FERTILIZING WEEDS FOR A PROFIT?

Chris M. Boerboom, Timothy L. Trower, Carrie A.M. Laboski, and Todd W. Andraski [1]

Introduction

The question "Fertilizing weeds for a profit?" certainly seems illogical because a corn grower would never intentionally fertilize weeds. However, the potential exists that weeds are being fertilized unintentionally in hundreds of fields in Wisconsin each year. The weeds that emerge and grow early in the season are competing with the corn for nutrients, but the amount of competition may not be fully understood. Considering the high cost of nitrogen, perhaps a more refined question to ask is "How do weeds and weed management affect a corn grower's profitable use of nitrogen?" The University of Wisconsin and other Midwest universities have introduced new nitrogen use guidelines to maximize the returns to nitrogen inputs. At the same time, many corn fields are being treated with postemergence herbicide programs, which increase the potential for early season weed competition. This increases the potential that weeds may compete and limit the nitrogen available for the corn. This may not be a concern when excess nitrogen is applied, which would be more affordable at lower nitrogen prices. However, this could be a significant concern when nitrogen rates are being optimized. Because of this concern, we wanted to determine if early season weed competition shifted the economic optimum nitrogen rates in corn.

Materials and Methods

Field studies were conducted at Arlington, WI in 2006 and 2007 to determine if the economic optimum nitrogen rate (EONR) in corn was affected by early season weed competition. To determine the nitrogen response of corn, nitrogen was applied preplant as 28% UAN at 0, 40, 80, 120, 160, and 200 lb/a and incorporated prior to planting glyphosate-resistant corn. The previous crop was soybean. Four weed management treatments were applied to each of these nitrogen rates. In one treatment, weeds were allowed to compete with corn until they were 4 inches tall, which is the timing when we typically recommend that they are controlled. A second treatment allowed weeds to compete until they were 12-inches tall to test the effect of a delayed postemergence herbicide application. These two timings were created by treating the weeds with 0.75 lb/a glyphosate at these weed growth stages. In both years of the study, the 12-inch timing was made 8 days after the 4-inch timing. These treatments were compared to corn that was grown under weed-free conditions, which was created by applying a preemergence herbicide after corn planting. Lumax was applied preemergence at 3 qt/a in 2006 while Camix at 2.4 qt/a was tank mixed with Princep at 1 qt/a and applied preemergence in 2007 for the weed-free control. Glyphosate was applied postemergence at 0.75 lb ae/a following the 2007 preemergence treatment due to poor activation, which was caused by low rainfall. The fourth treatment was a nontreated, weedy control. Weed

[1] Professor, Senior Outreach Specialist, Assistant Professor, and Researcher, Depts. of Agronomy and Soil Science, Univ. of Wisconsin-Madison, WI 53706.

biomass was collected from 0.25 m^2 quadrats on the dates when the weeds were controlled. Corn and weed biomass collected in 2006 was analyzed for nitrogen concentration. Samples from 2007 are still being analyzed. Corn was harvested for yield and grain was adjusted to 15.5% moisture. The study had a randomized complete block design with four replications.

Results and Discussion

Giant foxtail and common lambsquarters were the predominant weed species in both years. Weed densities averaged 890 and 390 plants/m^2 in 2006 and 2007, respectively, at the 4-inch weed control timing and 1,090 and 660 plants/m^2 in 2006 and 2007, respectively, at the 12-inch weed control timing. Weed biomass at the 4-inch weed control timing averaged 52 and 67 g/m^2 in 2006 and 2007 and 96 and 183 g/m^2 at the 12-inch weed control timing in 2006 and 2007. In general, weed growth nearly doubled in the 8 days between treatments in 2006 and was about 2.5 fold greater in 2007.

Weeds accumulated 12 lb/a of nitrogen at the 4-inch weed control timing compared to 25 lb/a of nitrogen at the 12-inch weed control timing in 2006 when averaged across all nitrogen rates. Corn biomass was sampled at tassel and nitrogen accumulation was 85 lb/a for the weed-free control, 82 lb/a for the 4-inch weed control timing, and 70 lb/a for the 12-inch weed control timing when averaged across all nitrogen rates.

