

Preemergence weed control in an Enlist soybean cropping system at Rosemount, MN - 2019. Gunsolus, Jeffrey L., Douglas W. Miller, Ryan Mentz, McKenzie Barth, and Lewis Sheaffer. The objective of this experiment was to evaluate weed control with several preemergence herbicides in an Enlist (2,4-D choline) tolerant soybean herbicide program. The experiment was conducted at Rosemount, MN on a Waukegon silt loam (4% sand, 52% silt, 44% clay) with pH 5.2 and 4.3% organic matter. Soil test P and K were 40 and 266 lbs/A, respectively. The area was weedy fallow in 2018 and was chisel plowed in the fall. In 2019, the area was field cultivated on April 25. On April 29, the area was fertilized with 60 lbs/A P and 60 lbs/A K. The area was field cultivated twice on May 30. On May 31, Enlist E3 Stine 14EA02 Brand soybeans were seeded in 30 inch rows at a rate of 150,000 seeds/A. The experimental design was a randomized complete block with four replications. Plot size was 15 by 30 feet. All treatments were applied to a 10 foot wide strip with a tractor mounted, compressed air sprayer with an eight nozzle boom and 15 inch nozzle spacing at 35 psi pressure producing a spray volume of 15 gpa. Preemergence treatments were applied on May 31 with 110015VS XR Teejet flat-fan spray tips. A single postemergence application of Enlist One (0.95 lbs ae/A) + Roundup PowerMax (1.12 lbs ae/A) was applied to all treatments (including the no-preemergence check) on June 26 with Teejet 110015 AIXR spray tips. Weed control and soybean injury were visually rated. Three 0.25 m² grids were established in each plot for weed density counts. Yields were not determined. Data are presented in the Tables below. Weed control and density data were evaluated with an analysis of variance. Various data transformations were used as referenced in the Tables. All data presented are the original un-transformed means. Application environmental conditions and weed data are presented below.

Treatment Date	May 31	June 26
Application	Preemergence	Postemergence
Target Weed Stage	--	2" weeds
Soybean Stage	--	1-2 trifoliolate / 5-7"
Air Temperature (°F)	80	79
Relative humidity (%)	49	50
Dewpoint (°F)	60	59
Soil Moisture	moist at 1"	moist at 0.5"
Soil Temperature (°F)	80	80
Sky	30% clouds	55% clouds
Wind (mph)	W 3-8	S 4
Rainfall before Application		
Week 1 (inch)	1.56	1.32
Rainfall after Application		
Week 1 (inch)	1.14	3.08
Week 2 (inch)	0.20	1.05
Weed Size (inches / leaf stage)		
Amaranth species*	--	0.25 -0.75" / cot – 2lf
Common Lambsquarters (Colq)	--	0.25 -0.75" / cot – 4lf
Common Ragweed (Corw)	--	0.25 -0.75" / cot – 2lf
Eastern Black Nightshade (Ebns)	--	0.25 -0.5" / cot – 2lf
Pennsylvania Smartweed (Pesw)	--	1.5-6"
Foxtail (90% giant and 10% yellow)	--	0.25-1.5" / 1-4lf
Woolly Cupgrass	--	1-3" / 1-4lf

* 90-95% tall waterhemp and 5-10% Powell amaranth

General Observations

Heavy wind-driven rain occurred five days after the preemergence herbicide application. Later observation of weed control led to the conclusion that surface movement of herbicides occurred across the treated plot area into the adjacent untreated plot rows and potentially causing a dilution effect in parts of the treated 4-row plot. This may have accounted for some of the variation in weed control and densities observed in the data.

The primary broadleaf weed species were amaranth species (about 90 -95% tall waterhemp and 5-10% Powell amaranth), common lambsquarters, and common ragweed. The amaranth species density was high (160/m² on June 25) and well distributed throughout the experimental area. Common lambsquarters (47/m²) and common ragweed (13/m²) populations were lighter but more variable across the experimental area. Light populations of eastern black nightshade and Pennsylvania smartweed were also present with variable densities.

