

CHANGING ECONOMICS OF WEED MANAGEMENT

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Introduction

The simplest part of weed management is selecting the right herbicide or mix of herbicides to control a specific weed complex. It is more difficult to understand and predict the timing and severity of weed competition with corn and soybeans. Given the uncertainty of weed growth and crop yields each year and the uncertainty of crop price, it becomes even more difficult to predict the most economically profitable weed management program that a grower should use in each field. I could argue that the investment in a good weed management program has the highest or one of the highest returns on investment next to purchasing seed (i.e., a given since a grower must purchase seed to get any return). Without weed management, corn and soybean yields can be reduced by 50% or more so weed management protects a substantial portion of gross returns. While it is wise to be as economical as possible with herbicide expenditures, the goal and achievement of yield protection cannot be forgotten and appropriate investments in weed management programs should be made. Even before the substantial increases in seed, fertilizer, and land input costs in 2008 and 2009, herbicide costs were a relatively small percentage of the total production costs of corn and soybean and herbicides protect a large percentage of the gross value relative to their costs (Table 1).

Table 1. Average chemical costs (predominately herbicides) and percentage of total production costs and gross crop value for cash corn and soybean as reported by the Profits through Efficient Production Systems (PEPS) program.

Crop	Year	Total production costs \$/acre	Gross value \$/acre	Chemical (herbicide)		
				Cost \$/acre	% of input costs	% of gross value
Corn	1997	295	491	22	7.5	4.5
	2002	288	446	20	6.9	4.5
	2007	351	633	27	7.7	4.3
Soybean	1997	201	357	30	14.9	8.4
	2002	179	319	14	7.8	4.4
	2007	220	557	16	7.3	2.9

Considering the changing economics of crop production, this presentation will review the following three aspects where weed management and economics interact.

1. Potential economic losses with postemergence weed management in corn and soybean.
2. Economics of preemergence herbicides in soybean production.
3. Interactions of weed management and nitrogen in corn: Part II.

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1. Postemergence Weed Management in Corn and Soybean

Most crop advisors recognize the potential for early-season weed competition to reduce corn and soybean yield potential. However, data to document the actual number of acres affected or the level of yield loss are lacking. The presentation “SURVEY OF POSTEMERGENCE WEED MANAGEMENT IN WISCONSIN FIELDS” at this conference documents that approximately 75% of surveyed corn and soybean fields, which are treated with postemergence herbicide programs were treated after the recommended time of weed control to prevent crop yield loss. The predicted yield loss in the corn fields based on the average weed densities and heights was 6.5%, which would equate to a \$39/acre loss based on a 150 bu/acre yield potential and a \$4/bu price (Table 2, see referenced presentation for more details). Economic losses would be even greater with higher yielding corn. The average predicted yield loss in soybean was similar at 6.6%, but the profit loss was not as great in soybean as corn with the yield and price used. Still, the predicted economic loss of \$26/acre in soybean is substantial. This information on the potential economic losses that are likely occurring in Wisconsin corn and soybean fields is compelling justification to consider management options to improve economic returns.

Table 2. Predicted yield and profit losses using WeedSOFT predictions based on the average densities and heights of the three most common weeds in corn and soybean fields in Wisconsin. Corn yield and price were set to 150 bu/acre and \$4/bu and soybean yield and price were set to 50 bu/acre and \$8/bu for this example.

	Corn	Soybean
Crop stage	V5	V4
Crop yield	150 bu/acre	50 bu/acre
Crop price	\$4/bu	\$8/bu
Predicted yield loss	6.5% or 9.75 bu/acre	6.6% or 3.3 bu/acre
Predicted profit loss	\$39/acre	\$26/acre

2. Economics of Preemergence Herbicides in Soybean Production

The increased price of glyphosate in 2008 was not viewed by soybean growers as a positive development. However, one positive aspect is that it made preemergence herbicides more affordable on a relative basis. Many preemergence soybean herbicides cost in the range of \$10-12/acre when applied at the reduced rates recommended in Roundup Ready soybeans. At these rates, these herbicides will control or reduce early season weed competition and allow greater flexibility in the timing of the postemergence glyphosate applications. Without the residual control provided by a preemergence herbicide, an increasing number of soybean fields are being treated with glyphosate twice.

