Blue Section: **Weed Control in Corn and Soybean** Page*

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Corn Programs. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to PRE, EPOST, and POST herbicide programs in corn. NK 'N20Y-3000GT' Roundup Ready corn was planted on April 24, 2012, followed by the application of PRE treatments at 12:01 pm with 74.8 F air, 58 F soil at a four inch depth, 25% relative humidity, 5% cloud cover, 1 to 3 mph E wind, dry soil surface and moist subsoil. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.3 pH. EPOST treatments were applied on June 6, 2012 at 10:30 am with 78 F air, 67 F soil at a four inch depth, 64% relative humidity, 100% cloud cover, 3 to 5 mph SE wind, dry soil surface, dry subsoil, good crop vigor and no dew present to V3 to V4 corn. Weed species present at the time of EPOST were: 2 to 5 inch (10 to 25/ft^2) yellow foxtail; 2 to 8 inch (5 to25/ft^2) common lambsquarters; 2 to 4 inch (5 to 25/ft^2) redroot pigweed; 1 to 3 inch (5 to 10/ft^2) hairy nightshade; 3 to 5 inch (10 to 25/ft^2) common ragweed; and 3 to 4 inch (1 to 3/ft^2) common cocklebur. POST treatments were applied on June 7 at 10:15 am with 79 F air, 66 F soil at a four inch depth, 56% relative humidity, 5% cloud cover, 6-8 mph S wind, dry soil surface, dry subsoil, good crop vigor and no dew present to V3 to V4 corn. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet nozzles for EPOST and POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Dry conditions before and after PRE application did not activate PRE herbicides and generally resulted in reduced weed control. By 28 DAT, most PRE fb POST treatments controlled weeds. This data shows the utility and good weed management of using a soil-applied followed by POST program. Herbicides with several mechanisms of actions were used to delay weed resistance. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Corn Programs (Zollinger, Kazmierczak, Wirth)

Treatment[1]	Rate	14 DAE							Prior to Post							28 DA POST						
		Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	% Control							% Control							% Control						
PRE/POST																						
Verdict	15fl oz	0	37	37	37	37	37	0	0	37	37	37	37	37	0	99	99	92	92	93	92	93
Tchdwn T+NPac AMS	30fl oz+2.5%v/v																					
Zemax	1qt	22	30	30	30	30	30	0	22	30	30	30	30	30	0	91	99	90	90	90	90	83
HalexGT+NIS+NPac AMS	3.6pt+0.25%v/v+2.5%v/v																					
Zemax	1.6qt	25	28	28	28	28	28	0	25	28	28	28	28	28	0	97	99	96	97	96	95	95
Tchdwn T+NPac AMS	30fl oz+2.5%v/v																					
Corvus	3.33fl oz	22	35	35	35	32	35	0	22	35	35	35	32	35	0	95	99	95	95	95	95	91
Tchdwn T+NPac AMS	30fl oz+2.5v/v																					
Resolve+Balance+Atrazine	1oz+0.67oz+0.556lb	17	33	33	33	33	33	0	23	33	33	33	33	33	0	95	99	99	99	96	95	95
Resolve+Iso+Meso+Abundit+AMS	1.2oz+0.3oz+2.5oz+1qt+3lb																					
Keystone LA+Hornet WDG	1.33qt+3oz	28	42	42	42	42	42	7	28	42	42	42	42	42	7	99	99	99	99	99	99	95
Durango+NPac AMS	1.5pt+2.5%v/v																					
SureStart	2pt	20	37	37	37	37	37	0	20	37	37	37	37	37	0	99	99	99	99	99	99	93
Durango+NPac AMS	1.5pt+2.5%v/v																					
SureStart+Atrazine	2pt+0.83lb	30	42	47	42	42	42	3	30	42	47	42	42	42	3	99	99	99	99	99	99	97
Durango+NPac AMS	1.5pt+2.5%v/v																					
PRE																						
Lumax	3pt	5	25	25	25	25	25	0	5	25	25	25	25	25	0	5	25	25	25	25	25	0
Zemax	2.4qt	15	30	30	30	30	30	0	15	30	30	30	30	30	0	15	37	37	37	37	37	0
Corvus	5.6fl oz	22	25	25	27	25	27	0	22	25	25	27	25	27	0	22	25	25	27	25	27	0
Corvus+Atrazine	5.6fl oz+0.83lb	15	37	37	37	37	37	13	15	37	37	37	37	37	13	7	35	37	37	30	37	13
Capreno+Atrazine	3fl oz+0.83lb	28	40	40	40	40	40	17	28	40	40	40	40	40	17	28	40	40	40	40	40	17
Resolve+Balance+Breakfree ATZ	1.2oz+0.8oz+1.5qt	30	37	37	37	37	36	0	30	37	37	37	37	36	0	30	63	53	37	37	36	0
Resolve+Balance+Breakfree ATZ	1oz+0.67oz+2qt	32	43	43	43	43	43	10	53	50	50	50	50	43	10	53	90	78	58	63	43	10
Resolve+Balance+Cinch ATZ	1oz+0.67oz+2qt	20	43	43	43	43	43	10	32	43	43	43	43	43	10	60	99	82	83	43	72	33
EPOST																						
Zemax+Tchdwn T+NPac AMS	1.6qt+30fl oz+2.5%v/v	22	25	25	25	25	25	0	22	25	25	25	25	25	0	0	95	99	95	95	95	95
(LSD (0.05)		14	8	8	8	9	8	4	12	7	7	7	8	8	4	8	5	5	4	7	6	4

[1] Iso = Isoxadifen safener; Meso = 50 WG Mesotrione; Tchdwn T = Touchdown Total (Glyphosate)

Corn response to nitrogen and timing of weed control, Carrington, 2012.
(Greg Endres and Mike Ostlie)

Trial objective was to determine the combination of soil N levels and timing of weed control to economically increase corn yield and quality. The dryland field trial was established at the NDSU Carrington Research Extension Center on a conventionally-tilled Heimdal-Emrick loam soil. Experimental design was split plot [main plot=N (3 treatments targeted at 50, 100, 150 lb soil N/acre) and subplots=initial timing of weed control (4 treatments targeted at PPI, early POST=2- to 4-inch weed height, late POST=8- to 12-inch weed height, and untreated check)] with four replications. Spring soil analysis indicated 41 lb nitrate-N/A, 5 ppm phosphorus, 174 ppm potassium, 0.61 ppm zinc, 3.1% organic matter, and 6.4 pH. Urea (46-0-0) was applied and mechanically incorporated on April 25 to reach targeted N rates. SureStart (acetochlor&clopyralid&flumetsulam&dichlormid safener) at 28 fl oz/A was PP applied on April 25 using a CO_2 hand-boom sprayer with 80015 flat fan nozzles delivering 14 gal/A at 35 PSI and incorporated twice at 1- to 2-inch depth with a field cultivator plus harrow. DeKalb Roundup Ready 'DKC33-53' (83-day relative maturity) was planted at 36,000 seeds/A in 30-inch row spacing on April 25. Starter liquid fertilizer 10-34-0 was in-furrow applied at 10 gal/A.
POST glyphosate (Roundup PowerMax) at 22 fl oz/A plus Class Act NG at 2.5% v/v was applied with 8001 flat fan nozzles delivering 12 gal/A at 35 psi. POST1 was applied to the PPI and early POST plots on May 31 with 66 degrees F, 32% RH, and 8 mph wind to 2- to 3-collar stage corn. POST2 was applied to the late POST plots on June 13 with 77 degrees F, 34% RH, and 3 mph wind to 5-collar corn. Table 1 lists weed species, size, and density during application of POST1 and POST2 treatments. A second POST application was applied to the early POST plots on June 22 with 68 degrees F, 61% RH, and 5 mph wind to 5-collar corn. A second POST application was applied to the PPI plots on June 29 with 68 degrees F, 66% RH, and 6 mph wind to 6- to 7-collar corn. The trial was harvested with plot combine on October 5.

Table 1.

Weed				
	POST1 (May 31)		POST2 (June 13)	
Species[1]	Size (inches in height)	Density (plt/ft2)	Size (inches in height)	Density (plt/ft2)
Grass	1 to 3	35	8 (average)	29
Broadleaf	1 to 3	25		23

[1]Grass= green and yellow foxtail; Broadleaf=common lambsquarters, prostrate and redroot pigweed, volunteer canola, and wild buckwheat.

Among soil N levels, plant chlorosis score was higher with low N and grain yield was reduced compared to 100 and 150 lb/acre of soil N (Table 2). Corn plants with PPI or early-POST weed control were generally taller and greener compared to the late-POST (POST2) weed control or untreated check. Silk dates were delayed as initial weed control was delayed. PPI and early-POST weed control resulted in greater seed yield and test weight compared to the late-POST weed control or untreated check. Basal stalk nitrate samples were collected on October 1 in 3 replications and analysis indicated nitrate-N levels were marginal (=possible that N deficiency limited yield) among N and weed control treatments. However, stalk nitrate levels were higher at 150 lb N/acre compared to lower N levels and stalk nitrate levels were higher with PPI and early-POST compared to late-POST weed control. Statistically significant interactions among N levels and initial timing for control of weeds occurred with stalk nitrate and seed moisture. Treatments where yield was not limited by N, based on the stalk nitrate test results, were with 150 lb N/acre and PPI or early-POST weed control.

Table 2. Corn response to N and timing of weed control, Carrington, 2012.									
Treatment	Plant[1]				Seed				
Factor	Height (cm)	Chlorosis (0-9)	Silk date	Basal stalk nitrate-N	Yield	Test weight	Moisture	Protein	Starch (dry matter)
	2-Jul	2-Jul	Jday	ppm	bu/A	lb/bu	%	%	%
soil N level (lb/A)									
50	78	3	202	242	83.6	57.2	15.3	7.3	73.2
100	82	2	201	306	102.8	57.6	15.0	8.2	72.6
150	83	2	201	602	97.1	57.6	15.1	8.7	72.0
LSD (0.05)	NS	1	NS	88	12.6	NS	NS	NS	NS
Weed control[2]									
untreated check	72	4	NA	NA	0.0	55.7	16.5	8.1	72.4
PPI/POST1/POST4	93	1	200	448	134.9	58.3	14.4	8.4	72.5
POST1/POST3	87	2	201	447	132.1	58.6	14.6	8.3	72.6
POST2	71	3	203	254	111.1	57.3	15.0	7.6	72.8
LSD (0.05)	7	1	1	102	14.5	0.6	0.9	NS	NS
mean	81	2	201	383	94.5	57.5	15.1	8.1	72.6
CV (%)	11.5	45.1	0.6	31.2	18.7	1.4	3.1	7.3	1.2
[1]Chlorosis: 0=dark green, 9=yellow; Basal stalk nitrate-N samples taken on October 1.									
[2]PPI=April 25; POST1=May 31; POST2=June 13; POST3=June 22; POST4=June 29.									

Weed control in corn. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate grass and broadleaf weed control in corn with various PRE and POST herbicides. Treatments were applied PRE (May 3) and POST at the V4 corn stage (June 4) with one exception. Resolve + glyphosate was applied at the V2 stage (May 24). Weed were ≤2 inches at the V2 stage and ≤4 inches at the V4 stage. No crop injury was observed with any treatment. All treatments provided excellent control of wild buckwheat, kochia, and lambsquarters. Most treatments provided good to excellent yellow foxtail control (89-99%) at the final evaluation on August 7. Resolve + glyphosate followed by glyphosate and Acetochlor followed by WideMatch + Atrazine provided lower foxtail control (77-80%).

Table. Weed control in corn. (1245)

			Weed Control[b]									
			Yeft			Wibw			Koch		Colq	
Treatment	Rate	Timing	25-May	3-Jul	7-Aug	25-May	3-Jul	7-Aug	3-Jul	7-Aug	3-Jul	7-Aug
			----------%----------									
Untreated[a]			0	0	0	0	0	0	0	0	0	0
Acetochlor+Atrazine / Gly+AMS	1.75 pt+0.375 lb / 22 fl oz+2.5%	PRE / V4	88	99	99	45	98	97	99	99	99	99
Acetochlor+Atrazine / Liberty+AMS	1.75 pt+0.375 lb / 22 fl oz+8.82%	PRE / V4	81	97	89	54	98	94	99	99	99	99
Acetochlor / Gly+AMS+Atrazine+Superb	1.75 pt / 22 fl oz+2.5%+0.375 lb+0.5%	PRE / V4	88	99	98	33	97	96	99	99	99	99
Balance Pro / Gly+AMS+Atrazine	2.5 fl oz / 22 fl oz+2.5%+0.375 lb+0.5%	PRE / V4	62	97	93	3	96	96	99	99	99	99
Acetochlor / Steadfast+Clarity+Atrazine+MSO+UAN	1.75 pt / 0.75 oz+4 oz+0.375 lb+1.5 pt+2 qt	PRE / V4	90	99	98	40	98	96	99	99	99	99
Acetochlor / Option+Status+MSO+UAN	1.75 pt / 1.5 oz+5 oz+1.5 pt+2 qt	PRE / V4	79	98	94	47	98	98	99	99	99	99
Acetochlor / WideMatch+Atrazine+Superb	1.75 pt / 1 pt+0.375 lb+0.5%	PRE / V4	84	83	80	47	98	98	99	99	99	99
Resolve+Gly+NIS / Gly+AMS	1 oz+22 fl oz+1% / 22 fl oz+2.5%	V2 / V4	29	91	77	17	95	95	99	99	99	99
Sharpen+Outlook / Gly+AMS	3.6 fl oz+15 fl oz / 22 fl oz+2.5%	PRE / V4	94	99	97	85	99	98	99	99	99	99
Acetochlor / Armezon+Atrazine+ MSO+AMS	1.75 pt / 0.75 fl oz+0.375 lb+1%+2.5%	PRE / V4	82	99	96	33	92	91	99	99	99	99
Acetochlor / Capreno+Atrazine+AMS+MSO	1.75 pt / 3 fl oz+0.375 lb+2.5%+1%	PRE / V4	78	99	97	23	99	99	99	99	99	99
LSD (0.05)			30	9	14	27	7	5	NS	NS	NS	NS
CV			25	6	10	45	4	3	0	0	0	0

[a] *Gly=Glyphosate*

[b] *Yeft=Yellow foxtail; Wibw=Wild buckwheat; Koch=Kochia; Colq=Common lambsquarters*

Corn Instigate. Zollinger, Richard K., Angela j. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to PRE and POST herbicide application in corn. NK "N2OY-3000GT' Roundup Ready corn was planted on April 24, 2012, followed by the application of PRE treatments at 11:49 am with 75.1 F air, 58 F soil at a four inch depth, 27% relative humidity, 10% cloud cover, 1 to 3 mph winds from the E, the soil surface was dry, and the subsoil was moist. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. Weed species present at the time of PRE were: yellow foxtail 1-4" (10-25/ft2), common cocklebur 2-4" (1/yd2), common lambsquarters 1-3" (1/yd2). POST treatments were applied on May 31, 2012 at 11:00 am with 76.5 F air, 61.4 F soil at a four inch depth, dry soil surface, moist subsoil, the crop vigor was good, and no dew present to V2 to V3 (8 to 10 inch) corn. Weed species present at the time of POST were: yellow foxtail 1-3" (25-30/ft^2), common cocklebur 2-4" (2-3/ft^2), common lambsquarters 2-5" (10-15/ft^2), red root pigweed 1-3" (1-10/ft^2), and 1-2" (3-5/ft^2) hairy nightshade. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

By 28 DAT, most treatments controlled weeds. This data shows the utility and good weed management of using a soil-applied followed by POST program. Herbicides with several mechanisms of actions were used to delay weed resistance. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Corn Instigate (Zollinger, Kazmierczak, Wirth)

		14 DAE						Prior to POST						28 DA POST					
Treatment[1]	Rate	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Cocb
	(Product/A)	% Control						% Control						% Control					
PRE/POST																			
(PRE) Resolve+Mesotrione (POST) Resolve+Meso+Iso+Abundit+AMS	1oz+5oz 1.2oz+2.5oz+0.3oz+2lb	13	47	47	47	43	20	13	47	47	47	43	20	99	99	99	99	99	99
(PRE) Resolve+Meso+Breakfree (POST)Abundit+AMS	1oz+5oz+3pt 32fl oz+2lb	33	50	50	50	50	10	43	99	93	85	96	13	99	99	99	99	99	88
(PRE) Resolve+Meso+Breakfree (POST) Abundit+AMS	1oz+5oz+4pt 32fl oz+2lb	33	50	50	50	50	22	58	99	99	99	99	22	99	99	99	99	99	92
(PRE) Resolve+Meso+Breakfree (POST) Abundit+AMS	1oz+5oz+1.25pt 32fl oz+2lb	18	40	40	40	40	10	22	79	79	73	79	10	99	99	99	99	99	92
(PRE) Resolve+Meso+Breakfree (POST) Abundit+AMS	1oz+5oz+2.25pt 32fl oz+2lb	23	43	47	43	43	10	43	99	99	78	99	13	99	99	99	99	99	92
POST																			
Lumax+Abundit+AMS	2.5qt+32fl oz+2lb	3	37	37	37	37	7	3	37	37	37	37	7	75	99	99	99	99	92
LSD(0.05)		13	12	12	12	13	12	19	30	30	29	29	7	0	0	0	0	0	4

[1] Iso = Isoxadifen safener; Meso = 50 WG Mesotrione.

Anthem in corn. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to PRE and EPOST herbicide programs in corn. NK 'N20Y-3000GT' Roundup Ready corn was planted on April 24, 2012, followed by the application of PRE treatments at 11:18 am with 74.8 F air, 58 F soil at a four inch depth, 26% relative humidity, 10% cloud cover, 1 to 3 mph E wind, dry soil surface, and moist subsoil. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. EPOST treatments were applied on May 31, 2012 at 11:10 am with 76.5 F air, 61.4 F soil at a four inch depth, 24% relative humidity, 15% cloud cover, 0.5 to 1.5 mph NNE wind, dry soil surface, wet subsoil, good crop vigor and no dew present to V2 to V3 (8 to 10 inch) corn. Weed species present at the time of EPOST were: 1 to 3 inch (10 to 25/ft^2) yellow foxtail; 1 to 6 inch (5 to10/ft^2) common lambsquarters; 2 inch (3 to 10/ft^2) redroot pigweed; 2 to 3 inch (1 to 10/ft^2) hairy nightshade; and 5 inch (3 to 15/ft^2) common cocklebur. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Dry conditions before and after PRE application did not activate herbicides and generally resulted in poor weed control. Weed control was similar at 7 DAPOST and 14 DAPOST. Anthem (fluthiacet + pyroxasulfone) PRE was weak on most weeds species. Anthem + Python gave the best weed control for PRE applications. All EPOST applications gave excellent control. (Department of Plant Sciences, North Dakota State University, Fargo).

Table. Anthem in corn (Zollinger, Kazmierczak, Wirth).