Woolly cupgrass (about 90%) was the primary grass species present. Foxtail species (about 7-10%) was the other major grass present and consisted of approximately 90% giant and 10% yellow foxtail. Grass species densities were variable throughout the experimental area. Woolly cupgrass was the primary grass to emerge after the sequential postemergence application. In addition, light and highly variable patches of wild proso millet (0-3%) emerged after the postemergence sequential application. Very few foxtail emerged after the post application.

The postemergence sequential application of Enlist One + Roundup PowerMax on June 26 controlled all emerged weeds. All weed control ratings and counts after this application pertain to newly emerged weeds. Soybean canopy competition was a factor in late season weed control and the resulting October 8 final ratings.

No soybean injury was observed.

Visual Weed Control Results

With the exception of Dimetric, all preemergence treatments provided excellent control of amaranth species on the June 25 rating date. These treatments also provided excellent residual control after the postemergence sequential application. Dimetric control of amaranth species was poor on June 25 and residual control did not differ from the untreated check at the later rating dates.

Valor EZ provided the least control of common lambsquarters on the June 25 rating date. Fierce MTZ, Boundary, and Dimetric provided good control and the remaining treatments generally provided excellent common lambsquarters control. Following the postemergence sequential application, residual lambsquarters control was excellent for all of the preemergence herbicide treatments with the exception of Dimetric which provided slightly reduced control. As a result of soybean canopy competition, no common lambsquarters were present in the preemergence herbicide treated plots on the October rating date. There were lambsquarters present in the no-preemergence check treatment.

On June 25, common ragweed control was fair to good with Authority First, Zidua Pro, Fierce MTZ Boundary, Valor EZ and the 11 oz/A rate of Authority Supreme HL. The other treatments provided very poor control of common ragweed. Very few common ragweed emerged after the postemergence application on June 26 resulting in the excellent control ratings at the later rating dates.

Eastern black nightshade was late emerging with little to none emerged on the June 25 rating date. Due to the low and variable population density, treatment differences in preemergence control were not significant. However, it was apparent the Dimetric was less effective than the other preemergence treatments based on visual observations. No nightshade was present in any of the treatments at the October rating as a result of soybean canopy competition.

The light and variable Pennsylvania smartweed populations made it difficult to visually rate control on June 25. Smartweed counts (Table 2) on June 25 were based on the whole plot area (225 ft²) rather than the three 0.25 m² quadrants that the other density counts were based on. There were no significant treatment differences in Pennsylvania smartweed densities on June 25. Most of the preemergence treatments showed good residual control following the postemergence sequential application with Dimetric providing slightly reduced residual control. All preemergence herbicides showed significantly better smartweed control than the untreated check on the July 25 and October 8 rating dates.

Valor EZ and Dimetric provided little to no control of foxtail species. Authority Supreme provided poor control, however the visual ratings for this treatment were highly variable between replications. All of the other treatments provided good to excellent foxtail control. The 11 oz/A rate of Authority Supreme HL and Boundary provided the best control of woolly cupgrass. The other treatments provided poor control with Authority First, Valor EZ, and Dimetric showing little to no control. Woolly cupgrass was the primary grass species to emerge after the postemergence sequential application. The Dimetric and Authority First treatments showed slightly less residual control of woolly cupgrass compared to the other preemergence herbicide treatments.

Weed Density Counts

Weed density counts generally matched the visual weed control data with deviations resulting from much higher variation in the count data. Visual weed control also took into consideration reduced weed size as a result of the herbicide treatment in addition to the actual density.

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Table 1. (Weed Control)

