

2012 - 2014 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 and effectively manage the weed seed bank. 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 (PRE) followed by postemergence (POST) herbicides were established in 2012, 2013 and 2014 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 PRE weed control (based on control of weed species present) followed by both timely and un-timely POST herbicides were established in 2012 and 2013. 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 POST 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 POST herbicides to control weeds. In 2014, different nozzles and spray volumes were also demonstrated.

The research site in 2014 was a Lawler loam series with a pH of 6.9, O.M of 2.2%, and soil test P and K levels of 49 ppm and 124 ppm, respectively. The field was moldboard plowed in the fall, disked in the spring and field cultivated once prior to planting. The soybean variety, NK S19-Z9 was planted on May 19, 2014, at a depth of 1.5 inches in 30 inch rows at a rate of 149,000 seeds per acre. A randomized complete block design was used with four replications. PRE treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 40 psi using TTI 110015 nozzles. POST

treatments were applied at 20 gpa, and 40 psi using TT-11002 nozzles. Evaluations of the plots were taken on June 9 and July 23, 2014. The center two rows of each plot were machine harvested on October 22, 2014. Application dates, environmental conditions, and weed stages are listed in Table 1. Impact of time of weed removal with PRE/POST and POST only systems in soybeans in 2014 are in Tables 2 and 3 and in Tables 4 and 5 in 2013. Additional results from 2013 are in Tables 6-9. Photographs of selected treatments in 2013 and 2014 are included in this report. (University of Minnesota Extension Regional Office, Rochester).

Table 1. Application timing, plant stage, environmental conditions in 2014.

Date	5/21	6/6	6/11	6/16
Treatment	PRE	POST I	POST II	POST III
Temperature				
Air	62.4	80	78	79
Soil	67.1	84.7	71.8	73.8
Relative Humidity (%)	54	37	40	53
Wind (mph)	16	0	8	3
Soil Moisture	Normal	Normal	Dry	Wet
Soybean				
Stage		V1	V2	V3
Height (inches)		4.0	7	10
Giant Ragweed				
Weed density (ft ²)		6.75		
Height (inches)		2.63		8.25
Common Lambsquarters				
Weed density (ft ²)		7.88		
Height (inches)		1.5		6.88
Common Waterhemp				
Weed density (ft ²)		3.13		
Height (inches)		1.88		7.63
Giant foxtail				
Weed density (ft ²)		0.88		
Height (inches)		1.5		
Rainfall after each application				
Week 1	0.03	0.06	4.61	4.10
Week 2	1.06	5.92	1.73	2.16
Week 3	0.04	0.58	1.27	0.14

Table 2. Impact of time of weed removal using a PRE/POST system in soybeans on weed control and yield at Rochester, MN in 2014.

Treatment	Rate	Giant ragweed		Common lambsquarters		Common waterhemp		Yield
		6/9	7/23	6/9	7/23	6/9	7/23	
	(rate/A)	(% Control)						(bu/A)
PRE / POST I (1-2 in giant ragweed)								
Boundary / Flexstar GT 3.5 + AMS + Upland MSO	1.5 pt/a / 3.5 pt/a + 8.5 lb/100 gal + 1 gal/100 gal	92	94	99	95	99	97	43.3 b
PRE / POST II (2-4 in giant ragweed)								
Boundary / Flexstar GT 3.5 + AMS + Upland MSO	1.5 pt/a / 3.5 pt/a + 8.5 lb/100 gal + 1 gal/100 gal	0	98	70	92	89	94	47.7 a
PRE / POST III (4-6 in giant ragweed)								
Boundary / Flexstar GT 3.5 + AMS + Upland MSO	1.5 pt/a / 3.5 pt/a + 8.5 lb/100 gal + 1 gal/100 gal	0	96	79	95	86	94	48.4 a
LSD (P=0.20)		1	NS	5	NS	5	NS	3.7

Table 3. Impact of time of weed removal using a POST only system in soybeans on weed control and yield at Rochester, MN, in 2014.

