

2013 Time of Weed Removal in Soybean: A Field Teaching Tool – Seeing is Believing

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Proper time of weed removal in soybean is a critical component of successful weed control programs that maximize crop yields. Over-reliance on postemergence glyphosate in corn and soybean has reduced herbicide diversification and the use of preemergence herbicides, and has over-simplified weed management programs. The result, increased early season weed competition, decreased time to effectively control weed populations, increased weed densities to be controlled by postemergence herbicides, increased risk of developing resistant weed populations, and ultimately reduced crop yield potential.

Field demonstrations and hands-on schools can be effective ways of teaching agricultural professionals and farmers the importance of these concepts, **Seeing is Believing**. The goal is to help growers focus on herbicide systems, develop long range plans and ultimately **Take Control** of weed management on their farm to preserve the technologies available.

Field demonstrations with different times of weed removal and systems of preemergence followed by postemergence herbicides were established in 2012 and 2013 at Rochester, Minnesota. Weeds were removed with herbicides at the following crop stages: 1) at planting, 2) V2-V3, 3) V4-V5 and 4) V6-V7. In addition, herbicide systems that compared broad and limited spectrum preemergence weed control (based on control of weed species present) followed by both timely and untimely postemergence herbicides were established. Field tours showed participants the value of robust early-season weed control and how this increased the time period (window of opportunity) for applications of effective postemergence herbicides to control weeds. The opposite demonstrated how poor or no early-season weed control greatly reduces the time period (window of opportunity) for applications of effective postemergence herbicides to control weeds.

The research site was a Lawler loam series with a pH of 6.6, O.M of 2.1%, and soil test P and K levels of 49 ppm and 135 ppm, respectively. The field was moldboard plowed in the fall, disked in the spring and field cultivated once prior to planting. The soybean variety, DuPont Pioneer 92Y22 was planted on May 15, 2013, at a depth of 1.5 inches in 30 inch rows at a rate of 163,000 seeds per acre. A randomized complete block design was used with four replications. Preemergence (PRE) and postemergence (POST) treatments were applied with a tractor-mounted sprayer delivering 15 gpa at

32 psi using Turbo Tee 11002 nozzles. Evaluations of the plots were taken on June 6, 17, and 26, July 11 and 15, and September 26, 2013. The center two rows of each plot were machine harvested on October 26, 2013. Application dates, environmental conditions, and weed stages are listed in

Table 1. Herbicide performance for giant ragweed, common lambsquarters, and common waterhemp, plus crop injury ratings are in Tables 2 through 5, respectively. (University of Minnesota Extension Regional Office, Rochester).

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

Date	5/15	6/10	6/27	7/1
Treatment	PRE	POST I	POST II	POST III
Temperature				
Air	70	73	81	80
Soil	64	71.3	75	82.4
Relative Humidity (%)	37	65	58	40
Wind (mph)	3	5	16	13
Soil Moisture	Normal	Normal	Wet	Normal
Soybean				
Stage		V1	V4	V5-R1
Height (inches)		3.0	8	10.5
Giant Ragweed				
Weed density (ft ²)		6.0	6.0	6.0
Height (inches)		2.4	17.0	
Common Lambsquarters				
Weed density (ft ²)		8.4	8.4	8.4
Height (inches)		0.4	7.3	
Common Waterhemp				
Weed density (ft ²)		42.0	42.0	42.0
Height (inches)		0.3	4.5	
Giant foxtail				
Weed density (ft ²)		38.3	38.3	38.3
Height (inches)		0.6	6.5	
Rainfall after each application				
Week 1	4.7	0.4	0.4	0.04
Week 2	1.0	3.7	0.4	0.9
Week 3	3.4	2.4	1.1	0.8

Comparisons:

- A. Four Treatments:
 1. Authority First + Dual II MAG PRE followed by an early (POST II) and late (POST III) application of Roundup PowerMax
 2. Warrent PRE followed by an early (POST II) and late (POST III) application of Roundup PowerMax
- B. Three Treatments:
 1. Roundup PowerMax applied at POST I
 2. Roundup PowerMax applied at POST II
 3. Roundup PowerMax applied at POST III

Consider a) what weeds were missed with the lack of a residual herbicide and b) what problems were encountered when herbicides were not applied at the most effective or “best” time for controlling weeds.
- C. Evaluate and compare several systems of PRE/POST or POST only

Table 2. Evaluation of herbicide systems for giant ragweed control in soybeans on June 6, 17, 26, July 11, 15 and September 26 and grain yield at 13% moisture at Rochester, MN, in 2013.

