

Comparison of the Impact of BMP Rates of Atrazine Tank Mixed with Several Broadleaf Herbicides in Field Corn at Rochester, MN, in 2007, 2008 and 2009

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The Minnesota Department of Agriculture has developed voluntary Best Management Practices (BMP) for the use of atrazine in areas where it is frequently detected in ground and surface waters. The purpose of these BMPs is to prevent the degradation of water resources while maintaining atrazine's effectiveness as part of an integrated weed management program. The objectives of this trial were: 1) To evaluate weed control of herbicide programs with and without atrazine applied at BMP rates, 2) To evaluate performance of herbicides used as replacements for atrazine and 3) To evaluate crop safety and economics of potential replacements in field corn in southeastern Minnesota.

In 2007, the research site was a Lawler loam series with a pH of 7.0 and soil test P and K levels of 16 ppm and 160 ppm, respectively. Spring fertilizer was broadcast ahead of planting on April 13, at a rate of 99-23-60-24 (N-P-K-S). The area was side dressed with an additional 30 lb/A of N on June 7. The field was spring disked twice and field cultivated once prior to planting. The corn hybrid, Pioneer 38H65, was planted on April 27, 2007 at a depth of 1.5 inches in 30 inch rows at 32,000 seeds per acre. Evaluations of the plots were taken on May 30, June 4, June 11, and June 28 and August 10, 2007.

In 2008, the research site was a Lawler loam series with a pH of 6.7, organic matter 3.2%, and soil test P and K levels of 22 ppm and 126 ppm, respectively. Spring fertilizer was broadcast ahead of planting on April 16, at a rate of 120-36-86-28 (N-P-K-S). The area was side dressed with an additional 35 lb/A of N on June 25. The field was fall chisel plowed, spring disked once and field cultivated once prior to planting. The corn hybrid, DeKalb DKC50-19 101RM, was planted on May 9, 2008, at a depth of 2.0 inches in 30 inch rows at 35,000 seeds per acre. Evaluations of the plots were taken on June 9, 18, July 1 and 30, 2008.

In 2009, treatments were modified to evaluate additional atrazine replacement options. The research site was a Lawler loam series with a pH of 6.8 and soil test P and K levels of 37 ppm and 115 ppm, respectively. Spring fertilizer was broadcast ahead of planting on April 17th at a rate of 126-35-120-24 (N-P-K-S). The area was side dressed with an additional 30 lb/A of N on June 15. The field was spring disked and field cultivated once prior to planting. The corn hybrid, Pioneer 35F44, was planted on May 8th, 2009, at a depth of 1.5 inches in 30 inch rows at 35,000 seeds per acre.

Evaluations of the plots were taken on May 28, June 11, 16, and 24, and August 27. Application dates, environmental conditions, and weed stages are listed below.

A randomized complete block design was used with four replications. Preemergence (PRE) and postemergence (POST) treatments were applied with a tractor-mounted sprayer delivering 20 gpa at 32 psi using Turbo Tee 11002 nozzles. Application dates, environmental conditions, and weed stages are listed below in Tables 1, 2, and 3. The center two rows of each plot were machine harvested on September 26, 2007, November 3, 2008, and November 13, 2009.

CONCLUSIONS

In 2007, soil applied atrazine (Bicep Lite II Mag) applied at recommended BMP rates for SE Minnesota resulted in no improvement of broadleaf weed control compared to the no atrazine control of Dual II Mag (data not shown). Postemergence programs that included atrazine at 0.5 lb/A, which is lower than the BMP rate of 0.8 lb/A for SE Minnesota, significantly improved postemergence weed control.

In 2007 and 2008, giant ragweed control was improved when postemergence treatments included atrazine. In 2008, Callisto + either Buctril or Clarity provided giant ragweed control similar to Callisto + AAtrex 4L. However, Callisto + Buctril resulted in 20% injury to corn. Hornet + AAtrex 4L or Callisto at a reduced rate, 1 fl oz/a, provided significantly greater giant ragweed control than Hornet applied alone. Hornet + Callisto provided greater giant ragweed control than Hornet + AAtrex 4L, 97 compared to 91%, respectively. In 2008, Clarity + Callisto provided giant ragweed control equivalent to Clarity + AAtrex 4L.