Given the potential for yield loss from early-season weed competition, an analysis of the partial returns to seed and herbicide program costs was conducted to determine if the costs of preemergence herbicides could be economically justified (Table 3). The returns for soybeans with different seed traits were also considered. In the analysis, several assumptions had to be made. For costs, the assumptions were: conventional, Roundup Ready, Roundup Ready 2 Yield, and LibertyLink soybean seed were \$30, \$46, \$63, and \$46/unit, respectively; soybean are planted at 175,000 seeds/acre at 140,000 seeds/unit; herbicide application cost is \$8/acre; branded glyphosate is \$12/acre; Ignite is \$11/acre; and Sonic is \$13/acre for 3 oz. For soybean yield, a base yield of 50 bu/acre is used with a 2% yield reduction for conventional soybeans; a 6% reduction for single postemergence herbicide programs (based on field trial results in 2008); and a 6% yield increase with Roundup Ready 2 Yield soybeans (although university data is not available to support this claim). Soybean price was set at \$8/bu. With these estimates, total seed

and herbicide program costs could range from a low of \$77/acre with a single application of Ignite to LibertyLink soybean to a high of \$126/acre for a two pass program with Roundup Ready 2 Yield soybean. However, the range in partial returns is only \$12/acre. Perhaps the most important fact is that the use of a preemergence herbicide with the herbicide resistant soybeans had a similar return to a single application of glyphosate or Ignite. Additional items to consider in this analysis are that a premium was not included in the market price for the conventional soybeans, which has the potential for an additional \$1-2/bu for various non-GMO soybeans. Also, the partial return for Roundup Ready 2 Yield soybeans could be lower if the yield increase is not obtained for this trait. Overall, partial returns will be greatly influenced by the yield potential of the soybean variety regardless of trait or cost of the herbicide program, but a preemergence herbicide program could be economically justified to protect that yield.

Table 3. Potential seed and herbicide costs and net returns for soybeans with different types of herbicide traits.

Trait	Herbicide program	Seed cost \$/acre	Herbicide cost \$/acre	Total cost \$/acre	Soybean yield bu/acre	Gross return \$/bu	Partial return \$/acre
Conventional	Sonic/Select Max (7 oz/9 oz)	38	53	91	49	392	301
Roundup Ready	Glyphosate (0.75 lb)	58	26*	84	47	376	292
	Glyphosate (0.75 + 0.75 lb)	58	46*	104	50	400	296
	Sonic/Glyphosate (3 oz/0.75 lb)	58	47*	105	50	400	295
RR 2Yield	Glyphosate (0.75 lb)	79	26*	105	50	400	295
	Glyphosate (0.75 lb + 0.75 lb)	79	46*	125	53	424	299
	Sonic/Glyphosate (3 oz/0.75 lb)	79	47*	126	53	424	298
LibertyLink	Ignite (22 oz)	58	19	77	47	376	299
	Ignite (22 oz + 22 oz)	58	38	96	50	400	304
	Sonic/Ignite (3 oz/22 oz)	58	40	98	50	400	302

* includes \$6/A for postemergence grass herbicide to control volunteer glyphosate-resistant corn.