When the main factors in this experiment are summarized, the general effects of weed management and the general effects of nitrogen rate can be reviewed and the results are as expected. Specifically, corn grain yields did not differ between the weed-free control and the 4-inch weed control timing, but were reduced 7 and 11% with the 12-inch weed control timing compared to the weed-free control in 2006 and 2007, respectively (Figure 1). These results are similar to previous experiments where weed control at the 4-inch timing is statistically similar to the weed-free control, but noticeable yield losses occur

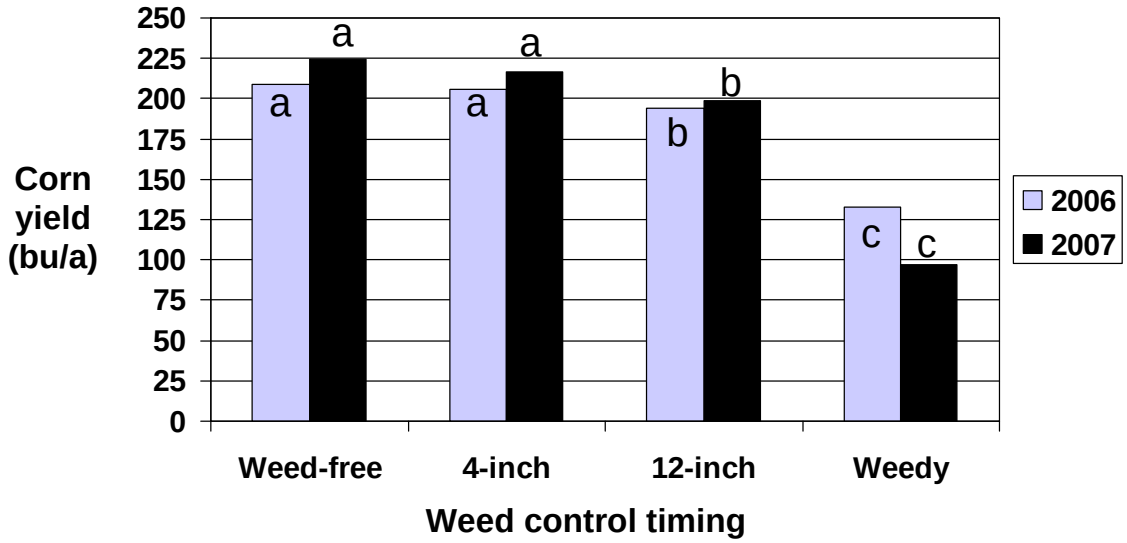

Figure 1. Corn yield with three weed control timings compared to a weedy control when averaged across nitrogen rates ranging from 0 to 200 lb/a.

with later weed control timings. The yield of the weedy control was reduced an average of 37 and 56% in 2006 and 2007, respectively, compared to the weed-free control.

The corn yield response to increasing nitrogen rates when averaged across the weed management treatments also fits our expectations with increasing yield with increasing nitrogen rate (Figure 2). However, the question is whether or not this nitrogen response shifts because of the early season weed competition. Therefore, the nitrogen response of each weed management treatment needs to be examined and the results for 2006 are shown as an example (Figure 3). The nitrogen response differs among the treatments. For corn without weed competition, yields begin to plateau at moderate rates of nitrogen and the corn yield response with the 4-inch weed control timing is similar. However, the corn yields with the 12-inch weed control timing are noticeably different. At low nitrogen rates, corn yields are significantly lower than the weed-free corn. With higher nitrogen rates, the corn yields begin to "catch up" with the yields of the weed-free corn. At the 160 and 200 lb N/a rates, the corn yields of all of the treatments with weed control were similar.

However, considering the cost of nitrogen, the original question needs to be asked "How do weeds and weed management affect a corn grower's profitable use of nitrogen?" The EONR was determined using a nitrogen fertilizer to corn price ratio of 0.15. In 2006, the EONR was 96 and 97 lb N/a for the weed-free corn and the 4-inch weed control timing, respectively, and 200 lb N/a for the 12-inch weed control timing (Table 1). In 2007, the EONR was 39 lb N/a for the weed-free control, 79 lb N/a for the 4-inch weed control timing, and 220 lb N/a for the 12-inch weed control timing. These results demonstrate that the optimum nitrogen rates were significantly affected by the timing of the weed control. Although high corn yields could be obtained with the delayed 12-inch weed control timing, the economic optimum nitrogen rate was increased by 100 lb N/a or more.

