MANAGING WEEDS, TIMING, AND RISK

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Maximizing return on investment in corn production is a balance of providing the lowest effective levels of inputs compared to projected returns. Weed control is an input that growers have numerous options to customize a program that fits weed spectrum, application timing, and most importantly cost. One variable that is critical in making herbicide decisions is the degree of risk associated with various herbicide programs. WeedSOFT is a computer program that assists growers in predicting yield loss and economic returns of herbicide programs based on the competitive loads of the weed species present. The competitive load (CL) of a weed species integrates a weed's density (D) and its competitive ability (CI). In a field crop, a weed's competitive ability is adjusted based on its size relative to the crop and becomes the adjusted competitive index (ACI). Then the CL is calculated as: $CL=D_{bi} \times ACI_i$. Total competitive load (TCL) is the sum of all the weed species present and is calculated as: $TCL = \Sigma(Dbi \times ACI_i)$. This TLC plus the length of weed competition is used in WeedSOFT to predict crop yield loss.

Two studies were conducted at the Arlington Research Station in 2005 to quantify the risk of reducing corn yield associated with various herbicide programs. In both studies, Dekalb DKC 50-20 field corn was planted in 30 inch rows on April 26 with preemergence herbicides applied on April 30. Weed species counts and heights were collected for 8 weeks after planting from two permanent quadrats per plot placed over the corn rows. Plots measured 10 by 25 feet with a randomized complete block trial design. Giant foxtail and common lambsquarters were the primary weed species present in both studies.

The first study measured the yield risk of a total postemergence program compared to a sequential preemergence/postemergence program in field corn. Outlook and G-Max Lite were applied preemergence at ½ labeled rates of 10 fl oz/a and 1.5 pt/a, respectively, alone or sequentially with glyphosate at 0.75 lb ae/a. Three postemergence timings were compared: early postemergence on June 13 (3 to 4 inch weeds in the nontreated control), mid-postemergence on June 17 (3 to 4 inch weeds in the Outlook treatment), and late postemergence on June 20 (6 to 8 inch weeds in the Outlook treatment).

Half rates of Outlook reduced TCL values by 75% and G-Max Lite reduced TCL values by 99% compared to the nontreated control when evaluated on June 30 (Table 1). TCL values for the preemergence herbicides remained constant regardless of the postemergence glyphosate timing, ranging from 223 to 279 with Outlook and 0 to 52 with G-Max Lite. This was in contrast to the TCL values of 4416 to 6406 for glyphosate applied postemergence at the early, mid-postemergence, and late postemergence application timings, respectively. Information collected from the study was entered into WeedSOFT to predict early season yield losses. The predicted early-season yield losses with the sequential glyphosate treatments following Outlook and G-Max Lite were less than 2% of the final corn yield. G-Max Lite followed by glyphosate at the mid-postemergence timing yielded the greatest at 207 bu/a compared to 102 bu/a for the nontreated control. All sequential glyphosate applications following Outlook yielded more than Outlook alone. Yields did not differ among G-Max Lite treatments applied alone or sequentially with glyphosate. WeedSOFT predicted early-season yield losses ranging from 19 to 22 bu/a with a

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single postemergence application of glyphosate. Yields did not differ among glyphosate treatments applied alone at the three postemergence timings and were similar to Outlook treatments, but generally less than G-Max Lite treatments.

Table 1. Effect of Weed Removal Timing on Total Competitive Load and Yields at Postemergence Glyphosate Application

Treatment	Application Timing	Weed Density		CL			Predicted	
		SETFA	CHEAL	SETFA	CHEAL	TCL	Yield loss[b]	Yield
							—— (bu/a) ——	
Nontreated		152	56	2471	3121	5593 [a]		102
Outlook	Pre	8	24	65	1338	1403 [a]		167
Outlook fb	Pre							
Glyphosate	early	0	8	0	223	223	5	188
Glyphosate	mid	4	8	26	223	249	5	206
Glyphosate	late	0	8	0	279	279	5	189
G-MAX Lite	Pre	4	0	33	0	33 [a]		193
G-Max Lite fb	Pre							
Glyphosate	early	0	0	0	0	0	0	203
Glyphosate	mid	4	0	33	0	33	0	207
Glyphosate	late	8	0	52	0	52	1	186
Glyphosate	early	364	48	4734	1672	6406	20	185
Glyphosate	mid	136	76	1769	2648	4416	19	178
Glyphosate	late	80	68	1040	3790	4831	22	171
LSD (P=0.10)								*22*