3. Interactions of Weed Management and Nitrogen in Corn: Part II.

Weed management is certainly not the most expensive input for corn production. Rather, nitrogen may be the most costly input, but weeds and weed management are linked to nitrogen because of weed competition. At last year's 2008 conference, we described the effects postemergence weed control timing on corn yield and the interaction with optimal nitrogen rates in the paper titled "FERTILIZING YOUR WEEDS FOR PROFIT?" The data from this Arlington field study showed that weeds can compete for a significant amount of nitrogen if they are not controlled in a timely manner. The nitrogen removed by the weeds can be replaced to restore corn yield, but the cost of additional nitrogen is expensive. At the same time, the cost to control weeds with a preemergence herbicide program to prevent weed competition for nitrogen

is greater than the cost of spraying glyphosate postemergence. To determine how the costs of nitrogen and weed control programs might be optimized, the corn yield response to nitrogen rates was analyzed for three weed management scenarios using a partial budget. Assumptions for the analysis were a corn price of \$4/bu, a nitrogen price of \$0.90/lb, a preemergence herbicide price and application of \$40/acre, and a postemergence herbicide price and application of \$22/acre.

Corn yields with the preemergence weed control program and when weeds were controlled at the 4-inch stage were similar in both 2006 and 2007 (Fig. 1 and 2). However, the additional 8 days of weed competition from the 4-inch timing until the 12-inch weed control timing reduced corn yield at the intermediate nitrogen rates. At the 200 lb/acre nitrogen rate, corn yields were similar for all weed control timings.

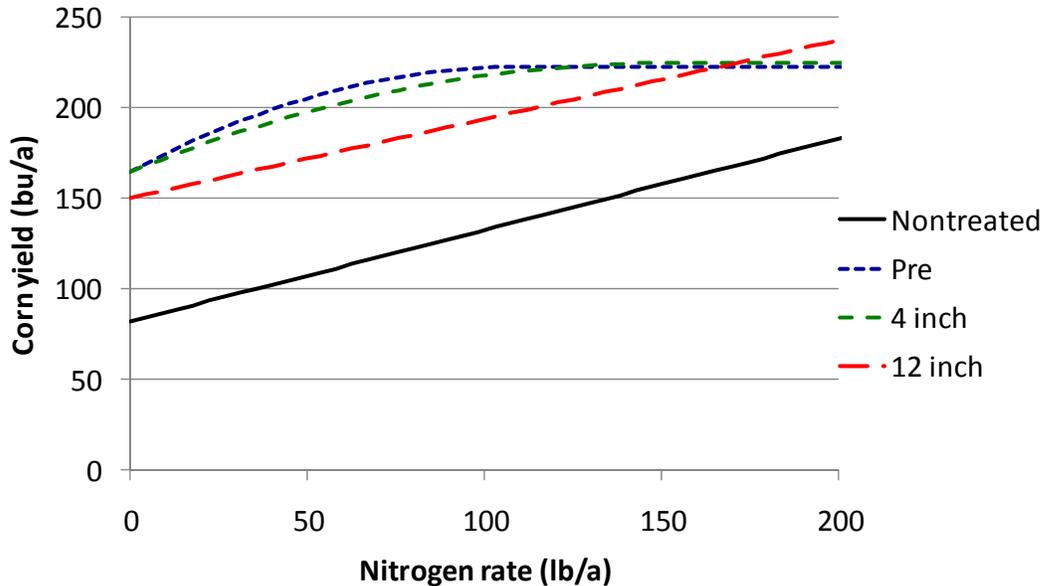


Figure 1. Corn yield response to increasing nitrogen rates when weeds were controlled preemergence or at the 4- or 12-inch growth stage in 2006 at Arlington, WI.