		7 DAPOST							14 DAPOST						
Treatment[1]	Rate	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	----------% Control----------							----------% Control----------						
PRE															
Anthem	10 fl oz	33	50	23	23	23	10	0	33	50	23	23	23	10	0
Anthem	12 fl oz	53	57	30	30	30	10	0	53	70	30	30	30	10	0
Anthem ATZ	2.5 pt	57	93	60	53	55	23	7	62	95	63	57	57	23	7
Anthem+Sharpen	10 fl oz + 2 fl oz	68	99	70	63	80	45	20	68	99	73	63	80	45	20
Anthem+Callisto	10 fl oz + 3 fl oz	60	37	33	33	33	13	0	60	37	33	33	33	13	0
Anthem+Python	10 fl oz + 1 oz	60	99	80	72	85	50	10	60	99	80	72	85	50	10
Harness Xtra	2 qt	60	99	75	35	57	20	0	63	99	76	42	60	20	0
SureStart	2 pt	37	33	27	27	30	17	0	37	33	27	27	30	17	0
EPOST															
Anthem+RUPM +AMS	8 fl oz + 22 fl oz + 8.5 lb/100gal	99	99	99	99	99	99	90	99	99	99	99	99	99	87
Anthem ATZ+RUPM +AMS	2 pt + 22 fl oz + 8.5 lb/100gal	99	99	99	99	99	99	90	99	99	99	99	99	99	82
Anthem+Callisto+ RUPM+AMS	8 fl oz+3 fl oz+22 fl oz +8.5 lb/100gal	99	99	99	99	99	99	93	99	99	99	99	99	99	90
RUPM +AMS	22 fl oz + 8.5 lb/100gal	99	99	99	73	80	63	92	99	99	99	75	80	63	92
LSD (0.05)		11	16	16	18	18	9	7	10	16	15	17	17	9	7

[1] RUPM = Roundup Powermax (Glyphosate)

2012 Residual Herbicide Evaluations in Corn with Verdict and Zidua

Mike Ostlie and Greg Endres

Two trials were established in 2012 at the Carrington Research Extension Center in collaboration with BASF to evaluate residual weed control options in corn with two different strategies. The first trial was initiated with several soil-applied residual herbicide application timings. The second trial was established with only a Preplant (PP) residual herbicide timing followed by post-emergence (POST) application of glyphosate. The trials were planted on May 10 and harvested on October 8. PP treatments were applied on May 9 and incorporated mechanically to one inch while POST treatments were applied at the V4 growth stage on Jun 22. The three highlighted treatments in Table 1 were applied just after corn emergence on May 18 and had no other herbicide treatment the remainder of the growing season. All POST treatments for both studies included Roundup Powermax at 22 fl oz/a with 8.5 lb/100 gal AMS and 0.25% v/v NIS.

When herbicide products were applied at corn emergence, initial weed control was much greater compared to PP. The lack of further weed management significantly reduced corn yields. Had a mid-season herbicide application been made, these treatments likely would have been amongst the best performing treatments. As it stands these plots only reached roughly half the yield of the two-application plots, although they were still far better than the nontreated plots.

Very high weed control levels were observed after the second herbicide application in all cases. Weed emergence was very poor after the POST application timing. Below average precipitation and closure of the corn canopy would have contributed to this. Thus, even treatments containing no residual component still had little weed pressure until near the time of corn maturity.

There were not many yield differences between treatments. In the second trial all treatments had statistically equivalent yields except the nontreated plots. In the first trial there were more differences. Most importantly, there was a 12% yield hit to the plots that received only Roundup Powermax, even though weed control was quite good after the second application. The yield hit is likely due to the enormous early-season weed pressure experienced this growing season. Without the residual component, weeds quickly emerged and competed with corn to likely reduce the yield potential even though the weeds were removed with a relatively early Roundup application.

Table 1. Weed control with Verdict and Zidua in corn

----------PP----------		----------POST----------		----------Control----------				----------Harvest----------		
Product	Rate	Product	Rate	3 weeks after PRE		3 weeks after POST		Moisture	Test Weight	Yield
	oz/a		oz/a	Foxtail* %	Lmbqtrs** %	Foxtail %	Lmbqtrs %	%	lb/bu	bu/a
Trial 1. PP and POST residual treatments										
non treated	-			0	0	0	0	16.1	50.15	17.9
Zidua	2.25	Status	4	54	44	95	93	16.6	55.04	138.6
Zidua	2.25	Armezon + AAtrex	0.75 + 1 (qt)	48	48	95	93	16.2	55.02	144.8
		Zidua + AAtrex +Armezon	2.25 + 1 (qt) + 0.75	83	95	79	23	18.4	53.02	93.2
Zidua + Sharpen	2.25 + 2.5	Status	4	56	56	95	88	16.0	54.87	133.7
Verdict	13	Status	4	38	60	95	91	16.2	55.65	140.7
Verdict	13	Armezon + AAtrex	0.75 + 1 (qt)	46	48	95	88	16.6	54.35	147.5
Verdict	13	Zidua + Status	2.25 + 2.5	34	41	95	93	16.4	54.83	154.4
Verdict	13	Status + Headline	4 + 6	48	55	95	93	16.6	54.97	158.4
Dual II	1.33	Laudis + AAtrex	3 + 1 (pt)	30	36	95	89	16.2	55.27	151.5
		Capreno + AAtrex	3 + 1 (pt)	83	95	78	21	18.1	52.62	83.1
		Surestart	1.75	89	88	56	21	18.3	51.83	76.1
Roundup Powermax	22	Roundup Powermax	22	0	0	95	94	17.3	54.35	130.1
LSD (0.05)				14	23	8	5	0.8	1.57	20.9
Trial 2. PP followed by glyphosate										
non treated	-			0	0	0	0	16.1	51.19	9.4
Zidua + Sharpen + AAtrex	2.25 + 2.5 + 1 (qt)			50	54	95	99	16.5	55.71	143.7
Zidua + Sharpen	2.25 + 2.5			56	44	94	99	16.3	55.92	157.1
Verdict	13			43	60	94	99	16.4	55.37	142.7
Verdict + AAtrex	13 + 1 (qt)			60	64	95	99	16.4	56.00	146.9
Zidua + Verdict	2.25 + 10			63	68	94	99	16.0	55.96	151.2
Lumax	2 (qt)			50	66	94	99	16.4	55.25	145.7
Surestart	1.75 (pt)			38	48	95	99	16.8	55.09	141.6
Harness Xtra	1.5 (pt)			69	69	93	99	15.8	55.68	138.7
LSD (0.05)				16	18	3	0	NS	3.20	23.4

*green and yellow foxtail **common lambsquarters

PRE Engenia and 2,4-D. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to PRE Engenia herbicide in corn. NK 'N20Y-3000GT' Roundup Ready corn was planted on April 24, 2012. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. PRE treatments were applied on April 24 at 11:28 am with 75.1 F air, 58 F soil at a four inch depth, 27% relative humidity, 10% cloud cover, 1 to 3 mph E wind, dry soil surface, and moist subsoil. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo Tee nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The objective of this study was to evaluate residual weed control from soil residue of dicamba and 2,4-D. Dry conditions before and after PRE application did not activate Dual II Magnum which resulted in poor grass control. This study was broadcast applied a ½ rate (1 pt/A) of Dual II Magnum to control annual grasses. The best weed control came from the lowest rate of Engenia (12.8 fl oz/A). However, very high infestations of grass weeds may have contributed to the high broadleaf weed control from dicamba by competing with broadleaf weeds. 2,4-D did not show significant residual soil activity on broadleaf weeds. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Engenia PRE (Zollinger, Kazmierczak, Wirth)

		14 DAE						28 DAE						56 DAE					
Treatment	Rate	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Cocb
	(Product/A)	% Control						% Control						% Control					
Untreated																			
+Dual II Magnum	1 pt	20	0	0	0	0	0	20	0	0	0	0	0	20	0	0	0	0	0
Engenia	12.8 fl oz	32	40	40	40	33	13	32	99	73	73	70	20	20	99	96	91	93	99
Engenia	19.2 fl oz	33	37	40	40	40	13	37	99	70	70	72	20	20	99	95	90	92	90
Engenia	25.6 fl oz	40	57	57	47	57	30	43	99	65	60	68	35	20	99	95	85	92	95
2,4-D Amine	16 fl oz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2,4-D Amine	24 fl oz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2,4-D Amine	32 fl oz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		10	6	4	10	8	11	6	0	4	2	3	3	0	0	1	1	4	0

POST Engenia and 2,4-D. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to POST Engenia herbicide in corn. NK 'N20Y-3000GT' Roundup Ready corn was planted on April 24, 2012. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. POST treatments were applied on June 6 at 9:25 am with 72 F air, 67 F soil at a four inch depth, 64% relative humidity, 100% cloud cover, 3 to 5 mph SE wind, dry soil surface, dry subsoil, crop vigor was stressed, and no dew present to V3 to V4 corn. Weed species present at the time of POST were: 1 to 6 inch (10 to 25/ft^2) yellow foxtail; 3 to 6 inch (5 to25/ft^2) common lambsquarters; 2 to 5 inch (10 to 20/ft^2) redroot pigweed; 3 to 5 inch (3 to 20/ft^2) hairy nightshade; 2 to 4 inch (1 to 5/yd^2) common cocklebur; 2 to 4 inch (1 to 4/yd^2) common ragweed; and 2 to 8 inch (1 to 5/yd^2) . Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 15 gpa at 40 psi through 11015 Air Induction nozzles. The experiment had a randomized complete block design with three replicates per treatment.

At 42 days after POST, Engenia and 2,4-D controlled most broadleaf weeds. Treatments that gave poor grass control may show high broadleaf weed control because very high foxtail populations out-competed the broadleaf weeds and reduced broadleaf weed infestations. Most treatments controlled wild mustard. 2,4-D at 24 fl oz/A as 32 fl oz/A also was effective in broadleaf weed control. Roundup PowerMax did not increase weed control from Engenia because weed control was already high. However, weed control was reduced when Roundup PowerMax was added to 2,4-D. All treatments with Roundup PowerMax gave good weed yellow foxtail control. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Corn BASF 1 (Zollinger, Kazmierczak, Wirth)

		7 DA POST	7 DA POST						14 DA POST	14 DA POST					
Treatment[1]	Rate	Corn	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Corn	Yeft	Wimu	Rrpw	Colq	Hans	Cocb
	(Product/A)	-% Injury-	----------% Control----------						-% Injury-	----------% Control----------					
Engenia +Preference	6.4 fl oz +0.25% v/v	0	12	18	18	18	18	18	0	10	40	35	35	35	37
Engenia +Preference	9.6 fl oz +0.25% v/v	0	23	25	25	25	25	25	0	23	63	33	33	33	33
Engenia +Preference	12.8 fl oz +0.25% v/v	0	20	33	35	35	35	35	0	20	40	47	47	47	50
2,4-D Amine +Preference	16 fl oz +0.25% v/v	22	7	20	20	20	20	20	12	7	75	40	40	40	40
2,4-D Amine +Preference	24 fl oz +0.25% v/v	12	10	20	20	20	20	20	13	10	77	43	43	43	43
2,4-D Amine +Preference	32 fl oz +0.25% v/v	23	12	28	28	28	28	28	18	12	57	23	33	33	37
Engenia+RUPM +Preference	6.4 fl oz + 14.2 fl oz +0.25% v/v	0	38	45	47	47	47	47	0	68	83	77	73	73	82
Engenia+RUPM +Preference	9.6 fl oz + 21.3 fl oz +0.25% v/v	5	62	62	62	62	62	62	5	82	85	87	87	87	87
Engenia+RUPM +Preference	12.8 fl oz + 28.4 fl oz +0.25% v/v	12	57	53	62	62	62	62	15	86	92	90	90	90	92
2,4-D Amine+RUPM +Preference	16 fl oz + 14.2 fl oz +0.25% v/v	9	20	45	45	45	45	45	11	50	57	60	60	60	60
2,4-D Amine+RUPM +Preference	24 fl oz + 21.3 fl oz +0.25% v/v	20	48	48	48	48	48	45	13	78	83	63	63	63	63
2,4-D Amine+RUPM +Preference	32 fl oz + 28.4 fl oz +0.25% v/v	33	60	60	60	60	60	60	25	87	90	85	88	77	93
RUPM+Preference	14.2 fl oz + 0.25% v/v	0	53	47	57	47	42	43	0	75	70	67	63	63	73
RUPM+Preference	21.3 fl oz + 0.25% v/v	0	52	42	50	42	33	38	0	83	82	85	70	70	92
RUPM+Preference	28.4 fl oz + 0.25% v/v	0	55	47	58	58	58	52	0	95	91	95	83	77	95
LSD (0.05)		7	7	7	5	7	7	7	4	10	11	14	12	12	12

[1] RUPM = Roundup Powermax (Glyphosate)

Table. Corn BASF 1 (Zollinger, Kazmierczak, Wirth)

Treatment[1]	Rate	28 DA POST	28 DA POST						42 DA POST	42 DA POST					
		Corn	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Corn	Yeft	Wimu	Rrpw	Colq	Hans	Cocb
	(Product/A)	-% Injury-	----------% Control----------						-% Injury-	----------% Control----------					
Engenia +Preference	6.4 fl oz +0.25% v/v	0	10	99	72	72	72	80	0	10	99	75	77	77	82
Engenia +Preference	9.6 fl oz +0.25% v/v	0	20	99	78	77	77	90	0	20	99	80	80	80	90
Engenia +Preference	12.8 fl oz +0.25% v/v	0	20	99	99	99	99	99	0	20	99	99	99	99	99
2,4-D Amine +Preference	16 fl oz +0.25% v/v	12	7	99	73	73	73	82	17	7	99	75	75	75	83
2,4-D Amine +Preference	24 fl oz +0.25% v/v	13	10	99	93	93	93	95	5	10	99	95	95	95	95
2,4-D Amine +Preference	32 fl oz +0.25% v/v	18	12	99	95	95	95	95	8	12	99	95	95	95	95
Engenia+RUPM +Preference	6.4 fl oz + 14.2 fl oz +0.25% v/v	0	77	93	82	82	82	83	0	78	95	83	83	83	85
Engenia+RUPM +Preference	9.6 fl oz + 21.3 fl oz +0.25% v/v	5	73	93	90	92	90	92	5	75	95	92	93	90	93
Engenia+RUPM +Preference	12.8 fl oz + 28.4 fl oz +0.25% v/v	15	90	99	92	92	92	93	8	90	99	93	93	93	95
2,4-D Amine+RUPM +Preference	16 fl oz + 14.2 fl oz +0.25% v/v	11	47	80	60	60	60	60	3	47	82	60	60	60	60
2,4-D Amine+RUPM +Preference	24 fl oz + 21.3 fl oz +0.25% v/v	13	78	93	75	77	75	75	8	82	93	77	78	77	77
2,4-D Amine+RUPM +Preference	32 fl oz + 28.4 fl oz +0.25% v/v	25	85	99	75	75	75	75	15	85	99	77	77	77	77
RUPM+Preference	14.2 fl oz + 0.25% v/v	0	70	83	67	67	67	75	0	70	85	68	68	68	77
RUPM+Preference	21.3 fl oz + 0.25% v/v	0	75	92	70	70	70	70	0	77	93	70	70	70	70
RUPM+Preference	28.4 fl oz + 0.25% v/v	0	90	99	73	73	73	72	0	90	99	73	73	73	72
LSD (0.05)		4	7	2	6	6	7	6	9	6	2	4	4	5	5

Glyphosate resistant ragweed control. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Mayville, ND to evaluate ragweed efficacy to PRE and POST herbicide programs. PRE treatments were applied on April 26, 2012 at 2:48 pm with 54.1 F air, 60.2 F soil at a four inch depth, 0% relative humidity, 25% cloud cover, 3 to 5 mph E wind, and adequate soil conditions. Weed species present at the time of PRE were: 0.5 to 1.5 inch (10 to 15/ft^2) common ragweed and 0.5 to 1 inch (1/yd^2) common lambsquarters. POST treatments were applied on June 1, 2012 at 9:30 am with 67 F air, 59.2 F soil at a four inch depth, 31% relative humidity, 50% cloud cover, 4 to 6 mph NW wind, and adequate soil conditions. Weed species present at the time of POST were: 2 to 4 inch (2 to 5/ft^2) common ragweed and 1 to 6 inch (15 to 25/yd^2) common lambsquarters. Soil characteristics were: 16.5% sand, 74.6% silt, 8.9% clay, silt loam texture, 3.3% OM and 6.7 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for PRE treatments and 17 gpa at 40 psi through 11002 AIXR nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

This experiment was conducted at a site with documented glyphosate resistant common ragweed. Dry conditions before and after PRE application may not have fully activated all PRE herbicides. By 28 DAT, most PRE fb POST treatments controlled weeds. POST only treatments did not control weeds. This data shows the utility and good weed management of using a soil-applied followed by POST program. Herbicides with several mechanisms of actions were used to delay weed resistance. (Dept of Plant Sciences, North Dakota State University, Fargo).

