Optimum glyphosate application timing in soybean as influenced by preemergence residual herbicide use following different planting dates

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Introduction

- Soybean growers are planting earlier in the spring to maximize yield potential.
- Earlier planting dates subject the crop to weed competition for longer durations of time.
  - May impact the optimum timing of a single postemergence (POST) glyphosate application
  - May require more intensive early-season weed control strategies, such as using a preemergence (PRE) residual herbicide, for adequate weed control and yield maximization

Objective

- Evaluate weed control and soybean yield as influenced by residual herbicide use and postemergence (POST) glyphosate application timing following three different planting dates

Materials and Methods

- A field study was conducted near Arlington, WI in 2012 and 2013.
- Plots were 3 m wide by 15 m long, and treatments were replicated four times.
- Trial area was cultivated in advance of the first planting date.
- Glyphosate was applied at 0.87 kg a.e. ha^{-1} prior to each planting date to control existing weeds.
- Soybeans were planted at 296,400 seeds ha^{-1} in rows 76 cm wide.
- Main plots were blocked by the planting date (PD)

	Planting Dates		
Year	Early	Mid	Late
2012	April 24	May 10	June 4
2013	April 29	May 14	June 3

- Subplots were a 2x4 factorial arranged as a RCB:
  - [2] With or without PRE residual herbicide (RH) application
    - RH = 0.26 + 0.03 kg a.i. ha^{-1} sulfentrazone + cloransulam-methyl
  - [4] POST glyphosate timing (GT): V1, V2, V4, R1
    - Glyphosate = 0.87 kg a.e. ha^{-1}
- Weeds were counted and measured for height prior to each POST glyphosate application timing and prior to soybean harvest
- Soybean yield was adjusted to 13% moisture

Results
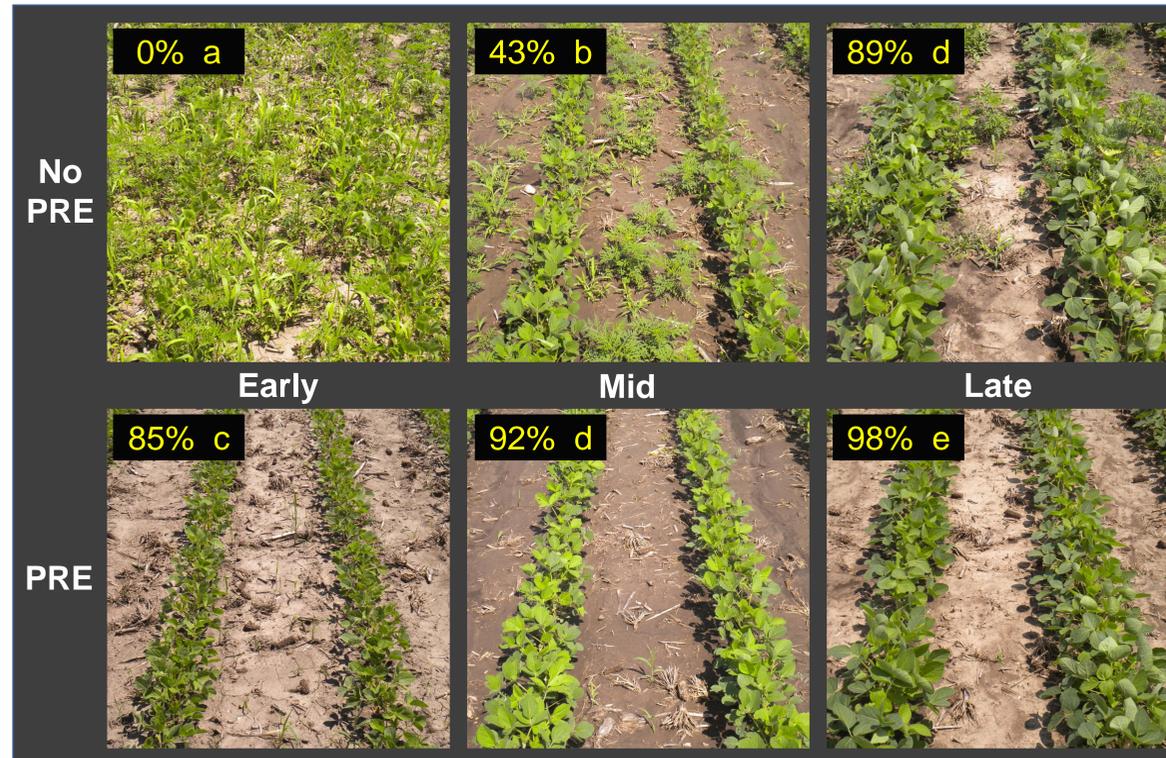
Figure 1. Percent reduction in total weed density at the time of POST glyphosate application. Percents with the same letters are not significantly different (P<0.05). All comparisons were made to the early planting date without a PRE treatment. Densities were averaged across all glyphosate application timings over two years. Pictures were taken at the V4 glyphosate timing in 2013.
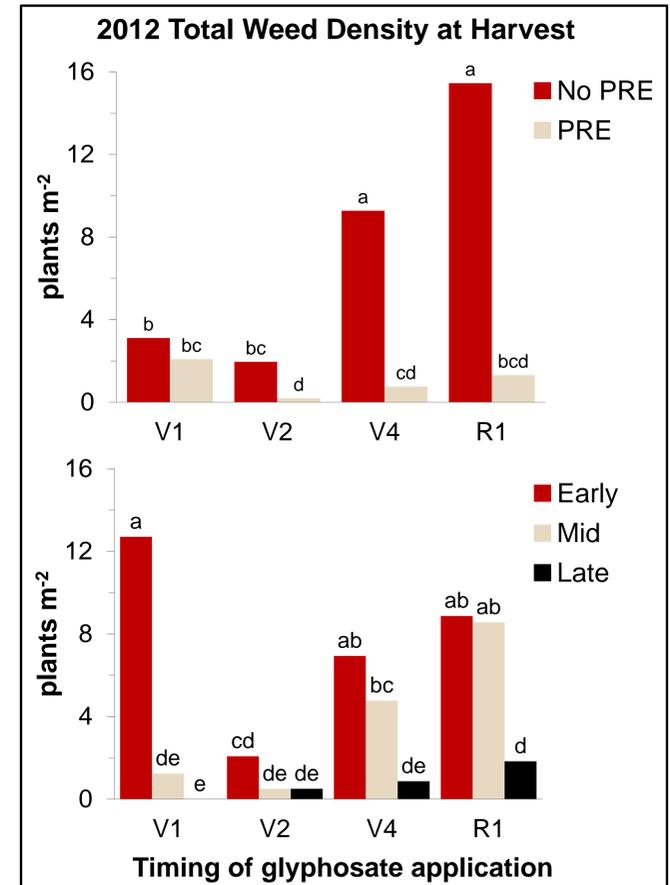
Table 1. Mean weed heights at POST glyphosate application as influenced by residual herbicide use (RH) and glyphosate application timing (GT). Heights were averaged across all planting dates over two years. Heights with the same letters are not significantly different (P<0.05).