[a] assessed at June 30

[b] early season yield loss predicted by WeedSOFT

A second study investigated the efficacy of half rates of soil-applied herbicides in a sequential application program to reduce the risk of yield loss with delayed postemergence applications. The soil applied herbicides were Harness at 1.1 pt/a, Define at 10 fl oz/a, atrazine at 1.5 pt/a, Dual II Magnum at 0.8 pt/a, Prowl H_20 at 1.25 pt/a, and Camix at 1.2 qt/a. All herbicide treatments except atrazine reduced giant foxtail height, ranging from a 38% reduction with Prowl H_20 to a 91% reduction with Harness (Figure 1). All soil-applied herbicides reduced giant foxtail density compared to the nontreated control (Figure 2). As expected, atrazine was the least effective on giant foxtail with a 42% reduction in density compared to 97% reduction for Harness at 61 days after application. Weed counts remained fairly constant with all treatments, including the nontreated control, from 32 to 61 days after application indicating only one weed cohort occurred in this study. This implies that controlling the early weed germination is more critical than long residual activity in planned sequential herbicide programs. The height and density of common lambsquarters had a similar to giant foxtail (data not shown).

Figure 1

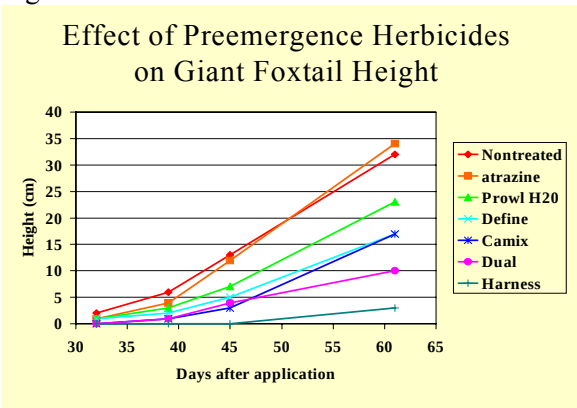


Figure 2

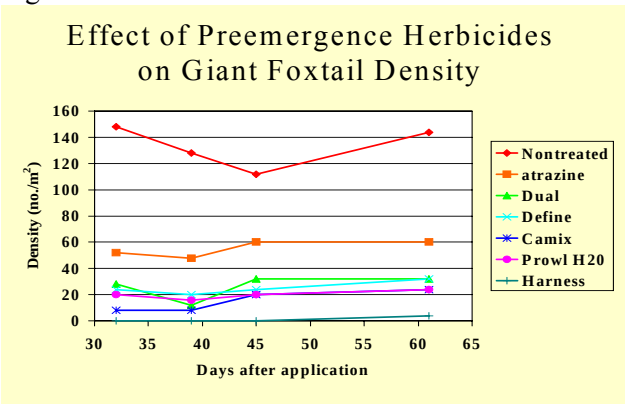
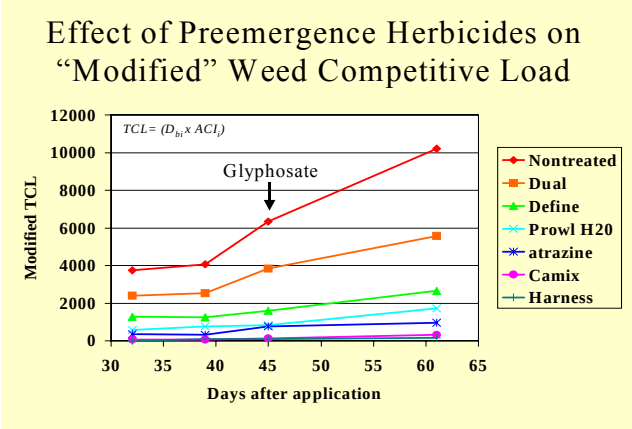


Figure 3 shows the TCLs for the herbicide treatments and the timing of the glyphosate application. Postemergence glyphosate was applied when the corn was at the V6 growth stage.