In 2007 and 2008, common waterhemp and common lambsquarters control were similar for Callisto and Callisto + AAtrex 4L. Hornet + AAtrex 4L and Clarity + AAtrex 4L provided greater control of common waterhemp and common lambsquarters in 2007. In 2008, common waterhemp control was improved significantly with the addition of either the BMP rate of atrazine or Callisto to Hornet as compared to Hornet alone. Also, common waterhemp control with Hornet + Callisto at 1 fl oz/a was significantly greater than with Hornet + AAtrex 4L, 94 compared to 80%, respectively.

In 2009, the addition of AAtrex 4L provided no additional control of common waterhemp, common lambsquarters, velvetleaf or woolly cupgrass for the preemergence programs of SureStart or Camix. For the postemergence programs in 2009, the addition of AAtrex 4L to Ignite improved common waterhemp and common lambsquarters control compared to Ignite alone or with Buctril. The addition of Buctril to Ignite reduced common lambsquarters to 83% control and woolly cupgrass to 87% control compared to Ignite alone (87 and 94%) or Ignite + AAtrex 4L (98 and 93%), respectively. The addition of AAtrex 4L or Buctril to Capreno or Halex GT did not improve common waterhemp, common lambsquarters or velvetleaf control. However, woolly cupgrass control was reduced with the addition of AAtrex 4L or Buctril to Capreno.

Corn grain yields were greater for both Callisto + AAtrex 4L and Hornet + AAtrex 4L when compared to their non-atrazine partners in 2007. Due to plot variability in 2008, corn yields were not significantly different at the $P \leq 0.10$. In 2009, corn grain yields for comparisons with and without AAtrex 4L were not different. However, Ignite + Buctril resulted in lower grain yield compared to Ignite alone or with AAtrex 4L, 163 compared to 182 and 180 bu/A, respectively.

BMP rates of atrazine can improve the effectiveness of Callisto, Hornet and Clarity on certain weeds and increase grain yields. The data from 2008 would indicate that Buctril, Callisto, and Clarity may be potential replacements for atrazine. However more research is necessary and crop safety is a concern with Buctril. (University of Minnesota Extension, Regional Office – Rochester).

Table 1. Application dates, conditions, and plant stages in 2007, 2008, and 2009.

Date	4/27/2007	5/23/2007	5/9/2008	6/2/2008	5/8/2009	6/11/2009	6/20/2009
Treatment	PRE	POST	PRE	POST I	PRE	POST I	POST II
Temperature (F)							
Air	71	70	61	72	69	67	83
soil	62.1	69.4	61	62	56	68.7	78.0
Relative Humidity (%)	34	70	32	57	33	48	39
Wind (mph)	10	23	9	8	0	10	13
Soil moisture	Adequate	Excessive	Adequate	Excessive	Inadequate	Adequate	Adequate
Corn							
stage	--	3 collar	--	V1-V2	--		7-collar
height (inch)	--	4.0	--	3.5	--	6.0	20.0
Giant Ragweed							
weed density (ft ²)	--	24.9	--	1.8	--	2.9	2.9
height (inch)	--	1.6	--	2.6	--	3.9	2.3
Common Lambsquarters							
weed density (ft ²)	--	4	--	21.5	--	12.1	12.1
height (inch)	--	1.1	--	1.3	--	6.6	
Common Waterhemp							
weed density (ft ²)	--	3.5	--	89.4	--	3.0	3.0
height (inch)	--	1.1	--	0.7	--	2.9	3.0
Giant Foxtail							
weed density (ft ²)	--	1.5	--	3	--	23.5	23.5
height (inch)	--	1.3	--	1.7	--	4.1	5.0
Velvetleaf							
weed density (ft ²)	--	1.5	--		--	0	0
height (inch)	--	2.0	--		--	1.5	
Rainfall after each application (inch)							
week 1	0.52	2.04	1.07	4.79	0.61	1.24	0.32
week 2	0.52	1.28	0.08	3.52	0.00	0.15	0.21
week 3	0.34	0.38	2.15	0.00	1.95	0.17	0.85

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Table 2. Performance of herbicide systems for giant ragweed control in field corn on May 30, June 4, 11, 28, and August 10 at Rochester, MN in 2007.

