PRO	6	fl oz/a	A								
	ENGENIA	12.8	fl oz/a	D	3 INCH WEEDS							
	NIS	0.25	% v/v	D	3 INCH WEEDS							
2	SOA 2, 14, 15 / 9					88	79	c	95	bc	96	ab
	ZIDUA PRO	6	fl oz/a	A								
	GLYPHOSATE	32	fl oz/a	D	3 INCH WEEDS							
3	SOA 2, 14, 15 / 4, 9					87	79	c	96	abc	98	ab
	ZIDUA PRO	6	fl oz/a	A								
	ENGENIA	12.8	fl oz/a	D	3 INCH WEEDS							
	GLYPHOSATE	32	fl oz/a	D	3 INCH WEEDS							
4	SOA 4						96	a	98	ab	99	a
	ENGENIA	12.8	fl oz/a	B	3 INCH WEEDS							
	NIS	0.25	% v/v	B	3 INCH WEEDS							
5	SOA 9						96	a	97	abc	97	ab
	GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS							
6	SOA 4, 9						98	a	99	a	99	a
	ENGENIA	12.8	fl oz/a	B	3 INCH WEEDS							
	GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS							
7	SOA 4						80	c	96	abc	95	ab
	ENGENIA	12.8	fl oz/a	C	6 INCH WEEDS							
	NIS	0.25	% v/v	C	6 INCH WEEDS							
8	SOA 9						80	c	91	d	87	c
	GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS							
9	SOA 4, 9						86	b	95	bc	95	b
	ENGENIA	12.8	fl oz/a	C	6 INCH WEEDS							
	GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS							
LSD P=.10						NS	5		3		4	

Table 3. Common lambsquarters control in PRE/POST or POST only systems in dicamba soybeans at Rochester, MN in 2016.

Pest Code		CHEAL										
Rating Date		Common Lambsquarters										
		Jun-6-2016	Jun-20-2016	Jun-28-2016	Jul-8-2016							
No.	Name	Rate	Unit	Code	Description	(% Control)						
1	SOA 2, 14, 15 / 4					99	99	a	99	a	99	a
	ZIDUA PRO	6	fl oz/a	A								
	ENGENIA	12.8	fl oz/a	D	3 INCH WEEDS							
	NIS	0.25	% v/v	D	3 INCH WEEDS							
2	SOA 2, 14, 15 / 9					98	99	a	99	a	99	a
	ZIDUA PRO	6	fl oz/a	A								
	GLYPHOSATE	32	fl oz/a	D	3 INCH WEEDS							
3	SOA 2, 14, 15 / 4, 9					99	99	a	99	a	99	a
	ZIDUA PRO	6	fl oz/a	A								
	ENGENIA	12.8	fl oz/a	D	3 INCH WEEDS							
	GLYPHOSATE	32	fl oz/a	D	3 INCH WEEDS							
4	SOA 4						95	b	98	a	98	ab
	ENGENIA	12.8	fl oz/a	B	3 INCH WEEDS							
	NIS	0.25	% v/v	B	3 INCH WEEDS							
5	SOA 9						94	b	90	b	90	c
	GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS							
6	SOA 4, 9						99	a	99	a	97	ab
	ENGENIA	12.8	fl oz/a	B	3 INCH WEEDS							
	GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS							
7	SOA 4						82	d	91	b	94	bc
	ENGENIA	12.8	fl oz/a	C	6 INCH WEEDS							
	NIS	0.25	% v/v	C	6 INCH WEEDS							
8	SOA 9						73	e	70	c	67	d
	GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS							
9	SOA 4, 9						88	c	89	b	96	ab
	ENGENIA	12.8	fl oz/a	C	6 INCH WEEDS							
	GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS							
LSD P=.10						NS	4		4		5	

Table 4. Common waterhemp control in PRE/POST or POST only systems in dicamba soybeans at Rochester, MN in 2016.

Pest Code					AMATA					
					Common Waterhemp					
Rating Date					Jun-6-2016	Jun-20-2016	Jun-28-2016	Jul-8-2016		
No.	Name	Rate	Unit	Code Description	(% Control)					
1	SOA 2, 14, 15 / 4 ZIDUA PRO ENGENIA NIS	6 12.8 0.25	fl oz/a fl oz/a % v/v	A D D	3 INCH WEEDS 3 INCH WEEDS	99	99	99	99	a a a
2	SOA 2, 14, 15 / 9 ZIDUA PRO GLYPHOSATE	6 32	fl oz/a fl oz/a	A D	3 INCH WEEDS	99	99	99	99	a a a
3	SOA 2, 14, 15 / 4, 9 ZIDUA PRO ENGENIA GLYPHOSATE	6 12.8 32	fl oz/a fl oz/a fl oz/a	A D D	3 INCH WEEDS 3 INCH WEEDS	99	98	99	99	a a a
4	SOA 4 ENGENIA NIS	12.8 0.25	fl oz/a % v/v	B B	3 INCH WEEDS 3 INCH WEEDS		83	83	83	c bc b
5	SOA 9 GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS		85	79	69	c c e
6	SOA 4, 9 ENGENIA GLYPHOSATE	12.8 32	fl oz/a fl oz/a	B B	3 INCH WEEDS 3 INCH WEEDS		93	86	78	b b c
7	SOA 4 ENGENIA NIS	12.8 0.25	fl oz/a % v/v	C C	6 INCH WEEDS 6 INCH WEEDS		75	79	77	d c cd
8	SOA 9 GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS		77	73	73	d d de
9	SOA 4, 9 ENGENIA GLYPHOSATE	12.8 32	fl oz/a fl oz/a	C C	6 INCH WEEDS 6 INCH WEEDS		88	83	79	bc bc bc
LSD P=.10					NS	5	6	5		

Table 5. Grass control in PRE/POST or POST only systems in dicamba soybeans at Rochester, MN in 2016.

Pest Code		GRASS			
Rating Date		Jun-6-2016	Jun-20-2016	Jun-28-2016	Jul-8-2016
No.	Name	Rate	Unit	Code	Description
(%) Control					
1	SOA 2, 14, 15 / 4				
	ZIDUA PRO	6	fl oz/a	A	
	ENGENIA	12.8	fl oz/a	D	3 INCH WEEDS
	NIS	0.25	% v/v	D	3 INCH WEEDS
					99
					96 a
					97 ab
					98 a
2	SOA 2, 14, 15 / 9				
	ZIDUA PRO	6	fl oz/a	A	
	GLYPHOSATE	32	fl oz/a	D	3 INCH WEEDS
					99
					97 a
					99 a
					98 a
3	SOA 2, 14, 15 / 4, 9				
	ZIDUA PRO	6	fl oz/a	A	
	ENGENIA	12.8	fl oz/a	D	3 INCH WEEDS
	GLYPHOSATE	32	fl oz/a	D	3 INCH WEEDS
					99
					97 a
					99 a
					98 a
4	SOA 4				
	ENGENIA	12.8	fl oz/a	B	3 INCH WEEDS
	NIS	0.25	% v/v	B	3 INCH WEEDS
					0
					0 d
					0 d
					0 d
5	SOA 9				
	GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS
					86
					84 c
					81 c
6	SOA 4, 9				
	ENGENIA	12.8	fl oz/a	B	3 INCH WEEDS
	GLYPHOSATE	32	fl oz/a	B	3 INCH WEEDS
					86
					84 c
					82 c
7	SOA 4				
	ENGENIA	12.8	fl oz/a	C	6 INCH WEEDS
	NIS	0.25	% v/v	C	6 INCH WEEDS
					0
					0 d
					0 d
					0 d
8	SOA 9				
	GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS
					93
					95 b
					89 b
9	SOA 4, 9				
	ENGENIA	12.8	fl oz/a	C	6 INCH WEEDS
	GLYPHOSATE	32	fl oz/a	C	6 INCH WEEDS
					93
					94 b
					87 b
LSD P=.10					
		NS		2	4
				4	4

Figure 1. Weed control on July 8, 2016 with Zidua Pro (PRE) followed by Engenia (POST) compared to Engenia used POST only in dicamba tolerant soybeans at Rochester, MN in 2016.

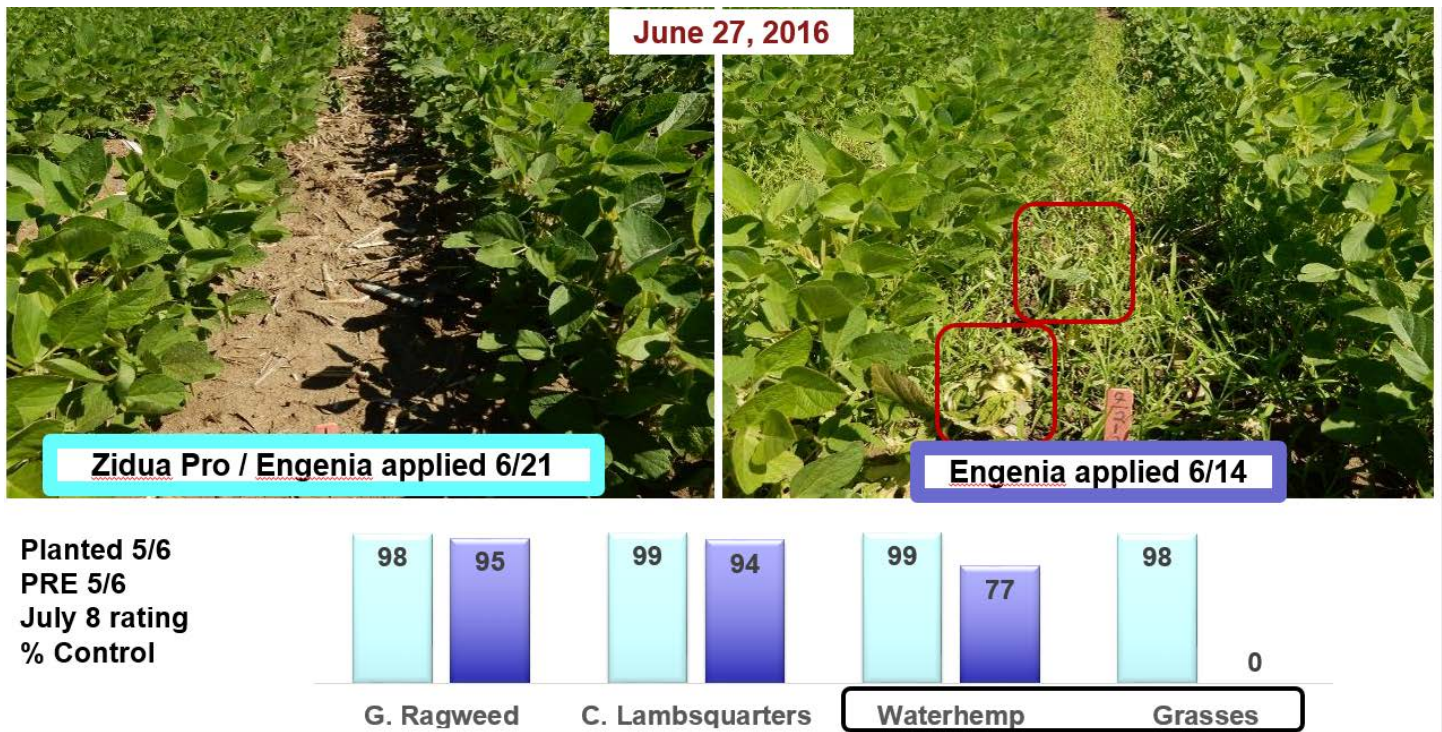
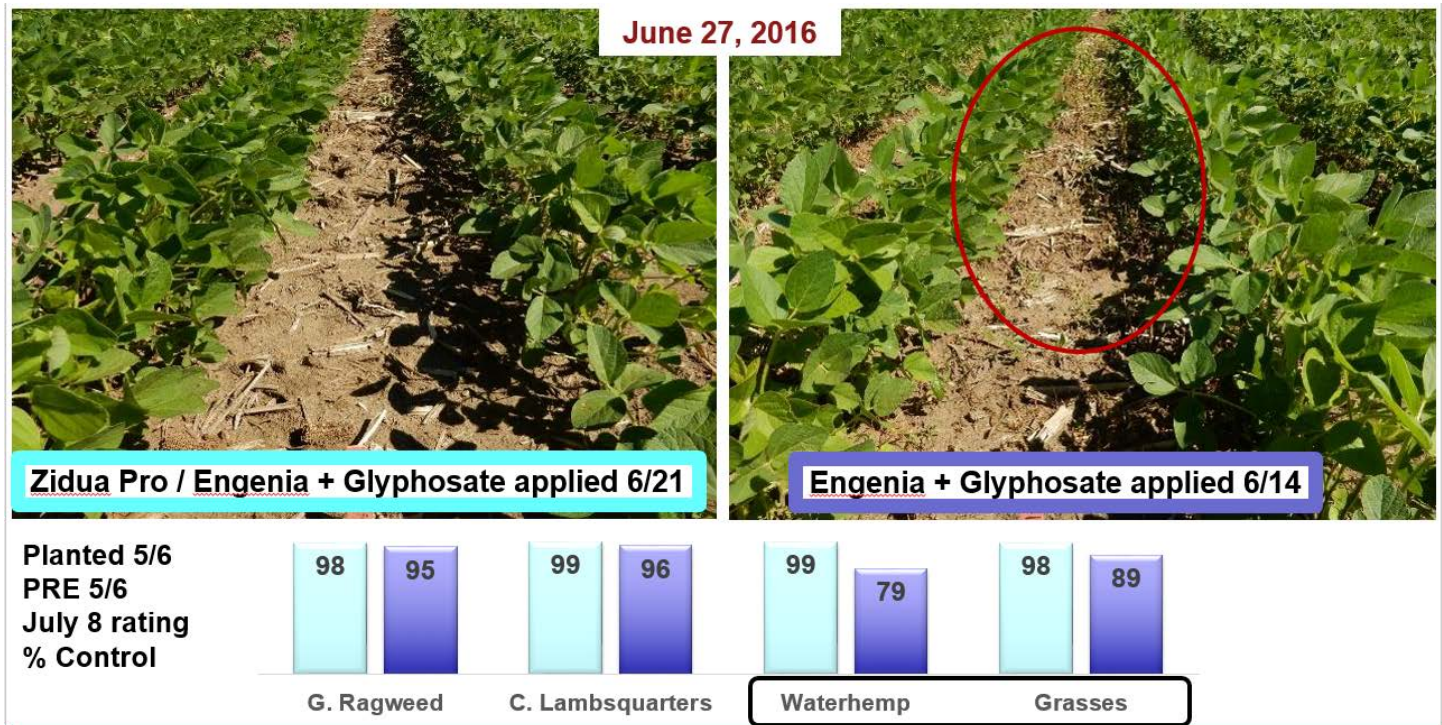


Figure 2. Weed control on July 8, 2016 with Zidua Pro (PRE) followed by Engenia + Glyphosate (POST) compared to Engenia + Glyphosate used POST only in dicamba tolerant soybeans at Rochester, MN in 2016.



University of Minnesota 2016 Statewide Soybean Weed Management at Rochester, MN.

Breitenbach, Fritz R., Lisa M. Behnken, Jeffrey L. Gunsolus and Thomas R. Hoverstad

The objective of this trial was to evaluate herbicide systems for weed control and crop response in soybeans in southeastern Minnesota. The research site was a loamy sand series with pH of 6.5, O.M. 2.1% and soil test P and K levels of 27 ppm and 124 ppm, respectively. The field was fall chisel plowed, spring disked and field cultivated once prior to planting. The previous crop was corn. The soybean variety was ASGROW AG1935 and was planted on May 17, 2016 at a depth of 1.5 inches in 30-inch rows at a rate of 165,000 seeds per acre. A randomized complete block design was used with four replications. Preemergence (PRE) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 30 psi with a ground speed of 4.5 mph using TTI 11002 nozzles. Postemergence (POST) treatments were applied at 15 gpa, 30 psi and ground speed of 4.5 MPH. When contact materials were applied as part of the treatment TTJ60 11002 nozzles were used. Systemic materials were applied with TTI 11002 nozzles. Evaluations of the plots were taken June 6, 10, 16, 22, 28, July 11 and September 27. The center two rows of each plot were machine harvested on October 10, 2016. Application dates, environmental conditions, and weed stages can be found in Table 1. Performance rating for giant ragweed, common lambsquarters, common waterhemp, grass control, and crop injury can be found in Tables 2 through 6, respectively. (University of Minnesota Extension Regional Office, Rochester.)

Table 1. Application timing, plant stages, environmental conditions.

Date	5/18	6/10	6/14	6/17	6/24
Treatment	PRE A	POST I B	POST II C	POST III D	POST IV E
Temperature (F)					
Air	64	83	73	75	64
Soil	59.7	73.7	73.9	73.7	65.1
Relative Humidity (%)	30	69	81	73	90
Wind (mph)	0	16	14	12	7
Soil Moisture	Normal	Normal	Normal	Normal	Normal
Soybean					
Stage		V2	V2	V3	V4-V5
Height (in)	0	5.3	6.9	8.0	10.0
Giant Ragweed					
Weed Density (ft ²)				10.5	
Height (in)		4.2	4.0	4.5	2.5
Common Lambsquarter					
Weed Density (ft ²)				1.5	
Height (in)		1.0	1.4	2.0	0.8
Common Waterhemp					
Weed Density (ft ²)				2.0	
Height (in)		0.8	1.5	1.8	2.3
Grass					
Weed Density (ft ²)				10.5	
Height (in)	0	1.9	2.8	2.5	2.1
Rainfall after each application (in)					
Week 1	0.56	2.82	1.64	1.69	0.78
Week 2	1.47	0.28	0.05	0.78	1.63
Week 3	1.32	0.78	1.95	1.63	1.15

Table 2. Giant ragweed control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code		AMBTR										YIELD					
Pest Name		Giant Ragweed															
Rating Date		June-10		June-16		June-22		June-28		July-11		Sept-27		Oct-10			
Treatment		Rate		Appl		Percent Control (%)										BU/A	
23 Weedy Check		0	k	0	l	0	j	0	j	0	h	0	k	15.4	h		
24 Weed-Free		100	a	100	a	100	a	100	a	100	a	100	a				
PRE (5/18/16) / POST II (6/14/16) 4 inch weeds																	
1 SOA 5, 15 / 9, 14		24	j	94	bcd	98	a-d	98	bcd	98	bcd	97	b-e	58.8	abc		
BOUNDARY 6.5 EC		1.75	pt/a	A													
FLEXSTAR GT 3.5		3.5	pt/a	C													
MSO		1	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
2 SOA 14 / 9, 15		58	ef	88	ghi	98	a-d	98	b-e	98	cde	97	b-e	58.3	a-d		
ROWEL		3	oz wt/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
WARRANT		1.9	qt/a	C													
N-Pa-K AMS		1.5	qt/a	C													
3 SOA 14,15 / 15, 9, 14		25	j	95	bc	98	abc	98	b-e	98	bcd	99	abc	53.3	efg		
BROADAXE XC		25	fl oz/a	A													
DUAL II MAGNUM		16	fl oz/a	C													
FLEXSTAR GT 3.5		3.5	pt/a	C													
MSO		1	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
4 SOA 5, 15 / 15, 9, 14		25	j	96	bc	99	ab	98	bc	99	bc	99	abc	53.2	efg		
BOUNDARY 6.5 EC		1.75	pt/a	A													
DUAL II MAGNUM		16	oz/a	C													
FLEXSTAR GT 3.5		3.5	pt/a	C													
MSO		1	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
6 SOA 14 / 9, 14, 15		60	e	94	bcd	97	bcd	98	b	98	bc	99	abc	49.8	g		
ROWEL		3	oz wt/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
WARRANT ULTRA		48	fl oz/a	C													
MSO		1	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
7 SOA 14 / 15, 14, 9		58	ef	97	b	98	bcd	97	c-g	97	def	97	c-f	51.5	fg		
ROWEL		3	oz wt/a	A													
WARRANT		1.9	qt/a	C													
COBRA		10	fl oz/a	C													
ROUNDUP POWERMAX		32	fl oz/a	C													
COC		0.5	qt/a	C													
N-Pa-K AMS		1.5	qt/a	C													
9 SOA 2, 14 / 9		45	h	84	jk	95	e-h	95	i	94	g	94	hij	62.8	a		
AUTHORITY ASSIST		12	fl oz/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
N-Pa-K AMS		1.5	qt/a	C													
12 SOA 14, 15, 5 / 9		61	e	89	fgh	97	b-e	97	d-g	96	f	95	ghi	55.6	c-f		
FIERCE		3	oz wt/a	A													
METRIBUZIN		4	oz wt/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
N-Pa-K AMS		1.5	qt/a	C													
13 SOA 2, 14, 15 / 9		33	i	82	k	96	d-g	97	fgh	94	g	93	ij	59.1	abc		
ZIDUA PRO		4.5	fl oz/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
NIS		0.25	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
14 SOA 14, 15 / 9		45	h	84	jk	98	bcd	97	d-g	97	ef	96	e-h	60.2	ab		
VERDICT		5	fl oz/a	A													
ZIDUA		2.3	fl oz/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
NIS		0.25	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
15 SOA 14, 15, 5 / 9		49	gh	86	ij	97	b-f	97	d-g	97	ef	95	fgh	62.4	a		
VERDICT		5	fl oz/a	A													
METRIBUZIN		5	oz wt/a	A													
ROUNDUP POWERMAX		32	fl oz/a	C													
NIS		0.25	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
16 SOA 2, 14 / 9		74	d	93	cde	97	b-f	97	fgh	96	f	96	d-g	60.4	ab		
SONIC		4.5	oz wt/a	A													
DURANGO DMA		32	fl oz/a	C													
N-Pa-K AMS		1.5	qt/a	C													
18 SOA 2, 14 / 9, 14		74	d	96	bc	98	bcd	98	bcd	98	bc	97	b-e	56.5	b-e		
SONIC		4.5	oz wt/a	A													
DURANGO DMA		32	fl oz/a	C													
FLEXSTAR		12	fl oz/a	C													
COC		0.5	% v/v	C													
N-Pa-K AMS		1.5	qt/a	C													
19 SOA 2, 14, / 9, 15		58	ef	88	ghi	94	gh	95	i	94	g	92	j	60.9	ab		
ENLITE 2.8 oz/A																	
- chlorimuron		0.33	oz wt/a	A													
- thifensulfuron		0.5	oz wt/a	A													
- flumioxazin		2	oz wt/a	A													
ABUNDIT EXTRA		32	fl oz/a	C													
CINCH		1	pt/a	C													
N-Pa-K AMS		1.5	qt/a	C													
20 SOA 2, 14 / 9		53	fg	87	hij	95	e-h	96	hi	94	g	93	j	58.8	abc		
ENLITE 2.8 oz/A																	
- chlorimuron		0.33	oz wt/a	A													
- thifensulfuron		0.5	oz wt/a	A													
- flumioxazin		2	oz wt/a	A													
ABUNDIT EXTRA		32	fl oz/a	C													
N-Pa-K AMS		1.5	qt/a	C													

Table 2 (continued). Giant ragweed control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code				AMBTR							YIELD						
				Giant Ragweed							13%						
Pest Name				June-10	June-16	June-22	June-28	July-11	Sept-27	Oct-10							
Rating Date										Percent Control (%)							BU/A
Treatment	Rate	Appl															
PRE (5/18/16) / POST III (6/17/16) 4 inch weeds																	
5	SOA 2 / 9, 14, 15			84	bc	91	efg	98	a-d	99	b	99	bc	98	abc	52.0	efg
	AUTHORITY FIRST	6.4	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	WARRANT ULTRA	48	fl oz/a														
	MISO	1	% v/v														
	N-Pa-K AMS	1.5	qt/a														
8	SOA 2, 14 / 9			78	cd	91	efg	96	d-g	97	e-h	98	bcd	98	bcd	62.8	a
	AUTHORITY FIRST	6.4	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
10	SOA 2, 14 / 9, 14, 15			81	c	91	efg	96	c-g	98	b-e	98	bc	98	bcd	61.6	a
	AUTHORITY FIRST	6.4	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	ANTHEM MAXX	2.5	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
11	SOA 2, 15, 14 / 9			79	cd	91	efg	97	b-f	98	bcd	98	bc	98	abc	60.0	abc
	FIERCE	3	oz wt/a														
	FIRSTRATE	0.3	oz wt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
PRE (5/18/16) / POST IV (6/24/16) 4 inch weeds																	
17	SOA 2, 14 / 9			89	b	94	bcd	93	hi	96	ghi	99	b	99	ab	60.5	ab
	SURVEIL	2.8	oz wt/a														
	DURANGO DMA	32	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
POST I (6/10/16) 2 inch weeds / POST IV (6/24/16) 4 inch weeds																	
21	SOA 9, 14 / 9			0	k	97	ab	95	fgh	98	b-f	98	bc	99	abc	59.4	abc
	ROUNDUP POWERMAX	32	fl oz/a														
	COBRA	8	fl oz/a														
	COC	1	pt/a														
	N-Pa-K AMS	1.5	qt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
22	SOA 9, 14, 15 / 9			0	k	92	def	92	i	97	fgh	98	bcd	98	bcd	54.2	d-g
	ROUNDUP POWERMAX	32	fl oz/a														
	ANTHEM MAXX	3	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
	ROUNDUP POWERMAX	32	fl oz/a														
	N-Pa-K AMS	1.5	qt/a														
LSD P=.10				6.0		3.1		2.4		1.0		1.2		1.8		4.5	

Table 3. Common lambsquarters control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code		CHEAL										YIELD																					
Pest Name		Common Lambsquarters										13%																					
Rating Date		June-10		June-16		June-22		June-28		July-11		Sept-27		Oct-10																			
Treatment		Rate		Appl		Percent Control (%)										BU/A																	
23 Weedy Check		0		c		0		d		0		f		0		e		0		d		15.4		h									
24 Weed-Free		100		a		100		a		100		a		100		a		100		a													
PRE (5/18/16) / POST II (6/14/16) 4 inch weeds																																	
1 SOA 5, 15 / 9, 14						99		b		99		b		99		b		99		b		99		b		58.8		abc					
BOUNDARY 6.5 EC		1.75		pt/a				A																									
FLEXSTAR GT 3.5		3.5		pt/a				C																									
MSO		1		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
2 SOA 14 / 9, 15						99		b		99		b		99		b		99		b		99		b		99		b		58.3		a-d	
ROWEL		3		oz wt/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
WARRANT		1.9		qt/a				C																									
N-Pa-K AMS		1.5		qt/a				C																									
3 SOA 14,15 / 15, 9, 14						99		b		99		b		99		b		99		b		99		b		99		b		53.3		efg	
BROADAXE XC		25		fl oz/a				A																									
DUAL II MAGNUM		16		fl oz/a				C																									
FLEXSTAR GT 3.5		3.5		pt/a				C																									
MSO		1		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
4 SOA 5, 15 / 15, 9, 14						99		b		99		b		99		b		99		b		99		b		99		b		53.2		efg	
BOUNDARY 6.5 EC		1.75		pt/a				A																									
DUAL II MAGNUM		16		oz/a				C																									
FLEXSTAR GT 3.5		3.5		pt/a				C																									
MSO		1		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
6 SOA 14 / 9, 14, 15						99		b		99		b		99		b		99		b		99		b		99		b		49.8		g	
ROWEL		3		oz wt/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
WARRANT ULTRA		48		fl oz/a				C																									
MSO		1		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
7 SOA 14 / 15, 14, 9						99		b		99		c		99		b		99		b		99		b		99		b		51.5		fg	
ROWEL		3		oz wt/a				A																									
WARRANT		1.9		qt/a				C																									
COBRA		10		fl oz/a				C																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
COC		0.5		qt/a				C																									
N-Pa-K AMS		1.5		qt/a				C																									
9 SOA 2, 14 / 9						99		b		99		b		99		b		99		b		99		b		99		b		62.8		a	
AUTHORITY ASSIST		12		fl oz/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
N-Pa-K AMS		1.5		qt/a				C																									
12 SOA 14, 15, 5 / 9						99		b		99		b		99		b		99		b		99		b		99		b		55.6		c-f	
FIERCE		3		oz wt/a				A																									
METRIBUZIN		4		oz wt/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
N-Pa-K AMS		1.5		qt/a				C																									
13 SOA 2, 14, 15 / 9						99		b		99		b		99		b		99		b		99		b		99		b		59.1		abc	
ZIDUA PRO		4.5		fl oz/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
NIS		0.25		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
14 SOA 14, 15 / 9						99		b		99		c		98		c		97		e		98		d		98		c		60.2		ab	
VERDICT		5		fl oz/a				A																									
ZIDUA		2.3		fl oz/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
NIS		0.25		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
15 SOA 14, 15, 5 / 9						99		b		99		b		99		bc		98		cd		98		d		98		c		62.4		a	
VERDICT		5		fl oz/a				A																									
METRIBUZIN		5		oz wt/a				A																									
ROUNDUP POWERMAX		32		fl oz/a				C																									
NIS		0.25		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
16 SOA 2, 14 / 9						99		b		99		c		99		b		99		b		99		b		99		b		60.4		ab	
SONIC		4.5		oz wt/a				A																									
DURANGO DMA		32		fl oz/a				C																									
N-Pa-K AMS		1.5		qt/a				C																									
18 SOA 2, 14 / 9, 14						99		b		99		b		99		b		99		b		99		b		99		b		56.5		b-e	
SONIC		4.5		oz wt/a				A																									
DURANGO DMA		32		fl oz/a				C																									
FLEXSTAR		12		fl oz/a				C																									
COC		0.5		% v/v				C																									
N-Pa-K AMS		1.5		qt/a				C																									
19 SOA 2, 14, / 9, 15						99		b		99		b		99		b		99		b		99		b		99		b		60.9		ab	
ENLITE 2.8 oz/A																																	
- chlorimuron		0.33		oz wt/a				A																									
- thifensulfuron		0.5		oz wt/a																													