Treatment	Rate	Giant ragweed		Common lambsquarters		Common waterhemp		Yield
		6/9	7/23	6/9	7/23	6/9	7/23	
	(rate/A)	(% Control)						(bu/A)
POST I (1-2 in weeds)								
Roundup PowerMax + AMS	32 fl oz/a + 17 lb/100 gal	70	95	70	87	70	88	50.3 a
POST II (2-4 in weeds)								
Roundup PowerMax + AMS	32 fl oz/a + 17 lb/100 gal	0	98	0	94	0	83	49.4 a
POST III (4-6 in weeds)								
Roundup PowerMax + AMS	32 fl oz/a + 17 lb/100 gal	0	98	0	70	0	66	41.8 b
LSD (P=0.20)		0	1	0	7	0	8	4.0

Table 4. Impact of time of weed removal using a PRE/POST systems in soybeans on weed control and yield at Rochester, MN, in 2013

Treatment	Rate	Giant ragweed			Common lambsquarters			Common waterhemp			Yield
		6/17	7/11	9/26	6/17	7/11	9/26	6/17	7/11	9/26	
	(rate/A)	(% Control)									(bu/A)
PRE / POST II (2-4 in weeds)											
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	84	92	95	99	99	99	99	98	97	32.2
Warrant / Roundup PowerMax + AMS	24 fl oz/a / 22 fl oz/a + 8.5 lb/100 gal	40	86	92	40	80	72	40	86	77	31.3
PRE/ POST III (4-6 in weeds)											
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	83	75	84	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	38	60	82	38	74	67	38	86	70	18.0

Table 5. Impact of time of weed removal using POST only systems in soybeans on weed control and yield at Rochester, MN, in 2013

Treatment	Rate	Giant ragweed			Common lambsquarters			Common waterhemp			Yield
		6/17	7/11	9/26	6/17	7/11	9/26	6/17	7/11	9/26	
	(rate/A)	(% Control)									(bu/A)
POST I (1-2 in weeds)											
Roundup PowerMax + AMS	32 fl oz/a + 17 lb/100 gal	96	86	78	98	87	84	99	68	68	28.9
POST II (2-4 in weeds)											
Roundup PowerMax + AMS	32 fl oz/a + 17 lb/100 gal	0	88	92	0	83	67	0	77	62	27.4
POST III (4-6 in weeds)											
Roundup PowerMax + AMS	32 fl oz/a + 17 lb/100 gal	0	78	92	0	73	73	0	60	67	21.0

Table 4. 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	6.1

Table 5. 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	6.1

Table 6. 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	6.1

Table 7. 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	6.1

Trt. 1(SOA 5, 15 / 9, 14)
TT-11002 @ 20 Gallons @ 40 PSI
Boundary 1.5 pt/a
PRE sprayed 5/21/14

Flexstar GT 3.5 3.5 pt/a + Ammonium Sulfate 8.5 lb/100 gal + Upland MSO 1 gal/100 gal
POST I (1-2 inch GIRW) sprayed 6/6/14

June 9, 2014



July 14, 2014



June 16, 2014



43.3 BU

Trt. 2 (SOA 5, 15 / 9, 14)
TT-11002 @ 20 Gallons @ 40 PSI
Boundary 1.5 pt/a
PRE sprayed 5/21/14

Flexstar GT 3.5 3.5 pt/a + Ammonium Sulfate 8.5 lb/100 gal + Upland MSO 1 gal/100 gal
POST II (2-4 inch GIRW) sprayed 6/11/14