Treatment	Rate	Giant Ragweed Control					Yield
		5/30	6/4	6/11	6/28	8/10	15.5%
	(rate/A)	Giant Ragweed Control (%)					(bu/A)
PRE							
Dual II Mag	1 pt	0	0	0	0	0	5
Bicep Lite II Mag	2.3 pt	0	0	0	0	0	4
PRE / POST I							
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	73	88	82	87	84	124
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5% v/v	95	96	94	96	95	159
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz + 1% v/v + 2.5% v/v	76	78	73	89	81	109
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz + 16 fl oz + 1% v/v + 2.5% v/v	92	93	90	92	93	142
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	76	85	79	77	74	97
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	93	94	88	90	86	120
	LSD (P=0.10)	4	3	3	3	3	25

Table 3. Performance of herbicide systems for giant ragweed control in field corn on June 9, 18, July 1 and 30 at Rochester, MN, in 2008.

Treatment	Rate	Giant Ragweed Control				Yield
		6/9	6/18	7/1	7/30	
	(rate/A)	Giant Ragweed Control (%)				(bu/A)
PRE / POST I						
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	71	84	86	86	187
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5% v/v	90	96	96	98	227
Dual II Mag / Callisto + Buctril + COC + 28% UAN	1 pt / 3 fl oz + 6 fl oz + 1% v/v + 2.5% v/v	95	96	96	96	234
Dual II Mag / Callisto + Clarity + COC + 28% UAN	1 pt / 3 fl oz + 4 fl oz + 1% v/v + 2.5% v/v	78	96	96	99	234
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz wt + 1% v/v + 2.5% v/v	75	83	92	86	194
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz wt + 16 fl oz + 1% v/v + 2.5% v/v	90	95	96	91	216
Dual II Mag / Hornet + Callisto + COC + 28% UAN	1 pt / 3 oz wt + 1 fl oz + 1% v/v + 2.5% v/v	80	92	92	97	212
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	72	92	89	92	209
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	91	97	95	97	230
Dual II Mag / Clarity + Callisto + COC + 28% UAN	1 pt / 1 pt + 1 fl oz + 1% v/v + 2.5% v/v	78	97	95	97	218
	LSD (P=0.10)	4	4	5	3	NS

Table 4. Performance of herbicide systems for common lambsquarters control in field corn on May 3, June 4, 11, 28, and August 10 at Rochester, MN in 2007.

Treatment	Rate	Common Lambsquarters Control					Yield 15.5%
		5/30	6/4	6/11	6/28	8/10	
	(rate/A)	(%)					(bu/A)
PRE							
Dual II Mag	1 pt	30	40	0	0	0	5
Bicep Lite II Mag	2.3 pt	36	40	0	0	0	4
PRE / POST I							
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	85	93	99	99	99	124
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5% v/v	99	99	99	99	99	159
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz + 1% v/v + 2.5% v/v	70	78	70	71	68	109
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz + 16 fl oz + 1% v/v + 2.5% v/v	98	99	99	99	99	142
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	75	73	77	81	74	97
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	97	98	99	99	99	120
	LSD (P=0.10)	4	6	4	4	3	25

Table 5. Performance of herbicide systems for common lambsquarter control in field corn on June 9, 18, July 1 and 30 at Rochester, MN, in 2008.

Treatment	Rate	Common Lambsquarter Control			Yield	
		6/9	6/18	7/1 7/30		
	(rate/A)	(%)			(bu/A)	
PRE / POST I						
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	81	99	99	98	187
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5 % v/v	96	99	99	99	227
Dual II Mag / Callisto + Buctril + COC + 28% UAN	1 pt / 3 fl oz + 6 fl oz + 1% v/v + 2.5% v/v	97	99	99	97	234
Dual II Mag / Callisto + Clarity + COC + 28% UAN	1 pt / 3 fl oz + 4 fl oz + 1% v/v + 2.5% v/v	80	99	99	99	234
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz wt + 1% v/v + 2.5% v/v	76	95	97	98	194
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz wt + 16 fl oz + 1% v/v + 2.5% v/v	94	99	99	98	216
Dual II Mag / Hornet + Callisto + COC + 28% UAN	1 pt / 3 oz wt + 1 fl oz + 1% v/v + 2.5% v/v	78	99	99	99	212
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	74	95	96	99	209
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	92	99	99	99	230
Dual II Mag / Clarity + Callisto + COC + 28% UAN	1 pt / 1 pt + 1 fl oz + 1% v/v + 2.5% v/v	81	99	99	99	218
	LSD (P=0.10)	5	2	2	NS	NS

Table 6. Performance of herbicide systems for common lambsquarters control in field corn on May 28, June 11, 16, and 24 and August 27 at Rochester, MN, in 2009.