Table 3 (continued). Common lambsquarters control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code				CHEAL						YIELD							
Pest Name				Common Lambsquarters						Oct-10							
Rating Date				June-10	June-16	June-22	June-28	July-11	Sept-27	BU/A							
Treatment	Rate	Appl		Percent Control (%)						BU/A							
PRE (5/18/16) / POST III (6/17/16) 4 inch weeds																	
5	SOA 2 / 9, 14, 15			99	b	99	b	99	b	99	b	99	b	52.0	efg		
	AUTHORITY FIRST	6.4	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	WARRANT ULTRA	48	fl oz/a	D													
	MSO	1	% v/v	D													
	N-Pa-K AMS	1.5	qt/a	D													
8	SOA 2, 14 / 9			99	b	99	b	99	b	99	b	99	b	62.8	a		
	AUTHORITY FIRST	6.4	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	N-Pa-K AMS	1.5	qt/a	D													
10	SOA 2, 14 / 9, 14, 15			99	b	99	b	99	b	99	b	99	b	61.6	a		
	AUTHORITY FIRST	6.4	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	ANTHEM MAXX	2.5	fl oz/a	D													
	N-Pa-K AMS	1.5	qt/a	D													
11	SOA 2, 15, 14 / 9			99	b	99	b	99	b	99	b	99	b	60.0	abc		
	FIERCE	3	oz wt/a	A													
	FIRSTRATE	0.3	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	N-Pa-K AMS	1.5	qt/a	D													
PRE (5/18/16) / POST IV (6/24/16) 4 inch weeds																	
17	SOA 2, 14 / 9			99	b	99	b	99	b	99	b	99	b	60.5	ab		
	SURVEIL	2.8	oz wt/a	A													
	DURANGO DMA	32	fl oz/a	E													
	N-Pa-K AMS	1.5	qt/a	E													
POST I (6/10/16) 2 inch weeds / POST IV (6/24/16) 4 inch weeds																	
21	SOA 9, 14 / 9			0	c	99	b	96	d	97	e	98	c	98	c	59.4	abc
	ROUNDUP POWERMAX	32	fl oz/a	B													
	COBRA	8	fl oz/a	B													
	COC	1	pt/a	B													
	N-Pa-K AMS	1.5	qt/a	B													
	ROUNDUP POWERMAX	32	fl oz/a	E													
	N-Pa-K AMS	1.5	qt/a	E													
22	SOA 9, 14, 15 / 9			0	c	99	c	95	e	98	d	99	b	99	b	54.2	d-g
	ROUNDUP POWERMAX	32	fl oz/a	B													
	ANTHEM MAXX	3	fl oz/a	B													
	N-Pa-K AMS	1.5	qt/a	B													
	ROUNDUP POWERMAX	32	fl oz/a	E													
	N-Pa-K AMS	1.5	qt/a	E													
LSD P=.10				0.5	0.2	0.7	0.6	0.5	0.6	0.5	0.6	0.5	0.6	4.53			

Table 4 (continued). Common waterhemp control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code				AMATA						YIELD							
Pest Name				Common Waterhemp						Oct-10							
Rating Date				June-10	June-16	June-22	June-28	July-11	Sept-27	BU/A							
Treatment	Rate	Appl		Percent Control (%)						BU/A							
PRE (5/18/16) / POST III (6/17/16) 4 inch weeds																	
5	SOA 2 / 9, 14, 15			99	b	99	b	99	b	99	b	99	b	52.0	efg		
	AUTHORITY FIRST	6.4	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	WARRANT ULTRA	48	fl oz/a	D													
	MSO	1	% v/v	D													
	N-Pa-K AMS	1.5	qt/a	D													
8	SOA 2, 14 / 9			99	b	99	b	99	b	99	b	99	b	62.8	a		
	AUTHORITY FIRST	6.4	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	N-Pa-K AMS	1.5	qt/a	D													
10	SOA 2, 14 / 9, 14, 15			99	b	99	b	99	b	99	b	99	b	61.6	a		
	AUTHORITY FIRST	6.4	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	ANTHEM MAXX	2.5	fl oz/a	D													
	N-Pa-K AMS	1.5	qt/a	D													
11	SOA 2, 15, 14 / 9			99	b	99	b	99	b	99	b	99	b	60.0	abc		
	FIERCE	3	oz wt/a	A													
	FIRSTRATE	0.3	oz wt/a	A													
	ROUNDUP POWERMAX	32	fl oz/a	D													
	N-Pa-K AMS	1.5	qt/a	D													
PRE (5/18/16) / POST IV (6/24/16) 4 inch weeds																	
17	SOA 2, 14 / 9			99	b	99	b	99	bc	99	b	99	b	99	b	60.5	ab
	SURVEIL	2.8	oz wt/a	A													
	DURANGO DMA	32	fl oz/a	E													
	N-Pa-K AMS	1.5	qt/a	E													
POST I (6/10/16) 2 inch weeds / POST IV (6/24/16) 4 inch weeds																	
21	SOA 9, 14 / 9			0	c	99	b	99	b	99	b	99	b	99	b	59.4	abc
	ROUNDUP POWERMAX	32	fl oz/a	B													
	COBRA	8	fl oz/a	B													
	COC	1	pt/a	B													
	N-Pa-K AMS	1.5	qt/a	B													
	ROUNDUP POWERMAX	32	fl oz/a	E													
	N-Pa-K AMS	1.5	qt/a	E													
22	SOA 9, 14, 15 / 9			0	c	99	b	98	d	99	bc	99	b	99	bc	54.2	d-g
	ROUNDUP POWERMAX	32	fl oz/a	B													
	ANTHEM MAXX	3	fl oz/a	B													
	N-Pa-K AMS	1.5	qt/a	B													
	ROUNDUP POWERMAX	32	fl oz/a	E													
	N-Pa-K AMS	1.5	qt/a	E													
LSD P=.10				.	.	0.3	0.4	0.3	0.6	4.53							

Table 5. Grass control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code	GRASS Species						YIELD Oct-10 BU/A		
	June-10	June-16	June-22	June-28	July-11	Sept-27			
Rating Date	Percent Control (%)								
Treatment	Rate	Appl							
23 Weedy Check			0 d	0 f	0 g	0 h	0 j	0 h	15.4 h
24 Weed-Free		E	100 a	100 a	100 a	100 a	100 a	100 a	
PRE (5/18/16) / POST II (6/14/16) 4 inch weeds									
1 SOA 5, 15 / 9, 14			99 b	99 ab	99 ab	99 b	99 b	99 abc	58.8 abc
BOUNDARY 6.5 EC	1.75 pt/a	A							
FLEXSTAR GT 3.5	3.5 pt/a	C							
MSO	1 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
2 SOA 14 / 9, 15			99 b	99 ab	99 b	98 cde	98 c-f	98 c-f	58.3 a-d
ROWEL	3 oz wt/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
WARRANT	1.9 qt/a	C							
N-Pa-K AMS	1.5 qt/a	C							
3 SOA 14,15 / 15, 9, 14			99 b	99 ab	99 ab	99 bc	99 b	99 bc	53.3 efg
BROADAXE XC	25 fl oz/a	A							
DUAL II MAGNUM	16 fl oz/a	C							
FLEXSTAR GT 3.5	3.5 pt/a	C							
MSO	1 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
4 SOA 5, 15 / 15, 9, 14			99 b	99 ab	99 ab	99 b	99 b	99 abc	53.2 efg
BOUNDARY 6.5 EC	1.75 pt/a	A							
DUAL II MAGNUM	16 oz/a	C							
FLEXSTAR GT 3.5	3.5 pt/a	C							
MSO	1 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
6 SOA 14 / 9, 14, 15			99 b	99 b	99 ab	99 ab	99 ab	99 ab	49.8 g
ROWEL	3 oz wt/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
WARRANT ULTRA	48 fl oz/a	C							
MSO	1 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
7 SOA 14 / 15, 14, 9			99 b	99 ab	99 b	98 de	98 def	98 c-f	51.5 fg
ROWEL	3 oz wt/a	A							
WARRANT	1.9 qt/a	C							
COBRA	10 fl oz/a	C							
ROUNDUP POWERMAX	32 fl oz/a	C							
COC	0.5 qt/a	C							
N-Pa-K AMS	1.5 qt/a	C							
9 SOA 2, 14 / 9			99 bc	99 ab	99 b	98 bcd	98 b-e	99 bcd	62.8 a
AUTHORITY ASSIST	12 fl oz/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
N-Pa-K AMS	1.5 qt/a	C							
12 SOA 14, 15, 5 / 9			99 b	99 ab	99 ab	98 cde	98 b-e	99 bcd	55.6 c-f
FIERCE	3 oz wt/a	A							
METRIBUZIN	4 oz wt/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
N-Pa-K AMS	1.5 qt/a	C							
13 SOA 2, 14, 15 / 9			99 b	99 ab	98 bc	98 cde	97 fgh	97 ef	59.1 abc
ZIDUA PRO	4.5 fl oz/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
NIS	0.25 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
14 SOA 14, 15 / 9			99 b	99 ab	99 ab	98 de	97 gh	97 fg	60.2 ab
VERDICT	5 fl oz/a	A							
ZIDUA	2.3 fl oz/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
NIS	0.25 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
15 SOA 14, 15, 5 / 9			99 b	99 b	98 bcd	97 ef	96 i	96 g	62.4 a
VERDICT	5 fl oz/a	A							
METRIBUZIN	5 oz wt/a	A							
ROUNDUP POWERMAX	32 fl oz/a	C							
NIS	0.25 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
16 SOA 2, 14 / 9			99 b	98 bcd	98 bcd	98 de	97 gh	98 def	60.4 ab
SONIC	4.5 oz wt/a	A							
DURANGO DMA	32 fl oz/a	C							
N-Pa-K AMS	1.5 qt/a	C							
18 SOA 2, 14 / 9, 14			99 b	99 ab	99 b	98 cde	98 c-f	98 b-e	56.5 b-e
SONIC	4.5 oz wt/a	A							
DURANGO DMA	32 fl oz/a	C							
FLEXSTAR	12 fl oz/a	C							
COC	0.5 % v/v	C							
N-Pa-K AMS	1.5 qt/a	C							
19 SOA 2, 14, / 9, 15			98 c	97 cde	99 b	98 de	98 efg	98 c-f	60.9 ab
ENLITE 2.8 oz/A									
- chlorimuron	0.33 oz wt/a	A							
- thifensulfuron	0.5 oz wt/a	A							
- flumioxazin	2 oz wt/a	A							
ABUNDIT EXTRA	32 fl oz/a	C							
CINCH	1 pt/a	C							
N-Pa-K AMS	1.5 qt/a	C							
20 SOA 2, 14 / 9			98 c	97 cde	97 de	97 fg	97 h	96 g	58.8 abc
ENLITE 2.8 oz/A									
- chlorimuron	0.33 oz wt/a	A							
- thifensulfuron	0.5 oz wt/a	A							
- flumioxazin	2 oz wt/a	A							
ABUNDIT EXTRA	32 fl oz/a	C							
N-Pa-K AMS	1.5 qt/a	C							

Table 5 (continued). Grass control with soybean herbicide systems at Rochester, MN in 2016.

Pest Code	GRASS Species						YIELD Oct-10 BU/A									
	June-10	June-16	June-22	June-28	July-11	Sept-27										
Rating Date	Percent Control (%)															
Treatment	Rate	Appl														
PRE (5/18/16) / POST III (6/17/16) 4 inch weeds																
5	SOA 2 / 9, 14, 15		99	b	98	bcd	99	ab	99	bc	99	b	99	abc	52.0	efg
	AUTHORITY FIRST	6.4 oz wt/a														
	ROUNDUP POWERMAX	32 fl oz/a														
	WARRANT ULTRA	48 fl oz/a														
	MSO	1 % v/v														
	N-Pa-K AMS	1.5 qt/a														
8	SOA 2, 14 / 9		99	b	98	bc	99	b	98	cde	99	b	99	bc	62.8	a
	AUTHORITY FIRST	6.4 oz wt/a														
	ROUNDUP POWERMAX	32 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
10	SOA 2, 14 / 9, 14, 15		98	c	97	de	99	ab	99	b	99	b	99	abc	61.6	a
	AUTHORITY FIRST	6.4 oz wt/a														
	ROUNDUP POWERMAX	32 fl oz/a														
	ANTHEM MAXX	2.5 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
11	SOA 2, 15, 14 / 9		99	b	99	ab	99	ab	98	bcd	99	bcd	99	bcd	60.0	abc
	FIERCE	3 oz wt/a														
	FIRSTRATE	0.3 oz wt/a														
	ROUNDUP POWERMAX	32 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
PRE (5/18/16) / POST IV (6/24/16) 4 inch weeds																
17	SOA 2, 14 / 9		99	bc	96	e	92	f	96	g	99	bcd	99	bcd	60.5	ab
	SURVEIL	2.8 oz wt/a														
	DURANGO DMA	32 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
POST I (6/10/16) 2 inch weeds / POST IV (6/24/16) 4 inch weeds																
21	SOA 9, 14 / 9		0	d	99	ab	97	cde	98	de	97	fgh	98	c-f	59.4	abc
	ROUNDUP POWERMAX	32 fl oz/a														
	COBRA	8 fl oz/a														
	COC	1 pt/a														
	N-Pa-K AMS	1.5 qt/a														
	ROUNDUP POWERMAX	32 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
22	SOA 9, 14, 15 / 9		0	d	99	ab	96	e	98	bcd	99	bc	99	bc	54.2	d-g
	ROUNDUP POWERMAX	32 fl oz/a														
	ANTHEM MAXX	3 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
	ROUNDUP POWERMAX	32 fl oz/a														
	N-Pa-K AMS	1.5 qt/a														
LSD P=10			0.7		1		1		1		1		1		4.5	

Table 6. Crop Response to herbicide systems in soybean at Rochester, MN in 2016.

Pest Code	CROP RESPONSE								YIELD Oct-10 BU/A			
	Rating Date		June-6	June-16	June-22	July-11	Percent Injury (%)					
Treatment	Rate	Appl										
23 Weedy Check			0	d	0	f	0	i	0	f	15.4	h
24 Weed-Free		E	0	d	0	f	0	i	0	f		
PRE (5/18/16) / POST II (6/14/16) 4 inch weeds												
1 SOA 5, 15 / 9, 14			3	d	58	c	24	c	5	d	58.8	abc
BOUNDARY 6.5 EC	1.75	pt/a										
FLEXSTAR GT 3.5	3.5	pt/a										
MSO	1	% v/v										
N-Pa-K AMS	1.5	qt/a										
2 SOA 14 / 9, 15			26	b	4	f	5	g	0	f	58.3	a-d
ROWEL	3	oz wt/a										
ROUNDUP POWERMAX	32	fl oz/a										
WARRANT	1.9	qt/a										
N-Pa-K AMS	1.5	qt/a										
3 SOA 14,15 / 15, 9, 14			5	d	65	b	35	a	10	b	53.3	efg
BROADAXE XC	25	fl oz/a										
DUAL II MAGNUM	16	fl oz/a										
FLEXSTAR GT 3.5	3.5	pt/a										
MSO	1	% v/v										
N-Pa-K AMS	1.5	qt/a										
4 SOA 5, 15 / 15, 9, 14			0	d	65	b	34	a	8	c	53.2	efg
BOUNDARY 6.5 EC	1.75	pt/a										
DUAL II MAGNUM	16	oz/a										
FLEXSTAR GT 3.5	3.5	pt/a										
MSO	1	% v/v										
N-Pa-K AMS	1.5	qt/a										
6 SOA 14 / 9, 14, 15			23	b	57	cd	28	b	2	ef	49.8	g
ROWEL	3	oz wt/a										
ROUNDUP POWERMAX	32	fl oz/a										
WARRANT ULTRA	48	fl oz/a										
MSO	1	% v/v										
N-Pa-K AMS	1.5	qt/a										
7 SOA 14 / 15, 14, 9			24	b	73	a	37	a	13	a	51.5	fg
ROWEL	3	oz wt/a										
WARRANT	1.9	qt/a										
COBRA	10	fl oz/a										
ROUNDUP POWERMAX	32	fl oz/a										
COC	0.5	qt/a										
N-Pa-K AMS	1.5	qt/a										
9 SOA 2, 14 / 9			5	d	0	f	1	hi	0	f	62.8	a
AUTHORITY ASSIST	12	fl oz/a										
ROUNDUP POWERMAX	32	fl oz/a										
N-Pa-K AMS	1.5	qt/a										
12 SOA 14, 15, 5 / 9			33	a	0	f	3	ghi	0	f	55.6	c-f
FIERCE	3	oz wt/a										
METRIBUZIN	4	oz wt/a										
ROUNDUP POWERMAX	32	fl oz/a										
N-Pa-K AMS	1.5	qt/a										
13 SOA 2, 14, 15 / 9			4	d	0	f	5	g	0	f	59.1	abc
ZIDUA PRO	4.5	fl oz/a										
ROUNDUP POWERMAX	32	fl oz/a										
NIS	0.25	% v/v										
N-Pa-K AMS	1.5	qt/a										
14 SOA 14, 15 / 9			5	d	0	f	4	gh	0	f	60.2	ab
VERDICT	5	fl oz/a										
ZIDUA	2.3	fl oz/a										
ROUNDUP POWERMAX	32	fl oz/a										
NIS	0.25	% v/v										
N-Pa-K AMS	1.5	qt/a										
15 SOA 14, 15, 5 / 9			4	d	0	f	1	hi	0	f	62.4	a
VERDICT	5	fl oz/a										
METRIBUZIN	5	oz wt/a										
ROUNDUP POWERMAX	32	fl oz/a										
NIS	0.25	% v/v										
N-Pa-K AMS	1.5	qt/a										
16 SOA 2, 14 / 9			0	d	0	f	0	i	0	f	60.4	ab
SONIC	4.5	oz wt/a										
DURANGO DMA	32	fl oz/a										
N-Pa-K AMS	1.5	qt/a										
18 SOA 2, 14 / 9, 14			4	d	51	d	21	cd	1	f	56.5	b-e
SONIC	4.5	oz wt/a										
DURANGO DMA	32	fl oz/a										
FLEXSTAR	12	fl oz/a										
COC	0.5	% v/v										
N-Pa-K AMS	1.5	qt/a										
19 SOA 2, 14, / 9, 15			15	c	26	e	18	de	0	f	60.9	ab
ENLITE 2.8 oz/A												
- chlorimuron	0.33	oz wt/a										
- thifensulfuron	0.5	oz wt/a										
- flumioxazin	2	oz wt/a										
ABUNDIT EXTRA	32	fl oz/a										
CINCH	1	pt/a										
N-Pa-K AMS	1.5	qt/a										
20 SOA 2, 14 / 9			11	c	0	f	0	i	0	f	58.8	abc
ENLITE 2.8 oz/A												
- chlorimuron	0.33	oz wt/a										
- thifensulfuron	0.5	oz wt/a										
- flumioxazin	2	oz wt/a										
ABUNDIT EXTRA	32	fl oz/a										
N-Pa-K AMS	1.5	qt/a										

Table 6 (continued). Crop Response to herbicide systems in soybean at Rochester, MN in 2016.

Pest Code	CROP RESPONSE				YIELD Oct-10 BU/A							
	June-6	June-16	June-22	July-11								
Rating Date	Percent Injury (%)											
Treatment	Rate	Appl										
PRE (5/18/16) / POST III (6/17/16) 4 inch weeds												
5	SOA 2 / 9, 14, 15		1	d	0	f	29	b	1	f	52.0	efg
	AUTHORITY FIRST	6.4 oz wt/a		A								
	ROUNDUP POWERMAX	32 fl oz/a		D								
	WARRANT ULTRA	48 fl oz/a		D								
	MSO	1 % v/v		D								
	N-Pa-K AMS	1.5 qt/a		D								
8	SOA 2, 14 / 9		0	d	0	f	1	hi	0	f	62.8	a
	AUTHORITY FIRST	6.4 oz wt/a		A								
	ROUNDUP POWERMAX	32 fl oz/a		D								
	N-Pa-K AMS	1.5 qt/a		D								
10	SOA 2, 14 / 9, 14, 15		0	d	0	f	15	e	0	f	61.6	a
	AUTHORITY FIRST	6.4 oz wt/a		A								
	ROUNDUP POWERMAX	32 fl oz/a		D								
	ANTHEM MAXX	2.5 fl oz/a		D								
	N-Pa-K AMS	1.5 qt/a		D								
11	SOA 2, 15, 14 / 9		23	b	0	f	3	ghi	0	f	60.0	abc
	FIERCE	3 oz wt/a		A								
	FIRSTRATE	0.3 oz wt/a		A								
	ROUNDUP POWERMAX	32 fl oz/a		D								
	N-Pa-K AMS	1.5 qt/a		D								
PRE (5/18/16) / POST IV (6/24/16) 4 inch weeds												
17	SOA 2, 14 / 9		25	b	0	f	0	i	0	f	60.5	ab
	SURVEIL	2.8 oz wt/a		A								
	DURANGO DMA	32 fl oz/a		E								
	N-Pa-K AMS	1.5 qt/a		E								
POST I (6/10/16) 2 inch weeds / POST IV (6/24/16) 4 inch weeds												
21	SOA 9, 14 / 9		0	d	58	c	18	de	4	de	59.4	abc
	ROUNDUP POWERMAX	32 fl oz/a		B								
	COBRA	8 fl oz/a		B								
	COC	1 pt/a		B								
	N-Pa-K AMS	1.5 qt/a		B								
	ROUNDUP POWERMAX	32 fl oz/a		E								
	N-Pa-K AMS	1.5 qt/a		E								
22	SOA 9, 14, 15 / 9		0	d	21	e	10	f	0	f	54.2	d-g
	ROUNDUP POWERMAX	32 fl oz/a		B								
	ANTHEM MAXX	3 fl oz/a		B								
	N-Pa-K AMS	1.5 qt/a		B								
	ROUNDUP POWERMAX	32 fl oz/a		E								
	N-Pa-K AMS	1.5 qt/a		E								
LSD P=.10			5		6		4		2		4.5	

Soybean Herbicide Evaluation

SWROC at Lamberton and SROC at Waseca

LINK: <http://appliedweeds.cfans.umn.edu/research-reports>



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SECTION

E

AGRONOMY

2016 Waterhemp Control in Edible Lima Bean Production in SE Minnesota

Breitenbach, Fritz R., Lisa M. Behnken, Jared Liebenow and Annette Kylo

Introduction:

Effective broadleaf weed control especially *Amaranthus* spp. (*A. tuberculatus* and *A. rudis*), has become challenging in many broadleaf crops in MN. In the lima bean production areas in SE Minnesota *Amaranthus* resistance is documented for ALS herbicides (Group-2), glycine herbicides (Group-9), and recently (2016) PPO herbicides (Group-14). Multi-herbicide resistant *Amaranthus* has also become widespread across Minnesota and has complicated weed control efforts. Pendimethalin tank mixed with imazethapyr is currently utilized on the majority of southeastern Minnesota lima bean production acres. Inadequate *Amaranthus* control with this program has resulted in fewer acres in production and reduced grower profits.

Materials and Methods:

In 2016, a trial was conducted in edible lima beans to evaluate both labeled and unlabeled herbicides. Labeled products included bentazon (POST), imazamox (POST), imazethapyr, (PPI), pendimethalin (PPI), and s-metolachlor (PPI and PRE). Herbicides without current lima bean labels included fomesafen (PRE and POST), sulfentrazone (PRE), and POST applied s-metolachlor. Weed control, crop response, and plump pod weight were collected as measures of performance in this trial. Rates used were based on soil type and seasonal limits. The research site was a Lawler loam series with a pH of 6.9, O.M. 2.2% and soil test P and K levels of 49 ppm and 124 ppm, respectively. The field was fall chisel plowed, spring disked and field cultivated prior to planting. Improved Kinstons lima bean was planted on June 17, 2016 in 30-inch rows at 115,000 seeds per acre. A randomized complete block design was used with four replications. PPI and PRE treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 40 psi using TTI 110015 spray tips immediately before and after planting. POST applications were made on July 15 at 15 gpa and 30 psi using TTIJ60 11002 nozzles for contact herbicides, and TTI 11002 nozzles for non-contact herbicides. Common waterhemp density on June 8 averaged 16 plants per square foot. Evaluations were taken on July 12 and July 19. On September 14, four feet of row from one of the two center rows were hand cut and plump pods were removed and weighed. Application dates, environmental conditions, and weed stages can be found in Table 1. Results are presented in Table 2.

Discussion:

Overall control of *Amaranthus* in this study was very good to excellent. Minor differences in *Amaranthus* control were observed (Table 2). The sequential application of s-metolachlor (PPI followed by POST) provided lower *Amaranthus* control than s-metolachlor applied PRE. Sulfentrazone, and the package mix of sulfentrazone and s-metolachlor provided excellent *Amaranthus* control. Fomesafen applied PRE or POST also provide excellent *Amaranthus* control. Crop response to both PRE applied and POST applied herbicides treatments were observed (Figure 1) and appeared to be the largest contributor to decreased plump pod weight other than zero weed control in the untreated check (Table 2). (University of Minnesota Extension Regional Office, Rochester).

Table 1. Application timing, plant stages, environmental conditions in 2016.

Date	6/17	6/17	7/15
Treatment	PPI (A)	PRE (B)	POST I (C)
Temperature (F)			
Air	82	81	62
Soil	56.3	71.3	69.5
Relative Humidity (%)	60	62	90
Wind (mph)	9	8	6
Soil Moisture	Normal	Normal	Normal
Lima bean			
Stage			V5
Height (inch)			12.0
Common Waterhemp			
Height (inch)			2.5
Common Lambsquarters			
Height (inch)			2.0
Grass			
Height (inch)			2.0
Rainfall after each application			
Week 1	0.41	0.41	2.00
Week 2	0.65	0.65	2.83
Week 3	1.66	1.66	1.28

Table 2. Waterhemp control, crop response and lima bean plum pod weight at Rochester, MN in 2016.