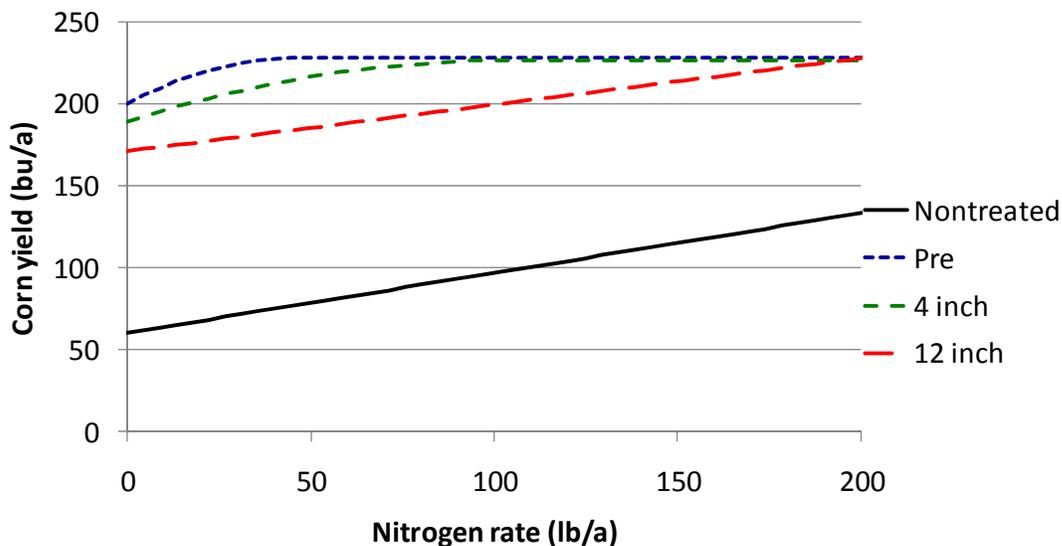


Figure 2. Corn yield response to increasing nitrogen rates when weeds were controlled preemergence or at the 4- or 12-inch growth stage in 2007 at Arlington, WI.

In 2006, the partial returns were greatest with the preemergence herbicide at moderate nitrogen rates and were very similar to when the weeds were controlled at the 4-inch timing (Fig. 3). If the preemergence weed control program was more expensive, the 4-inch weed control timing with glyphosate would have provided the highest return at the optimal nitrogen rate. At these moderate nitrogen rates, the economic return of the 12-inch weed control timing was greatly reduced, but increased with increasing nitrogen rates.

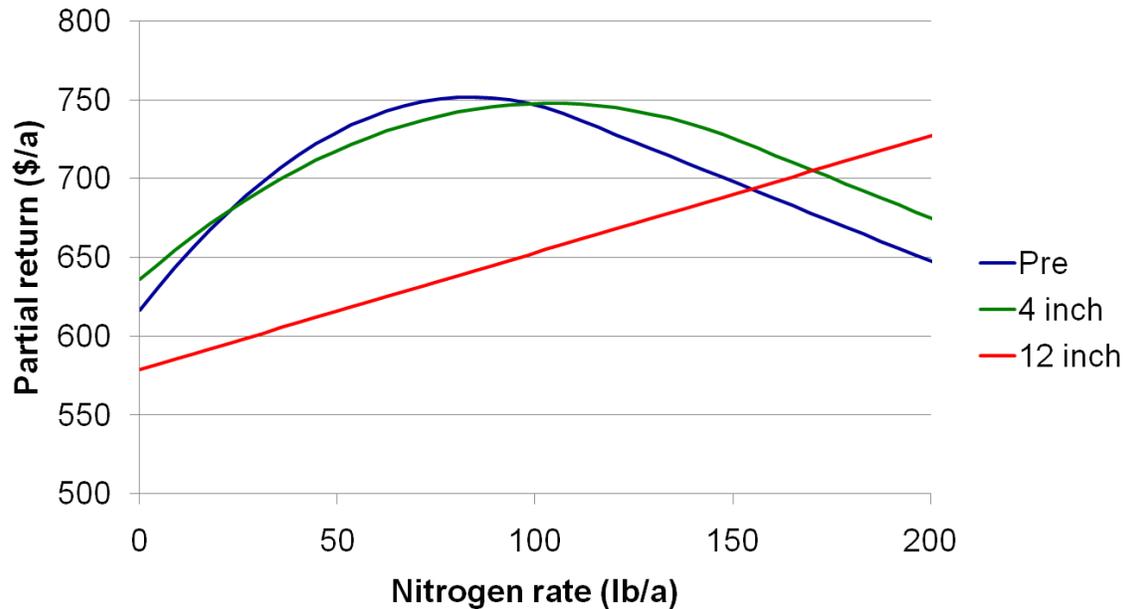


Figure 3. Partial returns for corn yield less nitrogen and weed control costs with increasing nitrogen rates when weeds were controlled preemergence or at the 4- or 12-inch growth stage in 2006 at Arlington, WI.

