

Bill Johnson

Glenn Nice

*Purdue Extension Weed
Science*

Shattercane Interference and Nitrogen Accumulation in Roundup Ready Corn

Shattercane is an especially competitive weed because plant heights can reach 10 feet, which results in crop shading, and the weed is similar to corn in growth and nutritional needs. There are few published references on shattercane interference in corn. Beckett et al. (1988) reported that shattercane interference in corn resulted in a 22% to 75% reduction in grain yield. They also determined that on a per plant basis, shattercane is more than twice as detrimental to corn yield as giant foxtail.

The goal of this article is to raise awareness of the effects of early-season weed competition on corn in weed management systems that are heavily reliant on a postemergence herbicide that will control relatively large weeds. The information presented in this specific article would apply to use of glyphosate in Roundup Ready corn, Liberty in Liberty Link corn, or Accent, Beacon, Steadfast, Option, or Equip in non-transgenic corn. All of these herbicides will control relatively large shattercane in corn unless the population is ALS resistant in which case the ALS herbicides will be less effective. Severe shattercane infestations in the eastern cornbelt are not as common as some other weeds such as foxtails, lambsquarters, and giant ragweed. However, our field surveys over the last three years have indicated that it is prevalent in almost every county sampled and Glenn, Tom and I receive a number of calls each year about shattercane management in corn. From a competitive standpoint, shattercane and johnsongrass would be similar in the amount of yield loss caused by interference in corn.

Prior to the introduction of Accent and Beacon about 20 years ago, shattercane was controlled in corn with preemergence herbicides and cultivation. Postemergence herbicides including Accent, Pursuit, Beacon, Steadfast, Option, Equip, Liberty, and glyphosate (Roundup/others) have been shown to be much more effective than soil-applied herbicides and cultivation for control of shattercane.

The respective labels for most of these herbicides indicate that they can be applied to shattercane up to 12 inches tall. In production fields it is common to delay applications until plants are 12 to 18 inches tall. This delay in application timing is to ensure that most of the seedlings have emerged and there is adequate leaf area for spray coverage. The concern we have with applications to 12 to 18 inch tall plants is that even though effective control can be attained, yield loss had occurred due to weed interference and growers are unaware of it.



Glenn Nice,
Purdue
University

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Knowledge to Go

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Nitrogen is a major economic input and is utilized in the plant to produce enzymes and proteins. Nitrogen has been shown to be a critical factor in weed competition. Research has shown that weeds reduce not only crop grain yield, but also the amount of macronutrients found in the corn plant. Yield reductions due to weed interference are increased by nitrogen deficiencies. However, corn-weed interactions are complex and additional stresses, such as drought have varying effects on yield losses.

We conducted field experiments to determine the impact of shattercane interference on corn grain yield and nitrogen uptake on a silt loam soil with 2.6% organic matter (Hans and Johnson 2002). A glyphosate-resistant

Table 1. Shattercane removal height and corresponding dates and corn growth when glyphosate was applied in 1999 and 2000 at Columbia, MO.

	1999			2000		
	Date	DAP ^a	Corn Growth Stage ^b	Date	DAP ^a	Corn growth stage ^b
3	May 27	24	V3	May 15	28	V2
6	June 8	36	V6	May 24	37	V4
9	June 11	39	V7	May 29	42	V5
12	June 15	43	V8	June 2	46	V6
15	June 17	45	V8	June 6	50	V6
18	June 21	49	V9	June 8	52	V7

^aDays after planting (DAP): May 3, 1999 and April 17, 2000.

^bCorn growth stage is designated by the number of fully exposed leaf collars. V2 = two fully exposed leaf collars, V3 = 3 fully exposed leaf collars, etc.

Table 2. Corn grain yield and biomass nitrogen at corn harvest in 1999 and 2000 at Columbia, MO.

Shattercane Removal height (in)	1999		2000	
	Corn grain yeild (bu/A)	Corn tissue nitrogen content (lb N/A)	Corn grain yeild (bu/A)	Corn tissue nitrogen content (lb N/A)
Weed free	75	72	214	128
3	70	64	195	95
6	68	66	178	119
9	64	77	174	94
12	58	65	162	85
15	44	40	149	93
18	45	56	149	73
Weedy check	11	9	123	62
LSD (0.05)	15	24	48	35

corn variety was planted and atrazine was applied premergence and used to control all weeds except shattercane. In essence, this system is similar to conditions experienced in production fields when all weeds are controlled

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by soil applied herbicides and shattercane comes through the soil applied herbicides and requires postemergence treatments to clean up the escapes.

Shattercane emerged at the same time as corn and our treatments consisted of glyphosate applied to various plots when shattercane was either 3, 6, 9, 12, 15, or 18 inches tall (Table 1). After glyphosate applications to specific plots, those plots were hand-weeded weekly thereafter to maintain weed-free conditions after the early-season interference. Average shattercane density in this experiment was 18 plants per square foot. Corn tissue N content and yield is shown in Table 2.