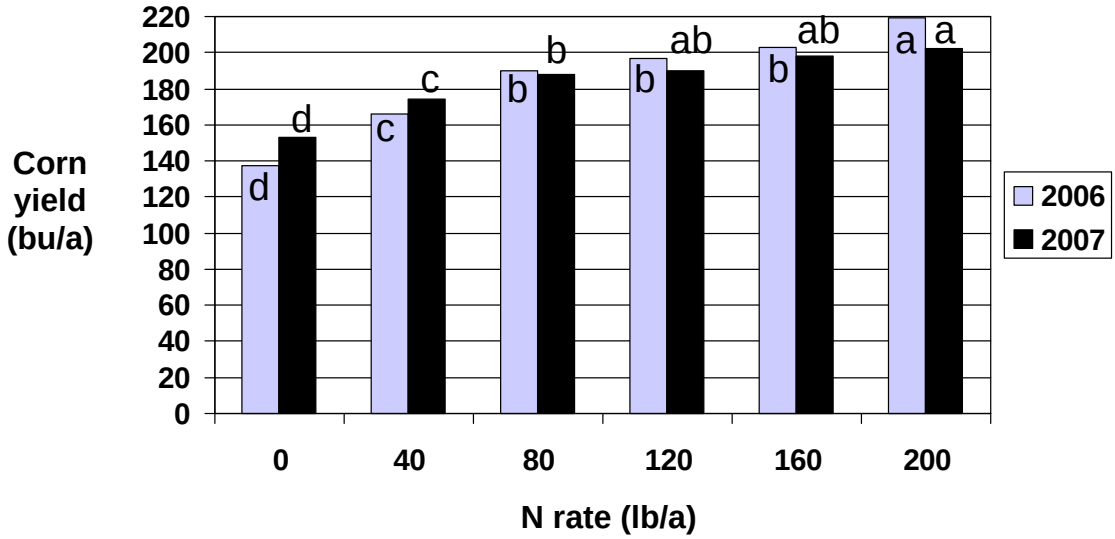

Figure 2. Corn yield with increasing nitrogen rates when averaged across weed control timings.

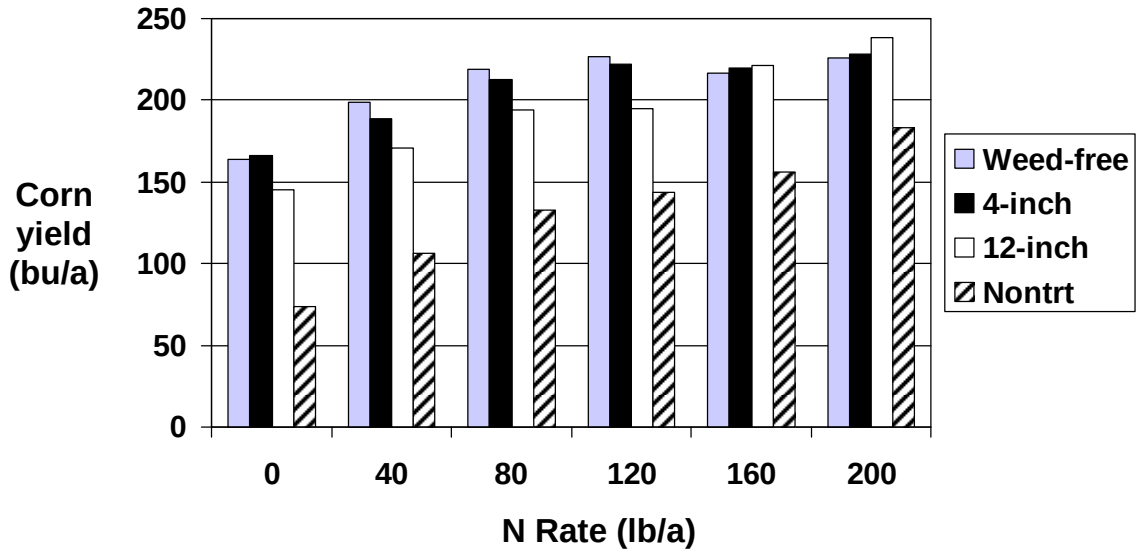

Figure 3. Corn yield with four weed management treatments and increasing nitrogen rates in 2006.

Table 1. Economic optimum nitrogen rates in corn with four weed management treatments at a 0.15 nitrogen:corn price ratio.

	Economic optimum nitrogen rate (lb N/a)	
Weed management treatment	2006	2007
Weed-free (preemergence)	96	39
4-inch weed control timing	97	79
12-inch weed control timing	200	220
Weedy (nontreated)	200	193

We certainly cannot afford to "fertilize weeds." These results demonstrate that early season weed competition for nitrogen can contribute to corn yield loss when postemergence herbicide applications are delayed and may increase the EONR. Weed management programs such as using preemergence residual herbicides that limit early season weed competition or provide complete control will optimize nitrogen use. Considering herbicide and nitrogen prices, it should be more profitable to use a preemergence herbicide than to compensate for a delayed postemergence herbicide application with an over-application of nitrogen.