Treatment	Rate (rate/A)	Common Lambsquarters Control					Yield (bu/A)
		5/28	6/11	6/16	6/24	8/27	
		Common Lambsquarters Control (%)					
Untreated Check		0	0	0	0	0	24
Weed Free		100	100	100	100	100	171
PRE							
SureStart	1.75 pt	89	96	96	81	82	162
SureStart+ Aatrex 4L	1.75 pt + 20 fl oz	86	95	94	81	82	160
PRE/POST I							
Dual II Mag/Laudis + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	63	63	60	93	99	163
Dual II Mag/Laudis + Clarity + COC + UAN	1 pt/3 fl oz + 4 fl oz + 1% v/v + 0.5 qt	61	61	60	93	99	168
Dual II Mag/Ignite + AMS	1 pt/22 fl oz + 10 lb/100 gal	56	61	71	93	87	182
Dual II Mag/Ignite + Aatrex 4L + AMS	1 pt/22 fl oz + 1 pt + 10 lb/100 gal	60	60	73	98	98	180
Dual II Mag/Ignite + Buctril + AMS	1 pt/22 fl oz + 6 fl oz + 10 lb/100 gal	56	60	71	85	83	163
Dual II Mag/Capreno + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	54	61	61	84	98	175
Dual II Mag/Capreno + Aatrex 4L + MSO + UAN	1 pt/3 fl oz + 1 pt + 1% v/v + 1.5 qt	58	61	63	99	99	162
Dual II Mag/Capreno + Buctril + COC + UAN	1 pt/3 fl oz + 6 fl oz + 1% v/v + 1.5 qt	59	63	65	99	98	178
PRE/POST II							
Camix/Accent + MSO + UAN	2 qt/0.67 oz wt + 1% v/v + 1.5 qt	90	99	99	99	99	180
Lumax/Accent + MSO + UAN	2.5 qt/0.67 oz wt + 1% v/v + 1.5 qt	95	99	99	99	99	175
POST I							
Halex GT + NIS + AMS	3.6 pt + 0.25 % v/v + 10 lb/100 gal	0	0	69	97	98	166
Halex GT + Aatrex 4L + NIS + AMS	3.6 pt + 1 pt + 0.25 % v/v + 10 lb/100 gal	0	0	66	99	99	176
Halex GT + Buctril + NIS + AMS	3.6 pt + 6 fl oz + 0.25 % v/v + 10 lb/100 gal	0	0	69	99	99	173
LSD (P=0.10)		5	2	4	4	3	17

Table 7. Performance of herbicide systems for common waterhemp control in field corn on May 30, June 4, 11, 28, and August 10 at Rochester, MN in 2007.

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Treatment	Rate	Common Waterhemp Control					Yield 15.5%
		5/30	6/4	6/11	6/28	8/10	
	(rate/A)	(%)					(bu/A)
PRE							
Dual II Mag	1 pt	40	70	0	0	0	5
Bicep Lite II Mag	2.3 pt	40	73	0	0	0	4
PRE / POST I							
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	96	92	97	90	94	124
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5% v/v	99	99	99	98	98	159
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz + 1% v/v + 2.5% v/v	81	91	78	82	70	109
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz + 16 fl oz + 1% v/v + 2.5% v/v	87	95	86	83	86	142
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	83	92	84	87	73	97
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	96	94	87	88	88	120
LSD (P=0.10)		4	5	4	4	4	25

Table 8. Performance of herbicide systems for common waterhemp control in field corn on June 9, 18, July 1 and 30 at Rochester, MN, in 2008.