Trial. Glyphosate resistant ragweed control. (Zollinger, Wirth, Kazmierczak)										
		Prior to POST			14 DA POST			28 DA POST		
Treatments[1]	Rate	Rrpw	Colq	Corw	Rrpw	Colq	Corw	Rrpw	Colq	Corw
	(Product/A)	% Control			% Control			% Control		
PRE/POST										
Clarity	1pt									
Clarity+RUWM+CANG	1pt+32fl oz+2.5%v/v	99	98	99	99	98	73	83	73	63
Clarity+Atrazine	1pt+0.42lb									
Laudis+RUWM+CANG	3fl oz+32fl oz+2.5%v/v	99	98	99	99	99	99	99	99	99
Harness Xtra	3qt									
Sharpen+Lorox	1fl oz+1.5lb	99	97	65	99	98	97	99	98	97
Balance Flexx	2.56fl oz									
Sharpen+Atrazine	1fl oz+0.42lb	99	99	99	99	99	99	99	99	99
TripleFlex	2pt									
Laudis+Starane NXT+MSO	3fl oz+14fl oz+1%v/v	99	99	97	99	99	98	99	99	98
Harness Xtra+Clarity	3qt+16fl oz									
Impact+RUWM+MSO	0.91fl oz+32fl oz+1%v/v	99	99	99	99	99	99	99	99	99
Valor SX	1.96oz									
RUWM+FirstRate+NIS	32fl oz+0.3oz+0.25%v/v	93	85	67	93	94	81	85	82	63
Spartan	6fl oz									
RUWM+Cobra+MSO	32fl oz+12.5fl oz++1%v/v	99	98	40	99	98	99	99	98	99
Zidua	2.94oz									
Flexstar+RUWM+NIS	28fl oz+32fl oz+0.25%v/v	77	43	30	96	92	96	90	82	93
Zidua+Atrazine	2.94oz+0.42lb									
RUWM+NIS	32fl oz+0.25%v/v	95	78	60	99	99	62	99	95	75
Fierce	4.5oz									
RUWM+NIS	32fl oz+0.25%v/v	99	99	92	99	99	80	99	99	85
POST										
Gramoxone Inteon+Atrazine+PO	48fl oz+0.42lb+1%v/v	0	0	0	99	62	70	53	28	82
Gramoxone Inteon+Lorox+Atrazi	48fl oz+1.5lb+0.42lb+0.25%v/v	0	0	0	99	78	82	72	72	65
RUWM+CANG	32fl oz+2.5%v/v	0	0	0	99	99	67	82	72	53
LSD (0.05)		7	7	13	6	5	11	3	3	5

[1] RUWM = Roundup WeatherMax (Glyphosate) ; CANG = Class Act NG (Adjuvant)

Corn Kochia. Zollinger, Richard K., Angela j. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Courtenay, ND to evaluate weed efficacy to EPP, PRE, and POST herbicide application. On May 1, 2012 at 11:00 am, there was an EPP application with 62 F air, 53 F soil at a four inch depth, 83 % relative humidity, 100% cloud cover, 7.5 to 9.5 mph from the SSE, the soil surface was wet, and the subsoil was moist. A PRE application was made on May 16, 2012 at 11:49 am with 62.3 F air, 59.5 F soil at a four inch depth, 15% cloud cover, 8.5 to 9.5 mph winds from the SSE, the soil surface was dry, and the subsoil was dry. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. POST treatments were applied on June 4, 2012 at 1:50 pm with 81 F air, 76 F soil at a four in depth, dry soil surface, dry subsoil, winds were from the NW at 3 to 5 mph. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for EPP and PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

No crop was planted so level of weed control was entirely from herbicide activity. Some rain did partially activate soil-applied herbicides. Kochia control was generally excellent at 14 DA PRE. POST Roundup + AMS treatment shows that about half the kochia population was susceptible to glyphosate and half was resistant. Observation of kochia emergence in this study shows that successive flushes of kochia occurred throughout the growing season (Roundup POST only treatment) rather than almost all kochia emerging in the first two weeks in the spring which is considered normal kochia biology. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Corn Kochia (Zollinger, Kazmierczak, Wirth)

Treatment[1]	Rate	Prior to POST Kochia	14 DA PRE Kochia	28 DA PRE Kochia	42 DA PRE Kochia
	(Product/A)				
EPP/PRE/POST					
Clarity/ Harness Xtra/ RUPM+AMS	12fl oz 2.3qt 22fl oz+17lb/100gal	40	90	91	93
Clarity+Sharpen/ Harness Xtra/ RUPM+AMS	12fl oz+2fl oz 1.2qt 22fl oz+17lb/100gal	80	92	93	95
Clarity+Zidua/ Harness Xtra/ RUPM+AMS	12fl oz+2oz 1.2qt 22fl oz+17lb/100gal	65	90	92	94
Clarity+Harness Xtra/ Harness Xtra/ RUPM+AMS	12fl oz+1qt 0.6qt 22fl oz+17lb/100gal	99	98	98	98
Clarity+Harness Xtra+Balance Flexx/ Harness Xtra+Balance Flexx/ RUPM+AMS	12fl oz+1qt+1.8fl oz 0.7qt+1.2fl oz 22fl oz+17lb/100gal	98	99	99	99
Clarity+Balance Flexx/ Balance Flexx+Atrazine/ RUPM+AMS	12fl oz+1.8fl oz 1.2fl oz+0.556lb 22fl oz+17lb/100gal	70	96	98	98
Clarity+Atrazine+Zidua/ Harness Xtra+Balance Flexx/ RUPM+AMS	12fl oz+0.556lb+2oz 0.7qt+1.2fl oz 22fl oz+17lb/100gal	87	92	96	96
Clarity/ Lumax/ RUPM+AMS	12fl oz 2qt 22fl oz+17lb/100gal	65	85	91	94
Clarity+Prowl H20/ Prowl H20+Authority MTZ/ RUPM+AMS	12fl oz+1.5pt 1pt+8oz 22fl oz+17lb/100gal	63	91	95	96
Clarity+Prowl H20+Spartan/ Prowl H20+Authority MTZ/ RUPM+AMS	12fl oz+1.5pt+5fl oz 1pt+8oz 22fl oz+17lb/100gal	78	92	96	96
Clarity+Spartan/ Authority MTZ/ RUPM+AMS	12fl oz+5fl oz 8oz 22fl oz+17lb/100gal	95	97	97	97
Clarity/ Authority MTZ/ RUPM+AMS	12fl oz 12oz 22fl oz+17lb/100gal	57	93	94	95
2,4-D Ester+Zidua+Sharpen/ Authority MTZ/ RUPM+AMS	1pt+2oz+1fl oz 12oz 22fl oz+17lb/100gal	90	97	98	98
2,4-D Ester+Prowl H20+Sharpen/ Authority MTZ/ RUPM+AMS	1pt+2.5pt+1fl oz 12oz 22fl oz+17lb/100gal	85	96	97	97
EPP/POST					
Clarity+Harness Xtra/ RUPM+AMS	12fl oz+1.2qt 22fl oz+17lb/100gal	99	98	98	98
EPP/PRE					
Clarity+Zidua+Sencor/ Authority MTZ	12fl oz+2oz+8.1oz 8oz	99	99	99	99
POST					
RUPM+AMS	22fl oz+17lb/100gal	0	0	50	53
LSD (0.05)		11	6	6	6

[1] RUPM = Roundup Powermax (Glyphosate)

Corn Yellow Foxtail. Zollinger, Richard K., Angela j. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to PRE and POST herbicide application in corn. NK "N2OY-3000GT' Roundup Ready corn was planted on April 24, 2012, followed by the application of PRE treatments at 11:18 am with 75.1 F air, 58 F soil at a four inch depth, 27% relative humidity, 10% cloud cover, 1 to 3 mph winds from the E, the soil surface was dry, and subsoil was moist. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. POST treatments were applied on June 6, 2012 at 10:15 am with 78 F air, 67 F soil at a four in depth, dry soil surface, dry subsoil, the crop vigor was good and no dew present to V3 to V4 corn. Weed species present at the time of POST were: yellow foxtail 1-6" (10-25/ft^2), common cocklebur 2-4" (1-5/yd^2), common lambsquarters 3-7" (1-10/ft^2), red root pigweed 2-5" (1-10/ft^2), wild mustard 3-6" (1-10/yd^2), and 1-2" (3-5/ft^2) hairy nightshade. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for PRE treatments and 15 gpa at 40 psi through 11002 Turbo TeeJet nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Balance Flexx does not control yellow foxtail. The objective of this study was to test management systems from PRE fb POST herbicide programs. Dry conditions before and after PRE application did not activate herbicides and generally resulted in poor weed control. PRE fb POST programs used in this study provide almost weed control. This data shows the utility and good weed management of using a soil-applied followed by POST program. Herbicides with several mechanisms of actions were used to delay weed resistance. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Corn Yellow Foxtail. (Zollinger, Kazmierczak, Wirth)

		14 DAE						Prior to Post						28 DA POST					
Treatment[1]	Rate	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Cocb
	(Product/A)	% Control						% Control						% Control					
PRE/POST																			
(PRE) Balance Flexx+Atrazine (POST) Laudis+Clarity +RUPM+AMS	3oz+0.556lb 3fl oz+8fl oz +22fl oz+8.5lb/100gal	33	43	43	43	43	0	38	43	43	43	43	0	99	99	96	96	99	96
(PRE) Balance Flexx (POST) Laudis+Atrazine +RUPM+AMS	3oz 2fl oz+0.556lb +22fl oz+8.5lb/100gal	30	27	27	27	27	0	30	23	27	27	27	0	99	99	95	95	98	99
(PRE) Balance Flexx+Atrazine (POST) Capreno+Clarity +RUPM+AMS	3oz+0.556lb 3fl oz+8fl oz +22fl oz+8.5lb/100gal	45	47	47	47	47	13	45	60	50	50	43	13	99	99	99	99	99	99
(PRE) Balance Flexx (POST) Capreno+Atrazine +RUPM+AMS	3 oz 3fl oz+0.556lb +22fl oz+8.5lb/100gal	30	35	35	35	35	0	62	35	35	35	35	0	99	99	99	99	99	99
POST																			
Impact+Atrazine +MSO+AMS	0.75fl oz+0.43lb +1%v/v+8.5lb/100gal	0	0	0	0	0	0	0	0	0	0	0	0	77	99	72	88	75	99
RUPM+Impact+Atrazine +MSO+AMS	22fl oz+0.5fl oz+0.43lb +1%v/v+8.5lb/100gal	0	0	0	0	0	0	0	0	0	0	0	0	70	99	72	95	93	99
LSD (0.05)		14	18	18	18	18	17	13	15	16	16	15	17	2	0	4	3	3	2

[1] RUPM = Roundup Powermax (Glyphosate)

Corn and Wheat Herbicide Demonstration in Wheat and Roundup Ready® Corn and Sugarbeet – Moorhead, MN – 2012 (Stachler) This trial contained **ONE replication**. Therefore it is a **non-replicated** demonstration trial and data are not analyzed and statistical comparisons can't be made! The soil was tilled two or three times prior to seedbed preparation using a spring-tooth harrow. The seedbed was prepared using an 11-foot Kongskilde S-tine field cultivator equipped with rolling baskets. This site has documented glyphosate-resistant waterhemp, however due to its non-uniform distribution glyphosate-resistant waterhemp from Richland County, ND was spread on May 11. Due to exceptionally dry conditions, crops were not seeded until May 25. 'Dekalb DKC48-12 RIB' corn was seeded 2 inches deep in four - 22 inch rows at 33,000 seeds per acre. 'Crystal 985 RR' sugarbeet was seeded 1.25 inches deep in four - 22 inch rows at 60,825 seeds per acre. An eight-foot strip of 'Velva' wheat was seeded 1.5 inches deep in 7.5 inch rows at 88 pounds per acre. Herbicide treatments were applied perpendicular to crop rows on May 25, June 22, and July 5. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center 6.7 feet of 11-foot wide plots measuring 22 feet in length.

Waterhemp, common lambsquarters, and redroot pigweed control was evaluated on June 26, July 5, 16, and August 10. All evaluations were a visual estimate of percent fresh weight reduction in the treated area compared to the adjacent untreated strip. This study was for demonstration purposes only and was comprised of one replication. No analysis has been performed on the following data and comparisons among treatments can't be made using statistical analysis.

Table 1. Application Information

Application code	A	B / C1[1]	C2[2] / D[3]
Date	May 25	June 22	July 5
Time of Day	7:15 PM	12:30 PM	1:20 PM
Air Temperature (F)	60	80	88
Relative Humidity (%)	37	34	33
Wind Velocity (mph)	6	3	2
Wind Direction	NW	NNW	NW
Soil Temp. (F at 6")	53	68	85
Soil Moisture	Good	Wet	Fair
Cloud Cover	85	20	5
Corn stage (avg)	PRE	V5	-
Wheat stage (avg)	PRE	2 tillers/early joint	-
Sugarbeet stage (avg)	PRE	V4	-
Waterhemp leaf stage [min./max. (ave.)]	-	Cotyledon/13 lf(5)	-
Waterhemp height [min./max. (ave.)]	-	0.25/4" (1.2")	-
Redroot pigweed leaf stage [min./max. (ave.)]	-	Cotyledon/16 lf (11)	-
Redroot pigweed height [min./max. (ave.)]	-	0.25/5" (1.7")	-
Lambsquarters leaf stage [min./max. (ave.)]	-	Cotyledon/18 lf (8.5)	-
Lambsquarters height [min./max. (ave.)]	-	0.25/5.5" (1.5")	-

[1]C1=June 22 application was to treatments 30, 31, 32

[2]C2=July 5 application was to treatments 24, 27, 29

[3]D=July 5 application was to treatments 2 – 14

Table 2. Corn and Wheat Herbicide Demonstration in Wheat and Roundup Ready® Corn and Sugarbeet – Moorhead, MN – 2012 (Stachler).

					June 26						July 5					
					Corn	HRSW	Sgrbt	Wahe	Rrpw	Colq	Corn	HRSW	Sgrbt	Wahe	Rrpw	Colq
Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Inju			Cntrl[2]			Inju			Cntrl[2]		
	Corn herbicides				%											
1	Untreated Check				0	0	0	0	0	0	0	0	0	0	0	0
2	R.U. P.MAX	32	fl oz/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	0	80	99	99
3	Ignite 280	22	fl oz/A	BD												
	N-Pak AMS	2.6	% v/v	BD	-	-	-	-	-	-	0	92	99	70	80	90
4	Ignite 280	22	fl oz/A	BD												
	Aatrex	12	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.6	% v/v	BD	-	-	-	-	-	-	0	99	70	88	97	93
5	R.U. P.MAX	32	fl oz/A	BD												
	Aatrex	12	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	70	75	99	99
6	R.U. P.MAX	32	fl oz/A	BD												
	Aatrex	16	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	70	70	99	99
7	R.U. P.MAX	32	fl oz/A	BD												
	Aatrex	24	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	90	80	99	99
8	R.U. P.MAX	32	fl oz/A	BD												
	Status	2.5	oz/A	B												
	Induce	0.3	% v/v	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	70	80	99	99
9	R.U. P.MAX	32	fl oz/A	BD												
	Status	2.5	oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	70	80	99	99
10	R.U. P.MAX	32	fl oz/A	BD												
	Status	5	oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	70	88	99	99
11	R.U. P.MAX	32	fl oz/A	BD												
	Status	8	oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	0	99	85	83	99	99

12	R.U. P.MAX	32	fl oz/A	BD												
	Status	5	oz/A	B												
	Aatrex	12	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	5	99	99	88	99	99
13	R.U. P.MAX	32	fl oz/A	BD												
	Status	5	oz/A	B												
	Aatrex	16	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	8	99	98	83	99	99
14	R.U. P.MAX	32	fl oz/A	BD												
	Status	5	oz/A	B												
	Aatrex	24	fl oz/A	B												
	Cide Winder	1.5	pt/A	BD												
	N-Pak AMS	2.5	% v/v	BD	-	-	-	-	-	-	8	99	97	90	99	99
15	R.U. P.MAX	32	fl oz/A	B												
	Anthem ATZ	32	fl oz/A	B												
	Cide Winder	1.5	pt/A	B												
	N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	99	99	99
16	R.U. P.MAX	32	fl oz/A	B												
	Laudis	3	fl oz/A	B												
	Cide Winder	1.5	pt/A	B												
	N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	97	99	99
17	R.U. P.MAX	32	fl oz/A	B												
	Laudis	3	fl oz/A	B												
	Aatrex	12	fl oz/A	B												
	Cide Winder	1.5	pt/A	B												
	N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	99	99	99
18	R.U. P.MAX	32	fl oz/A	B												
	Laudis	3	fl oz/A	B												
	Aatrex	16	fl oz/A	B												
	Cide Winder	1.5	pt/A	B												
	N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	99	99	99
19	R.U. P.MAX	32	fl oz/A	B												
	Laudis	3	fl oz/A	B												
	Aatrex	24	fl oz/A	B												
	Cide Winder	1.5	pt/A	B												
	N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	99	99	99
20	R.U. P.MAX	32	fl oz/A	B												
	Callisto	3	fl oz/A	B												
	Aatrex	12	fl oz/A	B												
	Cide Winder	1.5	pt/A	B												
	N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	98	99	99

21 R.U. P.MAX	32	fl oz/A	B													
Impact	0.8	fl oz/A	B													
Aatrex	12	fl oz/A	B													
Cide Winder	1.5	pt/A	B													
N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	95	99	99
22 R.U. P.MAX	32	fl oz/A	B													
Capreno	3	fl oz/A	B													
Cide Winder	1.5	pt/A	B													
N-Pak AMS	2.5	% v/v	B	-	-	-	-	-	-	0	99	99	92	99	99
23 Untreated Check				0	0	0	0	0	0	0	0	0	0	0	0
24 Harness	2.5	pt/A	A													
R.U. P.MAX	32	fl oz/A	C2													
N-Pak AMS	2.5	% v/v	C2	-	-	-	-	-	-	0	50	30	99	99	80
25 Harness	2.5	pt/A	A													
Sharpen	3	fl oz/A	A	-	-	-	-	-	-	0	65	99	99	99	99
26 Verdict	15	fl oz/A	A	-	-	-	-	-	-	0	45	99	99	99	99
27 Balance Flexx	4	fl oz/A	A													
R.U. P.MAX	32	fl oz/A	C2													
N-Pak AMS	2.5	% v/v	C2	-	-	-	-	-	-	0	15	99	75	75	75
28 Zemax	2.4	qt/A	A	-	-	-	-	-	-	0	40	99	99	99	99
29 SureStart	2	pt/A	A													
R.U. P.MAX	32	fl oz/A	C2													
N-Pak AMS	2.5	% v/v	C2	-	-	-	-	-	-	0	25	80	50	95	75
Wheat herbicides																
30 Pre-Pare	0.3	oz/A	A													
Starane Ultra	5.5	fl oz/A	C1	95	0	90	40	50	50	75	15	99	20	90	35
31 Sharpen	3	fl oz/A	A													
Saber	17	fl oz/A	C1	0	0	99	90	95	85	25	15	99	75	85	80
32 Zidua	2.5	oz/A	A													
Sword	12	fl oz/A	C1	0	5	95	97	97	85	15	20	90	75	85	75
33 Huskie	11	fl oz/A	B													
N-Pak AMS	0.5	lb ai/A	B	-	-	-	-	-	-	0	5	99	83	99	99
34 Bronate Advance	0.8	pt/A	B	-	-	-	-	-	-	15	0	99	55	63	85
35 Rage D-Tech	8	fl oz/A	B	-	-	-	-	-	-	15	10	85	70	90	85
36 Weld	1	pt/A	B	-	-	-	-	-	-	0	3	99	65	65	80
37 WideMatch	0.8	pt/A	B													
Harmony (50%)	0.4	oz/A	B	-	-	-	-	-	-	10	3	98	25	95	85
38 Supremacy	5	oz/A	B													
Induce	0.3	% v/v	B	-	-	-	-	-	-	15	3	97	20	95	85
39 Orion	17	fl oz/A	B													
Induce	0.3	% v/v	B	-	-	-	-	-	-	12	5	98	60	95	70
40 Huskie Complete	14	fl oz/A	B	-	-	-	-	-	-	3	15	99	85	99	95

NO LSD since trial is NON-REPLICATED (One replication)

[1]Application codes: A = PRE; B and C1 = POST on June 22nd; C2 and D = POST on July 5th.

[2]Visual control on June 26th is from the entire treated area averaged across all crops while the visual control for waterhemp, redroot pigweed, and lambsquarters on July 5th is mostly from the area seeded to sugarbeet.

Table 3. Corn and Wheat Herbicide Demonstration in Wheat and Roundup Ready® Corn and Sugarbeet – Moorhead, MN – 2012 (Stachler).

Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Aug 10 Corn Inju	Aug 10 HRSW Inju	Aug 10 Sgbt Cntrl[2]	Aug 10 Wahe in Sgbt area Cntrl[2]	Aug 10 Wahe in Corn area Cntrl[2]	Aug 10 Wahe in HRSW area Cntrl[2]	Aug 10 Rrpw Cntrl[2]	Aug 10 Colq Cntrl[2]
	Corn herbicides				%							
1	Untreated Check				0	0	0	0	0	0	0	0
2	R.U. P.MAX	32	fl oz/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	0	70	80	35	99	98
3	Ignite 280	22	fl oz/A	BD								
	N-Pak AMS	2.6	% v/v	BD	0	99	99	75	90	70	93	80
4	Ignite 280	22	fl oz/A	BD								
	Aatrex	12	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.6	% v/v	BD	0	99	99	95	95	95	99	92
5	R.U. P.MAX	32	fl oz/A	BD								
	Aatrex	12	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	60	70	78	65	99	99
6	R.U. P.MAX	32	fl oz/A	BD								
	Aatrex	16	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	75	60	83	65	99	99
7	R.U. P.MAX	32	fl oz/A	BD								
	Aatrex	24	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	95	70	88	65	99	99
8	R.U. P.MAX	32	fl oz/A	BD								
	Status	2.5	oz/A	B								
	Induce	0.3	% v/v	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	75	65	90	68	99	99
9	R.U. P.MAX	32	fl oz/A	BD								
	Status	2.5	oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	88	90	98	85	99	98
10	R.U. P.MAX	32	fl oz/A	BD								
	Status	5	oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	98	75	97	80	99	99
11	R.U. P.MAX	32	fl oz/A	BD								
	Status	8	oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	3	99	98	85	95	85	99	99

12	R.U. P.MAX	32	fl oz/A	BD								
	Status	5	oz/A	B								
	Aatrex	12	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	0	99	99	88	95	70	99	99
13	R.U. P.MAX	32	fl oz/A	BD								
	Status	5	oz/A	B								
	Aatrex	16	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	5	99	99	70	98	97	99	99
14	R.U. P.MAX	32	fl oz/A	BD								
	Status	5	oz/A	B								
	Aatrex	24	fl oz/A	B								
	Cide Winder	1.5	pt/A	BD								
	N-Pak AMS	2.5	% v/v	BD	5	99	99	92	99	95	99	99
15	R.U. P.MAX	32	fl oz/A	B								
	Anthem ATZ	32	fl oz/A	B								
	Cide Winder	1.5	pt/A	B								
	N-Pak AMS	2.5	% v/v	B	0	99	99	92	99	85	99	95
16	R.U. P.MAX	32	fl oz/A	B								
	Laudis	3	fl oz/A	B								
	Cide Winder	1.5	pt/A	B								
	N-Pak AMS	2.5	% v/v	B	0	99	99	95	99	99	98	95
17	R.U. P.MAX	32	fl oz/A	B								
	Laudis	3	fl oz/A	B								
	Aatrex	12	fl oz/A	B								
	Cide Winder	1.5	pt/A	B								
	N-Pak AMS	2.5	% v/v	B	0	99	99	85	99	99	99	99
18	R.U. P.MAX	32	fl oz/A	B								
	Laudis	3	fl oz/A	B								
	Aatrex	16	fl oz/A	B								
	Cide Winder	1.5	pt/A	B								
	N-Pak AMS	2.5	% v/v	B	0	99	99	99	99	97	85	97
19	R.U. P.MAX	32	fl oz/A	B								
	Laudis	3	fl oz/A	B								
	Aatrex	24	fl oz/A	B								
	Cide Winder	1.5	pt/A	B								
	N-Pak AMS	2.5	% v/v	B	0	99	99	99	99	99	99	99
20	R.U. P.MAX	32	fl oz/A	B								
	Callisto	3	fl oz/A	B								
	Aatrex	12	fl oz/A	B								
	Cide Winder	1.5	pt/A	B								
	N-Pak AMS	2.5	% v/v	B	0	99	99	97	99	98	99	99

21 R.U. P.MAX	32 fl oz/A	B									
Impact	0.8 fl oz/A	B									
Aatrex	12 fl oz/A	B									
Cide Winder	1.5 pt/A	B									
N-Pak AMS	2.5 % v/v	B	0	99	99	85	99	80	99	99
22 R.U. P.MAX	32 fl oz/A	B									
Capreno	3 fl oz/A	B									
Cide Winder	1.5 pt/A	B									
N-Pak AMS	2.5 % v/v	B	3	99	99	70	95	70	99	99
23 Untreated Check			0	0	0	0	0	0	0	0
24 Harness	2.5 pt/A	A									
R.U. P.MAX	32 fl oz/A	C2									
N-Pak AMS	2.5 % v/v	C2	0	99	30	93	97	92	99	90
25 Harness	2.5 pt/A	A									
Sharpen	3 fl oz/A	A	0	70	99	99	99	99	99	99
26 Verdict	15 fl oz/A	A	0	55	99	99	99	99	99	99
27 Balance Flexx	4 fl oz/A	A									
R.U. P.MAX	32 fl oz/A	C2									
N-Pak AMS	2.5 % v/v	C2	0	99	99	65	80	97	99	99
28 Zemax	2.4 qt/A	A	0	30	99	97	99	99	95	99
29 SureStart	2 pt/A	A									
R.U. P.MAX	32 fl oz/A	C2									
N-Pak AMS	2.5 % v/v	C2	0	99	99	45	63	45	99	95
Wheat herbicides											
30 Pre-Pare	0.3 oz/A	A									
Starane Ultra	5.5 fl oz/A	C1	75	10	99	10	15	40	99	55
31 Sharpen	3 fl oz/A	A									
Saber	17 fl oz/A	C1	0	5	99	40	93	97	99	95
32 Zidua	2.5 oz/A	A									
Sword	12 fl oz/A	C1	10	5	97	35	75	98	92	99
33 Huskie	11 fl oz/A	B									
N-Pak AMS	0.5 lb ai/A	B	10	10	99	40	85	88	99	97
34 Bronate Advance	0.8 pt/A	B	10	5	99	18	45	78	83	99
35 Rage D-Tech	8 fl oz/A	B	0	15	99	20	68	99	99	99
36 Weld	1 pt/A	B	3	5	99	28	45	80	50	99
37 WideMatch	0.8 pt/A	B									
Harmony (50%)	0.4 oz/A	B	3	5	99	10	25	35	99	99
38 Supremacy	5 oz/A	B									
Induce	0.3 % v/v	B	5	10	99	10	20	38	99	99
39 Orion	17 fl oz/A	B									
Induce	0.3 % v/v	B	3	5	99	22	48	70	99	99
40 Huskie Complete	14 fl oz/A	B	8	10	99	65	85	92	99	93
			NO LSD since trial is NON-REPLICATED (One replication)							

[1]Application codes: A = PRE; B and C1 = POST on June 22nd; C2 and D = POST on July 5th.

[2]Visual waterhemp control on August 10th is only from the treated area within each seeded crop and visual redroot pigweed and lambsquarters control is averaged across all crops within the entire treated area.

Summary:
This is a **non-replicated demonstration trial**, therefore the data presented may not be accurate, however this is the only data currently available in North Dakota for control of waterhemp in corn and wheat and some accurate trends are likely demonstrated.

This location has glyphosate-resistant waterhemp as indicated by the poor control (70 to 80%) of waterhemp following two glyphosate applications. In addition, only 88% of 25 originally flagged waterhemp plants were controlled following two glyphosate applications and none of the best surviving plants that were flagged following the first glyphosate application and prior to the second application were controlled on August 10th.

The presence of a crop canopy is extremely critical to maximizing weed control following herbicide applications as evidenced by the waterhemp control on August 10th with the various wheat herbicides. The hard-red spring wheat competed against waterhemp better than corn as evidenced by the 3 to 35% improvement of waterhemp control in the spring wheat compared to corn. The presence of a spring wheat canopy compared to the bare-ground area initially planted to sugarbeet improved waterhemp control the greatest at 79% with the Rage D-Tech treatment.

Verdict (15 fl oz/A), Harness (2.5 pt/A) plus Sharpen (3 fl oz/A), and Zemax (2.4 qt/A) controlled greater than 96% of waterhemp without a POST herbicide application of any type. The only other PRE followed by POST herbicide treatment controlling greater than 80% of waterhemp was Harness (2.5 pt/A) followed by glyphosate at least at 92%. All POST herbicide treatments controlled greater than 94% of waterhemp in the corn area, except glyphosate alone, glyphosate plus atrazine, Ignite alone, and glyphosate plus Status (2.5 oz/A) plus Induce (NIS). However, Capreno, Impact plus atrazine, and Status plus glyphosate usually controlled less than 86% of the waterhemp in the wheat and sugarbeet areas of the treatments, indicating little to no soil residual weed control and/or the presence of herbicide-resistant biotypes. The lack of complete control of waterhemp with atrazine is likely due to a resistant biotype which has recently been confirmed in this waterhemp population with preliminary greenhouse testing. However, atrazine likely improved waterhemp control when applied at 24 fl oz/A and definitely when applied with Ignite (glufosinate – Liberty) and HPPD inhibiting herbicides. Status should not be applied at 2.5 oz/A to control glyphosate-resistant waterhemp.

Only Sharpen followed by Saber, Zidua followed by Sword, Rage D-Tech, and Huskie Complete controlled greater than 90% of waterhemp in hard-red spring wheat, meaning few herbicide options are likely available to manage waterhemp in wheat.

PRE Weed Control in Soybean. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy in Roundup Ready soybean. 'A1026505' Roundup Ready soybean was planted on May 2, 2012. PRE treatments were applied on May 8, 2012 at 9:50 am with 50.5 F air, 46 F soil at a four inch depth, 89% relative humidity, 100% cloud cover, 4 to 6 mph winds from the N, moist soil surface, moist subsoil. POST glyphosate treatment was applied June 22, 2012 at 5:00 pm with 80 F air, 83 F soil at a four inch depth, 36% relative humidity, 0% cloud cover, 4-6 mph winds from the ENE, and adequate soil moisture. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The population of weeds was high for each species. No herbicide activating rainfall occurred after application. Conditions for most of the summer were hot with almost no rainfall. As a result PRE herbicides were not sufficiently activated allowing weed seed germination. The high infestation of weeds made it difficult to detect changes in weed control at each evaluation. The late season application of glyphosate significantly improved weed control. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. PRE weed control in soybean. (Zollinger, Wirth, Kazmierczak)

		14 DA PRE							28 DA PRE							45 DA PRE							14 DA POST & 28 DA POST						
Treatments	Rate	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	% Control							% Control							% Control							% Control						
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRE																													
MANA 14204	2pt	70	80	63	57	67	40	20	68	83	63	57	67	37	20	68	90	63	57	67	37	20	98	98	98	92	90	92	98
MANA 14204	3pt	73	87	72	72	75	50	20	73	87	72	68	75	50	20	73	87	72	68	75	50	20	99	99	99	90	90	90	99
Prefix	2pt	60	57	50	50	57	30	20	57	57	50	43	57	23	20	67	63	70	43	57	23	20	99	99	99	90	90	90	99
MANA 14223	20fl oz	43	40	40	40	40	27	20	43	40	40	40	40	27	20	60	40	40	40	40	27	20	99	99	99	90	90	90	99
MANA 14223	2pt	60	57	57	57	57	27	20	60	60	60	60	60	27	20	68	60	60	60	60	27	20	99	99	99	90	90	90	99
Boundary	20fl oz	50	40	40	40	40	27	20	50	40	40	40	37	27	20	67	63	60	62	67	37	20	99	99	99	71	90	70	99
Valor SX+Reflex	2oz+1pt	92	92	85	70	85	37	20	92	92	85	75	85	37	20	92	92	91	92	93	37	20	99	99	99	90	90	90	99
MANA 25311	1.65pt	90	90	23	47	70	30	20	90	90	40	53	70	30	20	90	90	68	68	85	48	20	99	99	99	90	90	90	99
MANA 25311	2.19pt	90	90	60	60	77	33	20	90	90	82	73	82	37	20	90	90	92	67	82	33	20	99	99	99	90	90	90	99
MANA 25350	0.75pt	90	90	60	60	78	37	20	90	90	67	62	78	40	20	90	90	83	62	78	40	20	99	99	99	90	90	90	99
MANA 25350	1pt	83	88	53	47	70	30	20	83	88	57	43	70	30	20	90	92	67	43	70	30	20	99	99	99	90	90	90	99
Valor SX+Pursuit	2oz+3fl oz	90	90	73	73	82	37	23	90	90	87	83	83	48	38	90	90	87	83	83	48	38	99	99	99	87	87	87	99
Valor SX	2oz	70	85	57	57	60	27	20	70	85	57	57	63	27	20	82	87	57	57	63	27	20	99	99	99	90	90	90	99
Pursuit	4fl oz	80	83	68	60	68	30	20	88	90	87	62	78	33	20	88	90	87	67	78	33	20	99	99	99	90	90	90	99
Sencor	10oz	83	73	62	57	72	33	20	83	77	65	57	72	33	20	93	93	68	47	72	33	20	99	99	99	90	90	90	99
Valor XLT	3oz	87	92	78	65	73	40	23	90	93	88	68	82	58	32	96	99	95	92	95	83	43	99	99	99	92	92	92	99
POST																													
Roundup PowerMax	22fl oz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99	99	90	70	83	73	90
LSD (0.05)		11	7	13	12	8	12	3	11	6	9	10	8	9	2	6	4	7	9	7	9	2	1	1	1	3	3	3	1

Post Weed Control in Soybean. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy in Roundup Ready soybean. Asgrin 'AG0832' Roundup Ready soybean was planted on May 2, 2012. POST treatments were applied on June 6, 2012 at 10:40 am with 78 F air, 67 F soil at a four inch depth, 64% relative humidity, 100% cloud cover, 3 to 5 mph winds from the SE, dry soil surface, dry subsoil, good crop vigor, and no dew present to 6 inch (V2-V3) soybean. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. Weed species present at the time of POST weeds were: 1 to 6 inch (3 to15/ft^2) common lambsquarters; 6 to 10 inch (2 to 5/yd^2) wild mustard; 3 inch (10 to 20/ft^2) redroot pigweed; 1 to 4 inch (1 to 5/ft^2) common ragweed; 1 to 3 inch (2 to15/ft^2) yellow foxtail; 7 to 8 inch (1 to 5/yd^2) wild buckwheat; 1 to 3 inch (1 to 10/ft^2) common cocklebur. POST Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8 gpa at 40 psi through 11001 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The population of weeds was high for each species. Drought conditions existed for most of the summer which resulted in drought stressed weeds. Weed size at application was taller than desired which may be another indication of poor weed control. The high infestation of weeds made it difficult to detect changes in weed control at each evaluation. (Dept of Plant Sciences, North Dakota State University, Fargo).

Trial. Post weed control in soybean. (Zollinger, Wirth, Kazmierczak)

		7 DAT	14 DAT	28 DAT	42 DAT	14 DAT							28 DAT							42 DAT						
Treatments	Rate	Soybean	Soybean	Soybean	Soybean	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	% Injury	% Injury	% Injury	% Injury	% Control							% Control							% Control						
MANA 14201+NIS	1pt+0.25%v/v	3	0	0	0	20	99	55	40	52	50	53	20	99	58	40	62	50	53	20	99	58	40	62	50	53
MANA 14201+NIS	1.6pt+0.25%v/v	10	3	0	0	25	99	55	38	50	50	53	25	99	62	38	50	50	57	25	99	65	38	50	50	60
Flexstar	1pt	6	5	0	0	20	99	50	40	50	50	53	20	99	50	40	50	50	53	20	99	50	40	50	50	53
Flexstar+NIS	1.6pt+0.25%v/v	6	6	0	0	23	98	60	40	50	50	53	23	98	60	40	50	50	53	23	98	60	40	50	50	53
MANA 14204+NIS	2pt+0.25%v/v	11	10	0	0	20	99	43	35	43	42	45	20	99	43	35	43	42	45	20	99	43	35	43	42	45
MANA 14204+NIS	2.33pt+0.25%v/v	13	11	0	0	7	99	52	40	50	50	50	7	99	52	40	50	50	50	7	99	58	45	50	50	58
Prifix+NIS	2.33pt+0.25%v/v	15	10	0	0	7	99	55	35	45	40	33	7	99	55	35	45	40	33	7	99	55	35	45	40	33
MANA 25311+NIS	1.5pt+0.25%v/v	4	3	0	0	57	99	53	40	50	50	53	73	99	57	40	50	50	53	73	99	57	40	50	50	53
MANA 25311+NIS	2pt+0.25%v/v	11	7	0	0	68	99	78	57	75	73	79	73	99	82	68	78	77	81	73	99	85	72	80	78	82
MANA 25350+NIS	0.75pt+0.25%v/v	3	2	0	0	50	99	50	20	37	37	47	57	99	57	40	37	37	47	57	99	57	40	37	37	47
MANA 25350+NIS	1pt+0.25%v/v	5	2	0	0	50	99	57	22	40	40	47	70	99	57	22	40	40	47	70	99	60	35	47	43	50
Warrant+NIS	2.25pt+0.25%v/v	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pursuit	4fl oz	0	0	0	0	50	99	57	40	50	50	50	67	99	57	40	50	50	50	67	99	57	40	50	50	50
Roundup PowerMax	22fl oz	0	0	0	0	99	99	97	86	90	90	93	88	99	72	86	90	90	93	88	99	72	78	82	73	82
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		2	3	0	0	8	1	6	8	6	7	10	9	1	7	6	5	7	10	9	1	5	7	6	7	9

PRE & EPOST Weed Control in Soybean. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy in PRE and EPOST Roundup Ready soybean. 'AG0801' Roundup Ready soybean was planted on April 30, 2012. PRE treatments were applied on May 1, 2012 at 9:40 am with 61 F air, 51.8 F soil at a four inch depth, 80% relative humidity, 100% cloud cover, 3 to 5 mph winds from the S, dry soil surface, and dry subsoil. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. EPOST treatments were applied on June 6, 2012 at 10:05 am with 78 F air, 67 F soil at a four inch depth, 64% relative humidity, 100% cloud cover, 3 to 5 mph winds from the SW, dry soil surface, dry subsoil, good crop vigor, and no dew present toV2-V3 soybean. Weed species present at the time of EPOST weeds were: 1 to 4 inch (1 to10/yd^2) common ragweed; 2 to 6 inch (1 to 25/ft^2) yellow foxtail; 2 to 3 inch (1 to 5/yd^2) common cocklebur; 1 to 9 inch (1 to 10/ft^2) common lambsquarter; 0.5 to 3 inch (1 to10/ft^2) redroot pigweed. PRE and EPOST treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The population of weeds was high for each species. No herbicide activating rainfall occurred after application. Conditions for most of the summer were hot with almost no rainfall. As a result PRE herbicides were not sufficiently activated allowing weed seed germination. The high infestation of weeds made it difficult to detect changes in weed control at each evaluation. Most treatments including glyphosate significantly improved weed control. PRE fb POST programs used in this study provide almost weed control. This data shows the utility and good weed management of using a soil-applied followed by POST program. Herbicides with several mechanisms of actions were used to delay weed resistance. (Dept of Plant Sciences, North Dakota State University, Fargo).