Treatment	Rate	Giant Ragweed Control						Yield
		6/6	6/17	6/26	7/11	7/15	9/26	
	(rate/A)	(% Control)						(bu/A)
PRE / POST II								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	68	81	69	91	94	94	32.2
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	41	39	0	86	90	91	31.3
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	46	36	0	88	90	90	25.8
PRE / POST III								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	70	82	69	74	82	83	29.6
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	38	38	0	59	80	85	18.0
(OpTill PRO) OpTill + Outlook / Roundup PowerMax+ AMS	2 oz/a + 10 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	65	74	53	74	81	83	27.6
(Gangster) Valor SX + FirstRate / Roundup PowerMax + AMS	3 oz/a + 0.6 oz/a / 22 fl oz/a + 8.5 lb/100 gal	94	94	94	94	96	97	30.9
POST I								
Roundup PowerMax + AMS	30 fl oz/a + 8.5 lb/100 gal	0	96	94	84	82	78	28.9
Flexstar GT 3.5 + MSO + AMS	3.5 pt/a + 0.5 % v/v + 8.5 lb/100 gal	0	98	97	94	96	93	28.1
Warrant + Cadet + Roundup PowerMax+ AMS	24 fl oz/a + 0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	95	93	81	86	82	21.4
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	9	96	94	80	83	81	22.6
POST II								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	88	93	91	27.1
Cadet + Roundup PowerMax + AMS	0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	0	0	78	85	83	20.6
POST III								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	76	85	90	21.0
POST I / POST III								
Roundup PowerMax + AMS / Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal / 22 fl oz/a + 8.5 lb/100 gal	0	95	95	96	97	96	32.4
LSD (P=0.10)		8	4	3	5	6	5	

Table 3. Evaluation of herbicide systems for common lambsquarters control in soybeans on June 6, 17, 26, July 11, 15 and September 26 and grain yield at 13% moisture at Rochester, MN, in 2013.

Treatment	Rate	Common Lambsquarters Control						Yield
		6/6	6/17	6/26	7/11	7/15	9/26	
	(rate/A)	(% Control)						(bu/A)
PRE / POST II								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	99	32.2
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	75	39	30	80	79	73	31.3
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	83	36	30	85	85	80	25.8
PRE / POST III								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	98	29.6
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	74	38	30	73	75	65	18.0
(OpTill PRO) + OpTill + Outlook / Roundup PowerMax + AMS	2 oz/a + 10 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	98	97	27.6
(Gangster) + Valor SX + FirstRate / Roundup PowerMax + AMS	3 oz/a + 0.6 oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	99	30.9
POST I								
Roundup PowerMax + AMS	30 fl oz/a + 8.5 lb/100 gal	0	99	99	89	85	86	28.9
Flexstar GT 3.5 + MSO + AMS	3.5 pt/a + 0.5 % v/v + 8.5 lb/100 gal	0	99	99	98	96	95	28.1
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	99	99	85	86	85	21.4
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	18	99	99	88	90	88	22.6
POST II								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	80	71	70	27.1
Cadet + Roundup PowerMax + AMS	0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	0	0	75	75	72	20.6
POST III								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	70	83	77	21.0
POST I / POST III								
Roundup PowerMax + AMS / Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal / 22 fl oz/a + 8.5 lb/100 gal	0	99	99	99	95	96	32.4
LSD (P=0.10)		12	2	0.3	8	10	10	

Table 4. Evaluation of herbicide systems for common waterhemp control in soybeans on June 6, 17, 26, July 11, 15 and September 26 and grain yield at 13% moisture at Rochester, MN, in 2013.

Treatment	Rate	Common Waterhemp Control						Yield
		6/6	6/17	6/26	7/11	7/15	9/26	
	(rate/A)	(% Control)						(bu/A)
PRE / POST II								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	97	32.2
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	76	39	75	85	80	76	31.3
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	83	36	75	91	87	84	25.8
PRE / POST III								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	98	98	29.6
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	76	38	75	83	75	68	18.0
(OpTill PRO) + OpTill + Outlook / Roundup PowerMax + AMS	2 oz/a + 10 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	97	91	99	93	89	27.6
(Gangster) + Valor SX + FirstRate / Roundup PowerMax + AMS	3 oz/a + 0.6 oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	98	30.9
POST I								
Roundup PowerMax + AMS	30 fl oz/a + 8.5 lb/100 gal	0	99	94	65	66	65	28.9
Flexstar GT 3.5 + MSO + AMS	3.5 pt/a + 0.5 % v/v + 8.5 lb/100 gal	0	99	99	99	99	98	28.1
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	99	96	81	85	85	21.4
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	18	99	99	81	88	86	22.6
POST II								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	75	69	64	27.1
Cadet + Roundup PowerMax + AMS	0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	0	0	77	73	70	20.6
POST III								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	60	69	68	21.0
POST I / POST III								
Roundup PowerMax + AMS / Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal / 22 fl oz/a + 8.5 lb/100 gal	0	99	97	96	92	93	32.4
LSD (P=0.10)		11	3	2	7	8	8	