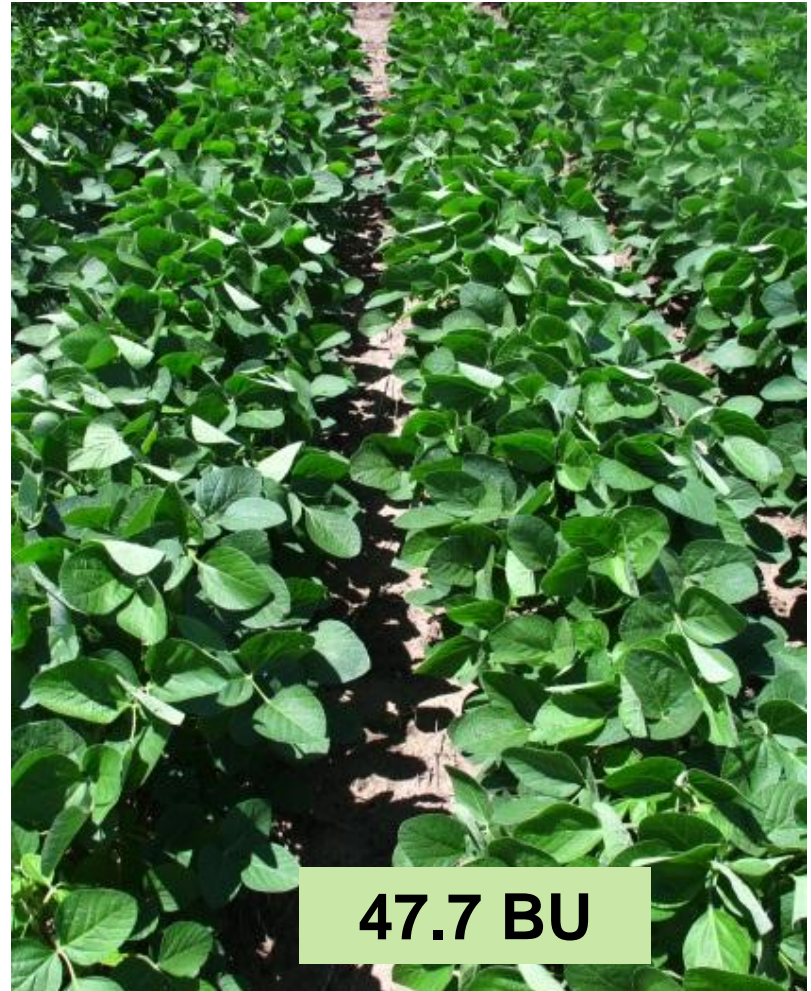
June 9, 2014



June 16, 2014



July 14, 2014



47.7 BU

**Trt. 3(SOA 5, 15 / 9, 14)
TT-11002 @ 20 Gallons @ 40 PSI
Boundary 1.5 pt/a - PRE sprayed 5/21/14
Flexstar GT 3.5 3.5 pt/a + AMS 8.5 lb/100 gal + Upland MSO 1 gal/100 gal
POST III (4-6 inch GIRW) sprayed 6/16/14**