Trial. PRE and EPOST weed control in soybean. (Zollinger, Wirther, Kazmierczak)

						Prior to POST						14 DA POST							28 DA POST & 42 DA POST						
Treatments	Rate	Soybean	Soybean	Soybean	Soybean	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	% Inj	% Inj	% Inj	% Inj	% Control						% Control							% Control						
PRE																									
Zidua	5.04oz	0	0	0	0	63	43	43	47	43	23	82	50	57	47	40	23	20	82	50	30	20	40	20	20
Zidua+Sharpen	3.36oz+1fl oz	0	0	0	0	70	87	83	53	83	43	77	53	83	47	30	20	20	70	50	80	37	30	20	20
Zidua+Spartan	3.36oz+4fl oz	0	0	0	0	70	92	92	72	92	50	77	68	92	62	27	20	20	67	72	92	62	27	20	20
Fierce	3oz	0	0	0	0	70	90	72	53	72	53	22	63	50	40	53	30	20	22	63	50	40	53	30	20
Fierce	3.75oz	0	0	0	0	68	93	93	65	93	67	40	78	70	47	50	20	20	30	87	70	47	50	20	20
Fierce	4.5oz	0	0	0	0	70	92	85	65	92	63	57	88	83	68	82	23	23	50	88	83	68	82	23	23
Classic+Valor SX+V-10206	0.35oz+2oz+1.5oz	0	0	0	0	72	99	95	72	99	72	85	99	95	75	99	38	90	85	99	95	75	99	38	90
Gangster FirstRate+Gangster Valor	0.4oz+2oz	0	5	5	5	99	99	99	99	99	99	99	99	99	99	99	67	90	99	99	99	99	99	67	90
EPOST																									
Rhythm+Glyfos X-tra+MSO+AMS	25.5fl oz+1qt+1%v/v+8.5lb/100gal	0	15	10	10	0	0	0	0	0	0	99	99	99	99	99	99	99	99	99	99	99	99	99	99
Dawn+Glyfos X-tra+MSO+AMS	24fl oz+1qt+1%v/v+8.5lb/100gal	0	12	10	10	0	0	0	0	0	0	99	99	99	99	99	99	99	99	99	99	99	99	99	99
Prefix+Glyfos X-tra+MSO+AMS	32fl oz+1qt+1%v/v+8.5lb/100gal	0	22	22	20	0	0	0	0	0	0	99	99	99	99	99	99	99	99	99	99	99	99	99	99
CHA-044+Glyfos X-tra+MSO+AMS	32fl oz+1qt+1%v/v+8.5lb/100gal	0	13	15	15	0	0	0	0	0	0	87	99	99	99	99	99	99	95	99	99	90	99	99	99
CHA-044+Glyfos X-tra+MSO+AMS	40fl oz+1qt+1%v/v+8.5lb/100gal	0	15	15	15	0	0	0	0	0	0	89	96	99	99	99	99	99	89	96	99	85	99	99	99
PRE/EPOST																									
Authority First	3oz																								
Durango+AMS	24fl oz+8.5lb/100gal	0	18	18	15	30	50	50	47	47	43	95	99	99	99	99	99	99	95	99	99	99	99	99	99
Authority First	4.5oz																								
Durango+AMS	24fl oz+8.5lb/100gal	0	0	0	0	47	67	67	67	67	60	99	99	99	86	99	86	99	99	99	99	86	99	86	99
EPOST/POST																									
Durango+First Rate+AMS	24fl oz+0.3oz+8.5lb/100gal																								
Durango+AMS	24fl oz+8.5lb/100gal	0	13	22	15	0	0	0	0	0	0	99	99	99	73	86	95	99	99	99	99	84	86	95	99
LSD (0.05)		0	3	2	0	8	7	8	11	8	8	9	6	4	5	4	5	2	3	5	2	5	4	4	2

Weed control with Zidua herbicide in soybean, Carrington, 2012. Greg Endres and Mike Ostlie. The experiment was conducted at the NDSU Carrington Research Extension Center in cooperation with BASF to evaluate soybean weed control with Zidua and other soil-applied herbicides. Experimental design was a randomized complete block with three replicates. The field trial was established on a conventionally-tilled Heimdal-Emrick loam soil with 3.1% organic matter and 6.4 pH. Treatments were applied with a hand-held boom sprayer delivering 14 gal/A at 35 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 25-ft plots. Preplant treatments were applied on May 17 with 85 F, 24% RH, and 9 MPH wind and incorporated with a field cultivator plus harrow set at a soil depth of 1 to 2 inches. Asgrow 'AG0430' Roundup Ready soybean seed was inoculated and planted at 175,000 seeds/A on May 18 in 30-inch rows. POST treatments were applied on June 22 with 68 F, 65% RH, and 4 mph wind to 2-trifoliate soybean, 1- to 4-inch tall green and yellow foxtail, 0.5- 4-inch tall common lambsquarters, and 2- to 4-inch tall wild buckwheat. The trial was harvested for seed yield on September 25.

Soybean emerged about June 3 and no crop response from PPI herbicides was noted on June 12. Foxtail control with soil-applied treatments when visually evaluated on June 15 was good to excellent (81 to 90%) with treatments 1-3 and 9 (Table). Also, common lambsquarters and wild buckwheat control with soil-applied herbicides was excellent, except generally with Sharpen as the only soil-applied treatment. Weed control following POST treatments was good to excellent (87 to 99%). Soybean grain yield and test weight was similar among treatments.

Table.

Herbicide				Weed control (%)[1]						Soybean	
Treatment[2]		Rate	Timing[3]	15-Jun			19-Jul			Yield	Test weight
No.		fl oz product/A		fota	cola	wibw	grass	cola	wibw	bu/A	lb/bu
1	Zidua + Sharpen	2.5 oz wt + 1	PPI	81	92	92	92	99	88	51.3	56.7
2	Zidua + Sharpen	2 oz wt +1	PPI	81	90	96	91	99	90	48.6	56.3
3	Verdict + Outlook	5 + 12	PPI	90	97	99	94	99	98	48.3	56.5
4	Valor	3 oz wt	PPI	75	98	99	92	99	99	49.8	56.6
5	Valor + Zidua	2 oz wt + 1.5 oz wt	PPI	78	91	97	92	99	97	51.2	56.4
6				0	0	0	95	98	91	47.4	56.8
7	Sharpen	1	PPI	58	80	81	97	98	87	48.3	56.5
	Extreme	36	POST								
8	Sharpen	1	PPI	68	87	91	97	99	96	47.3	56.5
	Zidua	1.5 oz wt	POST								
9	Zidua + Sharpen + Extreme	2 oz wt + 1 + 24	PPI	88	99	99	94	99	99	49.0	56.8
10	Authority MTZ	16 oz wt/A	PPI	72	99	99	92	99	99	47.9	56.5
C.V. (%)				8.2	6.4	8.8	2.4	0.5	6.0	4.7	0.6
LSD (0.05)				10	9	13	4	1	NS	NS	NS

[1]fota=green and yellow foxtail; cola=common lambsquarters; wibw=wild buckwheat; grass=green and yellow foxtail, and barnyardgrass.

[2]All treatments except #7 include POST Roundup PowerMax at 22 fl oz/A plus Class Act NG at 2.5% v/v.

[3]PPI=May 17; POST=June 22.

Soybean response to plant protection inputs, Carrington, 2012. Greg Endres and Mike Ostlie. The experiment was conducted at the NDSU Carrington Research Extension Center in cooperation with BASF to evaluate soybean yield response to preplant (PP) weed control followed by post-emergence (POST) application of a foliar fungicide and insecticide. Experimental design was a randomized complete block with four replicates. The field trial was established on a conventionally-tilled Heimdal-Emrick loam soil with 3.1% organic matter and 6.4 pH. Treatments were applied with a hand-held boom sprayer delivering 13 gal/A at 35 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 40-ft plots. PP herbicides were applied on May 17 with 88 F, 19% RH, and 9 MPH wind and incorporated with a field cultivator plus harrow set at a soil depth of 1 to 2 inches. Asgrow AG0430 and Integra 20090 Roundup Ready soybean seed were inoculated and planted at 175,000 seeds/A on May 18 in 30-inch rows. POST glyphosate (Roundup PowerMax) was applied at 0.75 lb ae/A plus NIS+AMS (Class Act NG) at 2.5% v/v on June 29 with 71 F, 62% RH, and 5 mph wind to 4-trifoliate soybean, 1- to 6-inch tall green and yellow foxtail, 1- to 10-inch tall common lambsquarters, and 1- to 5-inch tall wild buckwheat. Priaxor fungicide was applied solely at 4 oz product/A plus NIS (Preference) 0.25% v/v or as a tank mixture with Fastac insecticide at 4 oz product/A on July 23 with 77 F, 64% RH, and 7 mph wind to R3 (initial pod development) soybean. The trial was harvested for seed yield on September 25.

No crop response was observed from soil-applied herbicides when evaluated on June 30. Foliar disease notes were not recorded on August 9 due to minimal presence of disease. Seed yield of Asgrow AG0430 was 36.2 bu/A compared to 33.6 bu/A with Integra 20090 (LSD 0.05 = 2.1 bu/A). Weed control was excellent (95-98%) with Sharpen + Zidua followed by POST glyphosate (Table). Seed yield, test weight, seed count, oil, and protein were similar among POST pesticide treatments.

Table.

Pesticide		Weed control (%)[1]				Soybean				
Treatment[2]		30-Jun		30-Jul		Yield	Test weight	Seeds/lb	Oil	Protein
No.	Description	fota	cola	grass	cola	bu/A	lb/bu		%	%
1	untreated check	0	0	0	0	7.7	56.3	2729	19.9	32.2
2	glyphosate	72	71	95	98	44.7	56.3	2756	21.3	30.6
3	glyt + Priaxor at 4 fl oz/A + NIS at 0.25% v/v	72	71	96	98	43.3	56.2	2695	21.3	30.4
4	glyt + Priaxor at 4 fl oz/A + Fastac at 4 fl oz/A + NIS at 0.25% v/v	68	68	95	98	43.9	56.2	2664	21.3	30.5
C.V. (%)		5.9	5.2	2.6	2.6	8.1	0.4	5.1	1.7	1.6
LSD (0.05)		4	3	2	2	2.9	NS	NS	0.4	0.5

[1]fota=green and yellow foxtail; cola=common lambsquarters; grass=green and yellow foxtail, and barnyardgrass.

[2]Treatments 2-4 include PPI Sharpen at 1 fl oz/A + Zidua at 2.5 fl oz/A on May 17 and POST glyphosate (Roundup PowerMax at 22 fl oz/A plus Class Act NG at 2.5% v/v) on June 29. Fungicide (Priaxor) and insecticide (Fastac) + NIS (Preference) applied on July 23.

Timing of weed control in soybean, Carrington, 2012. Greg Endres and Mike Ostlie. The study is being conducted to build a North Dakota database documenting response of soybean to initial timing of weed control. Experimental design was a randomized complete block with four replicates. The field trial was conducted at the NDSU Carrington Research Extension Center on a conventionally-tilled Heimdal-Emrick loam soil with 3.1% organic matter and 6.4 pH with spring wheat as the previous crop. 'DSR0401' Roundup Ready inoculated soybean was planted May 15 in 14-inch rows. Treatments were applied with a hand-held boom sprayer delivering 17 gal/A (PPI) or 10 gal/A (POST) at 35 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 25-ft plots. Sharpen at 1 fl oz/A plus Zidua at 2.5 oz wt/A was PPI on May 14 with 83 F, 10% RH, and 13 mph wind and incorporated twice at 1- to 2-inch depth with a field cultivator plus harrow. Table 1 provides POST application details for glyphosate (Roundup Powermax at 22 fl oz/A plus Class Act NG at 2.5% v/v). The trial was harvested for grain yield on September 25.

Table 1. POST glyphosate application details for soybean response to timing of weed control, Carrington, 2012.

Application date	POST treatment	Soybean[1]		Average weed height	Weed density[2]		Environment			
		Stage	Plant height		Grass	Broad-leaf	Air temp.	RH	Wind speed	Clouds
			inches	inches	square foot		F	%	MPH	%
15-Jun	A	V1	2 to 4	2	13	5	77	34	3	35
29-Jun	B	V4	6 to 8	6 to 8	36	10	68	66	6	0
11-Jul	C	V6 to R1	15 to16	16	NA	NA	80	65	9	15
21-Jul	D	R2	NA	NA	NA	NA	86	52	7	25

[1]Soybean density on June 28 averaged 196,340 plants/A.

[2]Grass weeds include green and yellow foxtail, and barnyardgrass; Broadleaf weeds include common lambsquarters, and redroot and prostrate pigweed.

Plant maturity was delayed 3 to 6 days with the latest initial POST application of glyphosate (POSTC) or the untreated check compared to earlier weed control treatments (Table 2). Seed yield (45.5 and 47.1 bu/acre) was highest with initial weed control at planting or early POST. Yield was reduced 4, 17, and 47% with initial POSTA, POSTB, and POSTC treatments, respectively, compared to initial weed control at planting. Seed oil was higher but was offset by lower protein with the three early herbicide treatments compared to POSTC or untreated check.

Table 2. Soybean response to timing of weed control, Carrington, 2012.

Treatment		Physiological maturity	Seed yield	Test weight	Seeds/lb	Oil	Protein
Number	Description[1]	Jday	bu/A	lb/bu		%	
1	untreated	264	12.5	57.1	2890	18.8	32.9
2	PRE/POSTA/POSTD	258	47.1	56.8	2955	19.9	30.4
3	POSTA/POSTD	258	45.5	56.8	3000	19.9	30.7
4	POSTB	259	39.3	56.6	3040	20.0	31.1
5	POSTC	262	25.1	56.5	2890	19.1	32.5
C.V. (%)		0.4	13.4	0.5	1.8	1.0	1.5
LSD (0.05)		2	7.0	NS	85	0.3	0.7

[1]PPI=Sharpen at 1 fl oz/A plus Zidua at 2.5 oz wt/A;POSTA-D=Roundup Powermax at 22 fl oz/A plus Class Act NG at 2.5% v/v.

Timing of weed control in soybean, Langdon, 2012. Bryan Hanson and Richard Wilhelmi. A field study was conducted at the NDSU Langdon Research Extension Center to evaluate the response of soybean to initial timing of weed control. Experimental design was a randomized complete block with four replications. The soil type was a Svea-Barnes loam with 4.4 % organic matter and a pH of 6.6 with spring wheat as the previous crop. Pioneer '900Y71' Roundup Ready inoculated soybean was seeded on May 22 in 6-inch rows in plots that were was 3.5 ft x 16 ft with borders on either side. Herbicide treatments were applied with a hand-held boom delivering 10 gal/A at 40 PSI through 8001 flat fan nozzles. Application information for the herbicide treatments are given in Table 1. The trial was rototilled twice at 2-3 inches after the application of Sharpen and Zidua. The trial was harvested on September 20.

Table 1. Application details for soybean response to timing of weed control, Langdon 2012.

Treatment		Rate	Application		Soybean[2]		Environment		
		fl oz	Timing	Date	Stage	Plant Ht	Air Temp.	RH	Wind
ID	Description	product/A				in	F	%	MPH
1	Untreated Check								
2	Sharpen + Zidua +	1+2.5 oz wt	PPI	May 22			57	87	12
	RU[1] + Kicker-AMS 2.5% v/v	22	POST	June 21	V1-2	2	70	58	15
3	RU + Kicker-AMS 2.5% v/v	22	POST	June 21	V1-2	2	70	58	15
4	RU + Kicker-AMS 2.5% v/v	22	POST	June 26	V2-3	6	72	78	11
5	RU + Kicker-AMS 2.5% v/v	22	POST	July 3	V3-4	8	75	76	3

[1]RU=Roundup Powermax
[2]Soybean density on June 18 average 177,800 plants/A

Weed densities were reduced 67% using the Sharpen and Zidua PPI prior to the sequential RU treatment when compared to the untreated check (Table 2). No significant difference in yield was observed between the four herbicide treatments, however, the average yield of treatments 2, 3 and 4 was numerically 4.6 bu/A higher than the latest herbicide application. The average yield of all herbicide treatments was 70% greater than the untreated check.

Table 2. Soybean response to timing of weed control, Langdon 2012.

Treatment ID	Weed Height	Weed[1] Density- June 18	Yield
	in	Plants/ft^2	bu/A
1		70	13.7
2	2-4	23	47.5
3	2-4	89	47.8
4	4-8	86	46.4
5	8-20	72	42.6
C.V. %		32.4	10.9
LSD (0.05)		34	6.6

[1]Weeds consisted of mostly wild mustard, lambsquarters, redroot pigweed, smartweed, wild buckwheat and wild oats.

Liberty in LL soybean. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to PRE and POST herbicide programs in soybean. Peterson Farm 'L05-11N' Liberty Link soybean was planted on April 30, 2012, followed by the application of PRE treatments on May 1, 2012 at 9:30 am with 61 F air, 51.8 F soil at a four inch depth, 80% relative humidity, 100% cloud cover, 3 to 5 mph S wind, dry soil surface, and moist subsoil. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. POST (10-14 DAE) treatments were applied on May 31, 2012 at 11:20 am with 76.5 F air, 61.4 F soil at a four inch depth, 24% relative humidity, 15% cloud cover, 0.5 to 1.5 mph NNE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V1 soybean. Weed species present at the time of POST (10-14 DAE) were: 0.5 to 2 inch (1 to 15/ft^2) yellow foxtail; 1 to 3 inch (1/yd^2) Marshelder; 1 to 2 inch (2 to 5/ft^2) redroot pigweed; 1 to 6 inch (1 to 5/yd^2) wild mustard; and 1 to 4 inch (1 to 5/ft^2) common ragweed. POST (V3) treatments were applied on Jun 6, 2012 at 9:55 am with 78 F air, 67 F soil at a four inch depth, 64% relative humidity, 100% cloud cover, 3 to 5 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V2 to V3 soybean. Weed species present at the time of POST (V3) were: 1 to 6 inch (1 to 15/ft^2) yellow foxtail; 1 to 3 inch (1-5/yd^2) Marshelder; 1 to 3 inch (1 to 10/ft^2) redroot pigweed; 1 to 6 inch (1 to 3/yd^2) wild mustard; 1 to 4 inch (1 to 5/ft^2) common ragweed; 1 to 3 inch (1 to 10/yd^2) hairy nightshade; and 1 to 3 inch (1 to 2/yd^2) common mallow. POST (12" weed) treatments were applied on Jun 12, 2012 at 4:15 pm with 74 F air, 73 F soil at a four inch depth, 30% relative humidity, 0% cloud cover, 6 to 8 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V3 to V4 soybean. Weed species present at the time of POST (12" weed) were: 10 to 13 inch (10 to 20/ft^2) yellow foxtail; 11 to 13 inch (1-5/yd^2) Marshelder; 12 to 14 inch (20 to 25/ft^2) redroot pigweed; 18 to 20 inch (1 to 10/yd^2) wild mustard; 12 to 14 inch (1 to 5/ft^2) common ragweed; 11 to 13 inch (5 to 10/yd^2) hairy nightshade; 12 to 14 inch (1 to 10/yd^2) common lambsquarters; and 12 to 14 inch (1 to 10/yd^2) common cocklebur. POST (12-16 DA-B) treatments were applied on Jun 12, 2012 at 4:00 pm with 74 F air, 73 F soil at a four inch depth, 30% relative humidity, 0% cloud cover, 6 to 8 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V3 to V4 soybean. Weed species present at the time of POST (12-16 DA-B) were: 2 to 3 inch (5 to 15/ft^2) yellow foxtail. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Dry conditions before and after PRE application did not activate herbicides and generally resulted in reduced weed control. Hot temperatures and high light environmental conditions enhanced activity of Liberty. This data shows the utility and good weed management of using a soil-applied followed by POST program. Herbicides with several mechanisms of actions were used to delay weed resistance. This data also shows that application to small weeds is preferential to large weeds. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Liberty in LL soybean. (Zollinger, Wirth, Kazmierczak).