Treatment ^{1a}	Rate ^{2a}	Appl. ^{2b}	7/19/16 ^{3a}	6/10/16 ^{3b}	YIELD ^{3c}
Herbicide ^{4a}	Per-acre ^{4b}	Time ^{4c}	%-Control ^{4d}	%-Injury ^{4e}	Pod-wt ^{3d}
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	98-a ^{3a}	1...d ^{3b}	47...a ^{3c}
DUAL-MAGNUM ^{4a}	1.33-pt ^{4b}	B ^{4c}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	97-a ^{3a}	1...d ^{3b}	46...ab ^{3c}
SPARTAN ^{4a}	4.5-fl-oz ^{4b}	B ^{4c}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	99-a ^{3a}	11-bc ^{3b}	40-abc ^{3c}
DUAL-MAGNUM+REFLEX ^{4a}	1.33-pt+16-fl-oz ^{4b}	B ^{4c}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	99-a ^{3a}	13...b ^{3b}	38-bcd ^{3c}
AUTHORITY-ELITE ^{4a}	26-fl-oz ^{4b}	B ^{4c}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	98-a ^{3a}	6...c ^{3b}	36...cd ^{3c}
DUAL-MAGNUM ^{4a}	1.33-pt ^{4b}	B ^{4c}			
RAPTOR+BASAGRAN+NIS ^{4a}	4.0-fl-oz+8.0-fl-oz+0.25-% ^{4b}	C ^{4c}			
PROWL+PURSUIT+DUAL-MAGNUM ^{1a}	2.3-pt+3-fl-oz+1.0-pt ^{1a}	A ^{1a}	90-b ^{3a}	7-bc ^{3b}	29...de ^{3c}
DUAL-MAGNUM ^{4a}	1.0-pt ^{4b}	C ^{4c}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	99-a ^{3a}	40...a ^{3b}	26...e ^{3c}
DUAL-MAGNUM ^{4a}	1.33-pt ^{4b}	B ^{4c}			
REFLEX+BASAGRAN+NIS ^{4a}	12.0-fl-oz+8.0-fl-oz+0.25-% ^{4b}	C ^{4c}			
LSD-P=0.10			2 ^{3a}	3.07-11.31 ^{3b}	9 ^{3c}

1. Prowl= pendimethalin-3.3-EC, Pursuit= imazethapyr-2-EC, Dual-Magnum= s-metolachlor-7.62-EC, Spartan= sulfentrazone-4-F,
 ...Authority-Elite= sulfentrazone+s-metolachlor-7-EC, Reflex= fomesafen-2-SL, Basagran= bentazon-4-SL
 2. Application-date: A= PPI: 6/17/16, B= PRE: 6/17/16, C= POST: 7/15/16
 3. Plum-pod-weight= ounces-per-4-foot-of-row
 4. Automatic-square-root-transformation-of-X+.05



Figure 1. Waterhemp control, and crop response, with various herbicides in lima bean on August 1, 2016 at Rochester, MN.



Introduction: Effective broadleaf weed control especially *Amaranthus* spp. (*A. tuberculatus* and *A. rudis*), has become challenging in many broadleaf crops in MN. In the lima bean production areas in SE Minnesota *Amaranthus* resistance is documented for ALS herbicides (Group-2), glycine herbicides (Group-9), and recently (2016) PPO herbicides (Group-14). Multi-herbicide resistant *Amaranthus* has also become widespread across Minnesota and has complicated weed control efforts. Pendimethalin tank mixed with imazethapyr is currently utilized on the majority of southeastern Minnesota lima bean production acres. Inadequate *Amaranthus* control with this program has resulted in fewer acres in production and reduced grower profits.

Materials and Methods: In 2016 a trial was conducted in edible lima beans to evaluate both labeled and un-labeled herbicides. Labeled products included bentazon (POST), imazamox (POST), imazethapyr, (PPI), pendimethalin (PPI), and s-metolachlor (PPI and PRE). Herbicides without current lima bean labels included fomesafen (PRE and POST), sulfentrazone (PRE), and POST applied s-metolachlor. Weed control, crop response, and plump pod weight were

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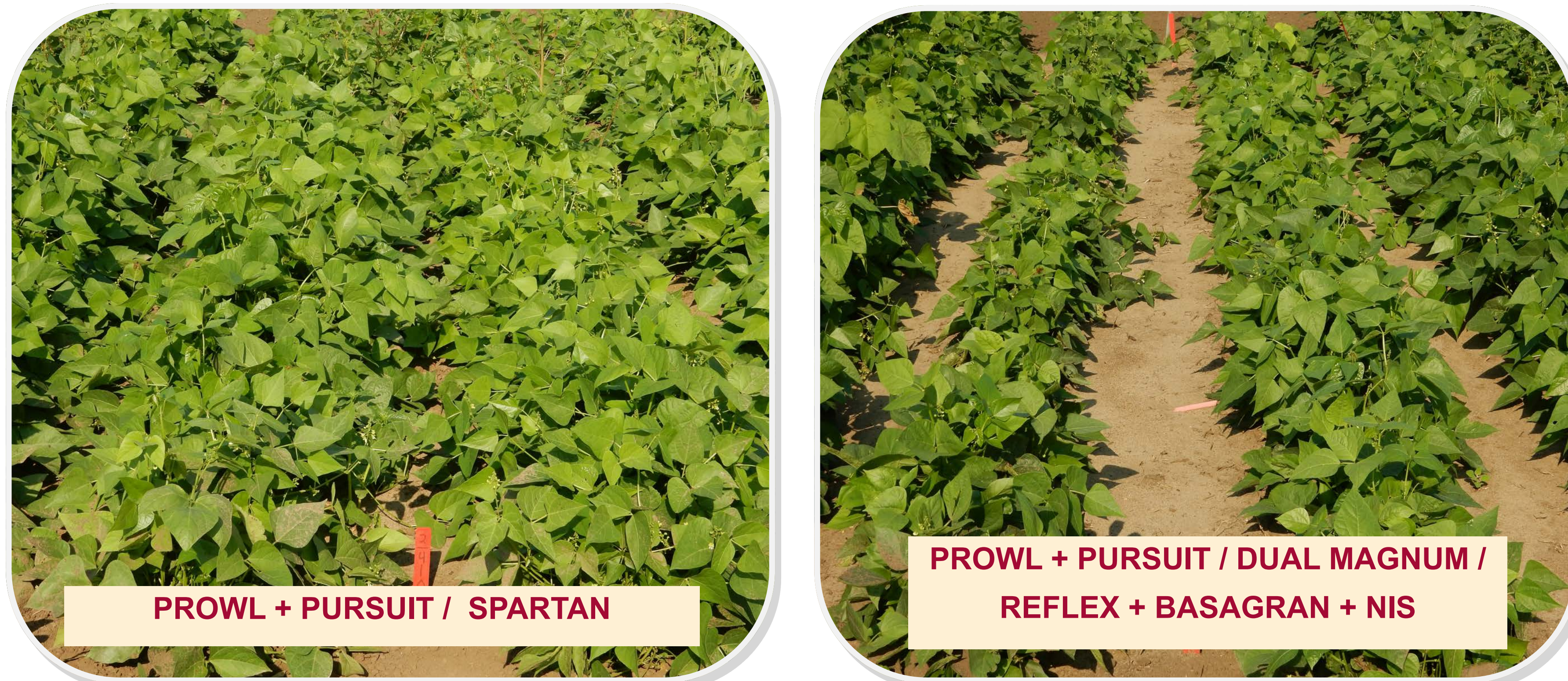


Figure 1. Waterhemp control, and crop response, with various herbicides in lima bean on August 1, 2016 at Rochester, MN.



Table 1. Waterhemp control, crop response, and lima bean plump pod weight at Rochester, MN in 2016.

Treatment ¹	Rate	Appl. ²	7/19/16	6/10/16	YIELD
Herbicide	Per acre	Time	% Control	% Injury ⁴	Pod wt ³
PROWL + PURSUIT / DUAL MAGNUM	2.3 pt + 3 fl oz / 1.33 pt	A B	98 a	1 d	47 a
PROWL + PURSUIT / SPARTAN	2.3 pt + 3 fl oz / 4.5 fl oz	A B	97 a	1 d	46 ab
PROWL + PURSUIT / DUAL MAGNUM + REFLEX	2.3 pt + 3 fl oz / 1.33 pt + 16 fl oz	A B	99 a	11 bc	40 abc
PROWL + PURSUIT / AUTHORITY ELITE	2.3 pt + 3 fl oz / 26 fl oz	A B	99 a	13 b	38 bcd
PROWL + PURSUIT / DUAL MAGNUM / RAPTOR + BASAGRAN + NIS	2.3 pt + 3 fl oz / 1.33 pt / 4.0 fl oz + 8.0 fl oz + 0.25 %	A B C	98 a	6 c	36 cd
PROWL + PURSUIT + DUAL MAGNUM / DUAL MAGNUM	2.3 pt + 3 fl oz + 1.0 pt / 1.0 pt	A C	90 b	7 bc	29 de
PROWL + PURSUIT / DUAL MAGNUM / REFLEX + BASAGRAN + NIS	2.3 pt + 3 fl oz / 1.33 pt / 12.0 fl oz + 8.0 fl oz + 0.25%	A B C	99 a	40 a	26 e
LSD P = 0.10			2	3.07-11.31	9

1. Prowl = pendimethalin 3.3 EC, Pursuit = imazethapyr 2 EC, Dual Magnum = s-metolachlor 7.62 EC, Spartan = sulfentrazone 4 F, Authority Elite = sulfentrazone + s-metolachlor 7 EC, Reflex = fomesafen 2 SL, Basagran = bentazon 4 SL
 2. Application date: A = PPI: 6/17/16, B = PRE 6/17/16, C = POST: 7/15/16
 3. Plump pod weight = ounces per 4 foot of row
 4. Automatic square root transformation of X+.05

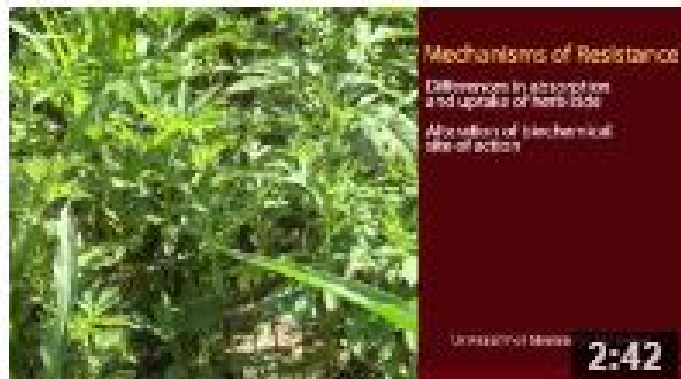
Soybean Herbicide Management Videos

LINK: <https://www.youtube.com/user/UMNCrops>



Herbicide Spray Drift Demonstration

by University of Minnesota Extension Crops



Herbicide Resistance Management Series:

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Herbicide Resistance Management: Herbicide Mode...

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F

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~ 1460 surveyed

Pesticide Safety & Environmental Education Program



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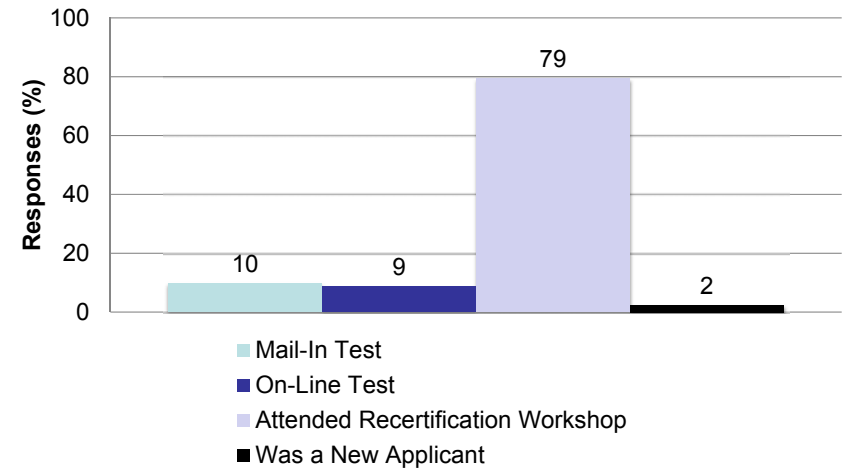
Section 1 Baseline/General Information



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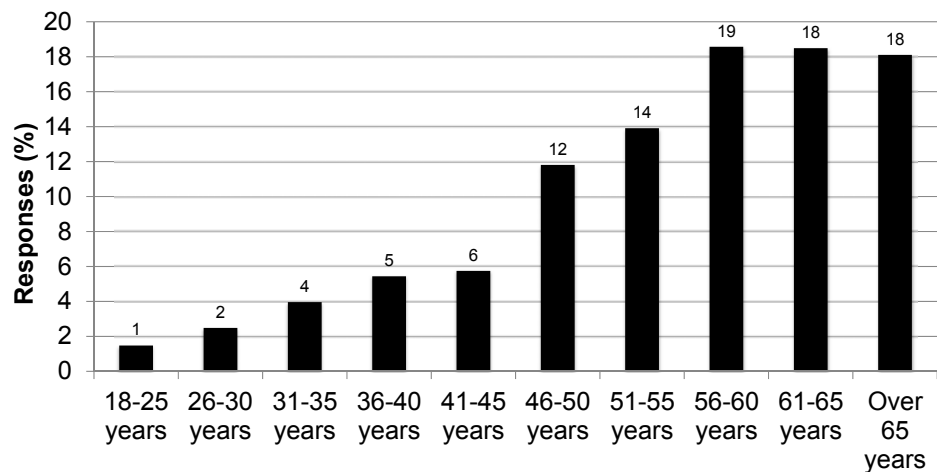
How did you last recertify? (3 years prior)

(1460 responses)



What is your age?

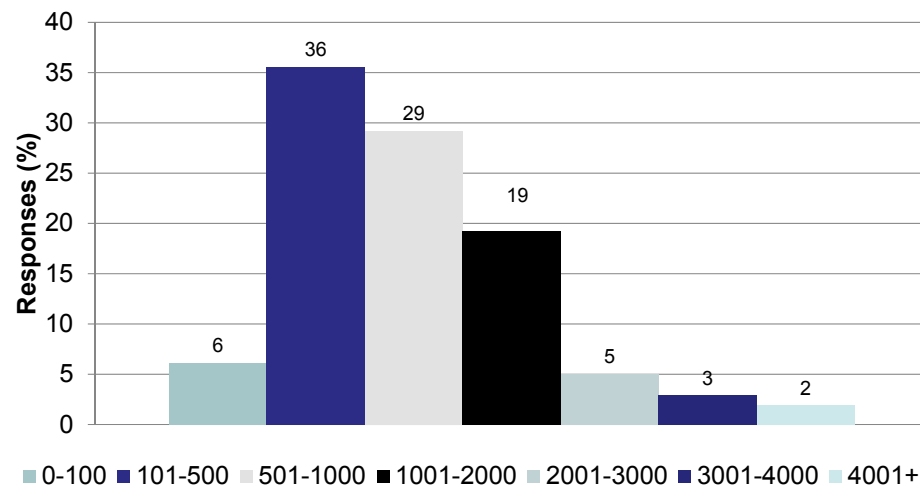
(1287 responses)



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How many acres do you farm?

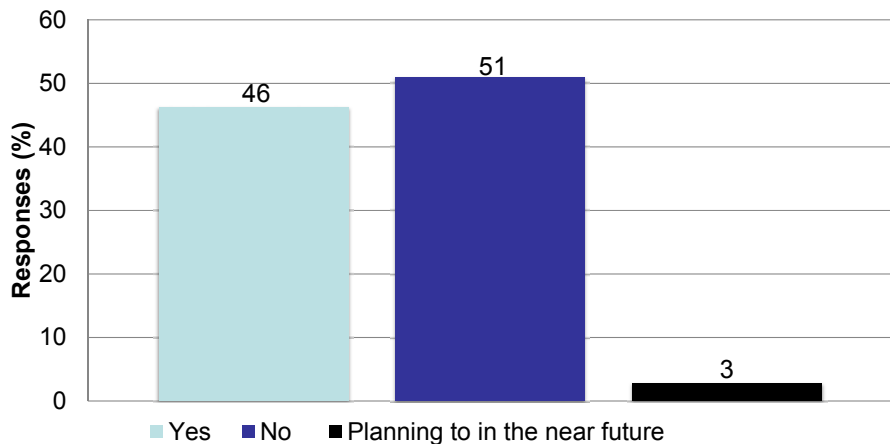
(1448 responses)



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Do you use a Smart Phone/Tablet/mobile device to access the internet while in the field?

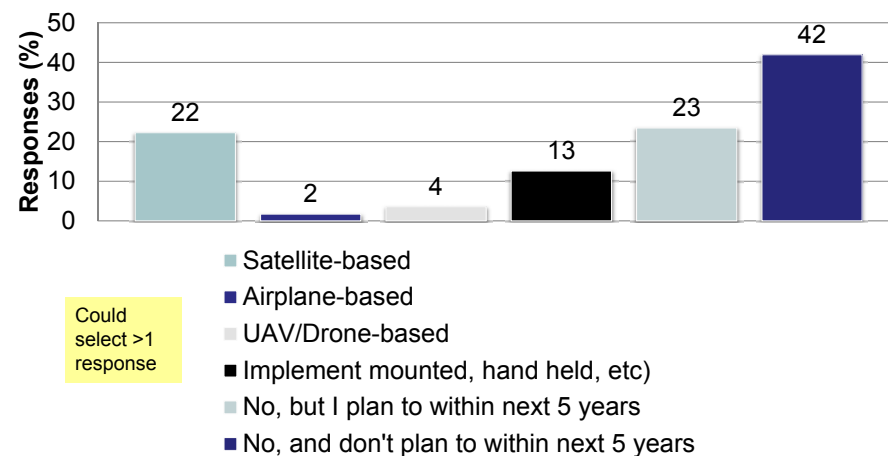
(1399 responses)



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In 2015, did you use remotely-sensed data collected by the following means for crop management?

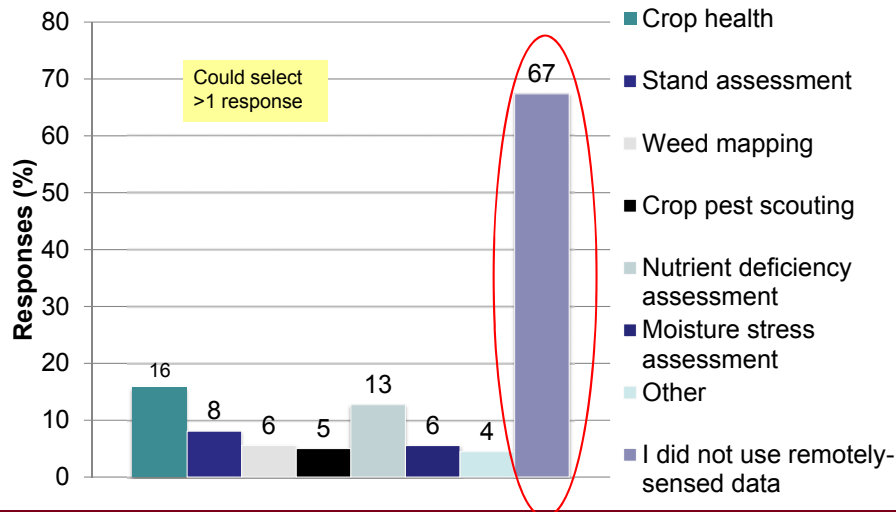
(589 responses)



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If you used remotely sensed data in 2015, how did you use the data?

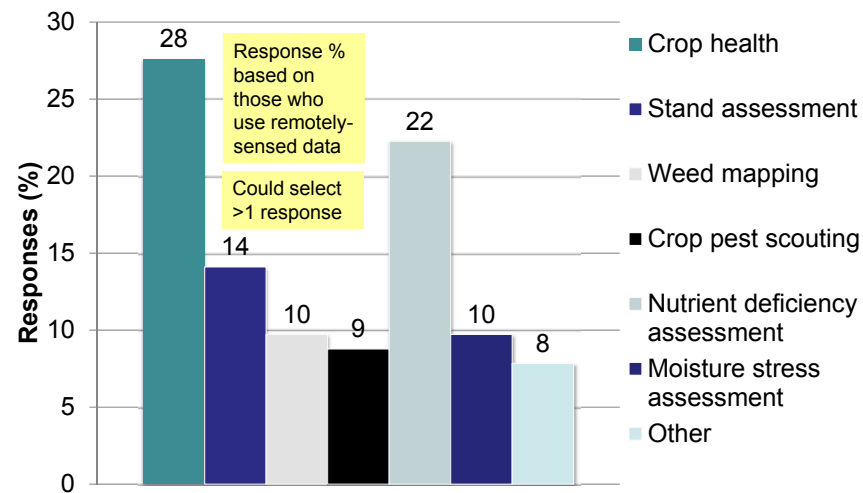
(558 responses)



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If you used remotely sensed data in 2015, how did you use the data?

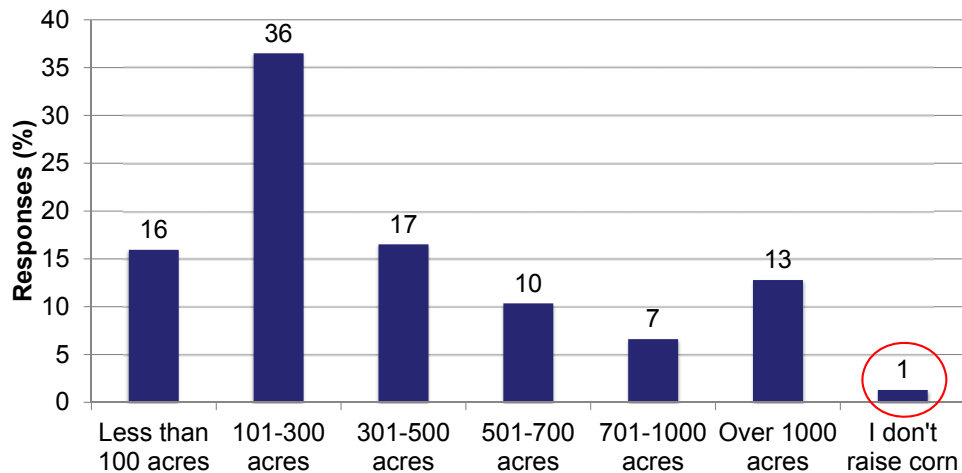
(319 responses)



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How many acres of corn do you raise?

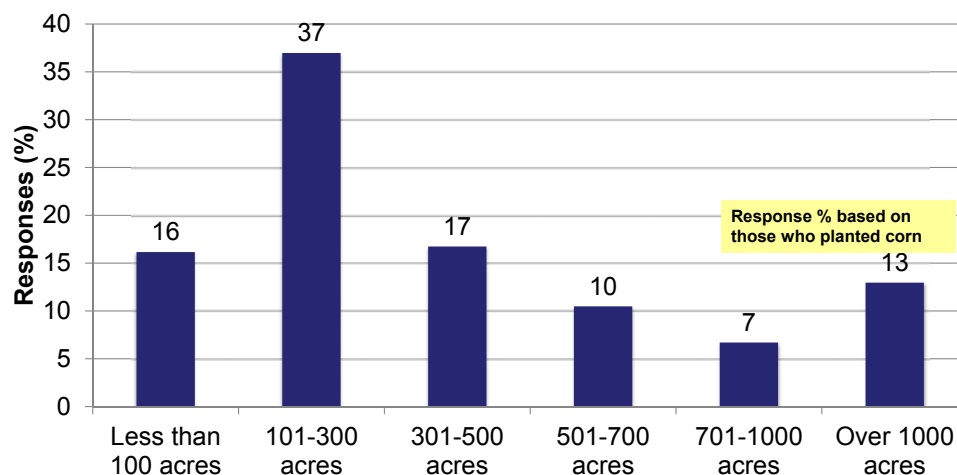
(696 responses)



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How many acres of corn do you raise?

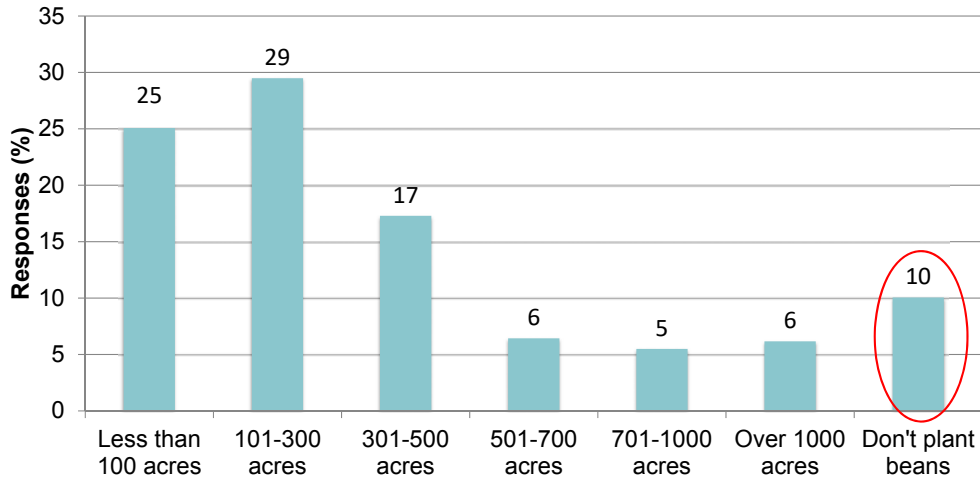
(687 responses)



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How many acres of soybeans do you raise?

(746 responses)

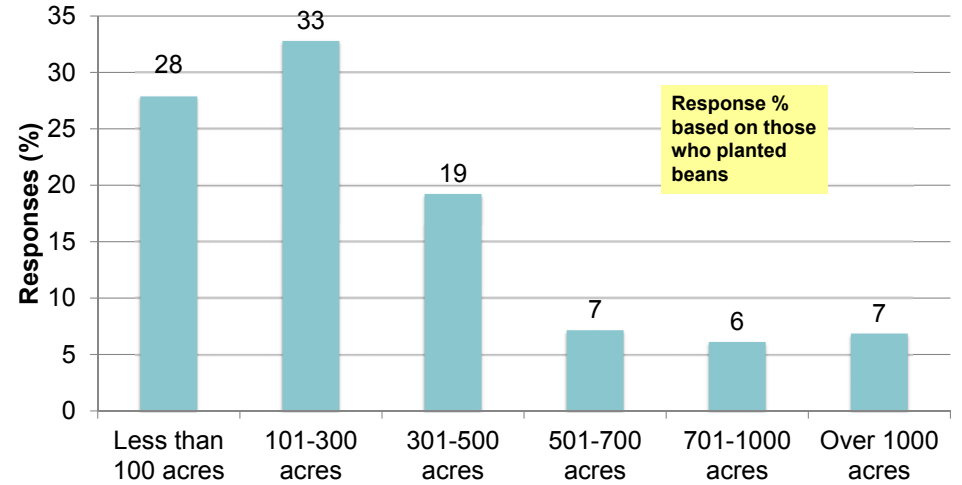


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How many acres of soybeans do you raise?