Table 5. Evaluation of herbicide systems for grass control in soybeans on June 6, 17, 26, July 11, 15 and September 26 and grain yield at 13% moisture at Rochester, MN, in 2013.

Treatment	Rate	Grass Control						Yield
		6/6	6/17	6/26	7/11	7/15	9/26	
	(rate/A)	(% Control)						(bu/A)
PRE / POST II								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	97	32.2
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	90	39	90	98	94	91	31.3
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	89	36	88	97	34	90	25.8
PRE / POST III								
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	99	97	29.6
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	90	38	90	98	95	93	18.0
(OpTill PRO) + OpTill + Outlook / Roundup PowerMax + AMS	2 oz/a + 10 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	96	97	97	95	94	27.6
(Gangster) + Valor SX + FirstRate / Roundup PowerMax + AMS	3 oz/a + 0.6 oz/a / 22 fl oz/a + 8.5 lb/100 gal	99	99	99	99	98	97	30.9
POST I								
Roundup PowerMax + AMS	30 fl oz/a + 8.5 lb/100 gal	0	99	97	86	81	83	28.9
Flexstar GT 3.5 + MSO + AMS	3.5 pt/a + 0.5 % v/v + 8.5 lb/100 gal	0	99	99	97	96	94	28.1
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	99	98	92	85	83	21.4
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	23	99	98	93	89	88	22.6
POST II								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	94	87	88	27.1
Cadet + Roundup PowerMax + AMS	0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	0	0	96	92	92	20.6
POST III								
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	0	95	93	88	21.0
POST I / POST III								
Roundup PowerMax + AMS / Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal / 22 fl oz/a + 8.5 lb/100 gal	0	98	96	98	94	94	32.4
LSD (P=0.10)		14	3	2	4	7	6	

Table 6. Crop response to herbicide systems in soybean on June 6, 17, 26, July 11, 15 at Rochester, MN, in 2013.

Treatment	Rate	Injury			
		6/6	6/17	6/26	7/11
	(rate/A)	(% Control)			
PRE / POST II					
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl ox/a / 22 fl oz/a + 8.5 lb/100 gal	0	0	0	0
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	0	0	0	0
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	0	0	5	0
PRE / POST III					
Authority First + Dual II MAG / Roundup PowerMax + AMS	3.2 oz/a + 16 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	0	0	0	0
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	0	0	0	0
(OpTill PRO) + OpTill + Outlook / Roundup PowerMax + AMS	2 oz/a + 10 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	0	0	0	0
(Gangster) + Valor SX + FirstRate / Roundup PowerMax + AMS	3 oz/a + 0.6 oz/a / 22 fl oz/a + 8.5 lb/100 gal	16	0	0	0
POST I					
Roundup PowerMax + AMS	30 fl oz/a + 8.5 lb/100 gal	0	0	0	0
Flexstar GT 3.5 + MSO + AMS	3.5 pt/a + 0.5 % v/v + 8.5 lb/100 gal	55	0	5	0
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	55	0	5	0
Warrant + Roundup PowerMax + AMS	24 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	4	0	0	0
POST II					
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	16	0
Cadet + Roundup PowerMax + AMS	0.6 fl oz/a + 22 fl oz/a + 8.5 lb/100 gal	0	0	26	0
POST III					
Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal	0	0	8	0
POST I / POST III					
Roundup PowerMax + AMS / Roundup PowerMax + AMS	22 fl oz/a + 8.5 lb/100 gal / 22 fl oz/a + 8.5 lb/100 gal	0	0	0	0
LSD (P=0.10)		5	0	5	0

Trt. 1

Authority First 3.2 oz/a + Dual II MAG 16 fl oz/a
PRE sprayed 5/15/2013
Roundup PowerMax 22 fl oz/a + AMS 8.5 lb/100 gal
POST II (V3-V4) sprayed 6/27/13