Treatment	Rate	Common Waterhemp Control				Yield
		6/9	6/18	7/1	7/30	
	(rate/A)	(%)				(bu/A)
PRE / POST I						
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	83	99	98	93	187
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5% v/v	92	99	98	94	227
Dual II Mag / Callisto + Buctril + COC + 28% UAN	1 pt / 3 fl oz + 6 fl oz + 1% v/v + 2.5% v/v	97	99	98	95	234
Dual II Mag / Callisto + Clarity + COC + 28% UAN	1 pt / 3 fl oz + 4 fl oz + 1% v/v + 2.5% v/v	78	99	97	95	234
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz wt + 1% v/v + 2.5% v/v	63	71	50	41	194
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz wt + 16 fl oz + 1% v/v + 2.5% v/v	81	87	84	80	216
Dual II Mag / Hornet + Callisto + COC + 28% UAN	1 pt / 3 oz wt + 1 fl oz + 1% v/v + 2.5% v/v	74	99	98	94	212
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	76	97	92	91	209
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	96	99	94	92	230
Dual II Mag / Clarity + Callisto + COC + 28% UAN	1 pt / 1 pt + 1 fl oz + 1% v/v + 2.5% v/v	86	99	96	92	218
LSD (P=0.10)		7	2	2	3	NS

Table 9. Performance of herbicide systems for common waterhemp control in field corn on May 28, June 11, 16, and 24 and August 27 at Rochester, MN, in 2009.

Treatment	Rate (rate/A)	Common Waterhemp Control					Yield (bu/A)
		5/28	6/11	6/16	6/24	8/27	
		%					
Untreated Check		0	0	0	0	0	24
Weed Free		100	100	100	100	100	171
PRE							
SureStart	1.75 pt	93	99	97	95	93	162
SureStart+ Aatrex 4L	1.75 pt + 20 fl oz	92	98	97	94	94	160
PRE/POST I							
Dual II Mag/Laudis + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	69	65	86	92	93	163
Dual II Mag/Laudis + Clarity + COC + UAN	1 pt/3 fl oz + 4 fl oz + 1% v/v + 0.5 qt	70	65	88	87	95	168
Dual II Mag/Ignite + AMS	1 pt/22 fl oz + 10 lb/100 gal	65	66	93	96	84	182
Dual II Mag/Ignite + Aatrex 4L + AMS	1 pt/22 fl oz + 1 pt + 10 lb/100 gal	66	66	90	98	98	180
Dual II Mag/Ignite + Buctril + AMS	1 pt/22 fl oz + 6 fl oz + 10 lb/100 gal	64	64	90	92	85	163
Dual II Mag/Capreno + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	69	65	82	96	99	175
Dual II Mag/Capreno + Aatrex 4L + MSO + UAN	1 pt/3 fl oz + 1 pt + 1% v/v + 1.5 qt	68	63	86	99	99	162
Dual II Mag/Capreno + Buctril + COC + UAN	1 pt/3 fl oz + 6 fl oz + 1% v/v + 1.5 qt	69	66	83	99	99	178
PRE/POST II							
Camix/Accent + MSO + UAN	2 qt/0.67 oz wt + 1% v/v + 1.5 qt	88	97	98	97	99	180
Lumax/Accent + MSO + UAN	2.5 qt/0.67 oz wt + 1% v/v + 1.5 qt	94	99	99	99	99	175
POST I							
Halex GT + NIS + AMS	3.6 pt + 0.25 % v/v + 10 lb/100 gal	0	0	90	99	97	166
Halex GT + Aatrex 4L + NIS + AMS	3.6 pt + 1 pt + 0.25 % v/v + 10 lb/100 gal	0	0	84	98	97	176
Halex GT + Buctril + NIS + AMS	3.6 pt + 6 fl oz + 0.25 % v/v + 10 lb/100 gal	0	0	85	98	98	173
LSD (P=0.10)		5	2	3	3	4	17

Table 10. Performance of herbicide systems for grass control in field corn on May 28, June 11, 16, and 24 and August 27 at Rochester, MN, in 2009.