(671 responses)

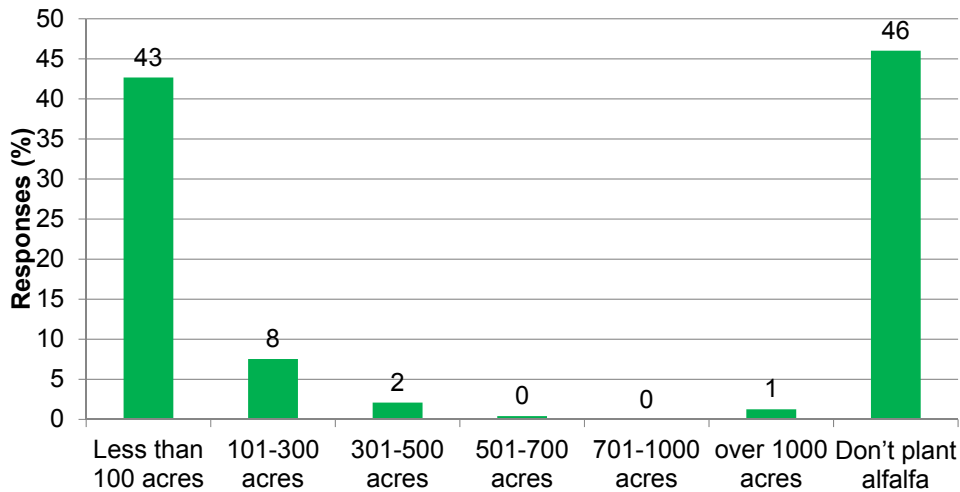


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How many acres of alfalfa do you raise?

(239 responses)

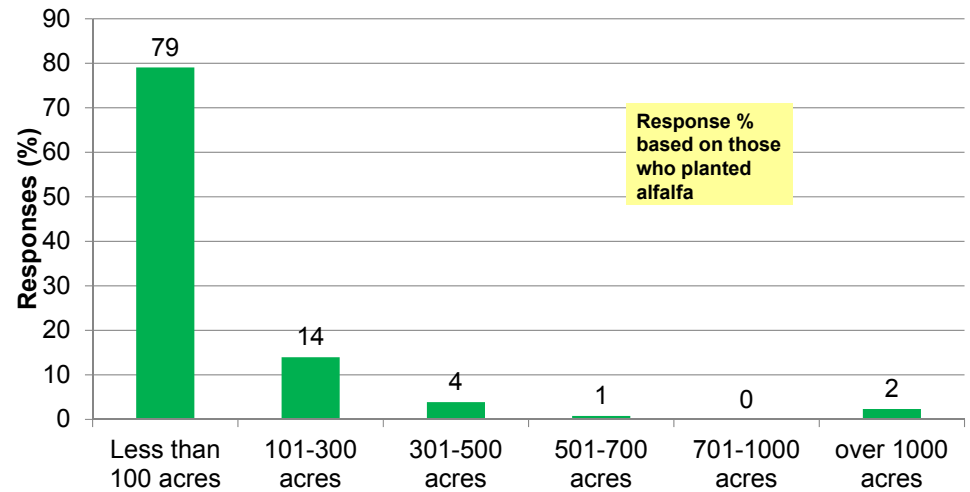


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How many acres of alfalfa do you raise?

(129 responses)

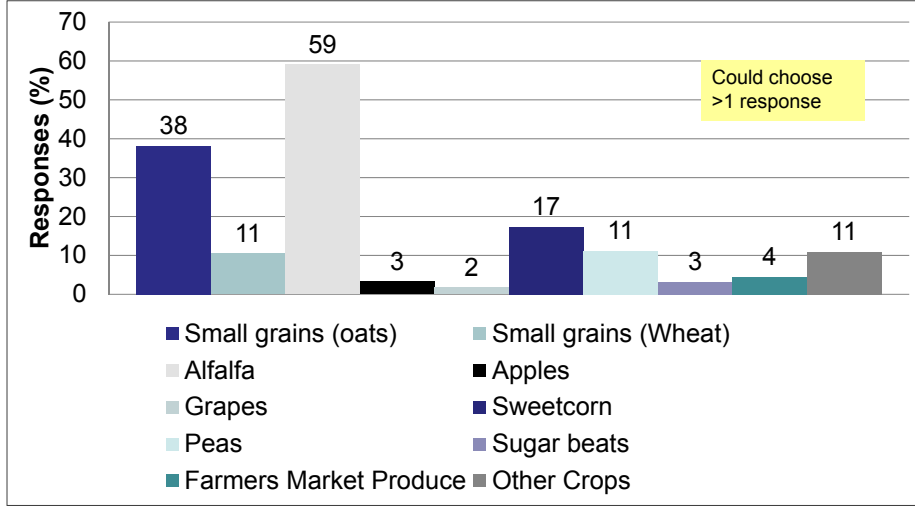


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What other crops do you raise? Select all that apply

(513 responses)



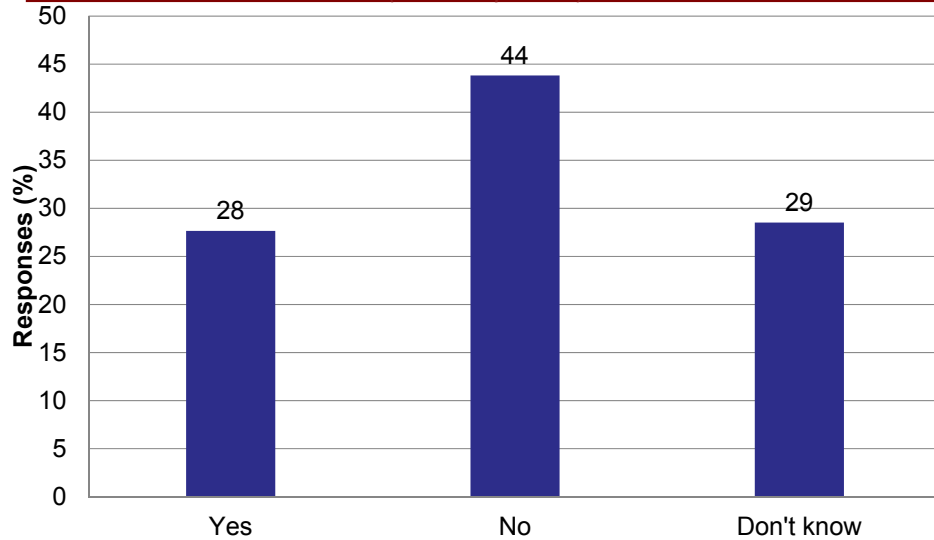
Section 2 Weed Management



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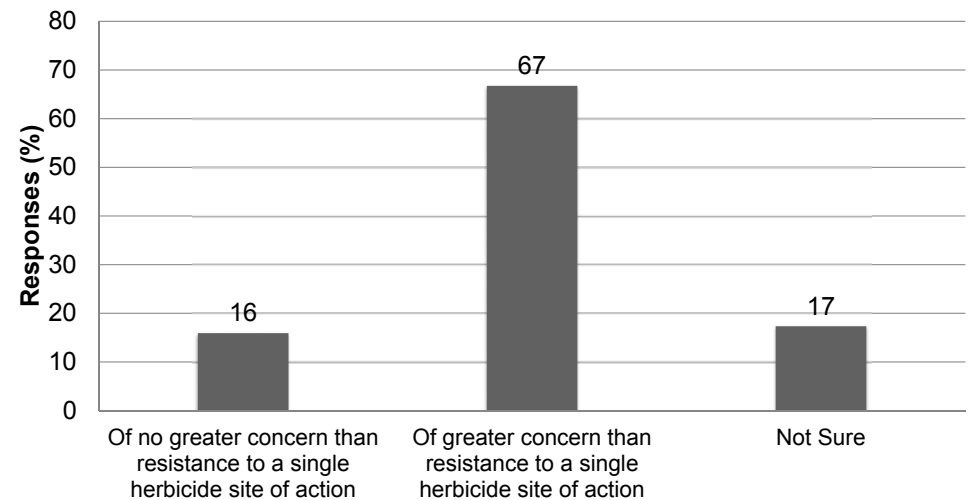
Do you think you have PPO-resistant weeds (Valor, Cobra, Flexstar) on your farm?

(1150 responses)



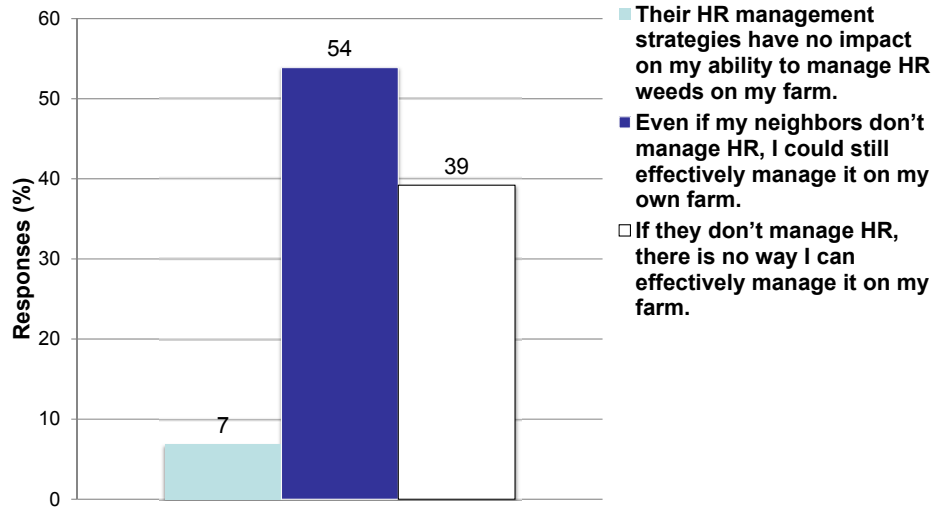
How concerned are you about the presence of weeds resistant to multiple herbicide sites of action on your farming operation?

(427 responses)



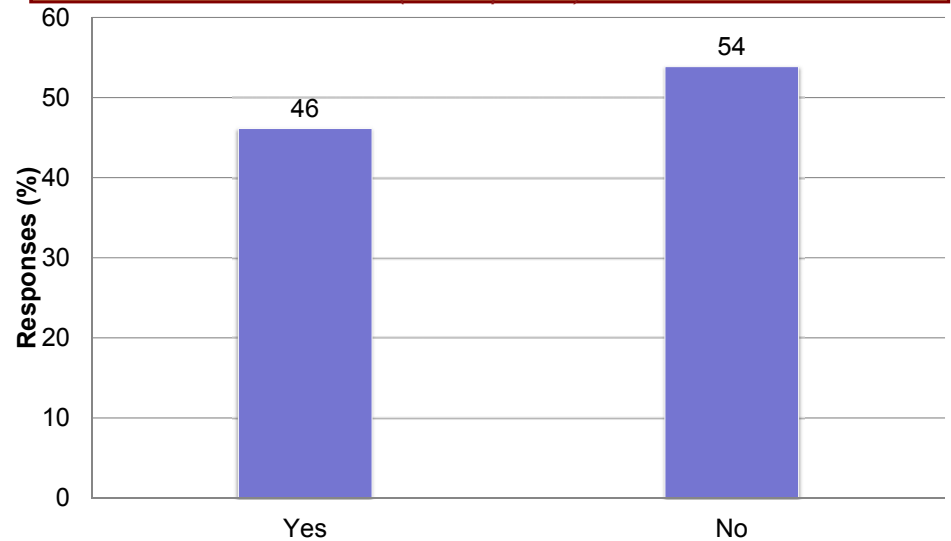
If weed resistance to multiple herbicides was confirmed in your community, which would best describe your opinion about your neighbor's management decisions?

(579 responses)



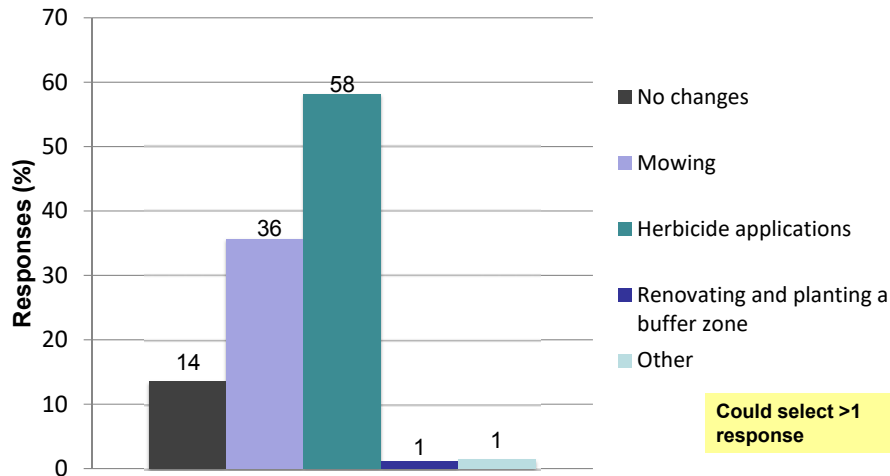
Have you ever discussed with the owner/manager of a field abutting or near one of yours whether herbicide resistant weeds are becoming a problem in your region?

(661 responses)



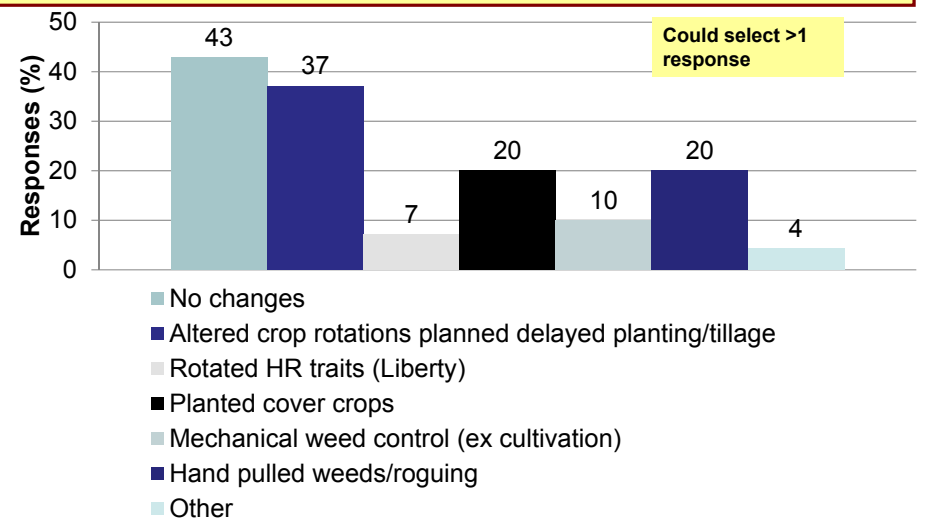
In 2015, I made a conscious effort to control weeds in my fence rows/ waterways, by: (select all that apply)

(272 responses)



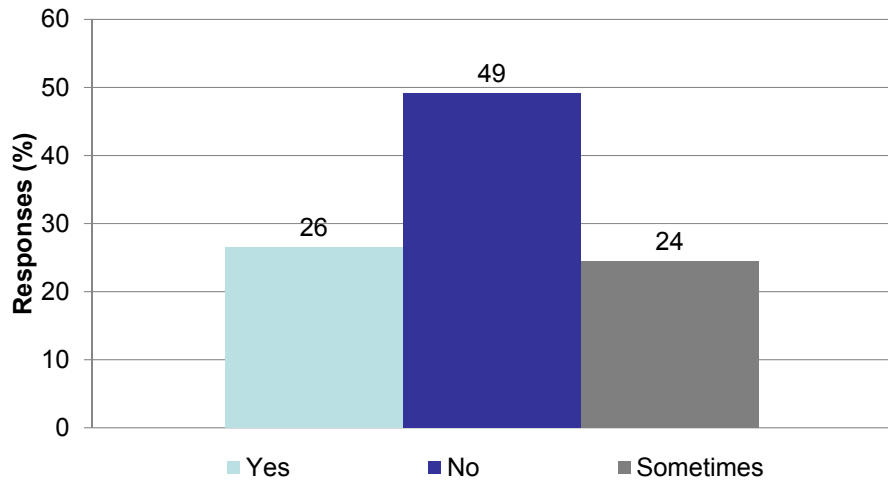
In 2015, I used the following weed management practice(s) on land I farm (select all that apply)

(70 responses)



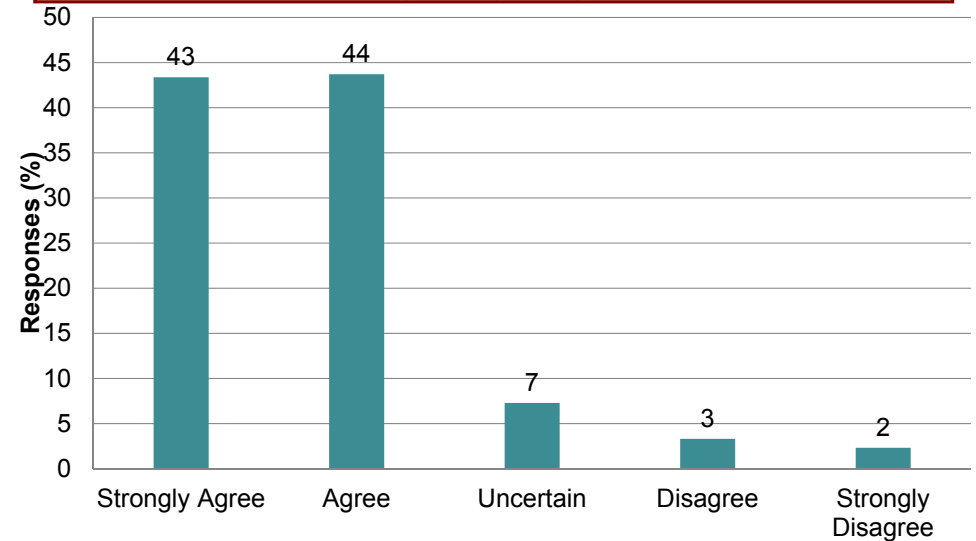
Do you map weedy spots and/or infestations in your field?

(340 responses)



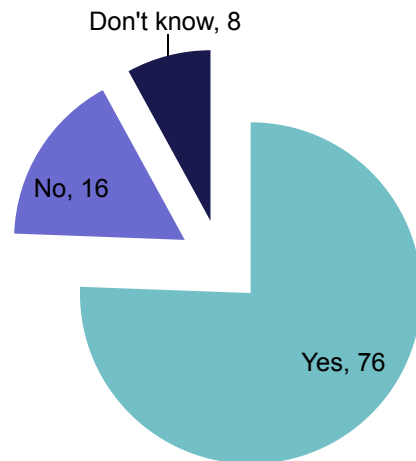
Glyphosate is still an extremely important herbicide component in my farming operation

(302 responses)



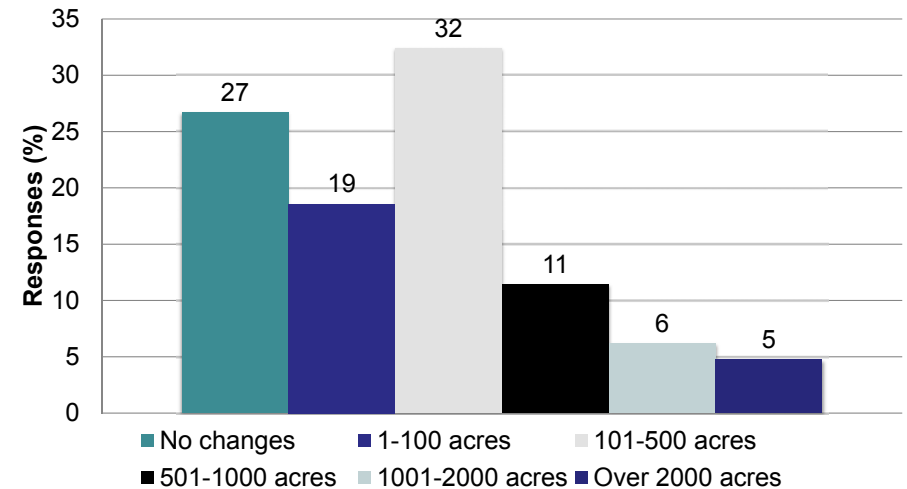
Do you think you have glyphosate resistant weeds on your farm?

(1192 responses)



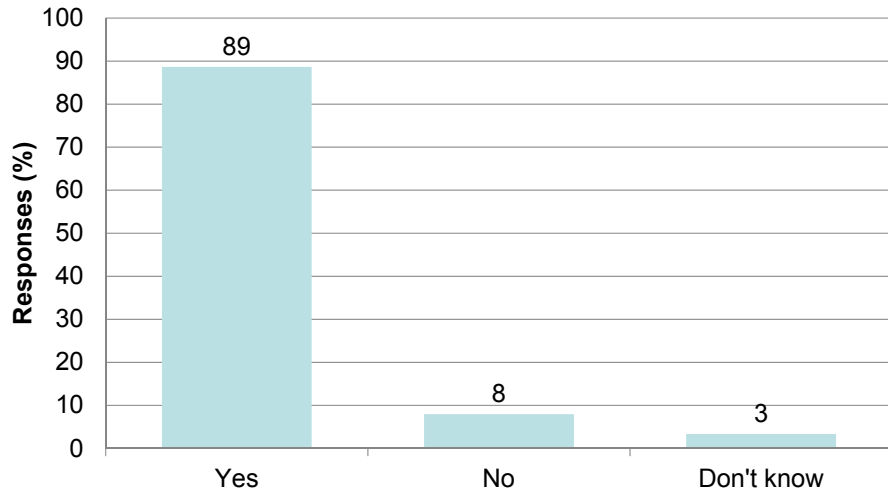
In 2015, on how many acres did you change your herbicide program to manage for resistant weeds?

(210 responses)



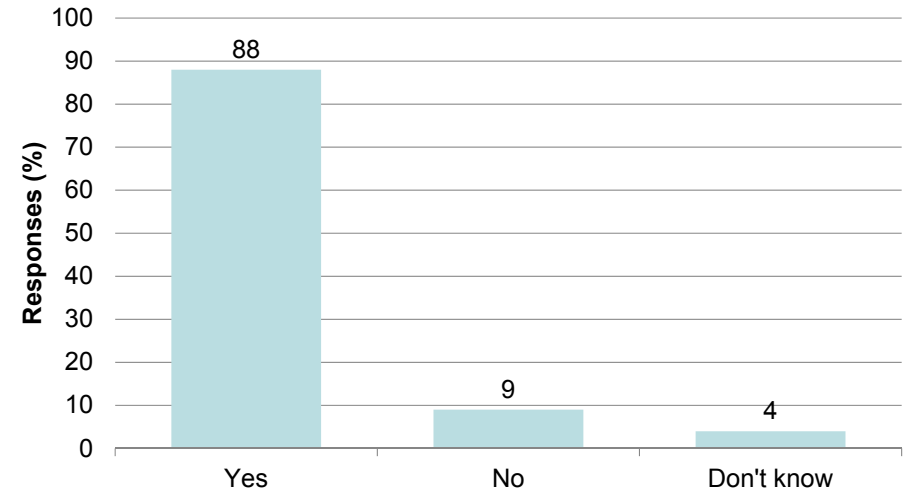
When planning weed management programs, do you purposefully utilize different SOA's?

(1129 responses)



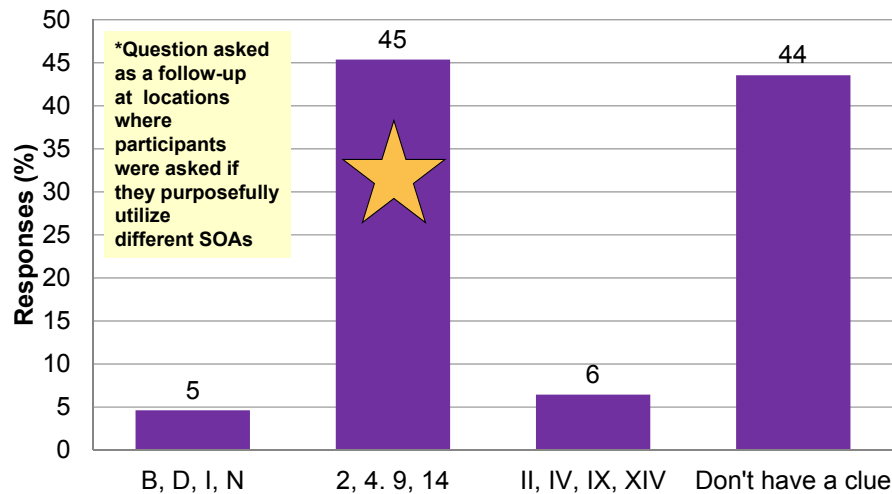
When planning weed management programs, do you purposefully utilize different SOAs?

(727 responses where follow-up question was asked about SOA classification)



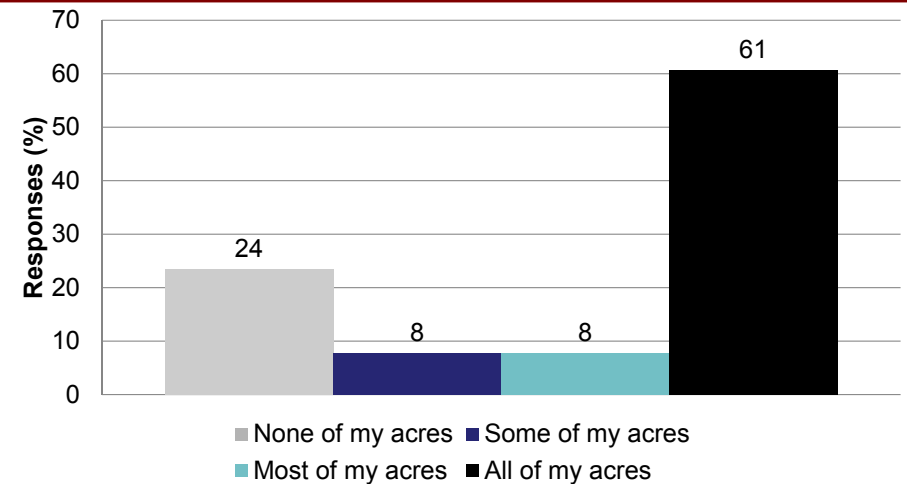
How are Herbicide SOAs classified?*

(714 responses)



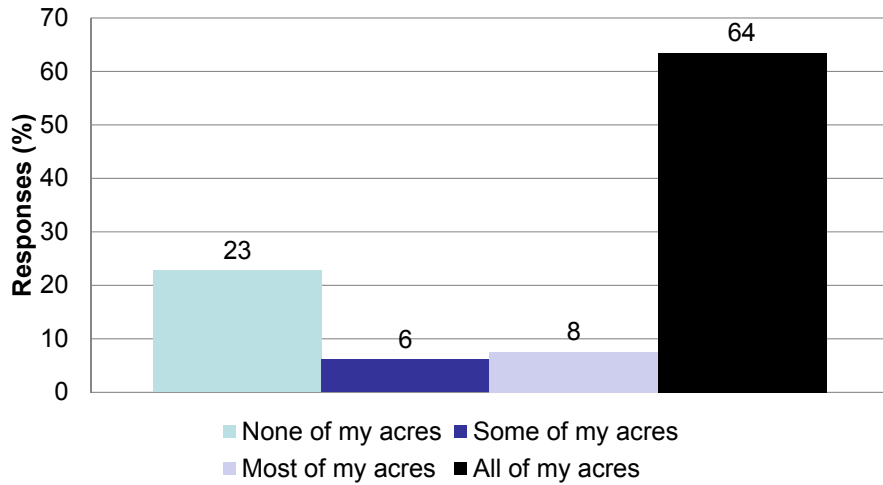
Last year, I used pre-emergence or preplant residual herbicide in Soybean on...

(917 responses)



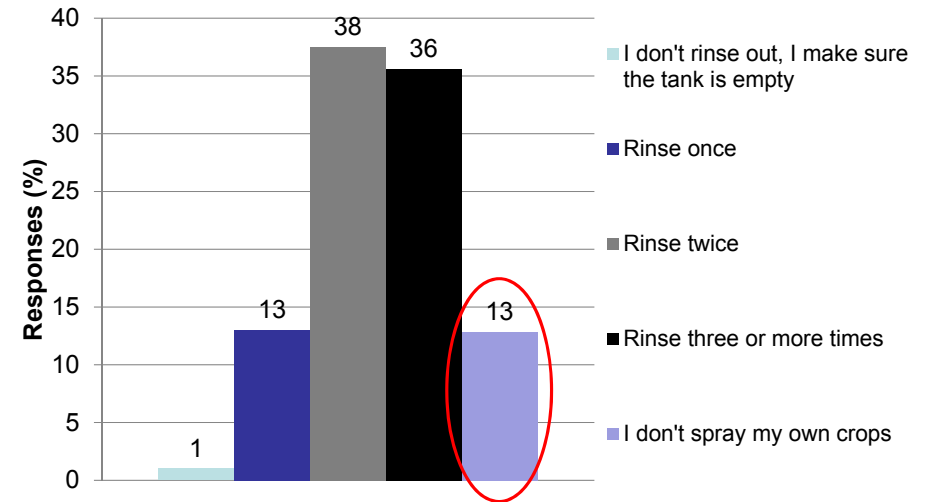
Last year, I used pre-emergence or preplant residual herbicide in Corn on...