		Prior to POST	72 DAT-E	Prior to POST							72 DAT-E							
Treatments	Rate	Soys	Soys	Yeft	Wimu	Rrpw	Colq	Ebns	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Ebns	Mrsh	Corw	Cocb
	Product/A	% Injury	% Injury	% Control							% Control							
PRE/10-14 DAE																		
Authority First	6oz																	
Liberty+Dual II Magnum+AMS	29fl oz+1.33pt+8.5lb/100gal	0	13	30	60	60	70	70	50	50	95	99	99	99	99	85	86	99
Authority First	6oz																	
Liberty+Zidua+AMS	29fl oz+2.5oz+8.5lb/100gal	0	22	30	60	60	70	70	50	50	99	99	99	99	99	99	99	99
PRE/10-14 DAE/12-16 DAB																		
Authority First	6oz																	
Liberty+Dual II Magnum+AMS	29fl oz+1.33+8.5lb/100gal																	
Warrant+AMS	1.5qt+8.5lb/100gal	0	15	30	60	60	70	70	50	50	99	99	99	99	99	90	90	99
PRE/V3 Soy																		
Authority First	6oz																	
Liberty+Dual II Magnum+AMS	29fl oz+1.33pt+8.5lb/100gal	0	20	30	60	60	70	70	50	50	93	99	99	99	99	90	95	99
12" weeds																		
Liberty+AMS	87fl oz+8.5lb/100gal	0	0	0	0	0	0	0	0	0	53	99	62	57	63	67	60	63
12" weeds/5-7 DAD																		
Liberty+AMS	43fl oz+8.5lb/100gal																	
Liberty+AMS	43fl oz+8.5lb/100gal	0	0	0	0	0	0	0	0	0	99	99	99	99	99	99	99	99
Liberty+AMS	36fl oz+8.5lb/100gal																	
Liberty+AMS	29fl oz+8.5lb/100gal	0	0	0	0	0	0	0	0	0	99	99	99	99	99	99	99	99
LSD (0.05)		0	6	0	0	0	0	0	0	0	4	0	2	4	4	4	1	4

Liberty application timing in soybean. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to different timings of POST Libery treatments in soybean programs. Peterson Farms 'L05-11N' Liberty Link soybean was planted on April 30, 2012. POST 2" weed treatments were applied on May 31, 2012 at 11:25 am with 76.5 F air, 61.4 F soil at a four inch depth, 24% relative humidity, 15% cloud cover, 0.5 to 1.5 mph NNE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V1 soybean.Weed species present at the time of POST 2" weeds were: 1 to 5 inch (10 to 25/ft^2) yellow foxtail; 2 to 4 inch (1 to 5/yd^2) common lambsquarters; 0.5 to 4 inch (10 to 25/ft^2) redroot pigweed; 1 to 3 inch (1 to 5/yd^2) hairy nightshade; 2 to 12 inch (3 to 10/yd^2) wild mustard; 1 to 3 inch (1 to 2/yd^2) common ragweed; 1 to 2 inch (1/yd^2) common mallow; and 1 to 3 inch (2 to 10/yd^2) wild buckwheat. POST 4" weeds treatments were applied on June 6, 2012 at 10:00 am with 78 F air, 67 F soil at a four inch depth, 64% relative humidity, 100% cloud cover, 3 to 5 mph SE wind, dry soil surface, dry subsoil, good crop vigor, and no dew present to V2 to V3 soybean. Weed species present at the time of POST 4" weeds were: 2 to 5 inch (10 to 25/ft^2) yellow foxtail; 3 to 5 inch (1 to 5/yd^2) common lambsquarters; 0.5 to 4 inch (10 to 25/ft^2) redroot pigweed; 2 to 4 inch (1 to 5/yd^2) hairy nightshade; 3 to 8 inch (1 to 5/yd^2) wild mustard; 2 to 4 inch (1 to 3/yd^2) common ragweed; 3 to 5 inch (1 o 5/yd^2) marshelder; and 6 to 8 inch (2 to 5/yd^2) wild buckwheat. POST 6" weeds treatments were applied on June 12, 2012 at 4:10 pm with 74 F air, 73 F soil at a four inch depth, 30% relative humidity, 0% cloud cover, 6 to 8 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V3 to V4 soybean. Weed species present at the time of POST 6" weeds were: 4 to 10 inch (15 to 20/ft^2) yellow foxtail; 10 to 14 inch (1 to 5/yd^2) common lambsquarters; 6 to 10 inch (10 to 20/ft^2) redroot pigweed; 6 to 10 inch (1 to 5/yd^2) hairy nightshade; 12 to 18 inch (2 to 15/yd^2) wild mustard; 8 to 10 inch (1 to 5/yd^2) common ragweed; 6 to 10 inch (1 o 5/yd^2) marshelder; and 10 to 12 inch (1 to 5/yd^2) wild buckwheat. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. POST Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Liberty application timing in soybean. (Zollinger, Kazmierczak, Wirth)

		14 DAT - 2"						14 DAT - 4"							28 DAT - A							21 DAT - C							35 DAT - C						
		Yeft	Wimu	Rrpw	Colq	Hans	Corw	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Cocb
Treatments	Rate	% Control						% Control							% Control							% Control							% Control						
2" Weeds																																				
Liberty+AMS	29fl oz+3lb	87	96	96	96	95	95	85	96	85	85	85	87	95	88	99	85	87	88	87	95	88	99	85	87	88	87	95	90	99	87	88	90	90	95
Liberty+AMS	36fl oz+3lb	88	95	95	95	95	95	93	98	92	95	95	95	95	95	99	92	95	95	95	95	95	99	92	95	95	95	95	95	99	93	95	95	95	95
4" Weeds																																				
Liberty+AMS	29fl oz+3lb	35	52	72	70	68	68	62	93	83	83	83	83	93	62	99	83	83	83	83	93	62	99	83	83	83	83	93	65	99	85	85	85	85	95
Liberty+AMS	36fl oz+3lb	35	70	72	70	70	70	57	78	78	80	77	78	86	57	73	72	73	70	70	86	57	73	72	72	70	70	86	60	75	75	75	70	70	87
6" Weeds																																				
Liberty+AMS	29fl oz+3lb	0	0	0	0	0	0	45	83	57	57	57	57	57	45	85	63	62	65	67	67	45	85	63	62	65	67	67	48	85	65	63	65	68	70
Liberty+AMS	36fl oz+3lb	0	0	0	0	0	0	47	73	70	70	70	70	70	50	73	70	70	70	70	70	50	73	70	70	70	70	70	50	77	70	70	70	70	70
LSD (0.05)		5	3	3	1	3	2	9	10	7	7	5	7	5	7	5	4	3	3	4	5	7	5	4	3	3	4	5	5	4	3	3	0	2	2

Liberty tankmixes in soybean. Zollinger, Richard K., Angela J. Kazmierczak, and Devin A. Wirth. An experiment was conducted near Prosper, ND to evaluate weed efficacy to EPOST herbicide programs in soybean. Peterson Farm 'L05-11N' Liberty Link soybean was planted on April 30, 2012. EPOST treatment was applied on May 31, 2012 at 11:30 am with 76.5 F air, 61.4 F soil at a four inch depth, 24% relative humidity, 15% cloud cover, 0.5 to 1.5 mph W wind, dry soil surface and moist subsoil, good crop vigor, and no dew present to V1 soybean. Soil characteristics were: 32.5% sand, 21.3% silt, 46.3% clay, clay texture, 4.4% OM and 7.6 pH. Weed species present at the time of EPOST were: 1 to 5 inch (10 to 25/ft^2) yellow foxtail; 2 to 4 inch (1 to5/ft^2) common lambsquarters; 0.5 to 4 inch (10 to 25/ft^2) redroot pigweed; 1 to 3 inch (1 to 5/yd^2) hairy nightshade; 2 to 12 inch (3 to 10/yd^2) wild mustard; 1 to 3 inch (1 to 2/yd^2) common ragweed; 1 to 2 inch (1/yd^2) common mallow; and 1 to 3 inch (2 to 10/yd^2) wild buckwheat. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Hot temperatures and high light environmental conditions enhanced activity of Liberty. This data shows the utility and good weed management of using herbicides with several mechanisms of actions to delay weed resistance. This data also shows that application to small weeds is preferential to large weeds. All herbicide combinations improved weed control when compared to Liberty alone, except Prefix and Warrant. Other data not shown has indicated that oil- based adjuvants like PO and PSO do not enhance Liberty. Prefix and Warrant contain emulsifiers that may act as oil adjuvants. Warrant is a microencapsulated formulation which may interact differently with Liberty than Dual which is an EC formulation but both are acetamide herbicides. The other herbicide treatments also contain oil adjuvant components but resulted in greater weed control. Antagonism has been seen when applying a contact type herbicide with a systemic (glyphosate + saflufenacil (Sharpen)). All tank-mixtures in this study included a contact (Liberty) plus systemic herbicides. (Dept of Plant Sciences, North Dakota State University, Fargo).

Trial. Liberty Tankmixes in soybean. (Zollinger, Wirth, Kazmierczak)

		14 DAT	28 DAT	14 DAT						28 DAT					
Treatments	Rate	Soybean	Soybean	Yeft	Wimu	Rrpw	Colq	Hans	Corw	Yeft	Wimu	Rrpw	Colq	Hans	Corw
	(Product/A)	% Injury	% Injury	% Control						% Control					
Liberty+AMS	22fl oz+3lb	0	0	75	93	93	93	95	95	82	92	88	93	95	95
Liberty+AMS+Prefix	22fl oz+3lb+2pt	18	18	63	90	82	83	83	87	73	96	85	83	82	83
Liberty+AMS+Boundary	22fl oz+3lb+1.2pt	35	35	85	95	95	95	95	95	83	99	95	95	95	95
Liberty+AMS+Flexstar+PO	22fl oz+3lb+0.75pt+1pt	15	15	77	95	95	95	95	95	87	95	95	95	95	95
Liberty+AMS+Raptor+MSO	22fl oz+3lb+3fl oz+1pt	10	10	78	95	95	95	95	93	88	95	95	95	95	93
Liberty+AMS+Dual Magnum	22fl oz+3lb+2pt	15	15	75	95	95	95	95	95	83	95	95	95	95	95
Liberty+AMS+Warrant	22fl oz+3lb+2qt	8	8	77	88	90	72	88	88	80	96	90	72	88	82
LSD (0.05)		6	6	9	3	3	3	3	4	5	2	2	3	3	3

Management of Glyphosate-Resistant Waterhemp in Roundup Ready® and LibertyLink® Soybean – Holloway, MN – 2012 (Stachler). 'Peterson Farm Seed 12R12' (Roundup Ready) and 'Peterson Farm Seed L10-11N' (Liberty Link) soybean were seeded 1 inch deep in 22 inch rows at 168,675 seeds per acre on April 24. Herbicide treatments were applied April 25, May 25, June 5, 22, 27, and July 9. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center four rows of six row plots 30 feet in length. Soygreen at 1.5 lb/acre + Class Act NG at 9.6 fl oz/A was broadcast June 9 to reduce iron chlorosis. Soybean were harvested October 11 from the center two rows of each plot and weighed. Moisture and test weight were taken using a Dickey John Mini GAC Plus.

Soybean injury was evaluated on May 30, June 5, 12, 22, July 7, 11, and August 7. Waterhemp, common lambsquarters, and redroot pigweed control were evaluated on June 5, 22, July 11, August 7, and October 8. All evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block in a split block arrangement with 4 replications. Data were analyzed with the ANOVA procedure of Agriculture Research Manager, version 8.4.2 software package.

Table 1. Application Information

Application code	A	B	C	D1[1]/ E1[2]	D2[1] / E2[2] / F	G[3]
Date	April 25	May 25	June 5	June 22	June 27	July 9
Time of Day	11:15 A	12:00 P	1:00 P	3:10 P	2:45 P	1:50 P
Air Temperature (F)	73	67	88	82	88	82
Relative Humidity (%)	50	41	28	34	48	36
Wind Velocity (mph)	13	3	3	1	2	5
Wind Direction	NW	W	E	NW	SE	NNW
Soil Temp. (F at 6")	58	60	79	76	78	82
Soil Moisture	Good	Wet	Good	Good	Good	Dry
Cloud Cover	75	90	10	5	25	10
Soybean stage (avg)	PRE	V1	V1.75	V6	R1	R1
Wahe leaf stage {min/max(ave)} – Trt.4	-	-	-	Cot/22(12)	-	-
Wahe height {min/max(ave)} – Trt.4	-	-	-	0.2/18"(5.2)	-	-
Wahe density (plants/m^2) – Trt.4	-	-	-	9	-	-
Wahe leaf stage {min/max(ave)} – Trt.6	-	-	-	-	Cot/21(8.7)	-
Wahe height {min/max(ave)} – Trt.6	-	-	-	-	0.2/13.3"(2.3)	-
Wahe density (plants/m^2) – Trt.6	-	-	-	-	0.9	-
Wahe leaf stage {min/max(ave)} – Trt.26	-	-	Cot[5]/12(4.5)	-	Cot[5]/12(3.8)	-
Wahe height {min/max(ave)} – Trt.26	-	-	0.1/3.5"(0.7)	-	0.1/5.8"(1.2)	-
Wahe density (plants/m^2) – Trt.26	-	-	36	-	11	-
Colq leaf stage {min/max(ave)} – Trt.4	-	-	-	10/20(12.3)	-	-
Colq height {min/max(ave)} – Trt.4	-	-	-	3/11"(4.2)	-	-
Colq density (plants/m^2) – Trt.4	-	-	-	0.75	-	-
Colq leaf stage {min/max(ave)} – Trt.26	-	-	Cot/16(7)	-	-	-
Colq height {min/max(ave)} – Trt.26	-	-	0.2/4"(1)	-	-	-
Colq density (plants/m^2) – Trt.26	-	-	6	-	0	-
Rrpw leaf stage {min/max(ave)} – Trt.4	-	-	-	2/22(11.7)	-	-
Rrpw height {min/max(ave)} – Trt.4	-	-	-	0.5/13.5"(4.3)	-	-
Rrpw density (plants/m^2) – Trt.4	-	-	-	2	-	-
Rrpw leaf stage {min/max(ave)} – Trt.26	-	-	Cot/12(5.5)	-	1/9(4.3)	-
Rrpw height {min/max(ave)} – Trt.26	-	-	0.1/4"(0.8)	-	0.2/1.2"(0.8)	-
Rrpw density (plants/m^2) – Trt.26	-	-	10	-	1.5	-

[1] Application D1 on June 22 made to treatments 1-4,12,20-23,31. Remaining 'D2' treatments made on June 27.
[2] Application E1 on June 22 made to treatments 19 and 38. Remaining 'E2' treatments made on June 27.
[3] Application G on July 9 made to treatments 20-25. No other 'G' treatments made.

Table 2. Management of Glyphosate-Resistant Waterhemp in Roundup Ready® and LibertyLink® Soybean – Holloway, MN – 2012 (Stachler).

Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Oct 11 Soyb Yield	June 5 Soyb Inju	June 5 Wahe[2] Cntl	June 22 Soyb Inju	June 22 Wahe[2] Cntl	June 22 Rrpw Cntl	June 22 Colq Cntl	Aug 7 Soyb Inju	Aug 7 Wahe[2] Cntl	Aug 7 Rrpw Cntl	Aug 7 Colq Cntl	October 8 Wahe[2] Cntl	October 8 Rrpw Cntl	October 8 Colq Cntl
LibertyLink Soybean					bu/A	----------												
1	Boundary	1.8	pt/A	A														
	Ignite 280	29	fl oz/A	D1(G)														
	N Pak-AMS	2.6	% v/v	D1(G)	29.3	3	97	2	89	83	92	7	97	97	99	93	93	93
2	Prefix	1.75	pt/A	A														
	Ignite 280	29	fl oz/A	D1(G)														
	N Pak-AMS	2.6	% v/v	D1(G)	34.5	3	95	3	87	80	85	3	96	96	99	94	98	98
3	Valor SX	2.5	oz wt/A	A														
	Dimetric	5.33	oz wt/A	A														
	Ignite 280	29	fl oz/A	D1(G)														
	N Pak-AMS	2.6	% v/v	D1(G)	26.4	3	93	4	77	81	70	5	98	99	99	95	97	97
4	Fierce	3	oz wt/A	A														
	Ignite 280	29	fl oz/A	D1(G)														
	N Pak-AMS	2.6	% v/v	D1(G)	33.8	4	87	2	69	74	73	4	81	96	99	77	94	94
5	Sharpen	1	fl oz/A	A														
	Zidua	2.5	oz wt/A	A														
	Ignite 280	29	fl oz/A	D2(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	30.0	10	98	21	94	93	96	14	99	99	99	99	99	99
6	Verdict	5	fl oz/A	A														
	Zidua	2.5	oz wt/A	A														
	Ignite 280	29	fl oz/A	D2(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	26.7	11	96	21	95	88	94	13	99	99	99	99	98	98
7	Ignite 280	29	fl oz/A	CF														
	N Pak-AMS	2.6	% v/v	CF	29.4	0	0	1	98	98	99	2	99	99	99	99	99	99
8	Cobra	12.5	fl oz/A	C														
	Ignite 280	29	fl oz/A	CF														
	N Pak-AMS	2.6	% v/v	CF	29.7	0	0	18	99	99	99	8	98	99	99	97	99	99
9	FlexStar	0.75	pt/A	C														
	Ignite 280	29	fl oz/A	CF														
	N Pak-AMS	2.6	% v/v	CF	27.9	0	0	9	97	98	99	5	99	99	99	99	99	99
10	Cadet	0.9	fl oz/A	C														
	Ignite 280	29	fl oz/A	CF														
	N Pak-AMS	2.6	% v/v	CF	25.2	0	0	16	93	97	99	10	99	99	99	98	99	99
11	Verdict	5	fl oz/A	A														
	Zidua	2.5	oz wt/A	A														
	FlexStar	0.75	pt/A	D2														
	Ignite 280	29	fl oz/A	D2(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	27.7	10	97	21	92	90	85	15	99	99	99	99	99	99
12	Boundary	1.8	pt/A	A														
	FlexStar	0.75	pt/A	D1														
	Ignite 280	29	fl oz/A	D1(G)														
	N Pak-AMS	2.6	% v/v	D1(G)	33.3	2	92	3	91	82	72	3	99	96	99	99	95	95
13	Outlook	10	fl oz/A	B														
	Ignite 280	29	fl oz/A	BE2														
	N Pak-AMS	2.6	% v/v	BE2	33.2	7	98	10	91	96	95	5	99	99	99	98	99	99
14	Outlook	10	fl oz/A	B														
	Cobra	12.5	fl oz/A	B														
	Ignite 280	29	fl oz/A	BE2														
	N Pak-AMS	2.6	% v/v	BE2	28.2	39	99	26	96	98	99	11	98	99	99	96	99	99

Table 2. Management of Glyphosate-Resistant Waterhemp in Roundup Ready® and LibertyLink® Soybean – Holloway, MN – 2012 (Stachler).

Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Oct 11 Soyb Yield	June 5 Soyb Inju	June 5 Wahe[2] Cntl	June 22 Soyb Inju	June 22 Wahe[2] Cntl	June 22 Rrpw Cntl	June 22 Colq Cntl	Aug 7 Soyb Inju	Aug 7 Wahe[2] Cntl	Aug 7 Rrpw Cntl	Aug 7 Colq Cntl	October 8 Wahe[2] Cntl	October 8 Rrpw Cntl	October 8 Colq Cntl
LibertyLink Soybean					bu/A	----------												
15	Zidua	2.5	oz wt/A	A														
	Verdict	5	fl oz/A	A														
	Outlook	10	fl oz/A	D2														
	Ignite 280	29	fl oz/A	D2(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	24.6	10	97	19	91	92	89	17	99	99	99	99	99	99
16	Zidua	2.5	oz wt/A	A														
	Verdict	5	fl oz/A	A														
	Cobra	12.5	fl oz/A	D2														
	Outlook	10	fl oz/A	D2														
	Ignite 280	29	fl oz/A	D2(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	24.1	9	95	20	90	91	92	25	99	97	99	99	98	98
17	Zidua	2.5	oz wt/A	A														
	Verdict	5	fl oz/A	A														
	Warrant	3	pt/A	D2														
	Cobra	12.5	fl oz/A	D2														
	Ignite 280	29	fl oz/A	D2(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	20.4	11	97	20	90	90	87	26	99	99	98	99	98	98
18	Non-treated Check				7.1	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Ignite 280	29	fl oz/A	BE1														
	N Pak-AMS	2.6	% v/v	BE1														
	+HandWeed				29.9	6	100	1	69	69	91	6	94	99	99	90	99	99
Roundup Ready Soybean																		
20	Boundary	1.8	pt/A	A														
	R.U. P. Max	44	fl oz/A	D1														
	R.U. P. Max	22	fl oz/A	G														
	N Pak-AMS	2.6	% v/v	D1G	36.6	3	90	4	70	72	76	3	95	99	99	95	99	99
21	Prefix	1.75	pt/A	A														
	R.U. P. Max	44	fl oz/A	D1														
	R.U. P. Max	22	fl oz/A	G														
	N Pak-AMS	2.6	% v/v	D1G	41.2	3	89	3	82	73	62	4	97	99	99	96	99	99
22	Valor SX	2.5	oz wt/A	A														
	Dimetric	5.33	oz wt/A	A														
	R.U. P. Max	44	fl oz/A	D1														
	R.U. P. Max	22	fl oz/A	G														
	N Pak-AMS	2.6	% v/v	D1G	37.5	5	76	6	63	60	54	2	83	99	99	83	99	99
23	Fierce	3	oz wt/A	A														
	R.U. P. Max	44	fl oz/A	D1														
	R.U. P. Max	22	fl oz/A	G														
	N Pak-AMS	2.6	% v/v	D1G	43.6	3	81	3	59	52	57	9	93	99	99	90	99	99
24	Sharpen	1	fl oz/A	A														
	Zidua	2.5	oz wt/A	A														
	R.U. P. Max	44	fl oz/A	D2														
	R.U. P. Max	22	fl oz/A	G														
	N Pak-AMS	2.6	% v/v	D2G	38.6	4	94	12	90	88	88	6	99	99	99	99	99	99

Table 2. Management of Glyphosate-Resistant Waterhemp in Roundup Ready® and LibertyLink® Soybean – Holloway, MN – 2012 (Stachler).

Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Oct 11 Soyb Yield	June 5 Soyb Inju	June 5 Wahe[2] Cntl	June 22 Soyb Inju	June 22 Wahe[2] Cntl	June 22 Rrpw Cntl	June 22 Colq Cntl	Aug 7 Soyb Inju	Aug 7 Wahe[2] Cntl	Aug 7 Rrpw Cntl	Aug 7 Colq Cntl	October 8 Wahe[2] Cntl	October 8 Rrpw Cntl	October 8 Colq Cntl
Roundup Ready Soybean					bu/A	----------												
25	Verdict	5	fl oz/A	A														
	Zidua	2.5	oz wt/A	A														
	R.U. P. Max	44	fl oz/A	D2														
	R.U. P. Max	22	fl oz/A	G														
	N Pak-AMS	2.6	% v/v	D2G	36.9	5	96	11	89	87	87	8	99	99	99	99	99	99
26	R.U. P. Max	44	fl oz/A	C														
	R.U. P. Max	22	fl oz/A	F														
	N Pak-AMS	2.6	% v/v	CF	43.6	0	0	3	85	99	99	1	79	99	99	75	99	99
27	Cobra	12.5	fl oz/A	C														
	R.U. P. Max	44	fl oz/A	C														
	R.U. P. Max	22	fl oz/A	F														
	Destiny HC	1.5	pt/A	C														
	N Pak-AMS	2.6	% v/v	CF	38.8	0	0	16	97	99	99	6	95	99	99	94	99	99
28	FlexStar GT	2.68	pt/A	C														
	R.U. P. Max	22.5	fl oz/A	C														
	R.U. P. Max	22	fl oz/A	F														
	Destiny HC	1.5	pt/A	C														
	N Pak-AMS	2.6	% v/v	CF	38.1	0	0	3	96	99	97	5	97	99	99	96	99	99
29	Cadet	0.9	fl oz/A	C														
	R.U. P. Max	44	fl oz/A	C														
	R.U. P. Max	22	fl oz/A	F														
	Destiny HC	1.5	pt/A	C														
	N Pak-AMS	2.6	% v/v	CF	33.8	0	0	17	90	99	99	6	87	99	99	79	99	99
30	Verdict	5	fl oz/A	A														
	Zidua	2.5	oz wt/A	A														
	FlexStar GT	2.68	pt/A	D2														
	R.U. P. Max	22.5	fl oz/A	D2														
	R.U. P. Max	22	fl oz/A	(G)														
	Destiny HC	1.5	pt/A	D2														
	N Pak-AMS	2.6	% v/v	D2(G)	36.4	4	95	10	94	85	87	9	96	99	99	96	99	99
31	Boundary	1.8	pt/A	A														
	FlexStar GT	2.68	pt/A	D1														
	R.U. P. Max	22.5	fl oz/A	D1														
	R.U. P. Max	22	fl oz/A	D1(G)														
	Destiny HC	1.5	pt/A	D1														
	N Pak-AMS	2.6	% v/v	D1(G)	36.0	3	91	4	77	76	80	5	92	99	99	89	99	99
32	Outlook	10	fl oz/A	B														
	R.U. P. Max	44	fl oz/A	B														
	R.U. P. Max	22	fl oz/A	E														
	N Pak-AMS	2.6	% v/v	BE	40.6	6	94	11	84	96	97	3	77	99	99	71	99	99
33	Outlook	10	fl oz/A	B														
	Cobra	12.5	fl oz/A	B														
	R.U. P. Max	44	fl oz/A	B														
	R.U. P. Max	22	fl oz/A	E														
	Destiny HC	1.5	pt/A	B														
	N Pak-AMS	2.6	% v/v	BE	33.5	44	99	27	93	97	97	9	83	99	99	71	99	99

Table 2. Management of Glyphosate-Resistant Waterhemp in Roundup Ready® and LibertyLink® Soybean – Holloway, MN – 2012 (Stachler).

					Oct 11	June 5		June 22				Aug 7				October 8		
Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Soyb Yield	Soyb Inju	Wahe[2] Cntl	Soyb Inju	Wahe[2] Cntl	Rrpw Cntl	Colq Cntl	Soyb Inju	Wahe[2] Cntl	Rrpw Cntl	Colq Cntl	Wahe[2] Cntl	Rrpw Cntl	Colq Cntl
Rounup Ready Soybean					bu/A	----------						%						
34	Zidua	2.5	oz wt/A	A														
	Verdict	5	fl oz/A	A														
	Outlook	10	fl oz/A	D2														
	R.U. P. Max	44	fl oz/A	D2														
	R.U. P. Max	22	fl oz/A	(G)														
	N Pak-AMS	2.6	% v/v	D2(G)	40.4	5	97	11	91	89	79	5	94	99	99	92	99	99
35	Zidua	2.5	oz wt/A	A														
	Verdict	5	fl oz/A	A														
	Cobra	12.5	fl oz/A	D2														
	Outlook	10	fl oz/A	D2														
	R.U. P. Max	44	fl oz/A	D2														
	R.U. P. Max	22	fl oz/A	(G)														
	Destiny HC	1.5	pt/A	D2														
	N Pak-AMS	2.6	% v/v	D2(G)	29.9	4	94	8	91	88	80	14	94	99	99	94	99	99
36	Zidua	2.5	oz wt/A	A														
	Verdict	5	fl oz/A	A														
	Warrant	3	pt/A	D2														
	Cobra	12.5	fl oz/A	D2														
	R.U. P. Max	44	fl oz/A	D2														
	R.U. P. Max	22	fl oz/A	(G)														
	Destiny HC	1.5	pt/A	D2														
	N Pak-AMS	2.6	% v/v	D2(G)	34.4	5	95	11	89	87	82	15	96	99	99	88	99	99
37	Non-treated Check				11.5	0	0	0	0	0	0	0	0	0	0	0	0	0
38	R.U. P. Max	44	fl oz/A	B														
	R.U. P. Max	22	fl oz/A	E1														
	N Pak-AMS	2.6	% v/v	BE1														
	+HandWeed				37.1	2	100	3	65	65	90	3	72	99	99	80	99	99
	LSD 5%				**8.5**	**3.0**	**4.9**	**5.3**	**12.0**	**12.0**	**14.3**	**6.1**	**9.7**	**2.7**	**0.5**	**12.5**	**2.2**	**0.8**
	CV%				**16**	**37**	**5**	**38**	**11**	**11**	**12**	**58**	**8**	**2**	**1**	**10**	**2**	**1**

[1]Application codes: A = PRE and B, C, D1, D2, E1, E2, F, and G = POST at respective dates in Table 1. (G) = planned application, but NOT applied.

[2]The waterhemp at this location is resistant to glyphosate, although most plants are not resistant.

Summary: This research site has glyphosate-resistant waterhemp based upon the fair (75%) control of waterhemp after two applications of Roundup PowerMAX and the 92% average mortality of 10 flagged waterhemp plants/plot on October 8th for treatments 22, 23, and 26. The high waterhemp mortality shows a limited frequency of glyphosate-resistant waterhemp at this site.

Due to the low frequency of glyphosate-resistant waterhemp and limited weed densities at this site, the greatest soybean yields were obtained from Roundup PowerMAX and Fierce followed by Roundup PowerMAX. Two applications of glyphosate in Roundup Ready soybean out-yielded all treatments in LibertyLink soybean based upon the varieties planted at this site.

Sharpen and Verdict treatments caused greater injury to the LibertyLink soybean variety at 20.3% (averaged across all treatments) on June 22nd that lasted through most of the season compared to the injury to Roundup Ready soybean variety at 10.5% (averaged across all treatments). At the time of the POST application, Sharpen plus Zidua and Verdict plus Zidua controlled the most waterhemp [92 and 91%, respectively]. Prefix and Boundary were similar, but controlled fewer waterhemp at 84 and 82%, respectively. Valor plus Dimetric (metribuzin) and Fierce controlled the fewest waterhemp (≤70%).

ONLY treatments 20, 21, 24, 25, 27, 28, 30, and 35 in Roundup Ready soybean controlled greater than 93% of glyphosate-resistant waterhemp on October 8th, meaning only certain timely herbicide sequences and combinations can be applied in Roundup Ready soybean to achieve excellent control. ALL treatments in LibertyLink soybean, except treatment 4, controlled greater than 92% of waterhemp on October 8th, meaning nearly any timely herbicide sequence or combination may be applied to achieve excellent control.

All treatments in Roundup Ready soybean controlled 99% of lambsquarters and redroot pigweed on October 8th and all treatments in LibertyLink soybean controlled greater than 96% of lambsquarters and 92% of redroot pigweed on October 8th.

Glyphosate-Resistant Waterhemp Control With Soil-Applied Herbicides Followed by Cobra Plus Glyphosate in Roundup Ready® Soybean -Holloway, MN - 2012 (Stachler) 'Peterson Farm Seed 12R12 RR2Y' (Roundup Ready) soybean was seeded 1 inch deep in 22 inch rows at 168,675 seeds per acre on April 24. Herbicide treatments were applied April 24, 25, and June 22, 27. All treatments were applied with a bicycle sprayer in 17 gpa spray solution equipped with 8002 XR flat fan nozzles and pressurized with CO_2 at 40 psi to the center four rows of six row plots 30 feet in length. Preplant-incorporated treatments were incorporated 2 inches deep with an 8-foot 'S-tine' field cultivator equipped with rolling baskets. Soygreen at 1.5 lb/acre + Class Act NG at 9.6 fl oz/A was broadcast June 6 to reduce iron chlorosis. Soybean was harvested October 11 from the center two rows of each plot and weighed. Moisture and test weight were taken using a Dickey John Mini GAC Plus.

Soybean injury was visually evaluated on June 22, July 7, 12, and August 7. Glyphosate-resistant waterhemp and redroot pigweed control were visually evaluated on June 22, July 12, August 7, and October 8. All evaluations were a visual estimate of percent fresh weight reduction on a scale of 0 (no control/injury) to 100 (complete control/injury) in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block with 4 replications. Data were analyzed with the ANOVA procedure using Agriculture Research Manager, version 8.4.2 software package.

Table 1. Application Information

Application code	A	B	C1[1]	C2[2]
Date	April 24	April 25	June 22	June 27
Time of Day	7:30 PM	10:40 AM	2:40 PM	4:00 PM
Air Temperature (F)	77	68	82	89
Relative Humidity (%)	28	51	36	49
Wind Velocity (mph)	4	3	1	2
Wind Direction	E	SE	NW	SE
Soil Temp. (F at 6")	60	54	76	80
Soil Moisture	Good	Good	Good	Good
Cloud Cover	50	20	5	90
Soybean stage (avg)	PPI	PRE	V5	R1
Waterhemp leaf stage [min/max(ave)] Trt.1	-	-	10/23 (12)	-
Waterhemp height [min/max(ave)] Trt. 1	-	-	3/14" (5.25")	-
Waterhemp density (plants/m^2) Trt. 1	-	-	4	-
Redroot pigweed leaf stage [min/max(ave)] Trt. 1	-	-	-	-
Redroot pigweed height [min/max(ave)] Trt. 1	-	-	-	-
Redroot pigweed density (plants/m^2) Trt. 1	-	-	0	-
Waterhemp leaf stage [min/max(ave)] Trt.5	-	-	1/22 (13)	-
Waterhemp height [min/max(ave)] Trt. 5	-	-	0.25/18" (6.1")	-
Waterhemp density (plants/m^2) Trt. 5	-	-	8	-
Redroot pigweed leaf stage [min/max(ave)] Trt. 5	-	-	2/25 (14)	-
Redroot pigweed height [min/max(ave)] Trt. 5	-	-	1/20" (6.8")	-
Redroot pigweed density (plants/m^2) Trt. 5	-	-	5	-
Waterhemp leaf stage [min/max(ave)] Trt.4	-	-	-	2/22 (10.7)
Waterhemp height [min/max(ave)] Trt. 4	-	-	-	0.5/15" (4")
Waterhemp density (plants/m^2) Trt. 4	-	-	-	1.25
Redroot pigweed leaf stage [min/max(ave)] Trt. 4	-	-	-	-
Redroot pigweed height [min/max(ave)] Trt. 4	-	-	-	-
Redroot pigweed density (plants/m^2) Trt. 4	-	-	-	0

[1] Application C1 on June 22 made to treatments 1, 5, 6.
[2] Application C2 on June 27 made to treatments 3, 4.

Table 2. Glyphosate-Resistant Waterhemp Control With Soil-Applied Herbicides Followed by Cobra Plus Glyphosate in Roundup Ready Soybean – Holloway, MN – 2012.

					Oct 11	June 22			July 7	July 12	Aug 7			Oct 8	
					Soyb	Soyb	Wahe	Rrpw	Soyb	Soyb	Soyb	Wahe	Rrpw	Wahe	Rrpw
Trt. No.	Treatment	Rate	Rate Unit	App. Code[1]	Yield	Inju	--- Cntrl ---		Inju	Inju	Inju	--- Cntrl ---		--- Cntrl ---	
					bu/A	%									
1	Valor SX	2.5	oz/a	B											
	FirstRate	0.5	oz/a	B											
	Cobra	12.5	fl oz/a	C1											
	R.U. P.MAX	44	fl oz/a	C1											
	Destiny HC	1.5	pt/a	C1											
	N-Pak AMS	2.5	% v/v	C1	27.1	12	86	97	29	27	9	98	99	95	99
2	Authority First	7	oz/a	B	24.4	11	98	99	14	12	3	93	99	92	99
3	Authority MTZ	16	oz/a	B											
	Cobra	12.5	fl oz/a	C2											
	R.U. P.MAX	44	fl oz/a	C2											
	Destiny HC	1.5	pt/a	C2											
	N-Pak AMS	2.5	% v/v	C2	22.4	11	96	99	31	26	15	99	99	96	99
4	OpTill	2	oz/a	B											
	Outlook	10	fl oz/a	B											
	Cobra	12.5	fl oz/a	C2											
	R.U. P.MAX	44	fl oz/a	C2											
	Destiny HC	1.5	pt/a	C2											
	N-Pak AMS	2.5	% v/v	C2	17.6	14	88	99	32	28	13	97	99	95	99
5	Treflan EC	2	pt/a	A											
	Cobra	12.5	fl oz/a	C1											
	R.U. P.MAX	44	fl oz/a	C1											
	Destiny HC	1.5	pt/a	C1											
	N-Pak AMS	2.5	% v/v	C1	23.3	13	63	64	29	26	8	96	98	94	98
6	Verdict	5	fl oz/a	A											
	Treflan EC	2	pt/a	A											
	Cobra	12.5	fl oz/a	C1											
	R.U. P.MAX	44	fl oz/a	C1											
	Destiny HC	1.5	pt/a	C1											
	N-Pak AMS	2.5	% v/v	C1	21.3	18	78	85	30	23	11	95	99	93	99
				LSD (P=.05)	**NS**	**NS**	**9.7**	**10.8**	**5.8**	**4.5**	**6.5**	**NS**	**NS**	**NS**	**NS**
				CV	**23.14**	**35.5**	**7.59**	**7.96**	**13.96**	**12.73**	**45.5**	**5.38**	**0.83**	**7.36**	**0.83**

[1]Application code: A = PPI; B = PRE; C = POST

Summary: Noticeable soybean injury was visible on June 22nd, but no treatment differences were observed. Soybean injury nearly doubled for all treatments after the POST application with the exception of Treatment 2 which received no POST herbicide, although few differences in injury were observed with treatments having a POST application. On June 22nd, Authority First and Authority MTZ controlled the most waterhemp followed by OpTill plus Outlook and Valor plus FirstRate (Gangster) followed by Verdict plus Treflan followed by Treflan. Valor plus FirstRate, Authority First, Authority MTZ, and OpTill plus Outlook controlled nearly all redroot pigweed on June 22nd followed by Verdict plus Treflan followed by Treflan. Authority First, Authority MTZ, and Treflan controlled waterhemp and redroot pigweed nearly equally with the remaining treatments controlling redroot pigweed better than waterhemp. All treatments provided similar control and yield at harvest.