Treatment	Rate	Grass Control					Yield
		5/28	6/11	6/16	6/24	8/27	
	(rate/A)	(%)					(bu/A)
Untreated Check		0	0	0	0	0	24
Weed Free		100	100	100	100	100	171
PRE							
SureStart	1.75 pt	96	89	92	80	71	162
SureStart+ Aatrex 4L	1.75 pt + 20 fl oz	95	88	89	82	69	160
PRE/POST I							
Dual II Mag/Laudis + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	89	81	91	90	89	163
Dual II Mag/Laudis + Clarity + COC + UAN	1 pt/3 fl oz + 4 fl oz + 1% v/v + 0.5 qt	87	79	91	88	86	168
Dual II Mag/Ignite + AMS	1 pt/22 fl oz + 10 lb/100 gal	89	78	98	97	94	182
Dual II Mag/Ignite + Aatrex 4L + AMS	1 pt/22 fl oz + 1 pt + 10 lb/100 gal	87	80	97	95	93	180
Dual II Mag/Ignite + Buctril + AMS	1 pt/22 fl oz + 6 fl oz + 10 lb/100 gal	84	75	87	94	87	163
Dual II Mag/Capreno + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	90	79	95	90	86	175
Dual II Mag/Capreno + Aatrex 4L + MSO + UAN	1 pt/3 fl oz + 1 pt + 1% v/v + 1.5 qt	89	79	93	89	83	162
Dual II Mag/Capreno + Buctril + COC + UAN	1 pt/3 fl oz + 6 fl oz + 1% v/v + 1.5 qt	89	76	94	88	77	178
PRE/POST II							
Camix/Accent + MSO + UAN	2 qt/0.67 oz wt + 1% v/v + 1.5 qt	93	81	89	81	94	180
Lumax/Accent + MSO + UAN	2.5 qt/0.67 oz wt + 1% v/v + 1.5 qt	93	82	87	79	95	175
POST I							
Halex GT + NIS + AMS	3.6 pt + 0.25 % v/v + 10 lb/100 gal		0	10	96	92	166
Halex GT + Aatrex 4L + NIS + AMS	3.6 pt + 1 pt + 0.25 % v/v + 10 lb/100 gal		0	6	93	94	176
Halex GT + Buctril + NIS + AMS	3.6 pt + 6 fl oz + 0.25 % v/v + 10 lb/100 gal		0	10	92	94	173
LSD (P=0.10)		4	5	2	3	3	17

Table 11. Performance of herbicide systems for velvetleaf control in field corn on May 28, June 11 and 24, and August 27 at Rochester, MN, in 2009.

Treatment	Rate	Velvetleaf Control				Yield
		5/28	6/11	6/24	8/27	
	(rate/A)	(%)				(bu/A)
Untreated Check		0	0	0	0	24
Weed Free		100	100	100	100	171
PRE						
SureStart	1.75 pt	89	90	78	81	162
SureStart+ Aatrex 4L	1.75 pt + 20 fl oz	86	86	77	76	160
PRE/POST I						
Dual II Mag/Laudis + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	0	0	92	91	163
Dual II Mag/Laudis + Clarity + COC + UAN	1 pt/3 fl oz + 4 fl oz + 1% v/v + 0.5 qt	0	0	94	98	168
Dual II Mag/Ignite + AMS	1 pt/22 fl oz + 10 lb/100 gal	0	0	87	81	182
Dual II Mag/Ignite + Aatrex 4L + AMS	1 pt/22 fl oz + 1 pt + 10 lb/100 gal	0	0	90	83	180
Dual II Mag/Ignite + Buctril + AMS	1 pt/22 fl oz + 6 fl oz + 10 lb/100 gal	0	0	92	89	163
Dual II Mag/Capreno + MSO + UAN	1 pt/3 fl oz + 1% v/v + 1.5 qt	0	0	94	94	175
Dual II Mag/Capreno + Aatrex 4L + MSO + UAN	1 pt/3 fl oz + 1 pt + 1% v/v + 1.5 qt	0	0	99	98	162
Dual II Mag/Capreno + Buctril + COC + UAN	1 pt/3 fl oz + 6 fl oz + 1% v/v + 1.5 qt	0		98	95	178
PRE/POST II						
Camix/Accent + MSO + UAN	2 qt/0.67 oz wt + 1% v/v + 1.5 qt	92	99	98	98	180
Lumax/Accent + MSO + UAN	2.5 qt/0.67 oz wt + 1% v/v + 1.5 qt	98	99	99	99	175
POST I						
Halex GT + NIS + AMS	3.6 pt + 0.25 % v/v + 10 lb/100 gal			98	99	166
Halex GT + Aatrex 4L + NIS + AMS	3.6 pt + 1 pt + 0.25 % v/v + 10 lb/100 gal			99	97	176
Halex GT + Buctril + NIS + AMS	3.6 pt + 6 fl oz + 0.25 % v/v + 10 lb/100 gal			99	98	173
LSD (P=0.10)		6	3	5	5	17

Table 12. Corn injury on June 9 and additional cost per acre over base herbicide program at Rochester, MN, in 2008.