(943 responses)



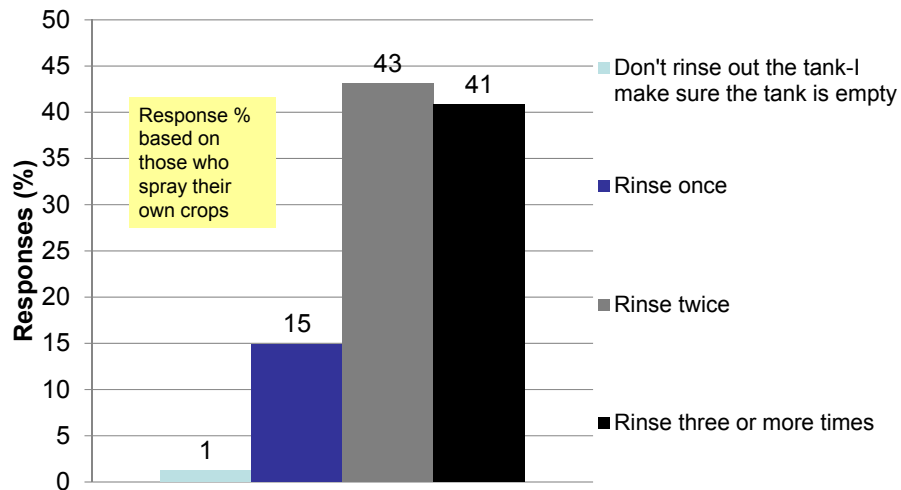
When rinsing out the tank between susceptible crops, I usually...

(770 responses)



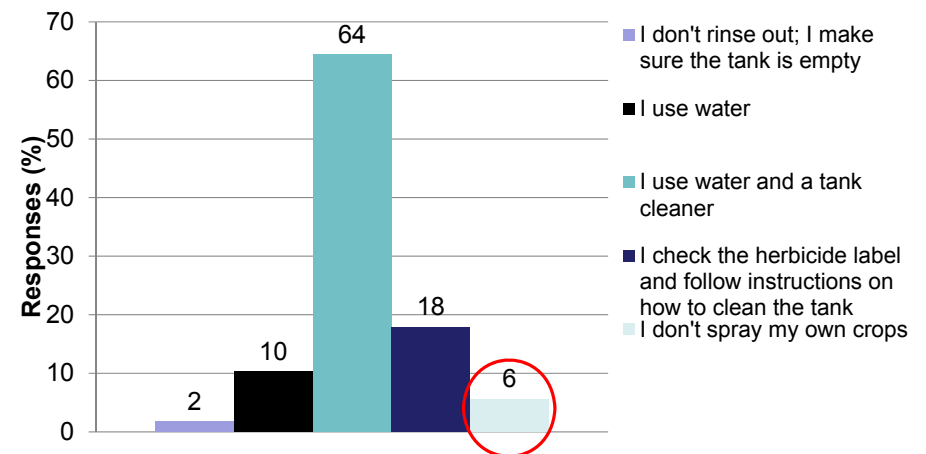
When rinsing out the tank between susceptible crops, I usually...

(1061 responses)



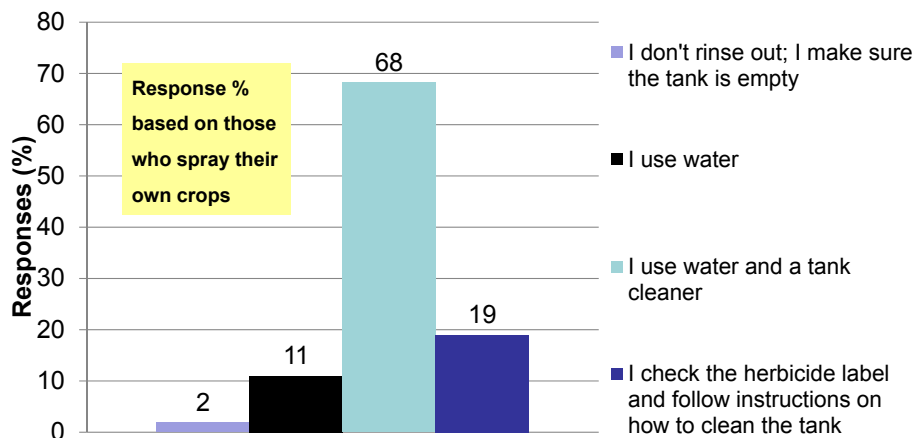
When changing from one crop to a susceptible crop, which method best describes how you clean the spray tank?

(503 responses)



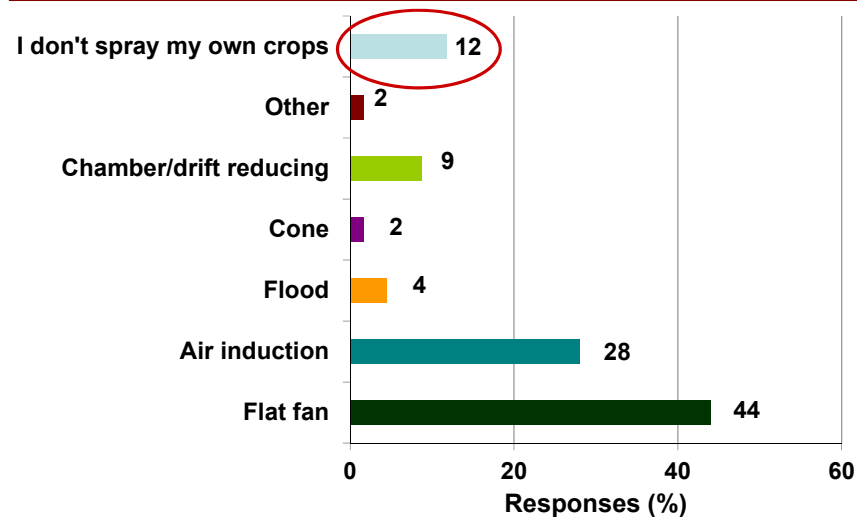
When changing from one crop to a susceptible crop, which method best describes how you clean the spray tank?

(475 responses)



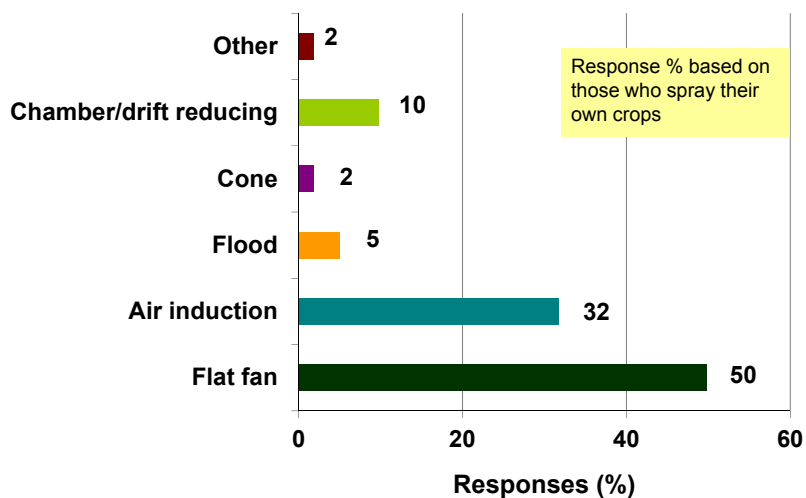
What type of nozzle do you usually use?

(818 responses)



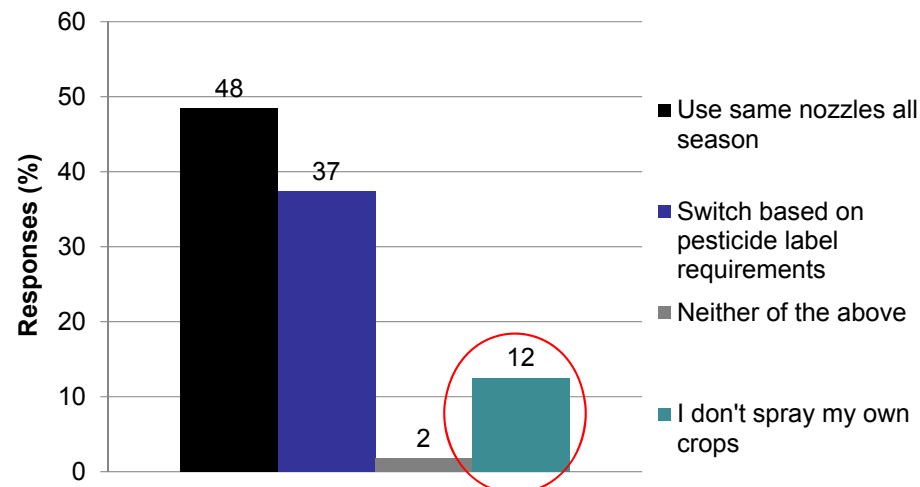
What type of nozzle do you usually use?

(722 responses)



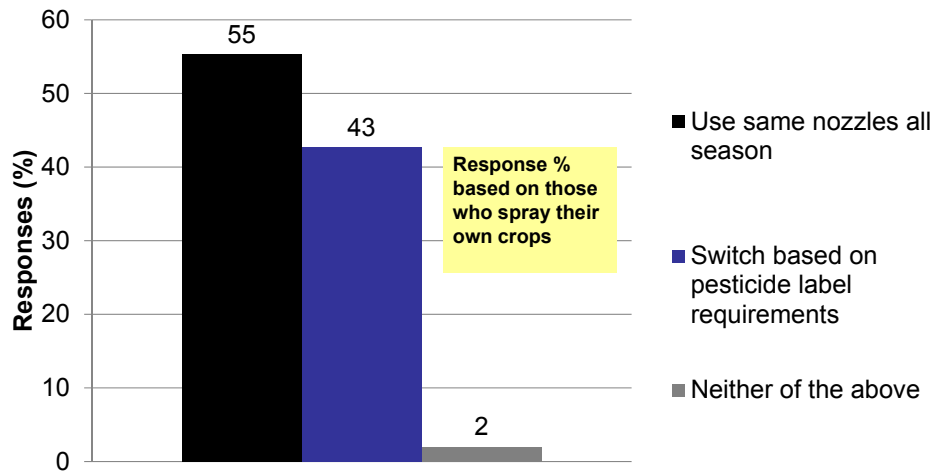
How many different types of nozzles do you use in a season?

(851 responses)



How many different types of nozzles do you use in a season?

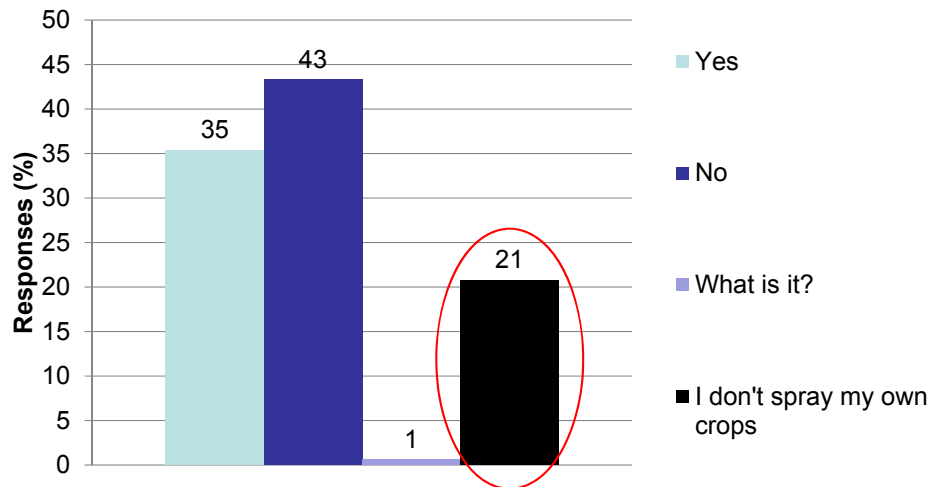
(745 responses)



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Do you have/use an in-the-tank rinsing nozzle in your spray tank for cleaning purposes?

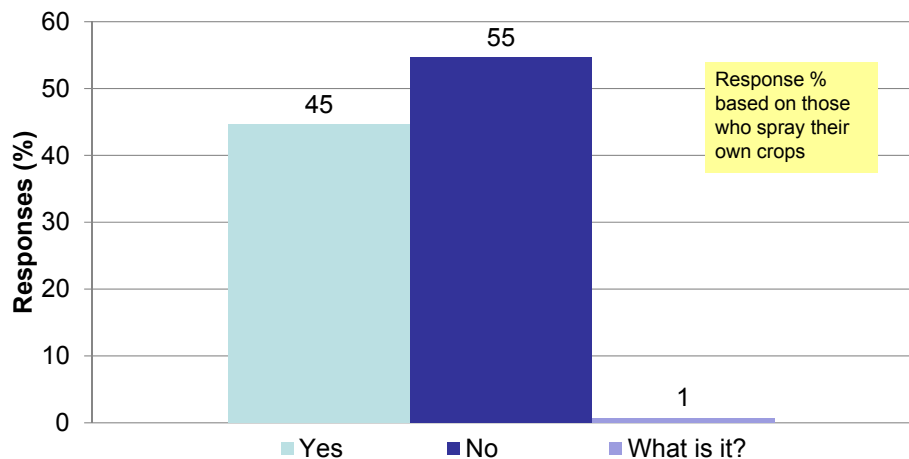
(342 responses)



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Do you have/use an in-the-tank rinsing nozzle in your spray tank for cleaning purposes?

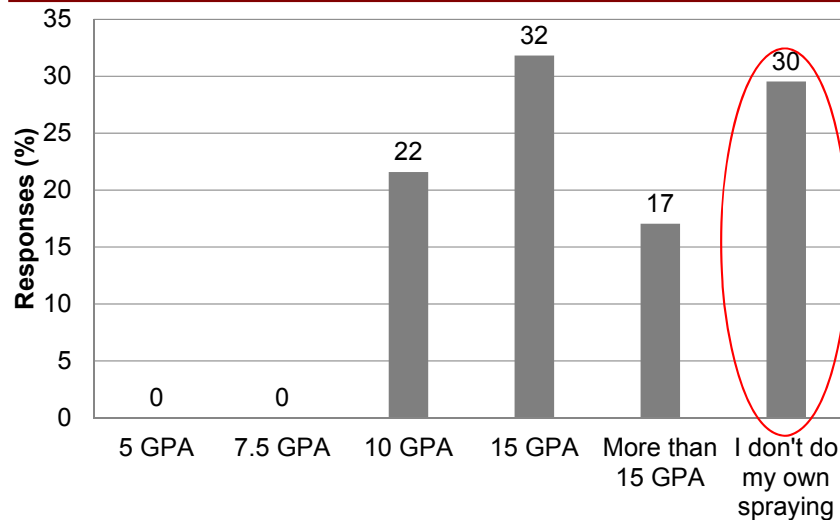
(271 responses)



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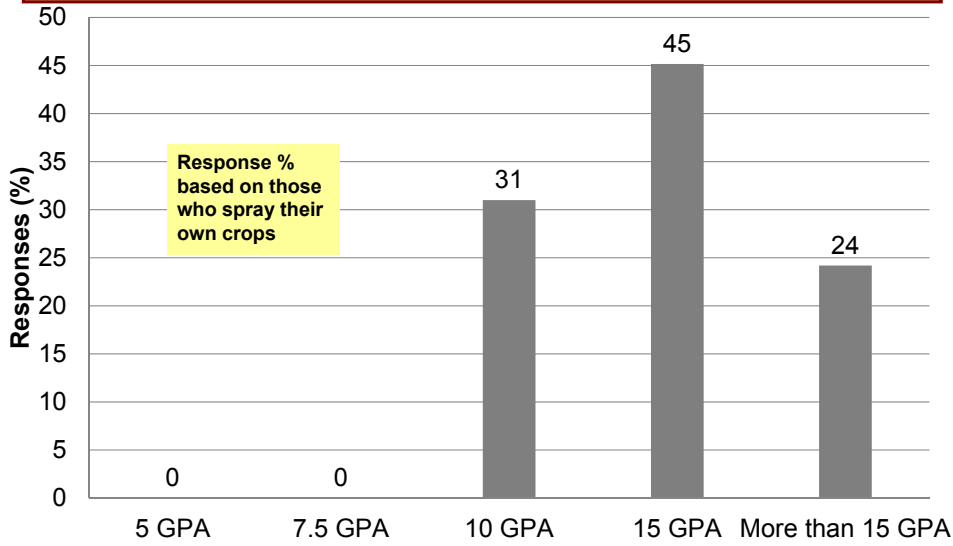
I generally apply contact pesticides like Liberty and Cobra at:

(88 responses)

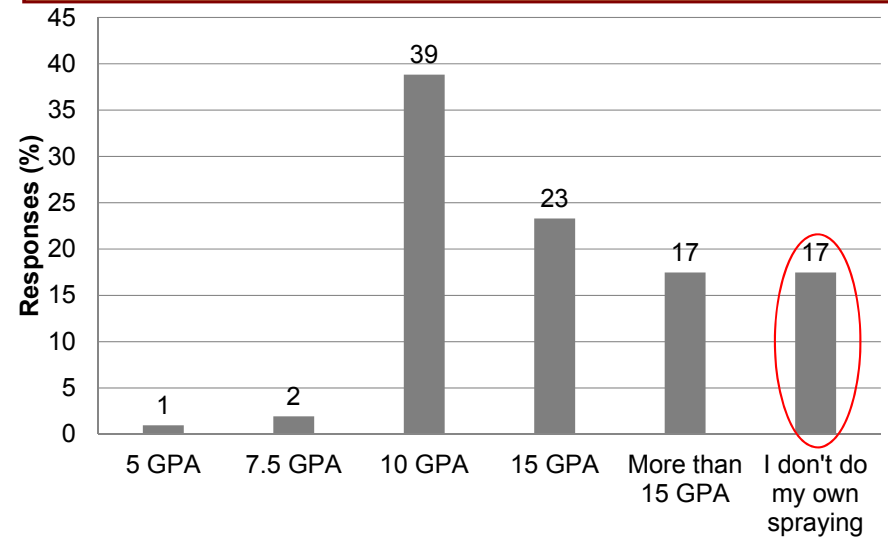


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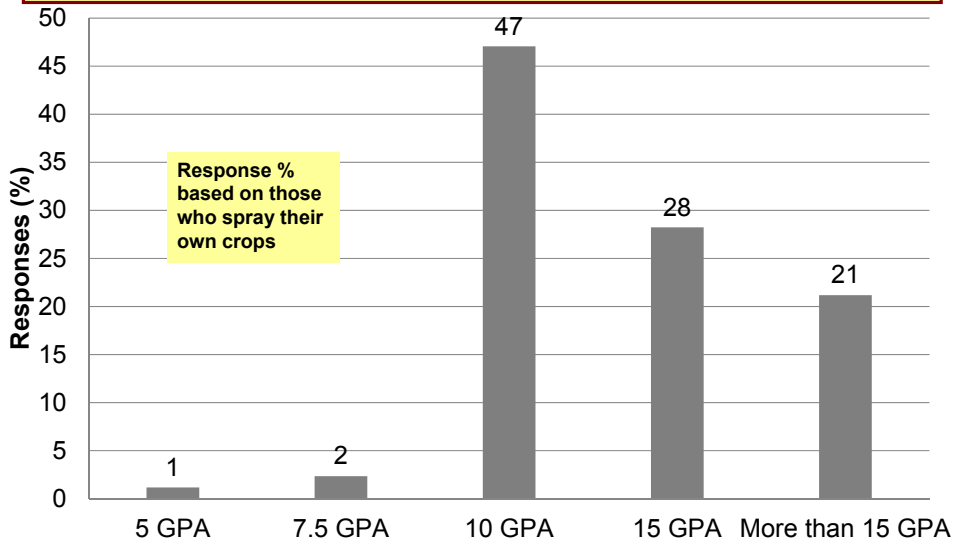
I generally apply contact pesticides like Liberty and Cobra at:
(62 responses)



I generally apply systemic pesticides like glyphosate and 2, 4-D at:
(103 responses)



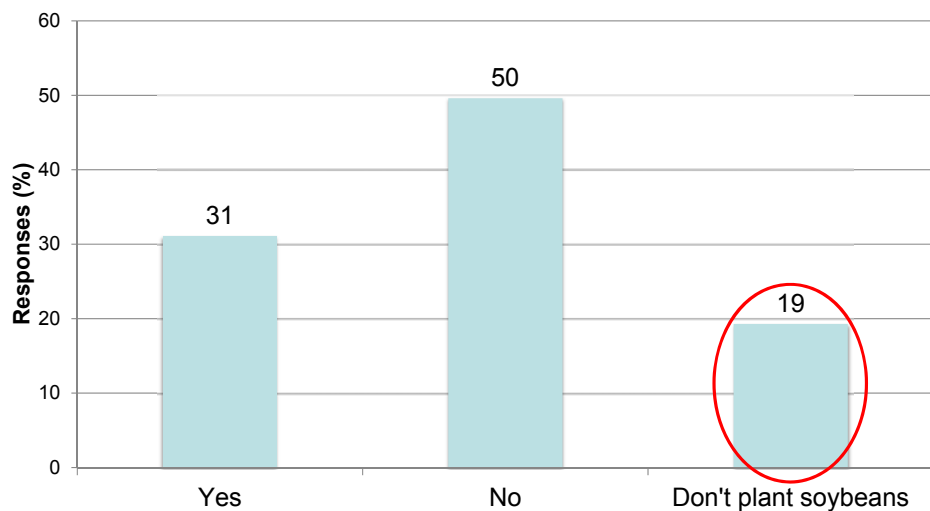
I generally apply systemic pesticides like glyphosate and 2, 4-D at:
(85 responses)



**Section 3
Insect Management**

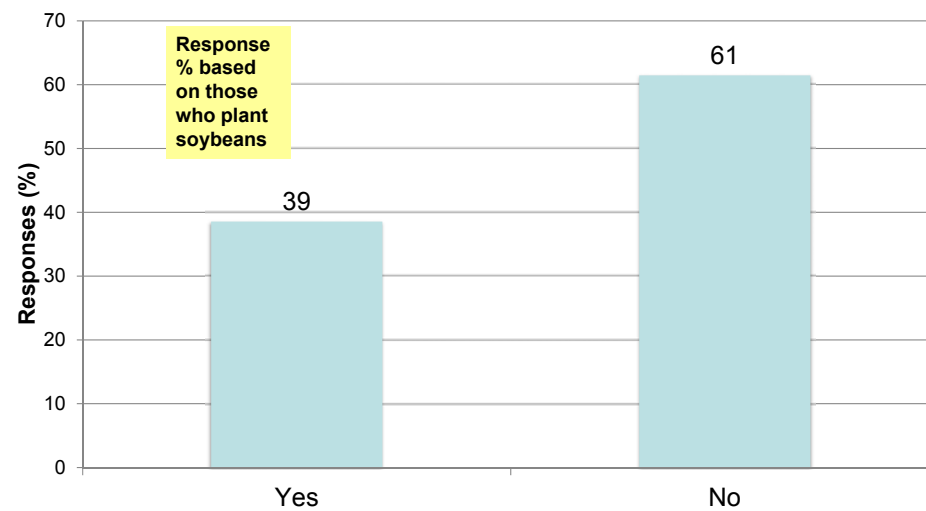
Do you use a Seed Treatment to control Soybean Aphid?

(254 responses)



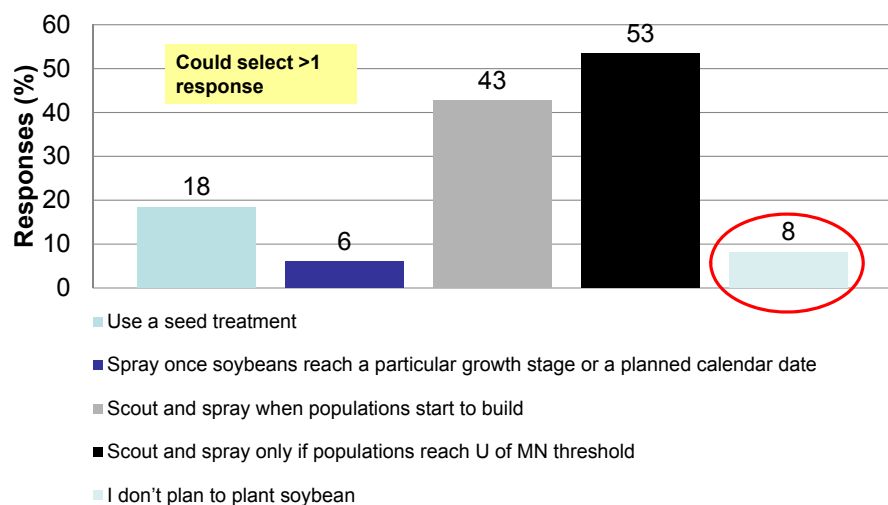
Do you use a Seed Treatment to control Soybean Aphid?

(205 responses)



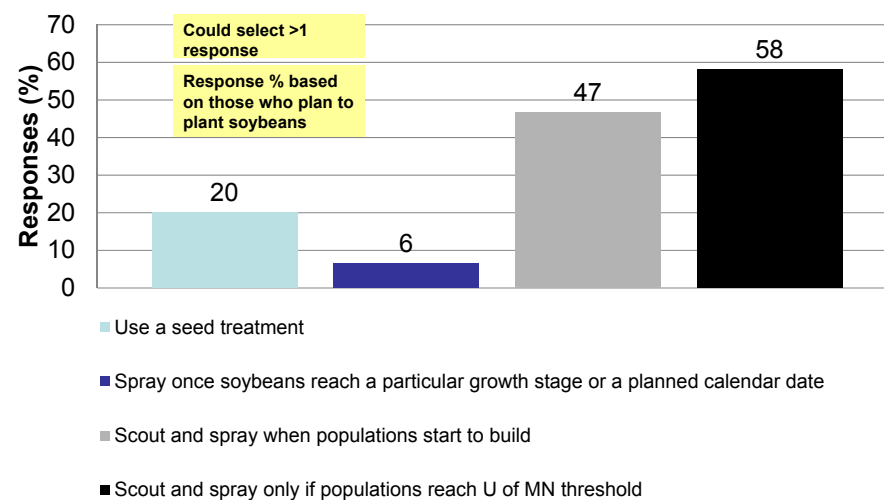
To control Soybean aphid, I plan to...

(1010 responses)

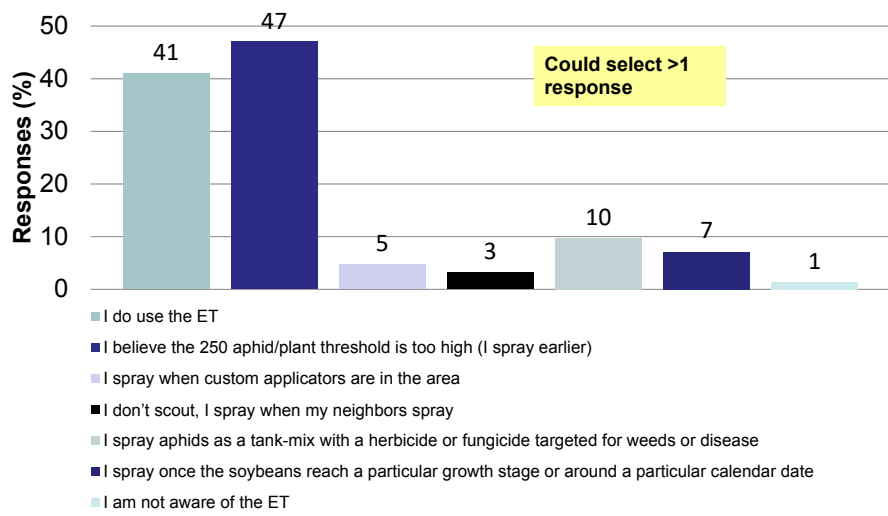


To control Soybean aphid, I plan to...