Preemergence Treatment ⁴	Rate	Amaranth ¹				Colq				Corw				Ebns				Pesw				foxtail ²		Wocg		all grass species ³		
		6/25	7/11	7/25	10/8	6/25	7/11	7/25	10/8	6/25	7/11	7/25	10/8	6/25	7/11	7/25	10/8	6/25	7/11	7/25	10/8	6/25	6/25	7/11	7/25	10/8		
	(product/A)	----- (% Control) -----																										
Authority First ⁵	6.4 oz	98 a	98 a	99 a	99 ab	100 a	100 a	100 a	100 a	91 a	99 a	99 a	100 a	--	99 a	99 a	100 a	--	100 a	100 a	100 a	98 ab	4 e	96 a	97 a	97 bc		
Authority Assist ⁶	10 oz	99 a	100 a	100 a	100 a	100 a	100 a	99 a	100 a	14 b	99 a	99 a	100 a	--	99 a	99 a	100 a	--	100 a	100 a	100 a	94 ab	21 cd	97 a	99 a	99 ab		
Authority Supreme ⁷	7 oz	99 a	99 a	99 a	100 a	97 ab	100 a	100 a	100 a	15 b	100 a	99 a	100 a	--	99 a	99 a	100 a	--	100 a	99 ab	100 a	45 c	28 c	98 a	99 a	99 a		
Authority Supreme HL ⁸	8 oz	99 a	98 a	99 a	99 ab	99 ab	98 a	99 a	100 a	16 b	100 a	100 a	100 a	--	99 a	99 a	100 a	--	99 a	99 ab	100 a	91 b	18 cd	99 a	99 a	99 a		
Authority Supreme HL	11 oz	100 a	100 a	100 a	100 a	100 a	98 a	99 a	100 a	78 a	100 a	100 a	99 a	--	100 a	100 a	100 a	--	99 ab	99 ab	100 a	97 ab	81 a	99 a	99 a	100 a		
Authority Supreme HL + Anthem Maxx ⁹	8 oz + 2.5 oz	99 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	23 b	99 a	99 a	100 a	--	100 a	100 a	100 a	--	98 ab	99 ab	99 a	95 ab	33 bc	99 a	99 a	100 a		
Zidua Pro ¹⁰	6 oz	99 a	98 ab	99 a	100 a	100 a	100 a	100 a	100 a	85 a	99 a	99 a	99 a	--	100 a	100 a	100 a	--	100 a	99 a	100 a	91 b	34 bc	98 a	99 a	99 a		
Fierce MTZ ¹¹	1 pt	98 a	100 a	100 a	100 a	94 cd	99 a	99 a	100 a	81 a	100 a	99 a	100 a	--	100 a	100 a	100 a	--	100 a	99 a	100 a	98 ab	46 b	99 a	99 a	100 a		
Boundary ¹²	29 oz	98 a	99 a	99 a	100 a	96 bc	98 a	99 a	100 a	73 a	100 a	100 a	100 a	--	99 a	99 a	100 a	--	99 a	99 a	100 a	100 a	89 a	99 a	99 a	100 a		
Valor EZ ¹³	2.5 oz	95 a	97 ab	99 a	100 a	86 e	99 a	99 a	100 a	86 a	100 a	99 a	100 a	--	99 a	99 a	100 a	--	100 a	100 a	100 a	15 d	6 de	98 a	98 a	99 a		
Dimetric ¹⁴	6 oz	64 b	93 c	95 b	97 bc	93 de	91 a	93 b	100 a	16 b	98 a	98 a	100 a	--	84 a	92 a	100 a	--	96 bc	98 b	99 a	0 e	3 e	93 a	89 a	96 c		
No Preemergence Applied		--	93 bc	93 b	94 c	--	96 a	98 a	95 b	--	96 a	96 a	98 a	--	97 a	97 a	100 a	--	90 c	91 c	92 b	--	--	97 a	93 a	94 c		
Data transformation applied ¹⁵		NT	AA	AA	AA	AA	AA	AA	NT	NT	AA	AA	AA		NT	NT	NT		AA	AA	NT	AA	AA	AA	NT	AA		

Means followed by same letter do not significantly differ (P=.05, LSD).

¹ 90-95% tall waterhemp and 5-10% Powell amaranth.

² 90% giant and 10% yellow foxtail

³ primarily woolly cupgrass with scattered giant/yellow foxtail and wild proso millet.

⁴ Preemergence applied May 31. A sequential postemergence application of Enlist One (0.95 lbs ae/A) + Roundup PowerMax (1.12 lbs ae/A) was applied to all treatments (including the no-preebergence check) on June 26.

⁵ Authority First 70DF = 63.1% sulfentrazone & 7.9% chloransulam-methyl..

⁶ Authority Assist 4L = sulfentrazone (3.3 lb ai/gal) & imazethapyr (0.67 lb ai/gal).

⁷ Authority Supreme 4.16SC = sulfentrazone (2.08 lb ai/gal) & pyroxasulfone (2.08 lb ai/gal).

⁸ Authority Supreme HL 1.0SC = non-labeled formulation from FMC.