| Herbicide strategy	Species[a]	GT x RH	Glyphosate timing			
			V1	V2	V4	R1
		p-value	weed height (cm)			
sulfentrazone + cloransulam	AMBEL	0.0078	0.7 a	0.7 a	1.5 ab	2.3 bc
No PRE herbicide	AMBEL		2.5 bc	4.0 c	8.5 d	19.5 e
sulfentrazone + cloransulam	CHEAL	0.0017	0.4 a	0.3 a	0.2 a	0.6 a
No PRE herbicide	CHEAL		2.0 b	2.2 b	3.7 c	7.5 d
sulfentrazone + cloransulam	Grass	NS	1.5	1.6	4.3	6.3
No PRE herbicide	Grass		4.2	5.0	9.9	13.2

[a]AMBEL, *Ambrosia artemisiifolia* L. (common ragweed); CHEAL, *Chenopodium album* L. (common lambsquarters). Grass species in the trial consisted of approximately 75% *Setaria faberi* Herrm. (giant foxtail) and 25% *Digitaria sanguinalis* (L.) *Scop.* (large crabgrass).

Figure 2. Influence of RH*GT (P=0.0003) and PD*GT (P=0.0036) on end of season weed density Density means with the same letters are not significantly different (P<0.05). Interactions were not significant (P<0.10) in 2013.
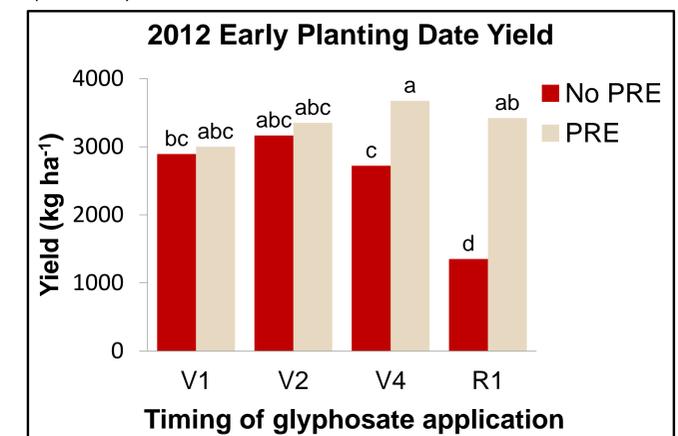
Figure 3. Influence of RH*GT (P=0.0011) on soybean yield. Yield means with the same letters are not significantly different (P<0.05). Interaction was not significant (P<0.10) at other planting dates in either year. Mean yield in 2013 was 3350 kg ha^{-1}

Discussion

The optimum timing of a POST glyphosate application was highly variable in our experiment and was potentially influenced by weather. The 2012 growing season was hot and dry until late-July. Under these conditions, delaying POST applications until V4 or R1 reduced yield at the early planting date when a PRE herbicide was not used (Figure 3). The 2013 season was cooler, and moisture was adequate during the same time period. Delaying application until R1 did not significantly reduce soybean yield in any of the planting dates, possibly due to the lack of competition for water. The use of a residual significantly reduced the number (Figure 1) and the height (Table 1) of weeds exposed to the POST glyphosate application. In conclusion, there is a trade-off between planting date and residual herbicide use for resistance management, where earlier planting may place greater reliance on a residual herbicide for reducing exposure to the POST herbicide application.