Corn yields were quite different between years because of the drought that began in the latter half of the 1999 season and timely rainfall late in the 2000 season. Season-long shattercane interference resulted in an 85% yield loss in 1999 and a 43% yield loss in 2000 (Table 2). Yield reductions occurred when shattercane was allowed to remain with corn until 12 inches tall before herbicide treatment. In both years, late season corn biomass N content was highly correlated ($r = 0.95$ and 0.84 , respectively) with corn yield. When shattercane was allowed to reach the maximum recommended height for nicosulfuron or primisulfuron application (12 inches), significant yield losses occurred and shattercane accumulated 10 and 20 lb N/A, while

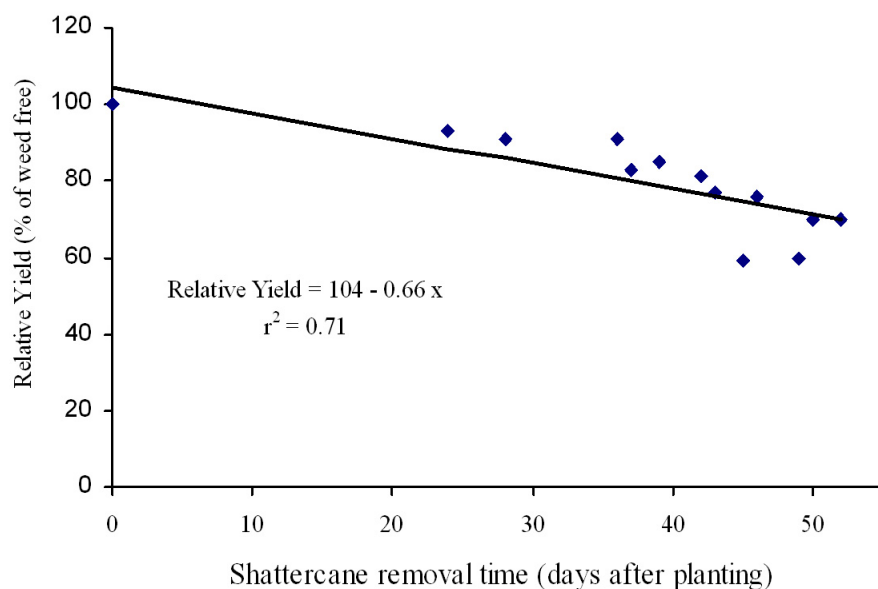


Figure 1. Percentage of maximum corn yeild at time of shattercane removal.

corn accumulated 10 and 16 lb N/A, respectively, in 1999 and 2000 (data not shown). This indicates that shattercane can accumulate significant amounts of N early in the season, similar to that reported for annual grasses in another article we posted earlier.

In addition, when shattercane reached 12 inches in height in these experiments, corn was at the V8 stage in 1999 and the V6 stage in 2000. The maximum recommended growth stage for most ALS corn herbicides that

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control grasses is V6. This is the stage in which the number of kernels/cob is determined. Herbicide stress at this stage can result in fewer kernels/cob, malformed ears and yield loss in certain hybrids.

Corn yields were converted to a percentage of the weed-free treatment in each year and are shown in Figure 1. This graphic shows the relative corn yield at each shattercane removal timing in days after planting. This graphic shows that corn yield was reduced 0.66% per day for each day the herbicide application was delayed past the optimal stage which occurred about 20 to 30 days after planting. In terms of real numbers, in a field with a 200 bu/A yield potential, this equates to over 1 bu/A/day in yield loss if the optimal timing for removal is missed!

The take home message from this study is that if soil-applied herbicides are not used or they have little or no effect on reducing shattercane infestations, the herbicide used, shattercane should be controlled before it reaches 12 inches tall if the average density is 18 plants per square foot or greater to avoid yield losses. From a management standpoint there are a few soil applied herbicides which provide suppression of shattercane and could be effective in reducing early-season density and competitiveness. In the Weed Control Guide for Ohio and Indiana, we have listed the relative effectiveness of a number of soil applied herbicides for shattercane in the weed response table on page 37. Keep in mind that none of them will provide complete control and that use of the upper end of the labeled rate for a soil type will be required to provide any meaningful activity. Herbicides which contain a chloroacetamide {acetochlor, metolachlor, dimethenamid (Outlook), flufenacet (Define)} provide some suppression if the rate is near the upper end of the labeled use rate. In addition, for low cost shattercane suppression, Prowl would be economical to use in these situations, but keep in mind that Prowl cannot be incorporated or corn injury will occur. Balance Pro also provides some suppression and is a common tankmix partner with atrazine and atrazine premixes.

References:

Beckett, T. H., E.W. Stoller, and L. M. Wax. 1988. Interference of four annual weeds in corn (*Zea mays*). *Weed Sci.* 36:764-769.

Hans, S. R., and W. G. Johnson. 2002. Influence of shattercane (*Sorghum bicolor* L. Moench.) on corn (*Zea mays* L.) yield and nitrogen accumulation. *Weed Technol.* 16:787-791.

Information listed here is based on research and outreach Extension programming at Purdue University and elsewhere. The use of trade names is for clarity to readers of this publication and does not imply endorsement of a particular brand nor does exclusion imply non-approval. Always consult herbicide labels for the most current and up-to-date precautions and restrictions. Copies, reproductions, or transcriptions of this document or its information must bear the statement "Produced and prepared by Purdue University Extension Weed Science" unless approval is given by the author.