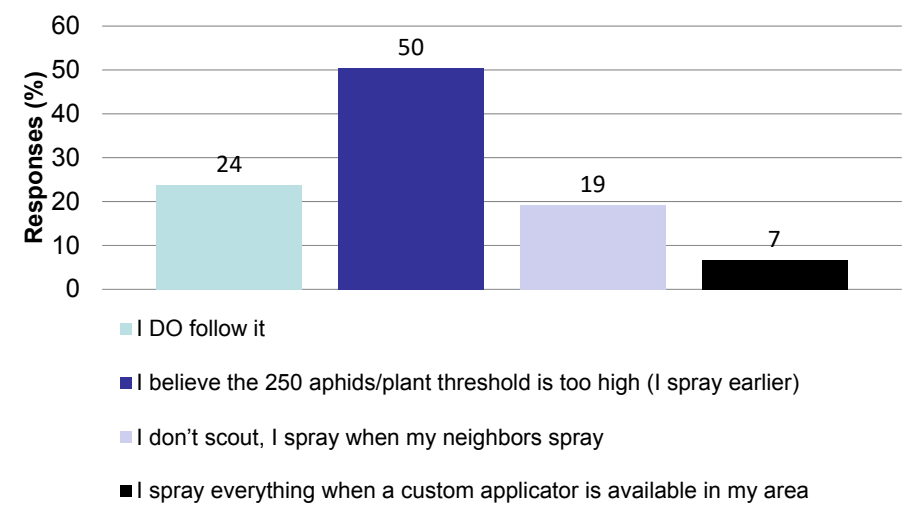
(927 responses)



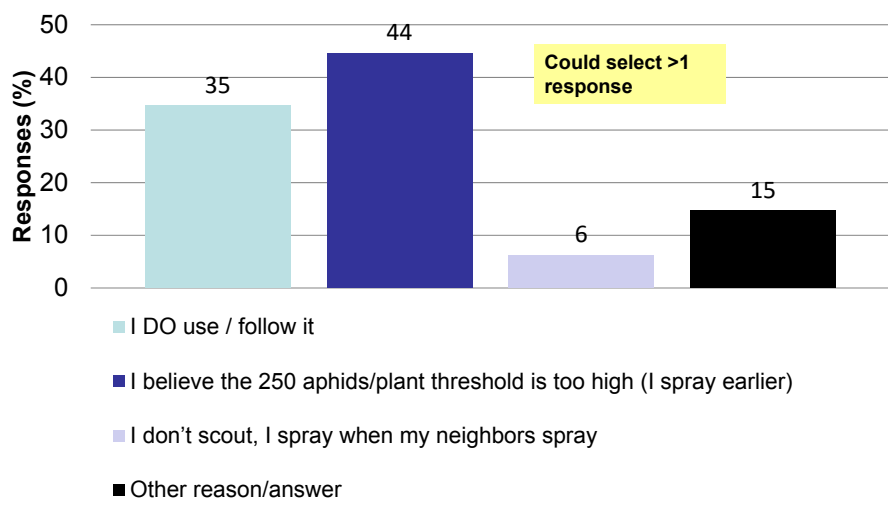
Why don't you follow the Recommended Economic Threshold (ET) of 250 aphids/plant? (841 responses)



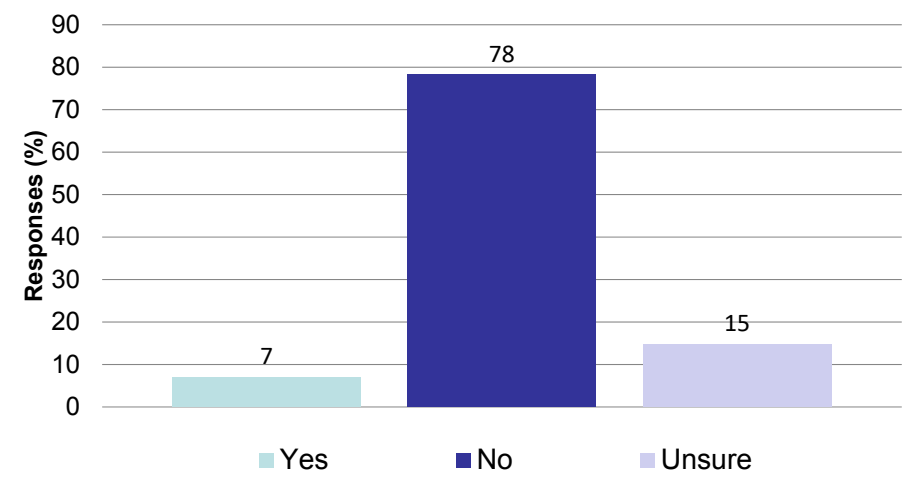
I don't always follow the 250 ET Because: (240 responses)



Why Don't I / I don't always follow the 250 ET because: (Combined - 1162 responses in 2016)

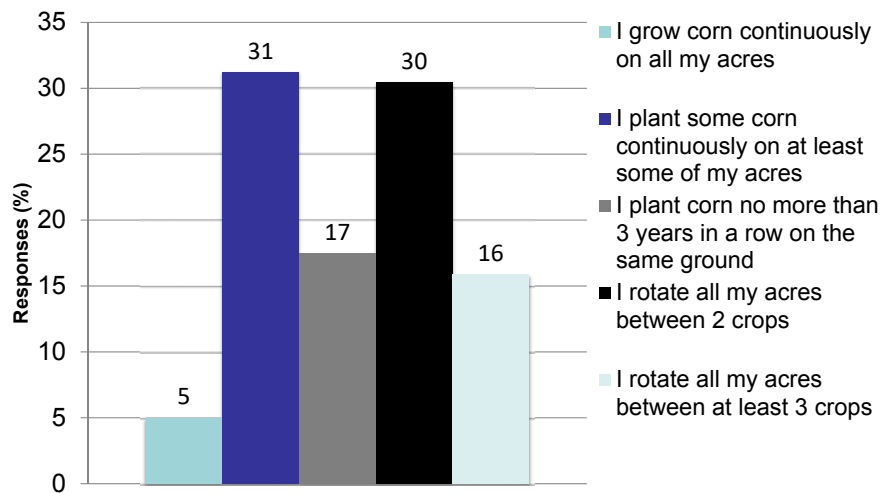


Do you think you have soybean aphid resistance issues? or, did an insecticide application fail on your farm? (358 responses)



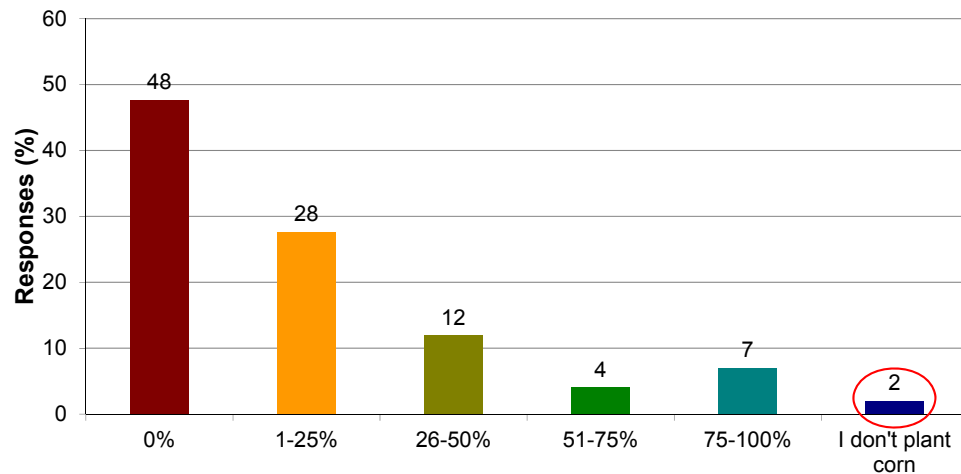
My Crop Rotation Consists of:

(378 responses)



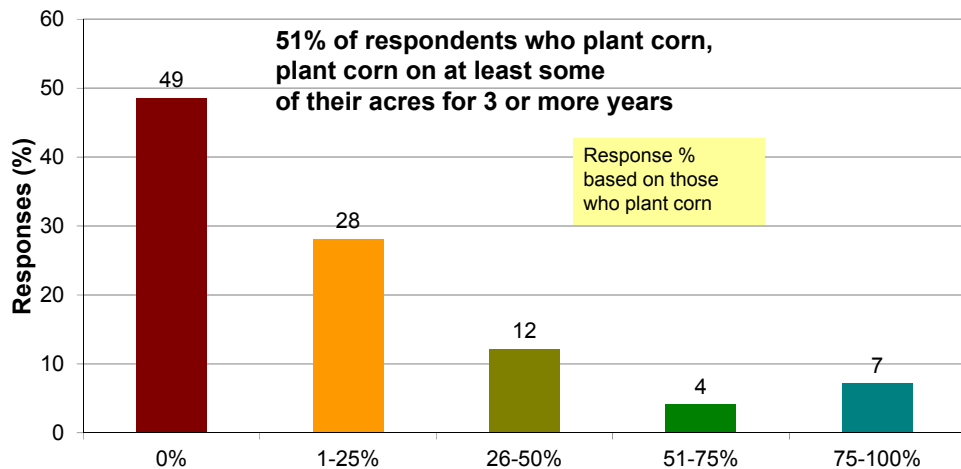
What percentage of your acres are 3 or more years of corn on corn?

(573 responses)

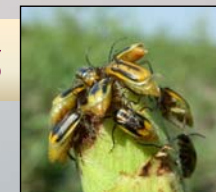


What percentage of your acres are 3 or more years of corn on corn?

(562 responses)



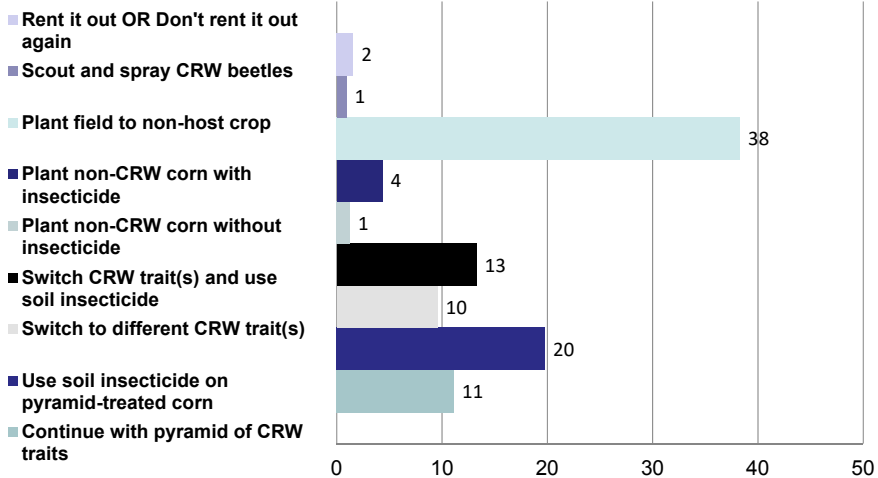
Corn Rootworm Case Study 1– 2015



- This field was corn-on-corn for the past 5 years.
- Planted the same CRW trait, VT Triple (Cry1Ab + Cry3Bb1) for three years, then switched to SmartStax (Cry3Bb1 + Cry34/35) for 2 years.
- Lodging in VT Triple was observed 3 years ago after thunderstorm. Rootworm feeding confirmed.
- No scouting for beetles done in 2014; no lodging observed last summer.
- If you were this grower, what would you do?

What would you do (Case Study 1)?

(324 responses)

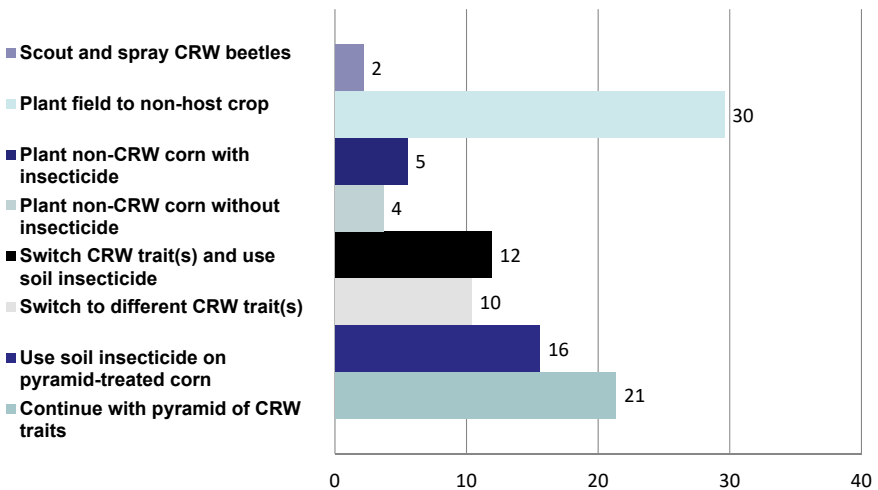


Corn Rootworm Case Study 2 - 2015

- This field has been in a C/SB rotation the past 20 years.
- Planted the same CRW trait for 3 crops, then switched to a pyramid-traited CRW hybrid last corn crop
- Extended diapause problems observed on farm 10 years ago.
- No scouting for beetles done in 2013; no lodging observed.
- If you were this grower, what would you do?

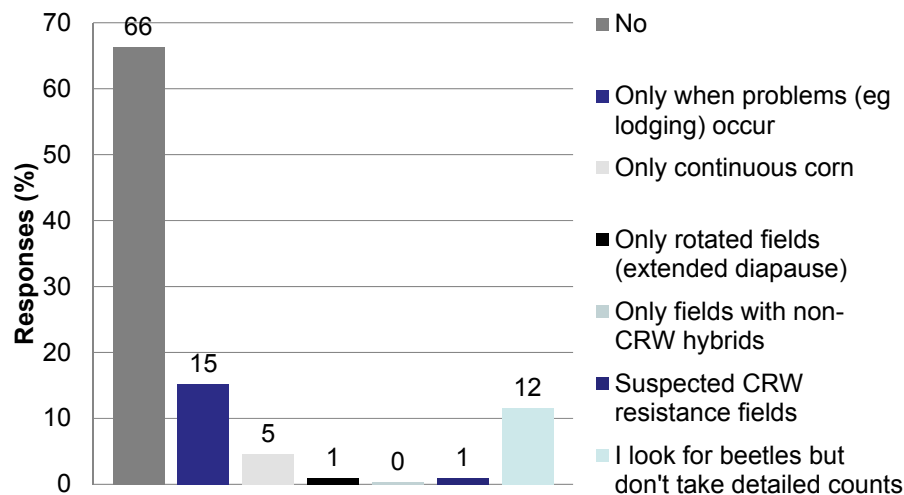
What would you do (Case Study 2)?

(328 responses)



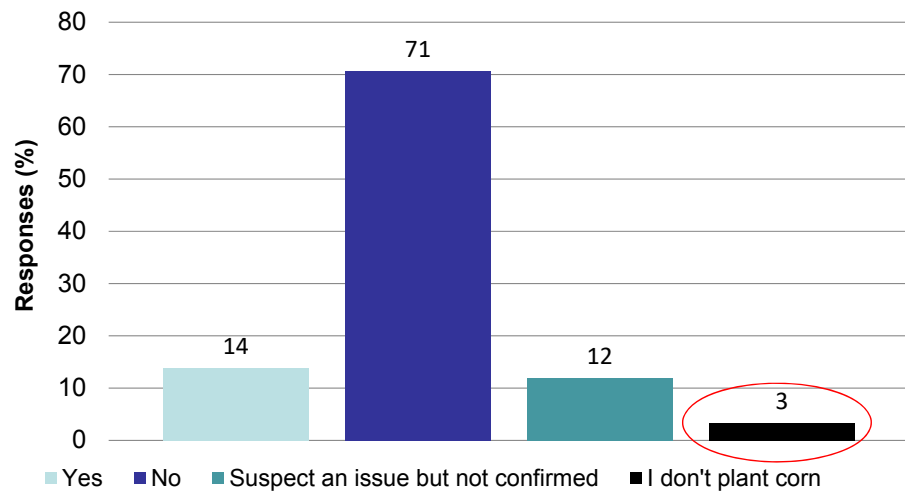
Do you take CRW beetle counts, whole plant, or sticky trap in your corn fields?

(303 responses)



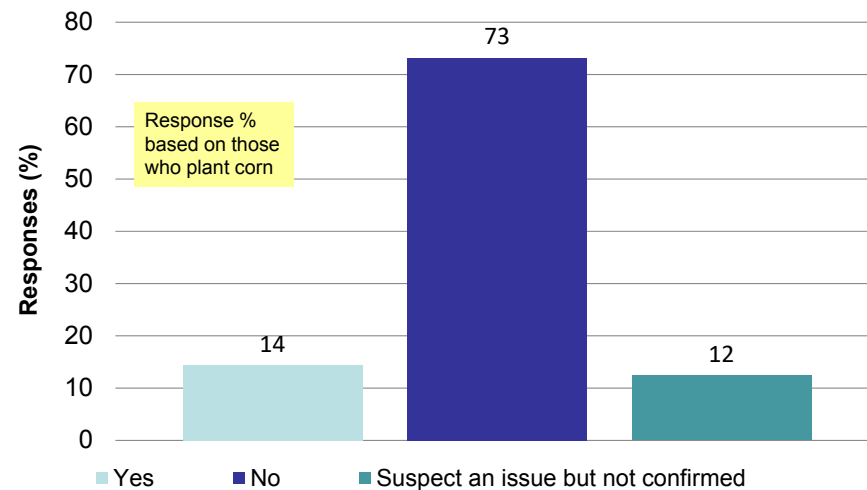
Has a CRW performance issue been confirmed on your farm?

(475 responses)



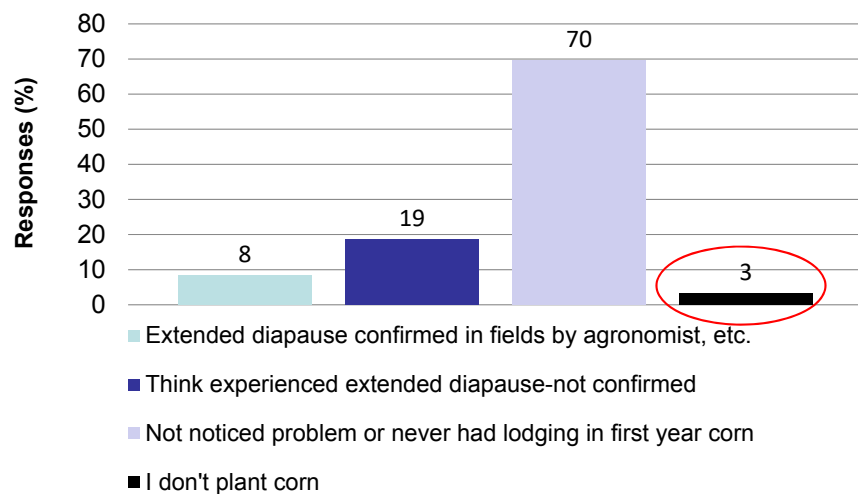
Has a CRW performance issue been confirmed on your farm?

(459 responses)



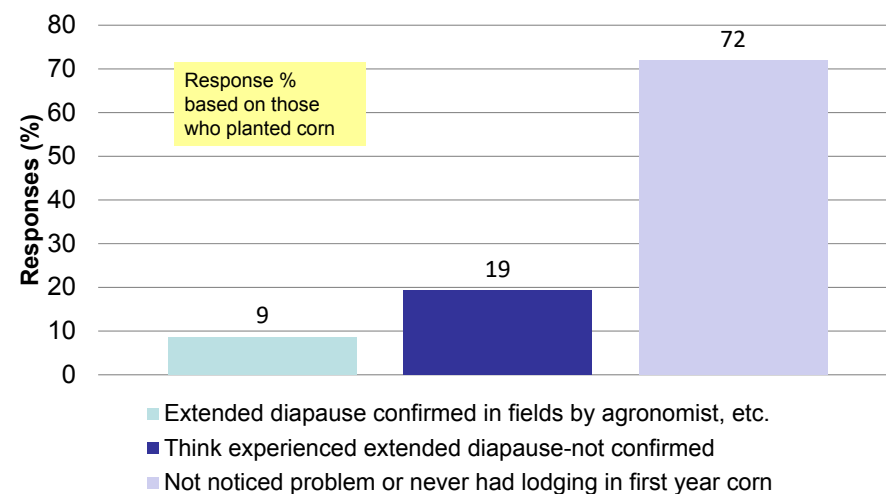
Regarding extended diapause of northern CRW

(469 responses)



Regarding extended diapause of northern CRW

(357 responses)



Section 4 Disease Management



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Section 5 Other Topics & General IPM



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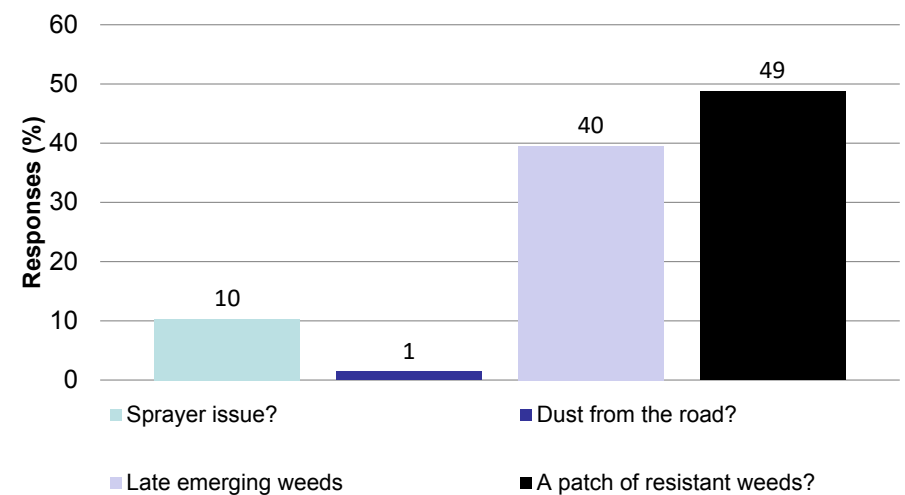
Are They Dead?
Nope, it's not simple anymore.

Were they sprayed at 2-3 inches?



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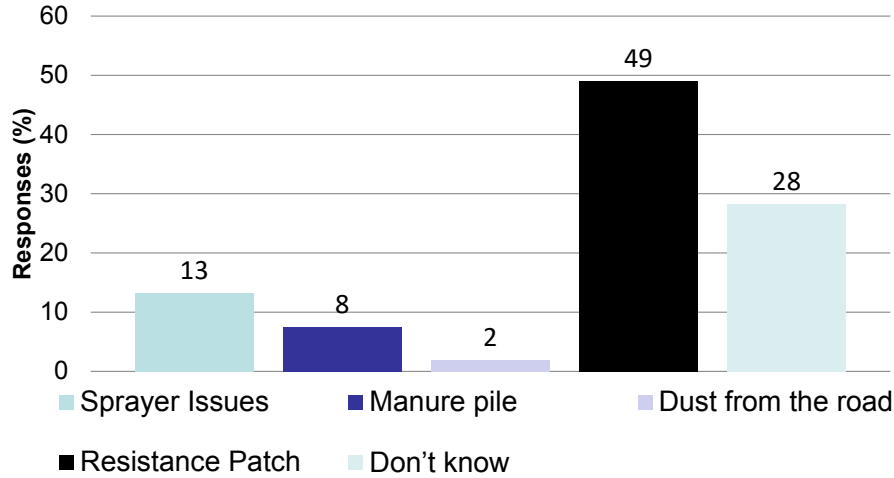
If you saw this patch in your field, what would you think?
(291 responses)



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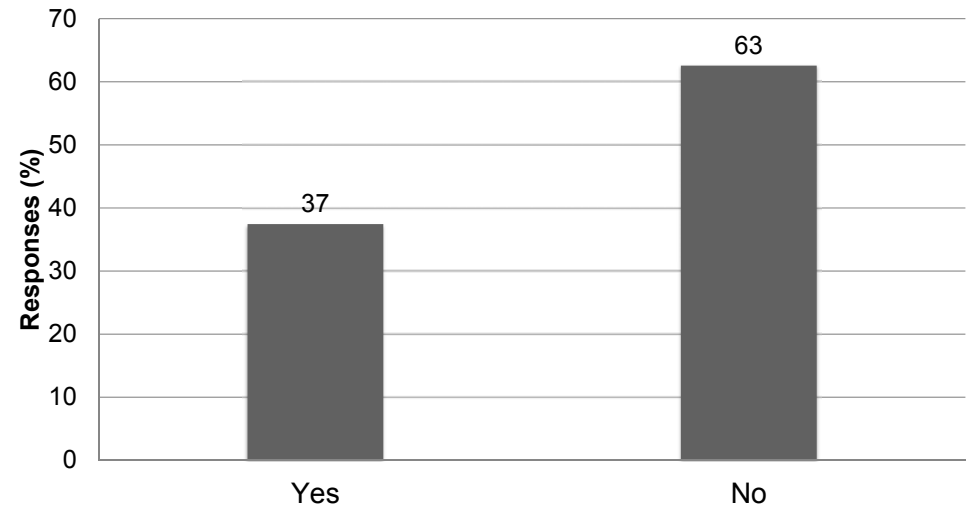
If this were your field, what would you think?

(53 responses)



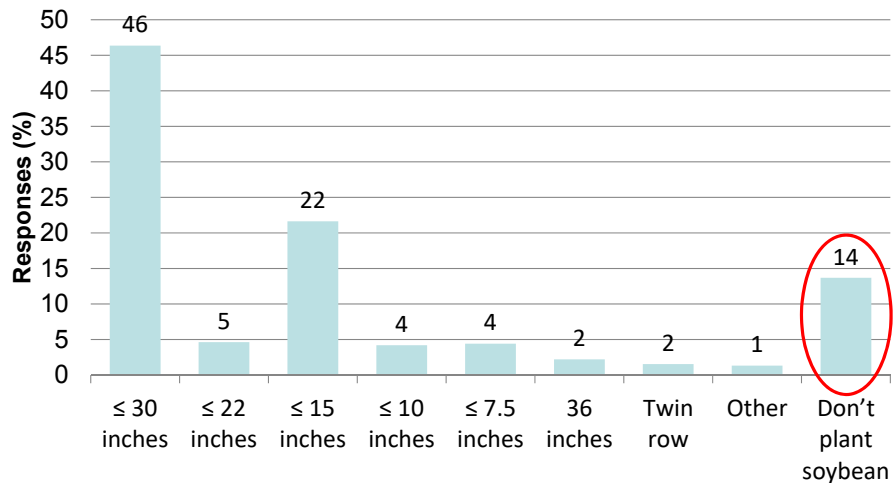
Do you plan on using the new Plant growth Regulator (PGR) technology on your farm?