Figure 3



The increase in TCL values from 32 to 61 days after application is not a function of increasing weed density, but of increasing weed heights. The herbicide treatments reduced TCL values from 40 to 98% at the time of the glyphosate application. The weed and crop information was entered into WeedSOFT to predict early-season yield loss.

The green portion of the bar in Figure 4 indicates the predicted early season yield loss at the time of the postemergence glyphosate timing while the blue indicates the predicted total yield loss if no postemergence glyphosate application was made. All six of the soil-applied herbicides when applied at half rates greatly reduced the predicted corn yield loss compared to the nontreated control.

The light gray portion of the bar in Figure 5 indicates the yield of the herbicide treatment applied alone while the dark gray bar indicates the added yield when postemergence glyphosate was applied. WeedSOFT predicted minimal yield losses with Harness or Camix due to the low TCL values, which was validated by the actual yields. Predicted yield losses for the remaining herbicides ranged from 5 to 6 bu/a from early season competition and 30 to 49 bu/a after total season competition. The light gray bars in Figure 5 correlate with the predicted yield losses in Figure 4. Increasing the TCLs values with soil-applied herbicides measured in Figure 3

corresponded with a decrease in corn yields in Figure 5. No yield differences were noted among the soil-applied herbicides when followed by a postemergence application of glyphosate (Figure 5). The sequential programs generally yielded more than the single postemergence glyphosate application.

Figure 4

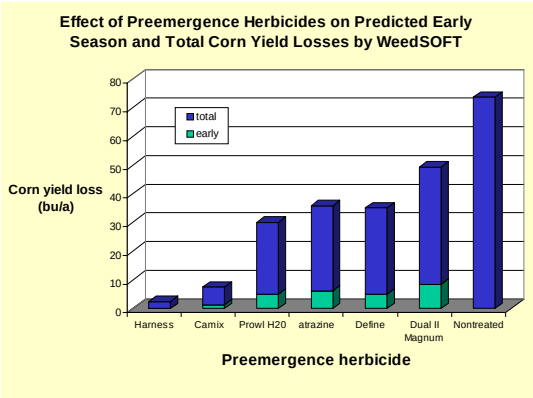
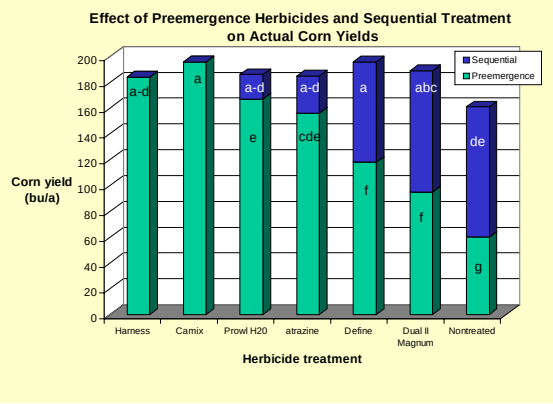


Figure 5



The results from these studies indicate that TCLs are a valid measure of the early season weed competitiveness and the associated risk of various herbicide programs. WeedSOFT proved to be an effective tool in assessing the relative risk of various herbicide programs. The program accurately ranked corn yields of the preemergence herbicides, but did not accurately quantify the yield loss. In this study, the preemergence herbicides differed in their ability to extend the postemergence application window, primarily due to differences in their weed control spectrum. Most importantly, the use of preemergence herbicides can reduce weed density and height which allows for delayed postemergence herbicide applications without increasing the risk of yield loss from early season weed competition.