Deleted: 1

Treatment	Rate (rate/A)	Injury 6/9	Economics ¹ (\$/A additional cost over base program)
PRE / POST I			
Dual II Mag / Callisto + COC + 28% UAN	1 pt / 3 fl oz + 1% v/v + 2.5% v/v	0	
Dual II Mag / Callisto + Aatrex + COC + 28% UAN	1 pt / 3 fl oz + 16 fl oz + 1% v/v + 2.5 % v/v	1	+ 1.50
Dual II Mag / Callisto + Buctril + COC + 28% UAN	1 pt / 3 fl oz + 6 fl oz + 1% v/v + 2.5% v/v	20	+ 3.40
Dual II Mag / Callisto + Clarity + COC + 28% UAN	1 pt / 3 fl oz + 4 fl oz + 1% v/v + 2.5% v/v	0	+ 3.30
Dual II Mag / Hornet + COC + 28% UAN	1 pt / 3 oz wt + 1% v/v + 2.5% v/v	0	
Dual II Mag / Hornet + Aatrex + COC + 28% UAN	1 pt / 3 oz wt + 16 fl oz + 1% v/v + 2.5% v/v	0	+1.50
Dual II Mag / Hornet + Callisto + COC + 28% UAN	1 pt / 3 oz wt + 1 fl oz + 1% v/v + 2.5% v/v	0	+5.00
Dual II Mag / Clarity + 28% UAN	1 pt / 1 pt + 2.5% v/v	0	
Dual II Mag / Clarity + Aatrex + 28% UAN	1 pt / 1 pt + 16 fl oz + 2.5% v/v	0	+1.50
Dual II Mag / Clarity + Callisto + COC + 28% UAN	1 pt / 1 pt + 1 fl oz + 1% v/v + 2.5% v/v	0	+6.20
LSD (P=0.10)		1	

1. Aatrex @ 16 oz = \$1.50, Buctril @ 6 oz = \$3.40, Callisto @ 1 oz/A = \$5.00, Clarity @ 4 oz = \$3.30.

Table 13. Performance and comparison of herbicide systems with and without atrazine in field corn at Rochester, MN, in 2007 and 2008

Treatment	Rate(s)	Injury ¹	Giant Ragweed ¹		Common Waterhemp ¹		Common Lambsquarters ¹		Yield	
		(%)	----- % control -----							
	(rate/A)	2008	2007	2008	2007	2008	2007	2008	2007	2008
POSTEMERGENCE²										
Callisto	3 fl oz	0	84	86	94	93	99	98	124	187
Callisto + atrazine	3 fl oz + 16 fl oz	1	95	98	98	94	99	99	159	227
Callisto + Buctril	3 fl oz + 6 fl oz	20	---	96	---	95	---	97	---	234
Callisto + Clarity	3 fl oz + 4 fl oz	0	---	99	---	95	---	99	---	234
Hornet	3 oz	0	81	86	70	41	68	98	109	194
Hornet + atrazine	3 oz + 16 fl oz	0	93	91	86	80	99	98	142	216
Hornet + Callisto	3 oz + 1 fl oz	0	---	97	---	94	---	99	---	212
Clarity	1 pt	0	74	92	73	91	74	99	97	209
Clarity + atrazine	1 pt + 16 fl oz	0	86	97	88	92	99	99	120	230
Clarity + Callisto	1 pt + 1 fl oz	0	---	97	---	92	--	99	---	218
LSD (P=.10)		1	3	3	4	3	3	NS	25	NS

1. Injury only occurred in 2008. Injury rating taken on 6/9/2008. Weed control rating 8/10/2007 and 7/30/2008.

2. All treatments had Dual II Magnum applied preemergence at 1 pt per acre.