Management of Glyphosate-Resistant Common Ragweed in Roundup Ready® and LibertyLink® Soybean – Mayville, ND – 2012 (Stachler).

A seedbed was prepared using an 11-foot Kongskilde S-tine field cultivator equipped with rolling baskets. 'Peterson Farm Seed 12R05' (Roundup Ready) and 'Peterson Farm Seed L05-11N' (LibertyLink) soybean were seeded 1 inch deep in 22 inch rows at 168,675 seeds per acre on May 3. Herbicide treatments were applied May 3 & 24, June 6, 8, 12, 21, & 29. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center four rows of six row plots 30 feet in length. Soybean was harvested October 12 from the center two rows of each plot and weighed. Moisture and test weight were taken using a Dickey John Mini GAC Plus.

Soybean injury was evaluated on May 31, June 8, 19, & 20, and July 2. Common ragweed, common lambsquarters, and redroot pigweed control were evaluated on June 8 & 20, July 2 & 14, Aug 8, and Sept 25. All evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block in a split-block arrangement with 4 replications. Data were analyzed with the ANOVA procedure of Agriculture Research Manager, version 8.4.2 software package.

Table 1. Application Information

Application code	A	B	C	D1[1]	D2[1] / E1[2]	E2[2] / F1[3]	F2[3] / G[4]
Date	May 3	May 24	June 6	June 8	June 12	June 21	June 29
Time of Day	3:00 P	12:30 P	6:00 P	1:00 P	2:00 P	10:00 A	1:00 P
Air Temperature (F)	64	68	82	80	65	70	87
Relative Humidity (%)	42	41	35	49	35	54	26
Wind Velocity (mph)	9	16	5	5	6	8	4
Wind Direction	NNW	W	S	W	SW	NW	WNW
Soil Temp. (F at 6")	61	61	76	70	65	56	80
Soil Moisture	Good	Good	Good	Good	Good	Good	Fair
Cloud Cover	70	90	70	8	40	0	10
Soybean stage (avg)	PRE	VC	V2	V2.5	V3.3	V5	R1
Corw **node** stage {min/max(ave)} – Trt.1	-	-	-	Cot/6(2.9)	-	-	1/2(1)
Corw height {min/max(ave)} – Trt.1	-	-	-	0.1/4"(1.2)	-	-	0.8/3"(1.3)
Corw density (plants/m^2) – Trt.1	-	-	-	66	-	-	3
Corw **node** stage {min/max(ave)} – Trt.6	-	-	-	-	Cot/6(4)	-	1/6(1.3)
Corw height {min/max(ave)} – Trt.6	-	-	-	-	0.1/6.5"(1.7)	-	0.5/5"(2.7)
Corw density (plants/m^2) – Trt.6	-	-	-	-	19	-	2
Corw **node** stage {min/max(ave)} – Trt.26	-	-	Cot[5]/5(3.1)	-	-	Cot/12(4)	-
Corw height {min/max(ave)} – Trt.26	-	-	0.1/4"(1.1)	-	-	0.2/8"(1.8)	-
Corw density (plants/m^2) – Trt.26	-	-	182	-	-	68	-
Colq leaf stage {min/max(ave)} – Trt.1	-	-	-	Cot/20(10.3)	-	-	Cot/7(4)
Colq height {min/max(ave)} – Trt.1	-	-	-	0.2/8"(2.1)	-	-	0.2/2"(1.1)
Colq density (plants/m^2) – Trt.1	-	-	-	26	-	-	4
Colq leaf stage {min/max(ave)} – Trt.26	-	-	Cot/17(7.8)	-	-	Cot/8(2.2)	-
Colq height {min/max(ave)} – Trt.26	-	-	0.2/6"(1.4)	-	-	0.2/2"(0.5)	-
Colq density (plants/m^2) – Trt.26	-	-	88	-	-	49	-
Rrpw leaf stage {min/max(ave)} – Trt.1	-	-	-	Cot/12(5.5)	-	-	2/4(3)
Rrpw height {min/max(ave)} – Trt.1	-	-	-	0.1/4.3"(1.2)	-	-	0.5/1"(0.8)
Rrpw density (plants/m^2) – Trt.1	-	-	-	6	-	-	1
Rrpw leaf stage {min/max(ave)} – Trt.26	-	-	Cot/12(5.5)	-	-	Cot/5(1.3)	-
Rrpw height {min/max(ave)} – Trt.26	-	-	0.1/4"(1)	-	-	0.2/2"(0.5)	-
Rrpw density (plants/m^2) – Trt.26	-	-	21	-	-	7	-

[1] Application D1 on June 8 made to treatments 1,4,12,20,23,31. Remaining 'D2' treatments made on June 12.
[2] Application E1 on June 12 made to treatments 19 and 38. Remaining 'E2' treatments made on June 21.
[3] Application F1 on June 21 made to treatments 7,10,26,29. Remaining 'F2' treatments made on June 29.
[4] Application G on June 29 made to treatments 1-6, 11-12, 15-17, 20-25, 31, 34. No other 'G' treatments made.
[5] Cot = cotyledon stage

Table 2. Management of Glyphosate-Resistant Common Ragweed in Roundup Ready® and LibertyLink® Soybean – Mayville, ND – 2012 (Stachler).

Trt No.	Herbicide	Rate	Rate Unit	App Code[1]	Oct 12 Soyb Yield	June 8 Soyb Inju	June 8 Corw[2] Cntl	June 8 Colq Cntl	June 8 Rrpw Cntl	July 14 Corw[2] Cntl	July 14 Colq Cntl	July 14 Rrpw Cntl	Sept 25 Corw[2] Cntl	Sept 25 Colq Cntl	Sept 25 Rrpw Cntl
LibertyLink Soybean					bu/A	----------%----------									
1	Boundary	1.8	pt/A	A											
	Ignite 280	29	fl oz/A	D1G											
	N Pak-AMS	2.6	% v/v	D1G	9.7	3	56	34	70	99	99	99	99	98	99
2	Prefix	1.75	pt/A	A											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	11	7	65	40	77	99	99	99	99	96	99
3	Valor SX	2.5	oz wt/A	A											
	Dimetric	5.33	oz wt/A	A											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	11	13	77	81	98	99	99	99	99	97	99
4	Fierce	3	oz wt/A	A											
	Ignite 280	29	fl oz/A	D1G											
	N Pak-AMS	2.6	% v/v	D1G	10	8	48	78	88	99	99	99	99	99	99
5	Sharpen	1	fl oz/A	A											
	Zidua	2.5	oz wt/A	A											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	10.8	8	69	55	67	99	99	99	98	96	98
6	Verdict	5	fl oz/A	A											
	Zidua	2.5	oz wt/A	A											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	11.7	8	69	56	74	99	99	99	98	99	99
7	Ignite 280	29	fl oz/A	CF1											
	N Pak-AMS	2.6	% v/v	CF1	10.2	0	0	0	0	98	95	96	96	92	97
8	Cobra	12.5	fl oz/A	C											
	Ignite 280	29	fl oz/A	CF2											
	N Pak-AMS	2.6	% v/v	CF2	8.6	0	0	0	0	99	99	99	99	89	99
9	FlexStar	0.75	pt/A	C											
	Ignite 280	29	fl oz/A	CF2											
	N Pak-AMS	2.6	% v/v	CF2	9.5	0	0	0	0	99	96	99	99	88	99
10	Cadet	0.9	fl oz/A	C											
	Ignite 280	29	fl oz/A	CF1											
	N Pak-AMS	2.6	% v/v	CF1	11.9	0	0	0	0	99	99	97	95	95	93
11	Verdict	5	fl oz/A	A											
	Zidua	2.5	oz wt/A	A											
	FlexStar	0.75	pt/A	D2											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	14.7	7	66	46	80	99	99	99	99	99	99
12	Boundary	1.8	pt/A	A											
	FlexStar	0.75	pt/A	D1											
	Ignite 280	29	fl oz/A	D1G											
	N Pak-AMS	2.6	% v/v	D1G	12.6	3	59	30	68	99	99	99	99	99	99
13	Outlook	10	fl oz/A	B											
	Ignite 280	29	fl oz/A	BE2											
	N Pak-AMS	2.6	% v/v	BE2	9.3	18	91	91	99	98	98	99	93	95	99
14	Outlook	10	fl oz/A	B											
	Cobra	12.5	fl oz/A	B											
	Ignite 280	29	fl oz/A	BE2											
	N Pak-AMS	2.6	% v/v	BE2	10.8	55	97	99	99	98	97	98	96	92	95

Table 2. Management of Glyphosate-Resistant Common Ragweed in Roundup Ready® and LibertyLink® Soybean – Mayville, ND – 2012 (Stachler).

					Oct 12	June 8				July 14				Sept 25		
Trt No.	Herbicide	Rate	Rate Unit	App Code[1]	Soyb Yield	Soyb Inju	Corw[2] Cntl	Colq Cntl	Rrpw Cntl	Corw[2] Cntl	Colq Cntl	Rrpw Cntl	Corw[2] Cntl	Colq Cntl	Rrpw Cntl
LibertyLink Soybean					bu/A	----------				%----------					
15	Zidua	2.5	oz wt/A	A											
	Verdict	5	fl oz/A	A											
	Outlook	10	fl oz/A	D2											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	17.6	7	64	48	77	99	99	99	97	99	99
16	Zidua	2.5	oz wt/A	A											
	Verdict	5	fl oz/A	A											
	Cobra	12.5	fl oz/A	D2											
	Outlook	10	fl oz/A	D2											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	8.5	5	71	56	81	99	98	99	99	98	99
17	Zidua	2.5	oz wt/A	A											
	Verdict	5	fl oz/A	A											
	Warrant	3	pt/A	D2											
	Cobra	12.5	fl oz/A	D2											
	Ignite 280	29	fl oz/A	D2G											
	N Pak-AMS	2.6	% v/v	D2G	9.4	7	68	44	81	99	99	99	99	96	99
18	Non-treated Check				0	0	0	0	0	0	0	0	0	0	0
19	Ignite 280	29	fl oz/A	BE1											
	N Pak-AMS	2.6	% v/v	BE1											
	+ Hand Weed				11.7	4	81	75	78	98	98	98	98	97	99
Roundup Ready Soybean															
20	Boundary	1.8	pt/A	A											
	R.U. P. Max	44	fl oz/A	D1											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D1G	8.6	9	60	62	75	83	99	99	83	97	99
21	Prefix	1.75	pt/A	A											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D2G	9.9	4	73	53	96	86	99	99	85	99	99
22	Valor SX	2.5	oz wt/A	A											
	Dimetric	5.33	oz wt/A	A											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D2G	9.8	8	75	77	91	72	99	99	67	99	99
23	Fierce	3	oz wt/A	A											
	R.U. P. Max	44	fl oz/A	D1											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D1G	11.1	8	39	78	96	83	99	99	83	99	99
24	Sharpen	1	fl oz/A	A											
	Zidua	2.5	oz wt/A	A											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D2G	7.7	7	65	51	76	79	99	99	72	99	99

Table 2. Management of Glyphosate-Resistant Common Ragweed in Roundup Ready® and LibertyLink® Soybean – Mayville, ND – 2012 (Stachler).

					Oct 12	June 8				July 14			Sept 25		
Trt No.	Herbicide	Rate	Rate Unit	App Code[1]	Soyb Yield	Soyb Inju	Corw[2] Cntl	Colq Cntl	Rrpw Cntl	Corw[2] Cntl	Colq Cntl	Rrpw Cntl	Corw[2] Cntl	Colq Cntl	Rrpw Cntl
Roundup Ready Soybean					bu/A	----------%----------									
25	Verdict	5	fl oz/A	A											
	Zidua	2.5	oz wt/A	A											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D2G	7.8	7	70	61	79	78	99	99	75	99	99
26	R.U. P. Max	44	fl oz/A	C											
	R.U. P. Max	22	fl oz/A	F1											
	N Pak-AMS	2.6	% v/v	CF1	8.4	0	0	0	0	67	99	99	58	97	99
27	Cobra	12.5	fl oz/A	C											
	R.U. P. Max	44	fl oz/A	C											
	R.U. P. Max	22	fl oz/A	F2											
	Destiny HC	1.5	pt/A	C											
	N Pak-AMS	2.6	% v/v	CF2	8.4	0	0	0	0	95	96	99	92	95	99
28	FlexStar GT	2.68	pt/A	C											
	R.U. P. Max	22.5	fl oz/A	C											
	R.U. P. Max	22	fl oz/A	F2											
	Destiny HC	1.5	pt/A	C											
	N Pak-AMS	2.6	% v/v	CF2	9	0	0	0	0	96	99	99	94	94	99
29	Cadet	0.9	fl oz/A	C											
	R.U. P. Max	44	fl oz/A	C											
	R.U. P. Max	22	fl oz/A	F1											
	Destiny HC	1.5	pt/A	C											
	N Pak-AMS	2.6	% v/v	CF1	8.8	0	0	0	0	59	99	99	34	97	99
30	Verdict	5	fl oz/A	A											
	Zidua	2.5	oz wt/A	A											
	FlexStar GT	2.68	pt/A	D2											
	R.U. P. Max	22.5	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	(G)											
	Destiny HC	1.5	pt/A	D2											
	N Pak-AMS	2.6	% v/v	D2(G)	11.2	4	66	55	82	98	99	99	eat98	98	99
31	Boundary	1.8	pt/A	A											
	FlexStar GT	2.68	pt/A	D1											
	R.U. P. Max	22.5	fl oz/A	D1											
	R.U. P. Max	22	fl oz/A	G											
	Destiny HC	1.5	pt/A	D1											
	N Pak-AMS	2.6	% v/v	D1G	13.3	6	61	54	80	99	99	99	99	99	99
32	Outlook	10	fl oz/A	B											
	R.U. P. Max	44	fl oz/A	B											
	R.U. P. Max	22	fl oz/A	E2											
	N Pak-AMS	2.6	% v/v	BE2	9.5	17	86	95	99	74	99	99	61	99	99
33	Outlook	10	fl oz/A	B											
	Cobra	12.5	fl oz/A	B											
	R.U. P. Max	44	fl oz/A	B											
	R.U. P. Max	22	fl oz/A	E2											
	Destiny HC	1.5	pt/A	B											
	N Pak-AMS	2.6	% v/v	BE2	7	64	98	99	99	89	95	98	75	85	96

Table 2. Management of Glyphosate-Resistant Common Ragweed in Roundup Ready® and LibertyLink® Soybean – Mayville, ND – 2012 (Stachler).

Trt No.	Herbicide	Rate	Rate Unit	App Code[1]	Oct 12 Soyb Yield	June 8 Soyb Inju	June 8 Corw[2] Cntl	June 8 Colq Cntl	June 8 Rrpw Cntl	July 14 Corw[2] Cntl	July 14 Colq Cntl	July 14 Rrpw Cntl	Sept 25 Corw[2] Cntl	Sept 25 Colq Cntl	Sept 25 Rrpw Cntl
Roundup Ready Soybean					bu/A	%--									
34	Zidua	2.5	oz wt/A	A											
	Verdict	5	fl oz/A	A											
	Outlook	10	fl oz/A	D2											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	G											
	N Pak-AMS	2.6	% v/v	D2G	8	8	68	49	82	71	99	99	69	98	99
35	Zidua	2.5	oz wt/A	A											
	Verdict	5	fl oz/A	A											
	Cobra	12.5	fl oz/A	D2											
	Outlook	10	fl oz/A	D2											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	(G)											
	Destiny HC	1.5	pt/A	D2											
	N Pak-AMS	2.6	% v/v	D2(G)	11	5	67	61	88	99	99	99	99	98	99
36	Zidua	2.5	oz wt/A	A											
	Verdict	5	fl oz/A	A											
	Warrant	3	pt/A	D2											
	Cobra	12.5	fl oz/A	D2											
	R.U. P. Max	44	fl oz/A	D2											
	R.U. P. Max	22	fl oz/A	(G)											
	Destiny HC	1.5	pt/A	D2											
	N Pak-AMS	2.6	% v/v	D2(G)	11.7	8	68	61	83	99	99	99	99	95	99
37	Non-treated Check				0	0	0	0	0	0	0	0	0	0	0
38	R.U. P. Max	44	fl oz/A	B											
	R.U. P. Max	22	fl oz/A	E1											
	N Pak-AMS	2.6	% v/v	BE1											
	+ Hand Weed				12.9	2	75	78	80	99	99	99	99	99	99
	LSD 5%				**4.6**	**3.4**	**6.8**	**10.6**	**10.0**	**4.7**	**1.8**	**1.4**	**5.9**	**4.6**	**2.1**
	CV%				**33.5**	**30.3**	**9**	**16**	**12**	**4**	**1**	**1**	**5**	**4**	**2**

[1]Application codes: A = PRE and B, C, D1, D2, E1, E2, F1, F2, and G = POST at respective dates in Table 1. (G) = planned application, but NOT applied.

[2]The common ragweed at this location is resistant to glyphosate, although not all plants are resistant.

Summary: This research site has glyphosate-resistant common ragweed based upon the poor (58%) control of common ragweed on Sept. 25th following two Roundup PowerMAX applications and the 84% average mortality of 10 flagged common ragweed plants/plot on August 8th for treatments 20, 23, 26, and 29.

The greatest soybean yields were obtained from treatments having a PRE herbicide(s) followed by Flexstar plus Liberty in LibertyLink soybean and a PRE herbicide(s) followed by Flexstar or Cobra plus Roundup PowerMAX in Roundup Ready soybean. There is no real difference in yield between the LibertyLink and Roundup Ready soybean varieties used in this trial. Soybean yields were low and the CV was high due to extreme moisture stress caused by the sandy soil at this site and limited rainfall.

At the time of the POST application, the most effective PRE treatment for control of common ragweed was Valor + Dimetric (metribuzin) [74%]. Prefix and Verdict or Sharpen plus Zidua provided similar control (67 to 69%) and Fierce provided the poorest control (44%).

ONLY treatments 27, 28, 31, 35, and 36 (PRE herbicide(s) followed by a tank-mixture with glyphosate) controlled greater than 91% of glyphosate-resistant common ragweed on September 25th, meaning only an effective PRE herbicide followed by a tank-mixture of Flexstar or Cobra with glyphosate can be applied in Roundup Ready soybean to achieve excellent common ragweed control. ALL treatments in LibertyLink soybean controlled greater than 91% of common ragweed, meaning any timely herbicide sequence or combination can effectively control common ragweed in LibertyLink soybean.

All treatments in Roundup Ready soybean controlled greater than 93% of lambsquarters and redroot pigweed (mostly redroot, but some prostrate and tumble) except for lambsquarters in treatment 33. All treatments in LibertyLink soybean controlled greater than 91% of lambsquarters and redroot pigweed, except for lambsquarters in treatments 8 and 9.