June 9, 2014



June 16, 2014



July 14, 2014



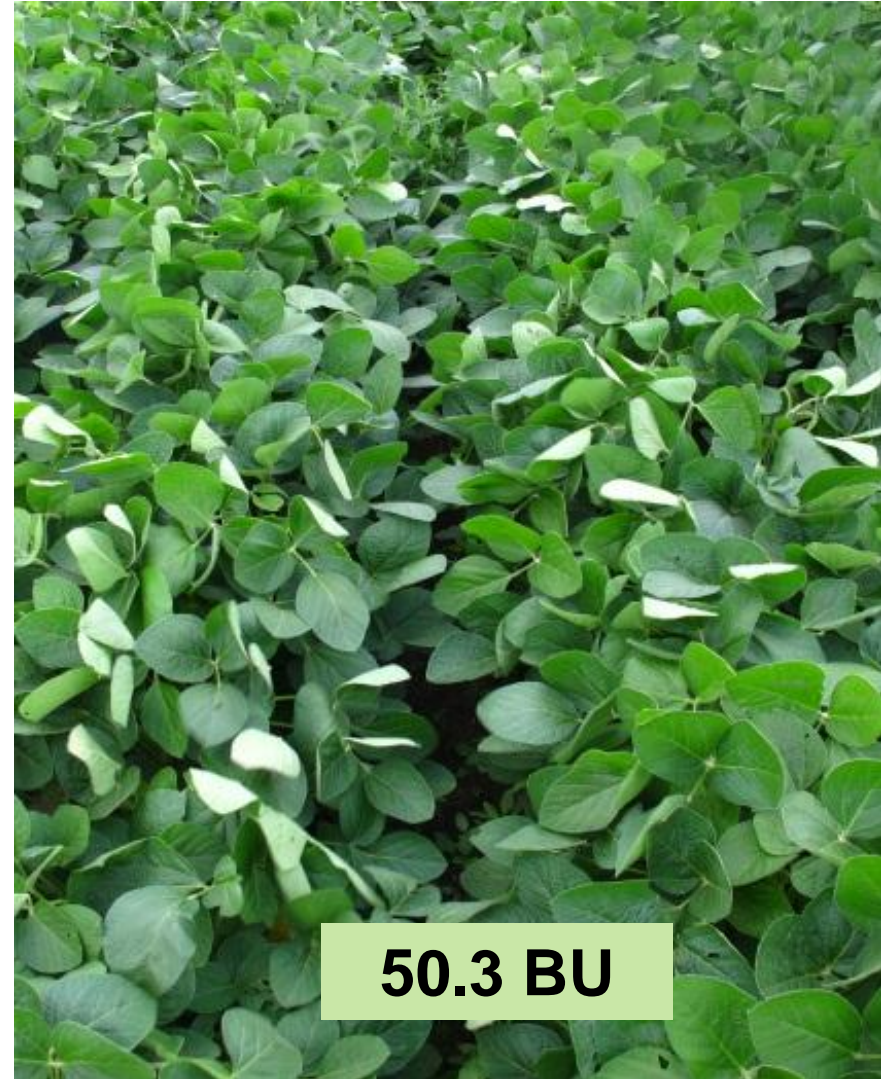
48.4 BU

Trt. 14 (SOA 9)
Roundup Powermax 32 fl oz/a + AMS 17 lb/100 gal
POST I (1-2 inch GIRW) sprayed 6/6/14

June 9, 2014



July 14, 2014



July 3, 2014



50.3 BU

Trt. 15 (SOA 9)
Roundup Powermax 32 fl oz/a + AMS 17 lb/100 gal
POST II (2-4 inch GIRW) sprayed 6/11/14

June 9, 2014



July 3, 2014



July 14, 2014



49.4 BU

Trt. 16 (SOA 9)
Roundup Powermax 32 fl oz/a + AMS 17 lb/100 gal
POST III (4-6 inch GIRW) sprayed 6/16/14

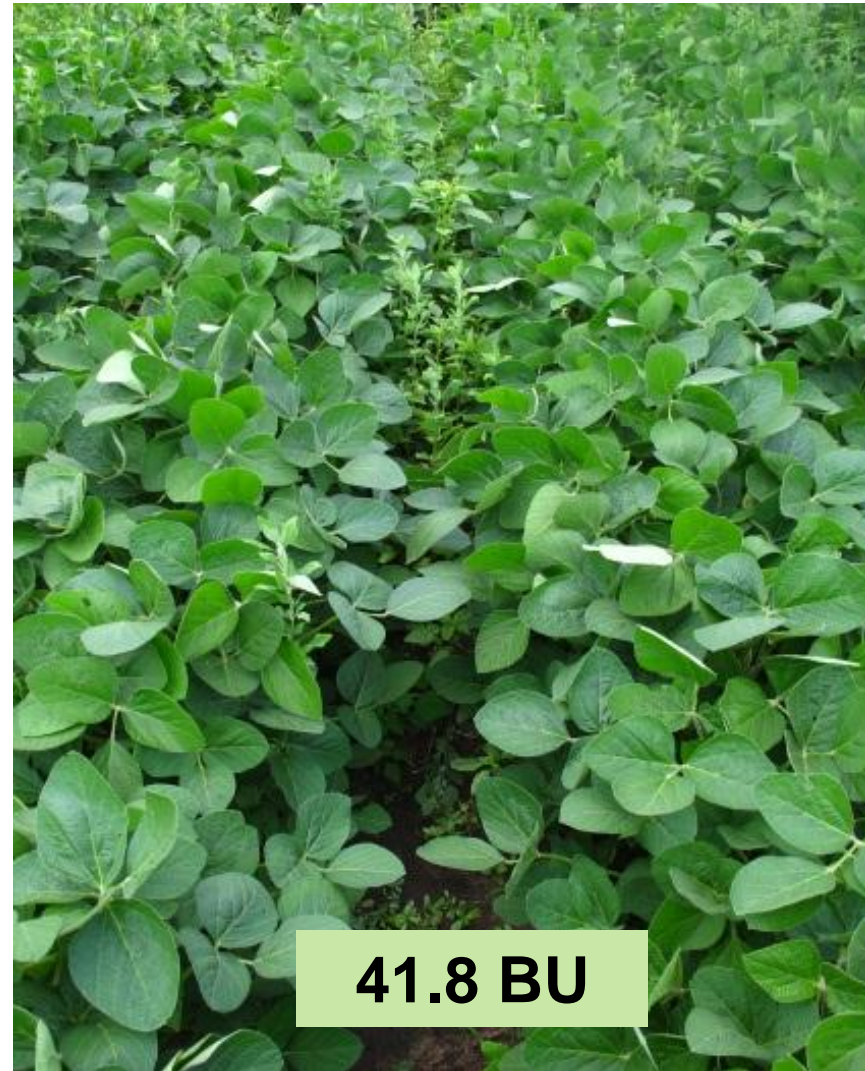
June 9, 2014



July 3, 2014



July 14, 2014



41.8 BU