(211 responses)



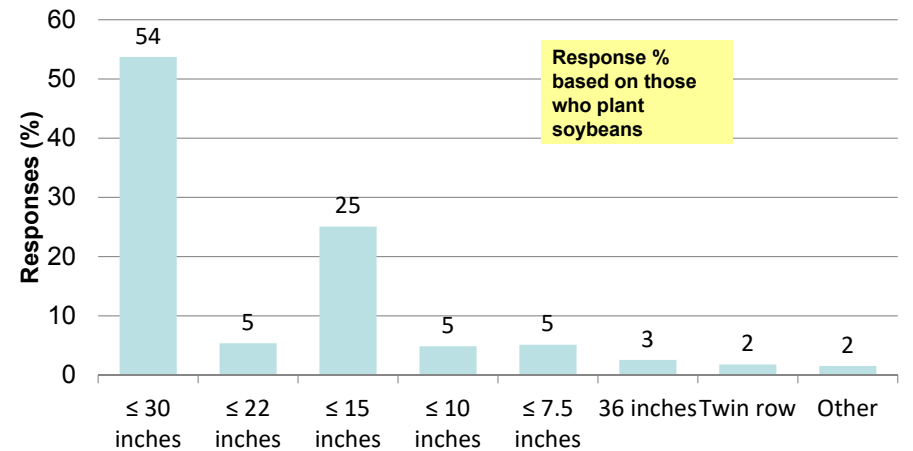
At what row width do you plant soybeans?

(453 responses)



At what row width do you plant soybeans?

(391 responses)

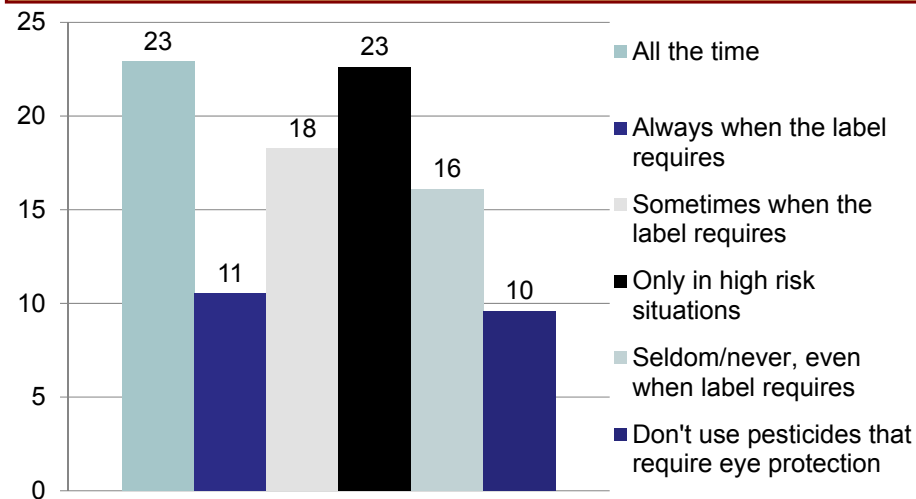


Section 6 Pesticide Safety



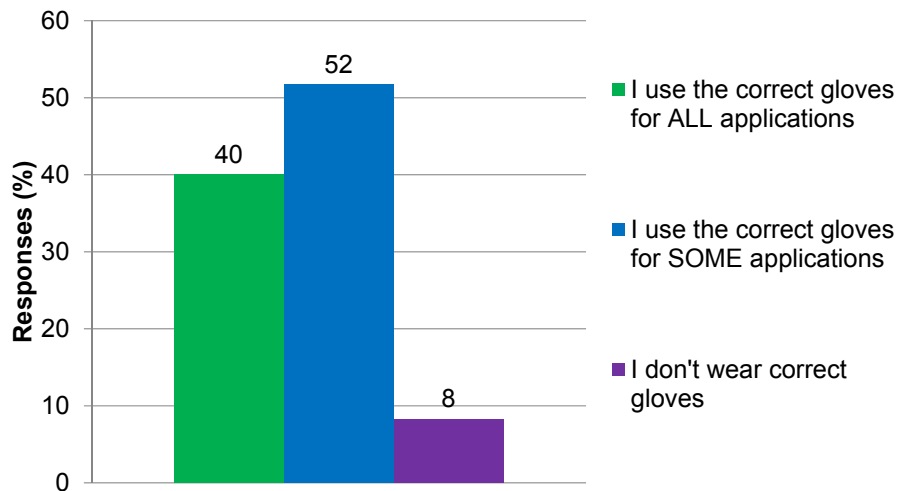
How often do you wear eye protection when using or handling pesticides?

(323 responses)



Do you wear the correct safety gloves when making pesticide applications?

(325 responses)

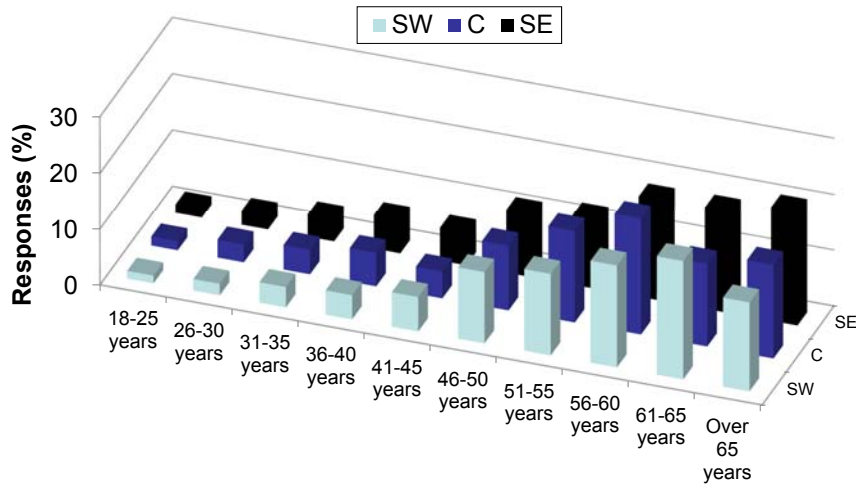


Section 7 Regional Comparisons



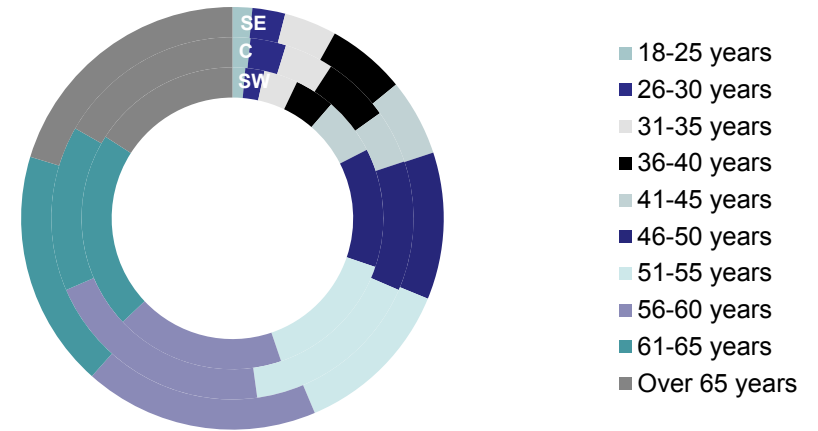
What is your age?

(1287 responses)



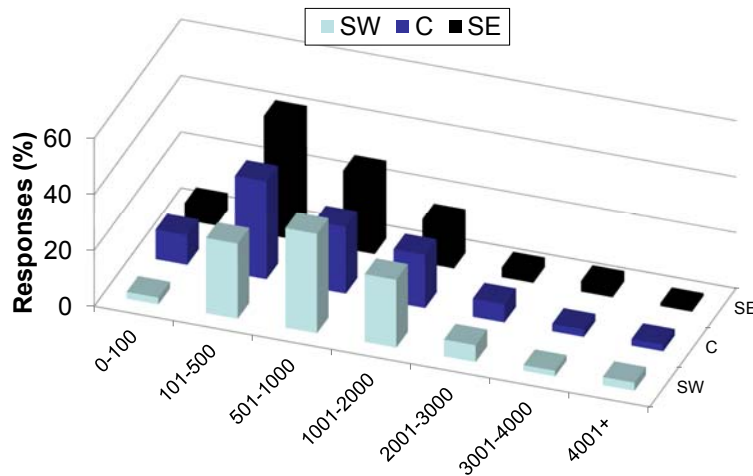
What is your age?

(1287 responses)



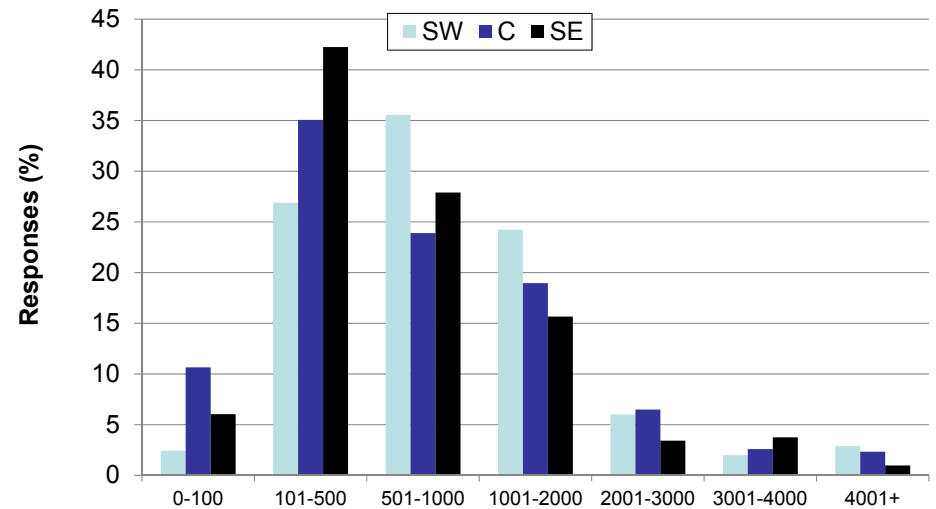
How many acres do you farm?

(1448 responses)



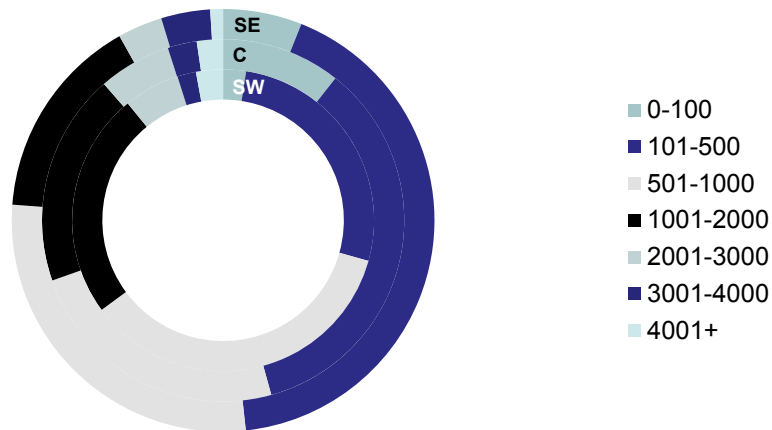
How many acres do you farm?

(1448 responses)



How many acres do you farm?

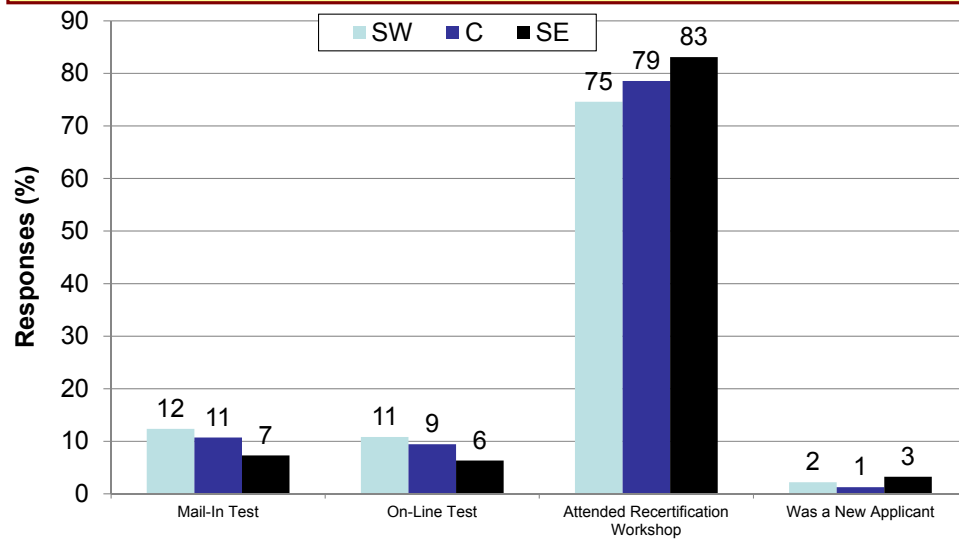
(1448 responses)



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How did you last recertify? (3 years prior)

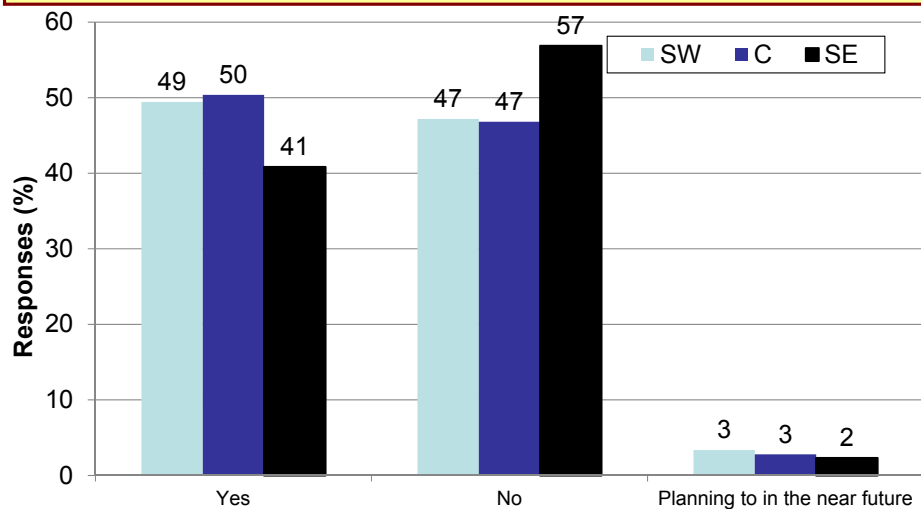
(1460 responses)



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Do you use a Smart Phone/Tablet/mobile device to access the internet while in the field?

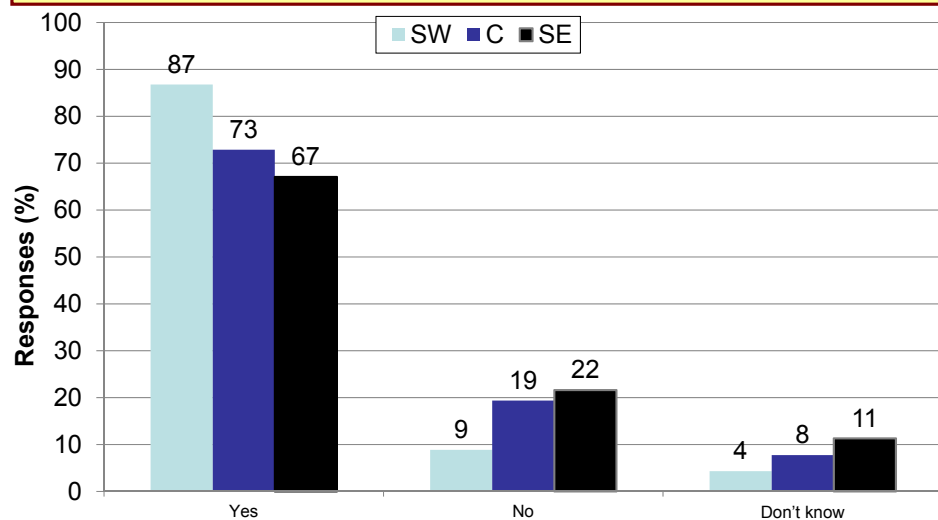
(1399 responses)



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Do you think you have glyphosate resistant weeds on your farm?

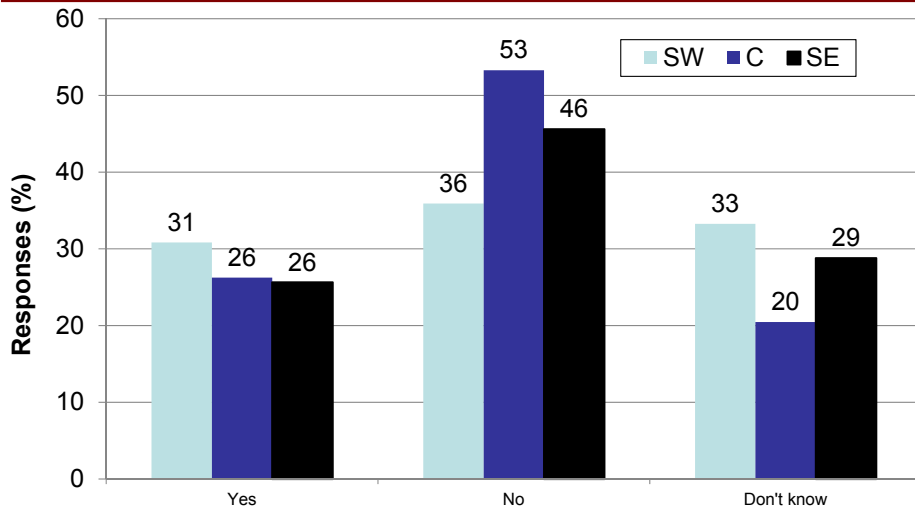
(1192 responses)



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Do you think you have PPO-resistant weeds (Valor, Cobra, Flexstar) on your farm?

(1150 responses)

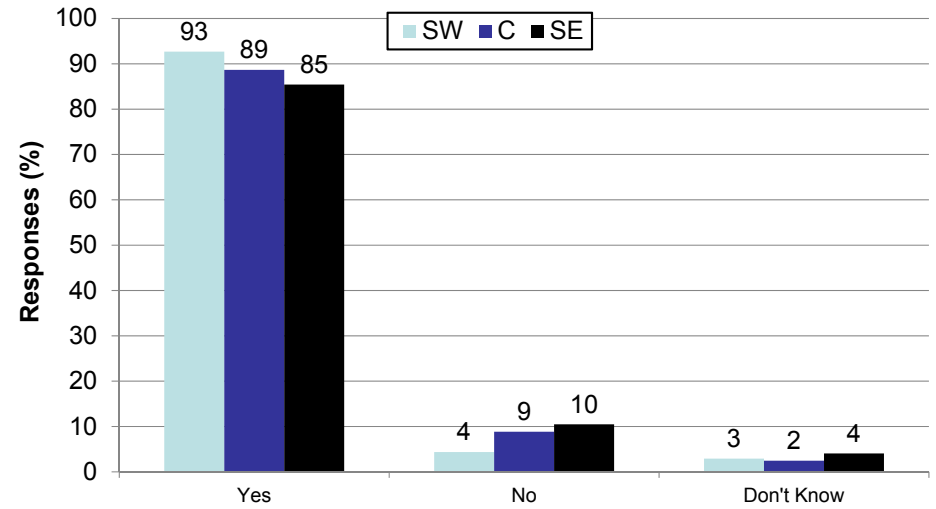


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When planning weed management programs, do you purposefully utilize different SOAs?

(525 responses where follow-up question was asked about SOA classifications)

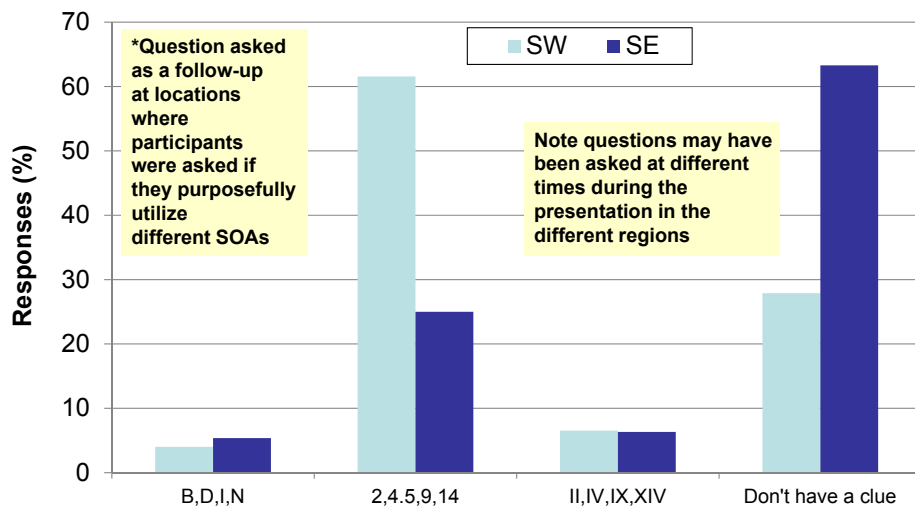


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How are herbicide SOAs classified?

(714 responses)

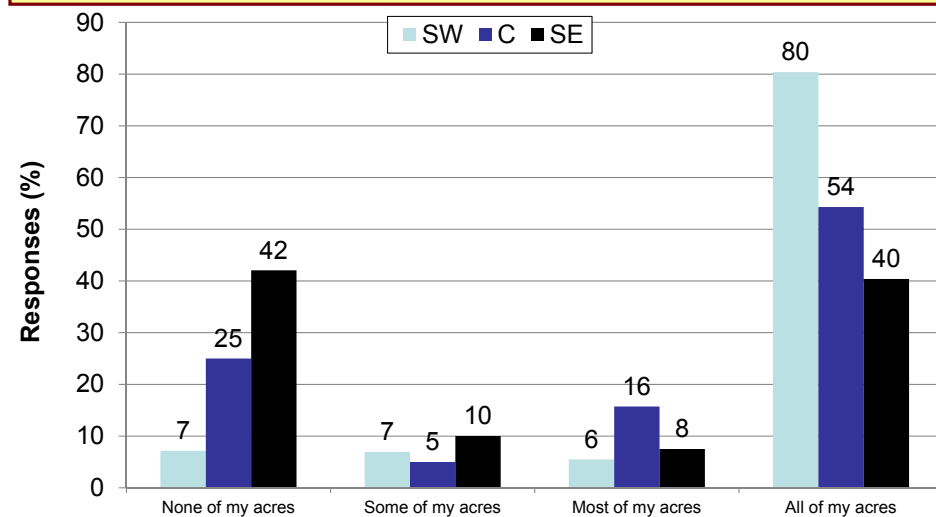


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Last year, I used pre-emergence or preplant residual herbicide in Soybean on...

(917 responses)

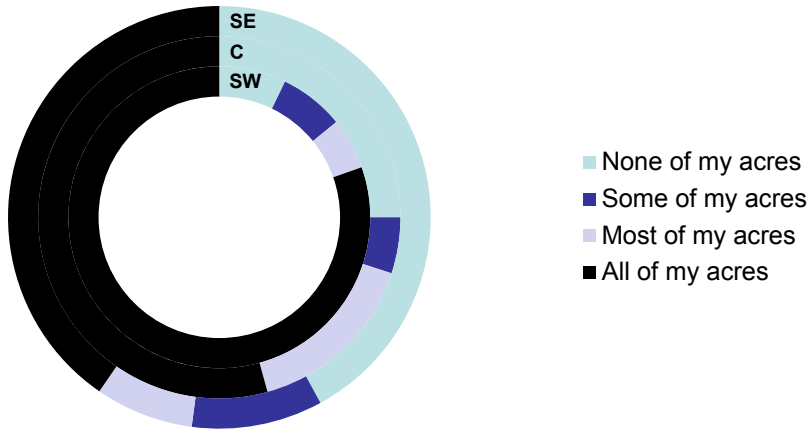


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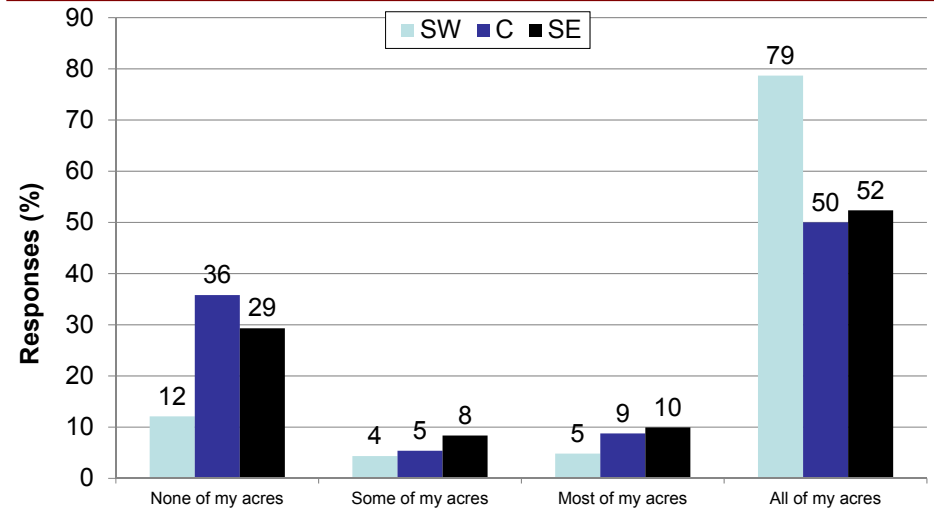
Last year, I used pre-emergence or preplant residual herbicide in Soybean on...

(917 responses)



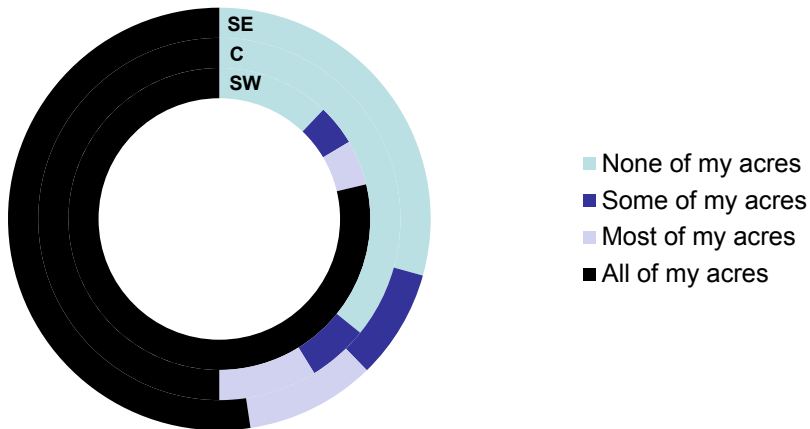
Last year, I used pre-emergence or preplant residual herbicide in Corn on...

(943 responses)



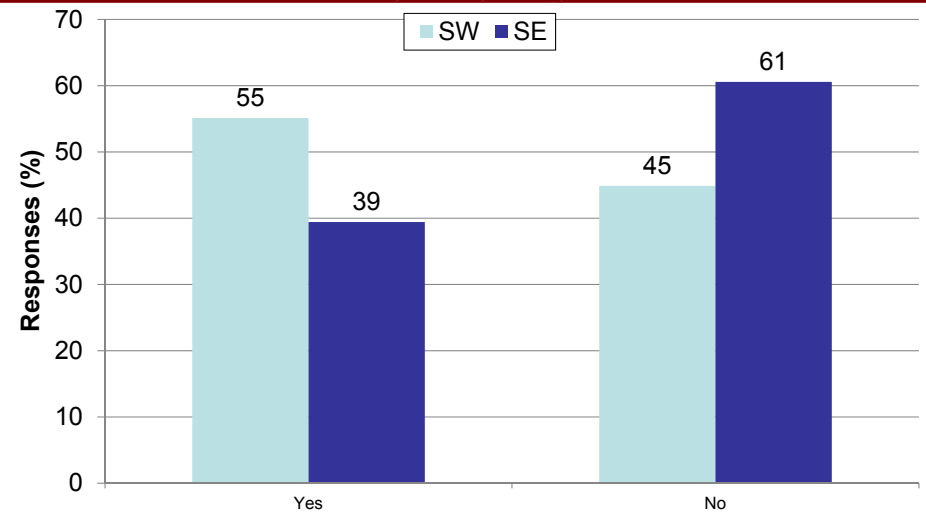
Last year, I used pre-emergence or preplant residual herbicide in Corn on...