In 2007, the partial returns were greatest with the preemergence herbicide at low nitrogen rates because the economic optimum nitrogen rate was low (Fig. 4). The returns when the weeds were controlled at the 4-inch timing were less than the preemergence treatment over the range of low nitrogen rate and they were similar after the economic optimum nitrogen rate was reached and when the returns were declining with the cost of the additional nitrogen. The partial returns were dramatically lower with the 12-inch weed control timing even when the high nitrogen rates compensated for the extended weed competition.

These partial returns are based on high nitrogen prices which may not continue into the future. However, partial budgets based on nitrogen prices of \$0.60/lb yield similar responses although the partial returns are proportionately greater at the higher nitrogen rates. Overall, this data supports that an investment in preemergence weed control may be more profitable than applying nitrogen at rates above the economic optimum rates.

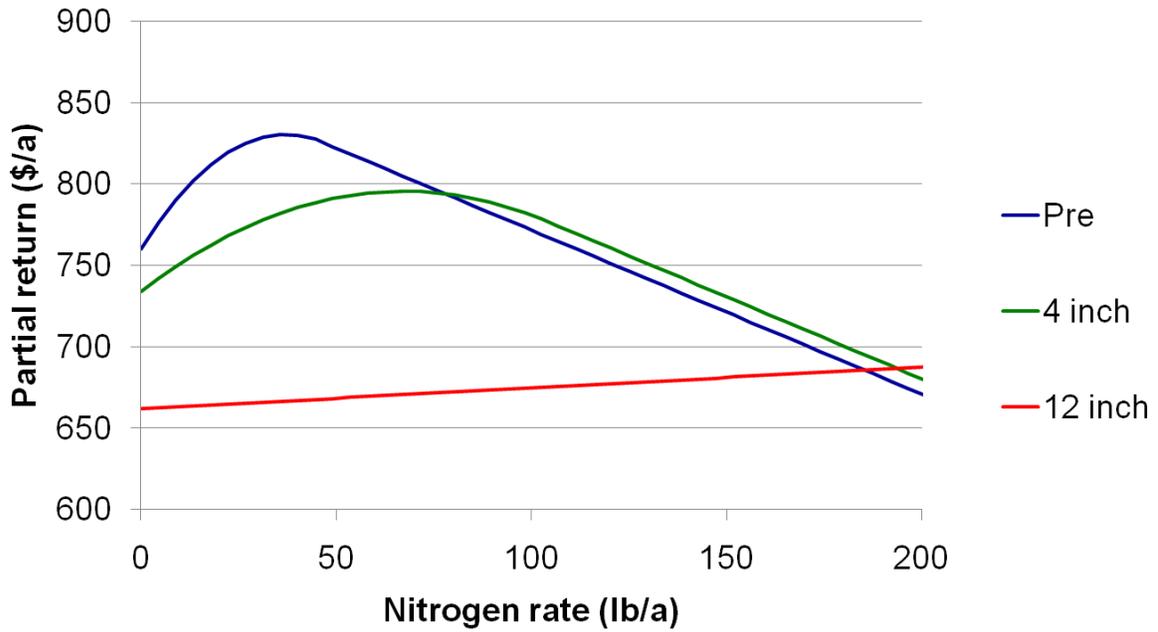


Figure 4. Partial returns for corn yield less nitrogen and weed control costs with increasing nitrogen rates when weeds were controlled preemergence or at the 4- or 12-inch growth stage in 2007 at Arlington, WI.