⁹ Anthem Maxx 4.3SC = fluthiacet-methyl (0.126 lb ai/gal) & pyroxasulfone (4.174 lb ai/gal).

¹⁰ Zidua Pro 4.09L = 2.28 lbs ai/gal pyroxasulfone & 0.48 lbs ai/gal saflufenacil & 1.33 lbs ai/gal imazethapyr .

¹¹ Fierce MTZ 2.64 SC = flumioxazin (0.5 lb ai/gal) & pyroxasulfone (0.64 lb ai/gal) & metribuzin (1.5 lb ai/gal).

¹² Boundary 6.5L = S-metolachlor (5.25 lb ai/gal) & metribuzin (1.25 lb ai/gal).

¹³ Valor EZ1 4SCG = flumioxazin.

¹⁴ Dimetric 75DF = metribuzin.

¹⁵ Data transformation - AA = Automatic arcsine square root %, AL = Automatic log of X+1, AS = Automatic square root transformation of X+0.5, NT = Not transformed.

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Table 2. (Weed Density Counts)

Preemergence Treatment ³	Rate (product/A)	Amaranth ¹		Colq		Corw		Ebns		Pesw		all grass species ²	
		6/25	8/1	6/25	8/1	6/25	8/1	6/25	8/1	6/25	8/1	6/25	8/1
(# / m ²)													
Authority First ⁴	6.4 oz	3.0 abc	0.0 a	0.0 a	0.0 a	4.0 cde	0.0 a	--	0.0 a	0.7 a	0.0 a	46.7 bc	2.3 abc
Authority Assist ⁵	10 oz	1.7 abc	0.0 a	0.0 a	0.0 a	4.3 de	0.3 a	--	0.0 a	0.7 a	0.0 a	33.3 abc	2.0 abc
Authority Supreme ⁶	7 oz	1.7 abc	0.3 a	2.7 ab	0.0 a	2.7 bcd	0.0 a	--	0.0 a	2.1 a	0.0 a	51.3 bc	0.7 ab
Authority Supreme HL ⁷	8 oz	3.0 bc	0.0 a	0.3 a	0.0 a	4.0 de	0.0 a	--	0.0 a	1.5 a	1.0 a	32.0 abc	0.7 ab
Authority Supreme HL	11 oz	0.0 a	0.0 a	0.0 a	0.0 a	0.7 abc	0.0 a	--	0.0 a	1.1 a	0.0 a	13.3 a	0.3 ab
Authority Supreme HL + Anthem Maxx ⁸	8 oz + 2.5 oz	0.7 ab	0.0 a	0.0 a	0.0 a	2.3 bcd	0.0 a	--	0.0 a	0.8 a	0.0 a	34.0 abc	0.0 a
Zidua Pro ⁹	6 oz	1.3 ab	0.7 a	0.0 a	0.0 a	0.0 a	0.0 a	--	0.0 a	1.0 a	0.3 a	44.0 bc	2.0 abc
Fierce MTZ ¹⁰	1 pt	1.7 abc	0.0 a	4.7 bc	1.0 ab	0.3 ab	0.0 a	--	0.0 a	0.4 a	0.7 a	25.0 ab	0.3 ab
Boundary ¹¹	29 oz	11.0 cd	1.3 a	1.7 ab	4.7 bc	2.0 a-d	0.0 a	--	0.7 ab	0.5 a	0.0 a	28.7 ab	2.3 bc
Valor EZ ¹²	2.5 oz	2.7 abc	2.0 a	6.7 bc	0.0 a	2.0 a-d	0.3 a	--	0.0 a	0.8 a	0.0 a	39.7 abc	6.7 cd
Dimetric ¹³	6 oz	13.3 d	25.7 c	10.0 c	3.7 abc	7.7 ef	0.7 a	--	1.3 b	0.7 a	0.7 a	61.3 c	15.3 d
No Preemergence Applied	--	160.0 e	11.7 b	47.0 d	6.0 c	13.3 f	0.0 a	--	2.3 c	1.7 a	0.7 a	99.3 d	19.3 d
Data transformation applied ¹⁴		AL	AL	AL	NT	AA	NT		NT	NT	NT	NT	AL

Means followed by same letter do not significantly differ (P=.05, LSD).

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