June 24, 2013

Yield = 123% of Mean



October 7, 2013

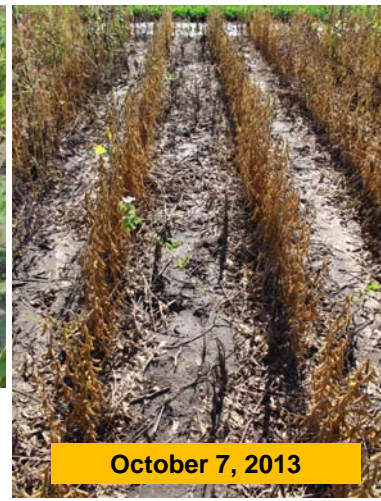
Trt. 2

Authority First 3.2 oz/a + Dual II MAG 16 fl oz/a
PRE sprayed 5/15/2013
Roundup PowerMax 22 fl oz/a + AMS 8.5 lb/100 gal
POST III (V5-R1) sprayed 7/1/2013



July 1, 2013

Yield = 112% of Mean



October 7, 2013

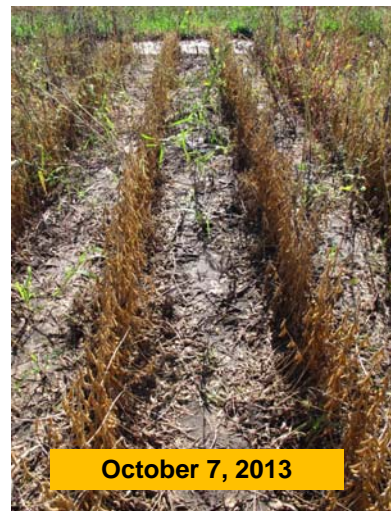
Trt. 3

Warrant 24 fl oz/a
PRE sprayed 5/15/2013
Roundup PowerMax 22 fl oz/a + AMS 8.5 lb/100 gal
POST II (V3-V4) sprayed 6/27/13



June 24, 2013

Yield = 116% of Mean



October 7, 2013

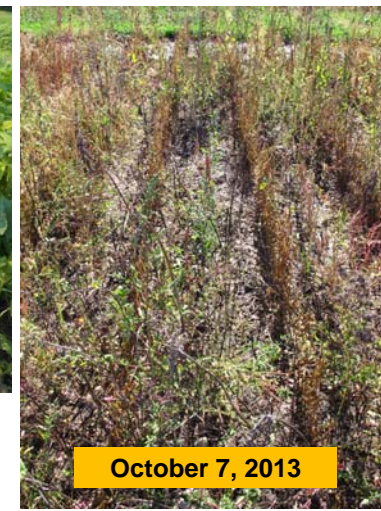
Trt. 4

Warrant 24 fl oz/a
PRE sprayed 5/15/2013
Roundup PowerMax 22 fl oz/a + AMS 8.5 lb/100 gal
POST III (V5-R1) sprayed 7/1/2013



July 1, 2013

Yield = 68% of Mean



October 7, 2013

Trt. 5
Roundup PowerMax 30 fl oz/a + AMS 8.5 lb/100 gal
POST I (V1-V2) sprayed 6/10/13



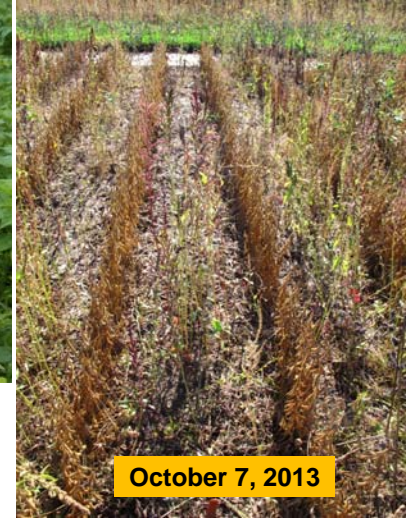
Yield = 105% of Mean



Trt. 6
Roundup PowerMax 22 fl oz/a + AMS 8.5 lb/100 gal
POST II (V3-V4) sprayed 6/27/13



Yield = 102% of Mean



Trt. 7
Roundup PowerMax 22 fl oz/a + AMS 8.5 lb/100 gal
POST III (V5-R1) sprayed 7/1/2013



Yield = 83% of Mean

