

WEED COMPETITIVE LOADS IN ROUNDUP READY CORN

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It is anticipated that more than 50% of the corn grown in 2007 will contain the Roundup Ready trait. Adoption of Roundup Ready corn and the low price of glyphosate are causing many growers to reassess their weed management practices and consider taking advantage of the low price of glyphosate and reducing their reliance on soil-applied atrazine and atrazine premix products. However, it appears that many growers are over estimating the ability of corn to tolerate early-season weed competition and not sustain yield losses.

A regional project that investigated the effectiveness of total postemergence weed control programs using only glyphosate in Roundup Ready corn (Gower et al. 2003) illustrates our current knowledge about the competitive ability of weeds in a Roundup Ready corn system. A total of 35 experiments were conducted in nine Midwest states. Most sites had high weed densities. Glyphosate was applied several times during the growing season based on the size of the dominant weeds in the field. The impact of late-emerging weeds on mid-season weed control is illustrated in Table 1. Overall weed control increased as applications were delayed. For example, a single application when weeds were 12 inches tall resulted in 95% control, whereas spraying 2-inch weeds resulted in only 73% control. The reduced weed control was due to weeds that emerged after application, rather than an inability of glyphosate to kill the larger weeds. Looking only at weed control would suggest that delaying herbicide applications is an effective strategy to enhance weed control.

In this study, treatments were included that determined yield loss associated with the weeds that emerged with the crop, controlled at a specific height, and the plots kept weed-free for the remainder of the season (see footnote 1 in Table 1). The study also included treatments that utilized a single postemergence treatment of glyphosate and weeds were allowed to naturally reinfest the area after treatment (see footnote 2 in Table 1). Corn subjected only to weed competition from emergence to postemergence application began to suffer yield losses when herbicide application was made to 4-inch tall weeds (Table 1). Applying the herbicide when weeds were 4 inches tall resulted in a 3% yield loss, and each delay approximately doubled the yield loss. The reduction in corn yields due to competition prior to the post-emergence application illustrates the risk of delaying treatment in hopes of minimizing problems with late emerging weeds.

Although early applications (2-4-inch weeds) minimized competition from weeds that emerged with the crop, weeds emerging after the early application were able to compete with the corn and reduce yields. If you compare the yield losses in both sets of treatments at the 4-inch application timing, weeds emerging after the 4-inch application timing added an additional 3% yield loss to the 3% loss caused by early-season competition. This study illustrates the difficulty in obtaining maximum yields with a single post-emergence application of herbicides without residual activity.

Table 1. The effect of application timing on weed control and corn yields.

Application timing (Weed Size)	Weed control	Corn yield loss ¹ (Early-season competition only)	Corn yield loss ² (Early- and late season competition)
	----- % -----		
2"	73	0	7
4"	83	3	6
6"	90	6	7
9"	93	14	11
12"	95	22	21

¹Weeds emerging after herbicide application controlled with hand weeding. This column would represent what would happen if a residual herbicide were tank mixed with glyphosate and applied postemergence.

²Weeds allowed to emerge after herbicide application and compete with corn for the remainder of the growing season. This column would represent what would happen if only a single postemergence treatment of glyphosate were used without any residual herbicides.

Traditional corn production systems have relied heavily on soil-applied atrazine and atrazine premix herbicides. In that system, early-season weed interference is minimal. However, the use of soil-applied corn herbicides is being scrutinized by growers because of cost. This is no doubt causing corn producers to reduce reliance on soil-applied herbicides and increase their reliance on glyphosate to maintain commercially acceptable weed control.

As herbicide management strategies change in response to these pressures, weed-crop interference dynamics will also likely change. However, our understanding of the dynamics of weed interference in glyphosate-resistant corn under different rates of soil-applied herbicides is limited. Therefore the objective of this presentation is to discuss the effectiveness of various soil-applied corn herbicides in reducing early-season weed competition in Roundup Ready corn.

Field experiments were conducted in Indiana, Ohio and Illinois in 2006 to evaluate the effectiveness of various rates of soil-applied herbicides in reducing early-season weed interference in Roundup Ready corn production. Common experimental protocols were utilized at each site and the experimental factors included:

1. Soil applied herbicide rate (full rate vs reduced rate).
2. Soil applied herbicide timing (early preplant vs. preemergence).
3. Postemergence glyphosate timing (optimal vs. late).

The herbicide strategies included products and rates that would provide a range of none (e.g., no soil applied herbicide used) to marginal (e.g., 1 lb/A of atrazine) to excellent (e.g., a full rate of Lexar) early-season weed control with the idea that all treatments would receive at least 1 postemergence application of glyphosate. We collected data on weed density and size just prior to the postemergence glyphosate treatment and at the end of the season and crop yields. Information about seed production from weeds that were not controlled by the herbicide treatments was also recorded.

It is important to note that when designing a weed management program it is important to consider these factors:

1. In-season weed control efficacy.
2. Weed seed production.

3. Crop yields.
4. Cost.
5. Potential for development of herbicide-resistant weed populations.

It is important to consider weed seed production because weeds that survive postemergence treatments of glyphosate are likely to have tolerance to glyphosate and thus are contributing to a weed population that will become increasingly tolerant to glyphosate. Since we are heavily reliant on glyphosate in both corn and soybeans, most weed scientists now feel that weed seed production should be minimized in an attempt to delay the onset of weed populations that cannot be effectively managed with glyphosate. As expected, treatments that utilized higher rates of soil applied herbicides usually provided better weed control in the early part of the growing season prior to the postemergence glyphosate treatment and at the end of the season. Treatments that provided better control also reduced weed seed production. Corn yield data has not been analyzed yet, but will be discussed in the presentation.

References:

Gower, Loux, Cardina, Harrison, Sprankle, Probst, Bauman, Bugg, Curran, Currie, Harvey, Johnson, Kells, Owen, Regehr, Slack, Spaur, Sprague, VanGessel and Young. 2003. Effect of postemergence glyphosate application timing on weed control and grain yield in glyphosate-resistant corn: Results of a 2-year multistate study. *Weed Technol.* 17:821-828.