(943 responses)

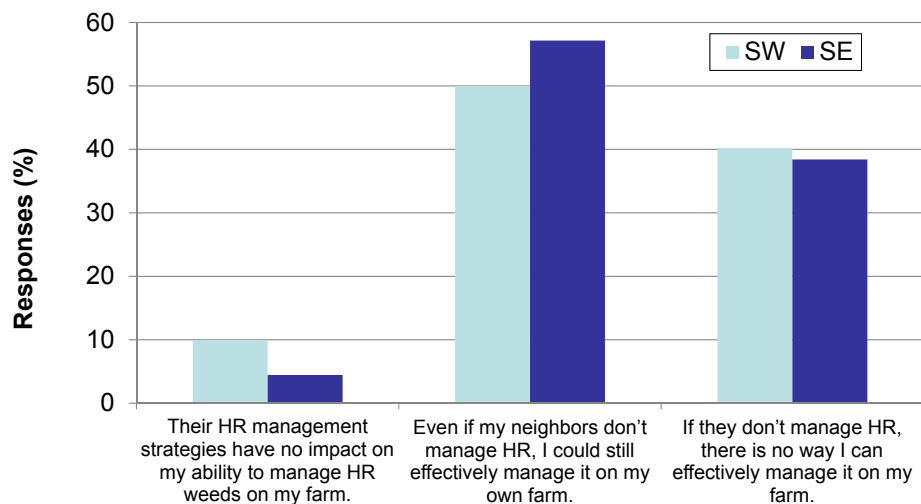


Have you ever discussed with the owner/manager of a field abutting or near one of yours whether herbicide resistant weeds are becoming a problem in your region?

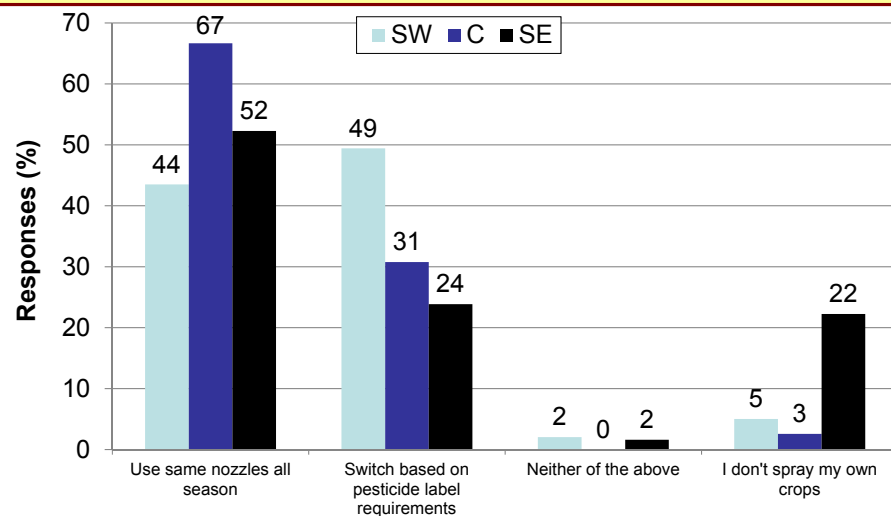
(661 responses)



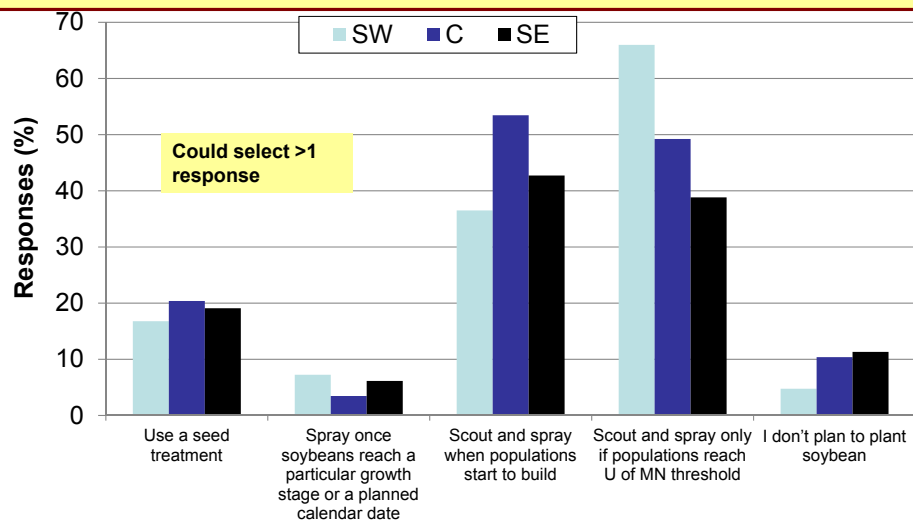
If weed resistance to multiple herbicides was confirmed on your farm, which would best describe your opinion about your neighbor's management decisions?
(579 responses)



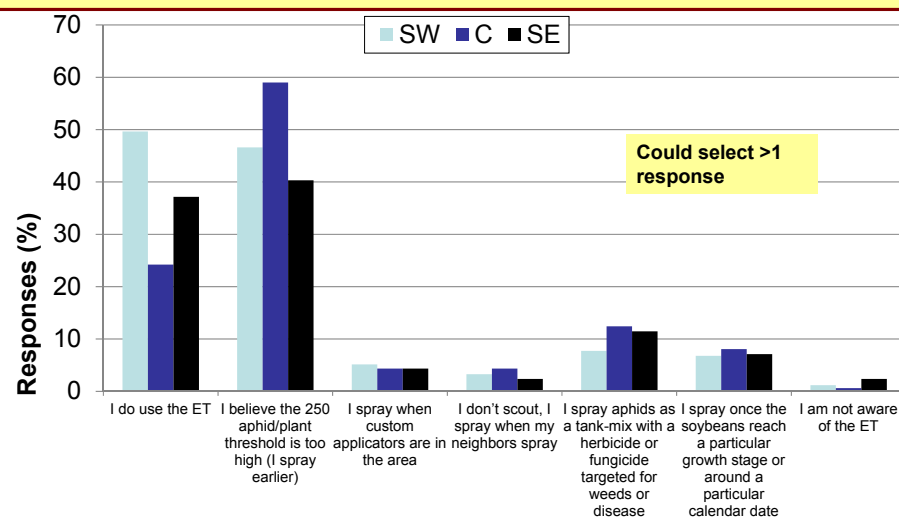
How many different types of nozzles do you use in a season?
(851 responses)



To control Soybean Aphid, I plan to...
(1010 responses)



Why don't you follow the recommended Economic Threshold (ET) of 250 aphids/plant?
(841 responses)



How Well Do Farmers' Current Practices Fit with Upcoming Herbicide-Resistant Crop Technologies?

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INTRODUCTION

New herbicide-resistant crop technologies have specific application requirements to help reduce drift potential, injury to sensitive crops, and to ensure product stewardship. These practices include the use of drift-reducing nozzles, specific tank cleaning procedures, and preemergence/residual herbicides to diversify chemical weed control.



OBJECTIVES

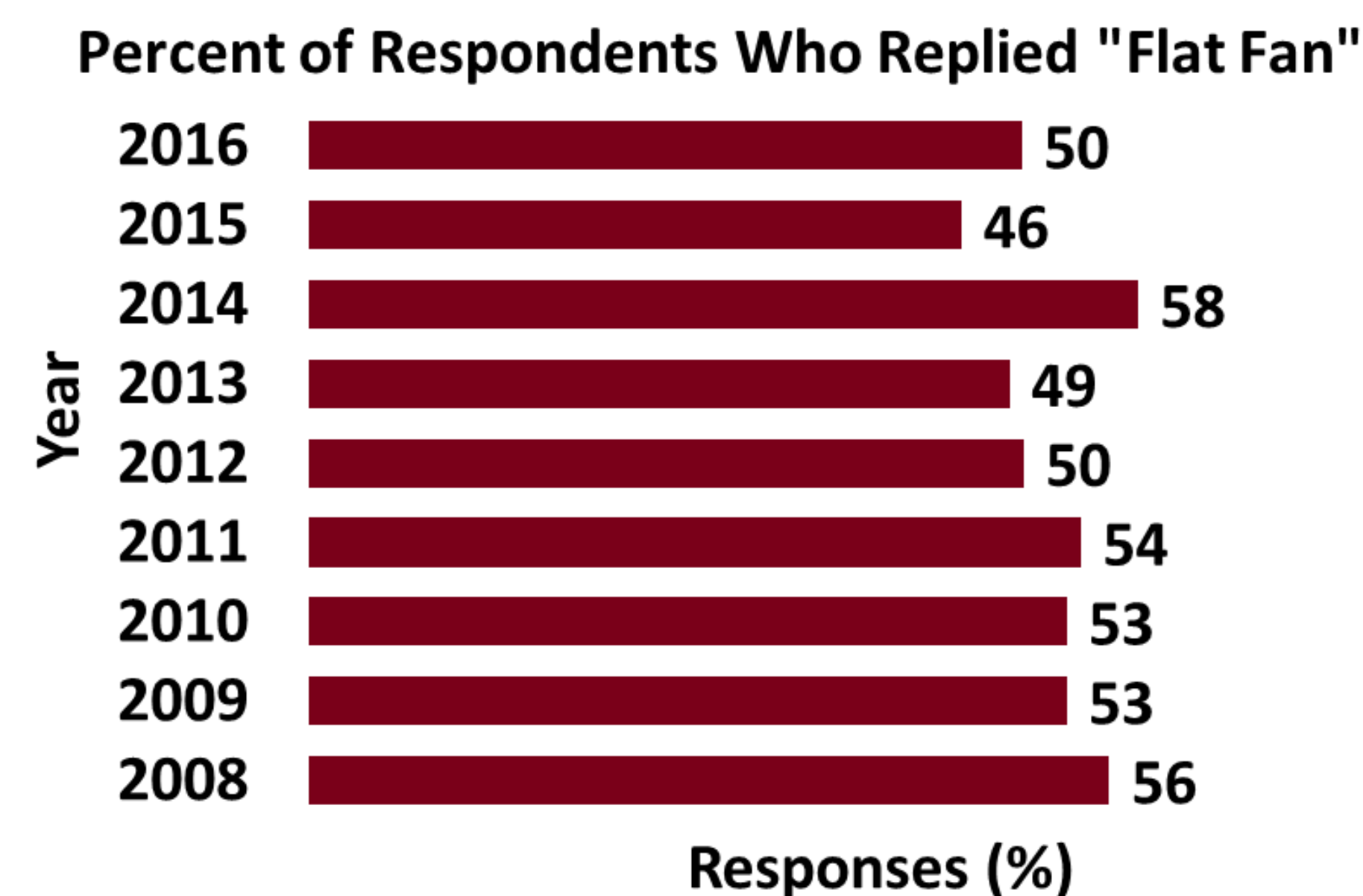
- Survey farmers at private pesticide applicator recertification (PAR) workshops to identify common farmer practices related to pesticide application and weed management.
- Identify areas where farmers' reported practices do not coincide well with the proposed application requirements and weed management system recommendations for new herbicide-resistance crop technologies.
- Utilize survey results to develop research and outreach activities to address these concerns.

MATERIALS AND METHODS

- Paper surveys were utilized from 2003 through 2008
- In 2008, Turning Technologies' ResponseCards were first used, beginning the paper survey phase-out.
- TurningPoint® has been used exclusively since 2009.
- Participation was voluntary and all responses were anonymous.
- All questions may not have been asked at each PAR workshop, and all attendees did not necessarily answer every question.
- PAR is conducted on an annual basis.
- Private certification is good for three years and each sample year represents one of three farmer cohorts.
- Cohort comparisons can help show changes in practices over time.

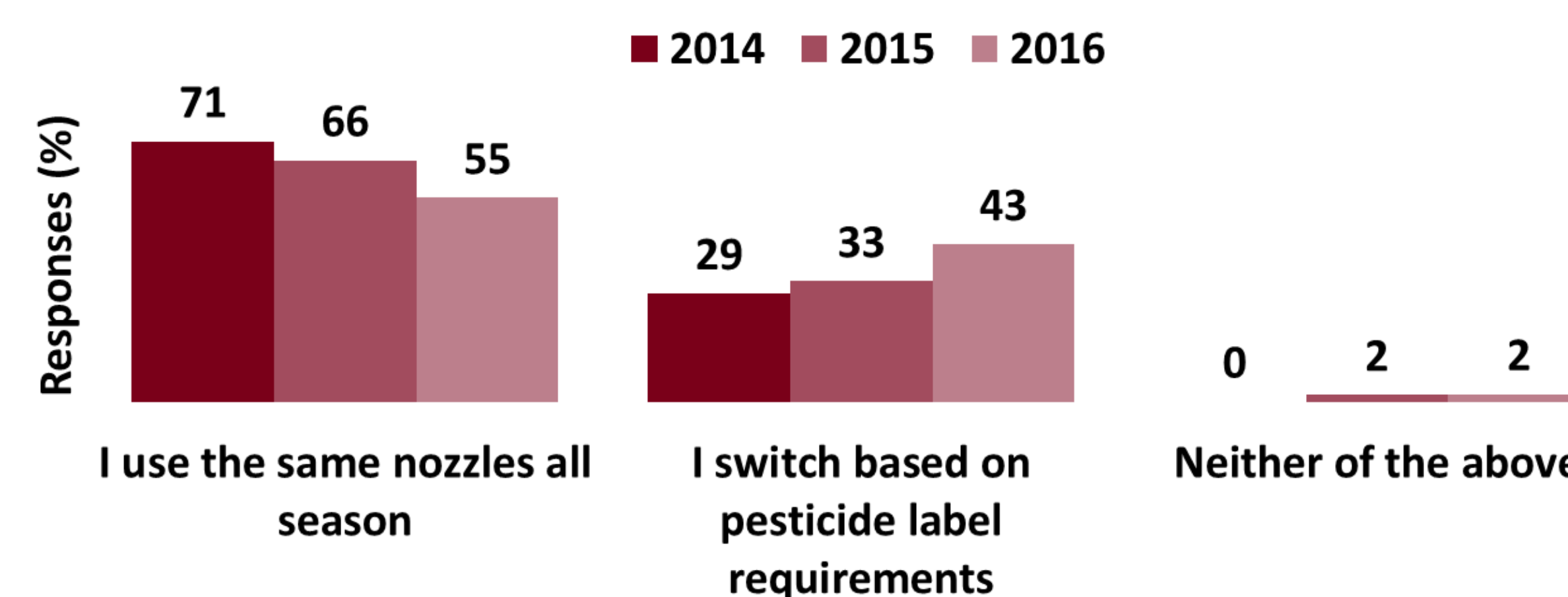
RESULTS AND DISCUSSION

Figure 1: Flat-fan nozzles continue to be the most widely used nozzle type, as indicated by response to the question "What type of nozzle do you usually use". In contrast, new herbicide-resistant technologies will require drift-reducing nozzles.*



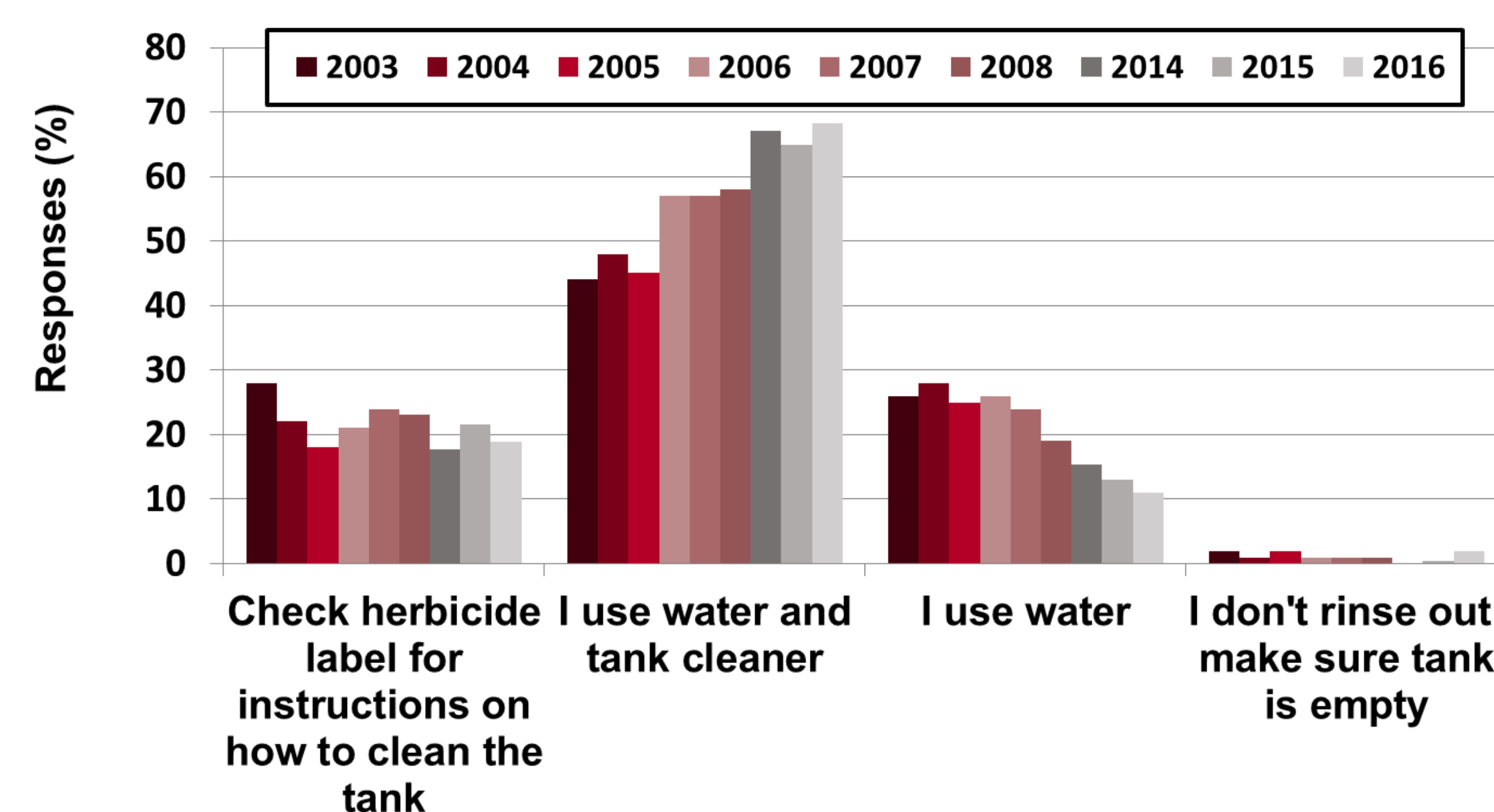
*Year (n) = 2008 (363), 2009 (462), 2010 (252), 2011 (220), 2012 (320), 2013 (653), 2014 (392), 2015 (659), and 2016 (722).

Figure 2: When asked "How many different types of nozzles do you use in a season", an increasing percentage indicate they switch based on pesticide label requirements. The majority, however, report using the same nozzles all season.*



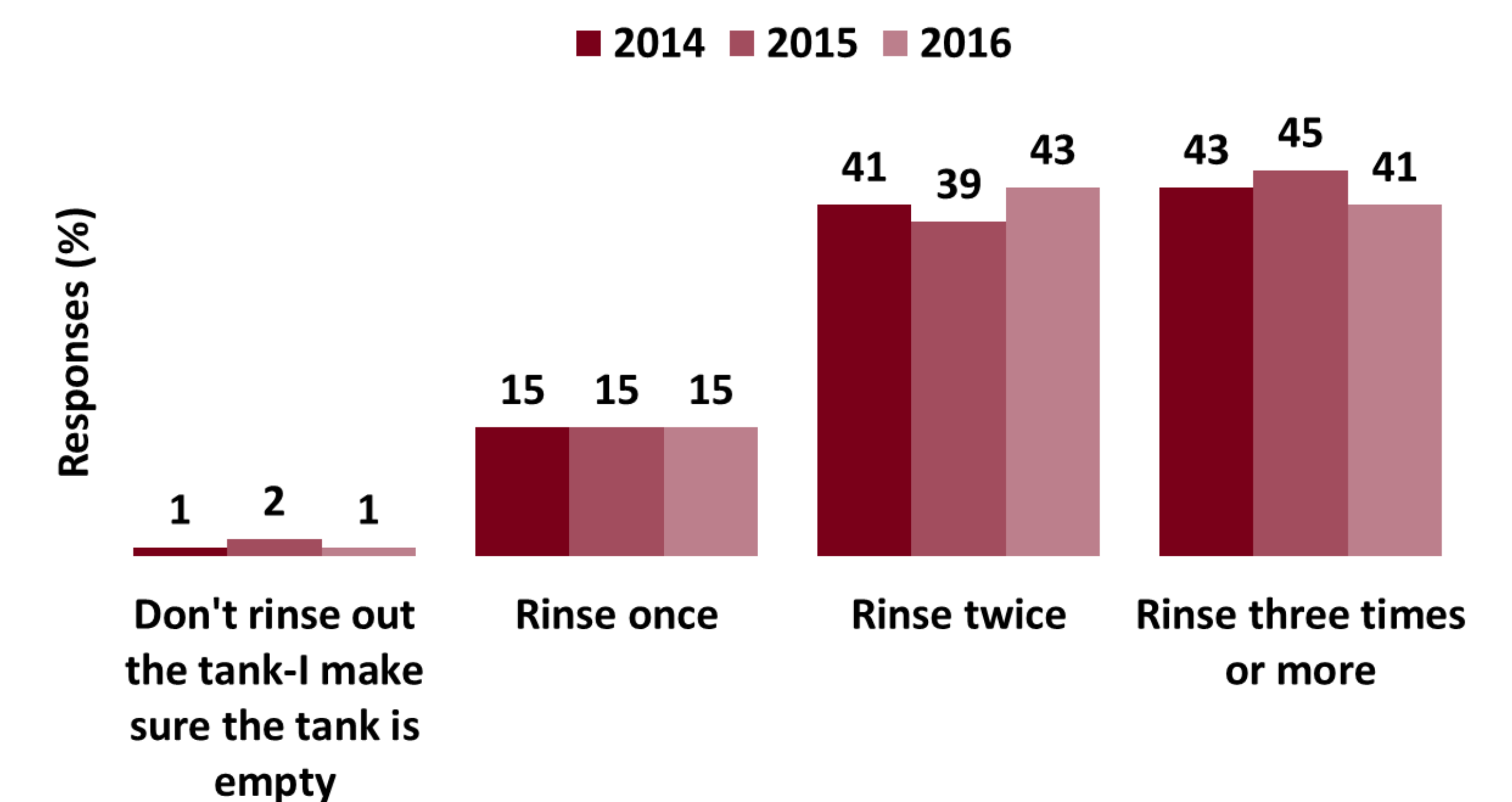
* Year (n) = 2014 (201), 2015 (554), and 2016 (754).

Figure 3: When asked "Which method best describes how you clean the spray tank" when switching to a susceptible crop, approximately 20% of the respondents report checking the herbicide label for instructions.*



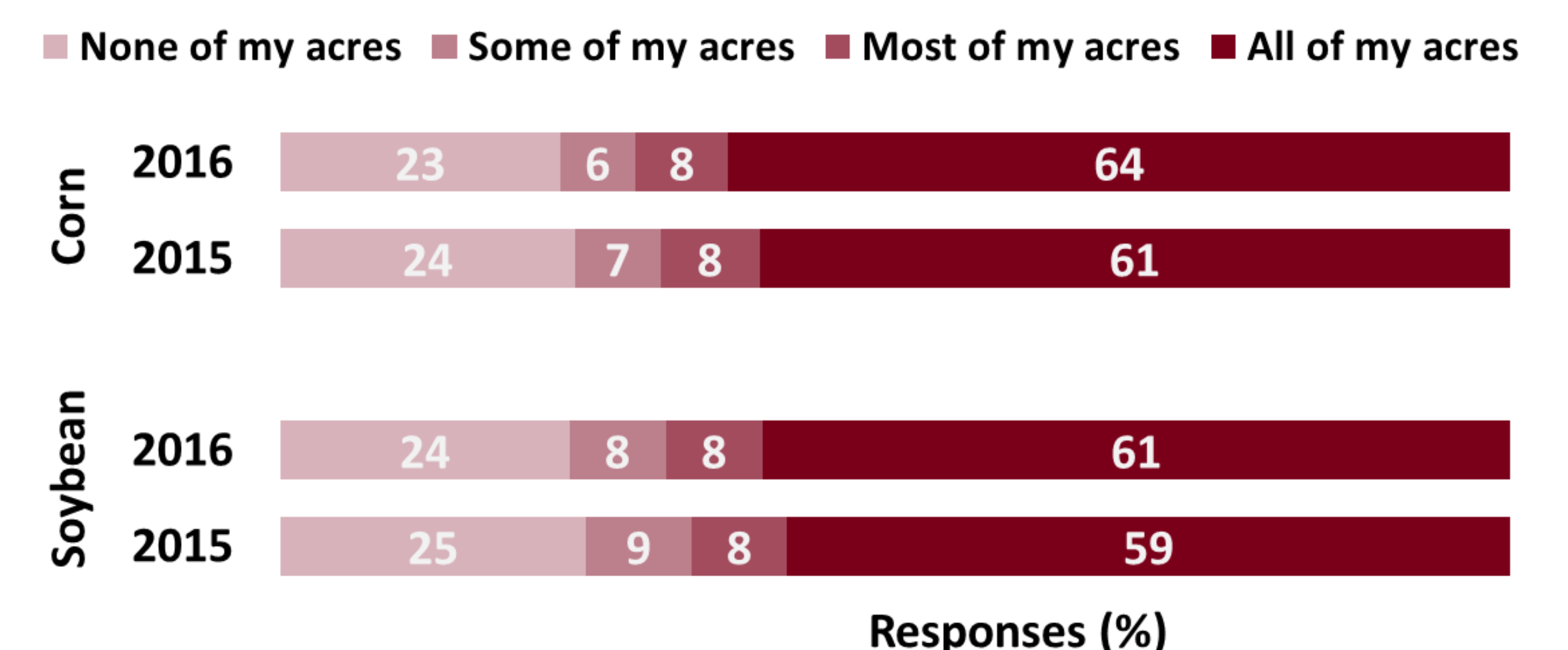
* Year (n) = 2003 (190), 2004 (410), 2005 (440), 2006 (681), 2007 (465), 2008 (1,194), 2014 (391), 2015 (794), and 2016 (475). Respondents were told to check only one answer, but some still selected more than one from 2003 to 2008, thus percentages may exceed 100% within a year.

Figure 4: Less than half of the farmers surveyed report rinsing the tank three or more times between susceptible crops, although pesticide labels for products with the new herbicide-resistant technologies list specific tank-cleaning procedures, including triple rinsing the tank.*



*Data reflects response to "When rinsing out the tank between susceptible crops, I usually...". Year (n) = 2014 (392), 2015 (1,061), and 2016 (770).

Figure 4: Although use of a preemergence/residual herbicide is promoted as a key part of the new herbicide-resistant technology systems, 23 to 25% of the farmers surveyed in 2015 and 2016 report not using one on any of their corn or soybean acres the previous year.*



*Data reflects response to "Last-year I used a pre-emergence or preplant residual herbicide in corn or soybean on...". Year (n) for soybean = 2015 (868), 2016 (917). Year (n) for corn = 2015 (931), 2016 (943).

CONCLUSIONS

- The majority of farmers surveyed use flat-fan nozzles.
- Most will need to switch to a drift-reducing nozzles.
- Over time more farmers report switching nozzles based on pesticide label requirements, but this number was less than half of the farmers surveyed.
- About 20% of the respondents checked the label for tank cleanout instructions.
- ≥ 55% reported they rinse the tank less than three times.
- Use of a pre-emergence/residual herbicide is encouraged with the new technologies: 23 to 25% of the respondents reported not using one in corn or soybean.