Effect of Sidedress Nitrogen Application Rate and Presence of Common Lambsquarters on Corn Grain Yield

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INTRODUCTION

- Common lambsquarters is a highly competitive weed and one of the most widely distributed weeds in the world (Holm et al., 1977).
- A previous study found a 12% corn grain yield loss occurred at 4.9 common lambsquarters plants m^{-1} of row (Beckett et al., 1988). In this study, common lambsquarters emerged with the corn.
- Preemergence (PRE) and early postemergence (POST) herbicide applications may result in weed re-infestations (Gower et al., 2002). However, late POST applications may result in yield loss. Previous weed control timing studies have not evaluated the effect of weed re-infestations on corn grain yield. This study was designed to simulate common lambsquarters re-infestation (after a PRE or early POST) herbicide application.
- Weeds actively compete with crops for N. At higher N rates, weeds may be removed later without reducing corn grain yield (Evans et al., 2003).
- As N supply increases, common lambsquarters tend to assimilate greater amounts of N and produce greater shoot biomass (Blackshaw et al., 2003). However, N management recommendations often do not consider weed pressure as a factor that may influence N loss.

OBJECTIVES

- To evaluate the effect of sidedress N rate on N assimilation by late-season common lambsquarters populations.
- To evaluate the effect of sidedress N application rate and common lambsquarters on corn grain yield.

METHODS

- A study was conducted in 2009 and 2010 at the Montcalm Research Farm in Entrican, MI, in irrigated corn.
- A randomized complete block design was used.
- Treatments included:
  - Presence or absence of common lambsquarters.
  - Sidedress N application rate (0, 56, 112, 168, and 224 kg N ha^{-1}).
- At planting, 78 kg N ha^{-1} was applied to the entire field. Weeds were controlled using glyphosate (0.87 kg ae ha^{-1}), s-metolachlor (1.40 kg ai ha^{-1}), and atrazine (1.12 kg ai ha^{-1}). Cultural practices are displayed in Table 1.
- Common lambsquarters (2-5 cm tall) were transplanted from near by field into the study when corn was at V7. The common lambsquarters were placed 10-15 cm from the corn row at 5 plants m^{-1} of row.
- Urea was hand applied at V7 and incorporated with irrigation.
- Just prior to weed senescence, weeds were counted and collected along 1.5 m of each of the center two rows of corn. Fresh and dry weights were recorded.
- Total N was measured in the above-ground lambsquarters biomass using the Kjeldahl method.
- Yield was determined at 15.5% grain moisture.
- Cumulative growing degree days were calculated using a base temperature of 10°C.
- PROC GLM and Fisher's Protected LSD in SAS used to determine significance (at α = 0.10) and separate means.

Table 1. Cultural practices and dates

	2009	2010
Hybrid	Golden Harvest H7149GT	Dekalb 4661
Corn planted	May 16	April 28
Date herbicide applied	June 12	June 9
Weeds transplanted	June 26	June 16
Harvest	Nov. 23	Oct. 11

Figure 1. Cumulative growing degree days in 2009 and 2010.

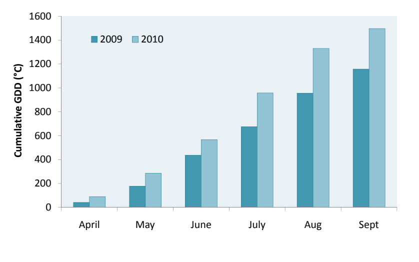


Figure 2. Common lambsquarters shoot biomass as affected by sidedress N rate.

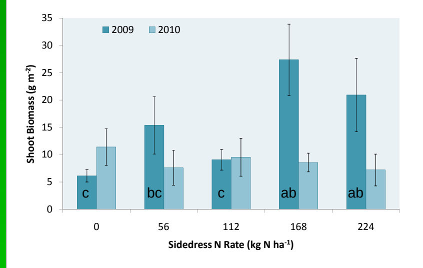


Figure 3. Percent total N of common lambsquarters as affected by sidedress N rate.

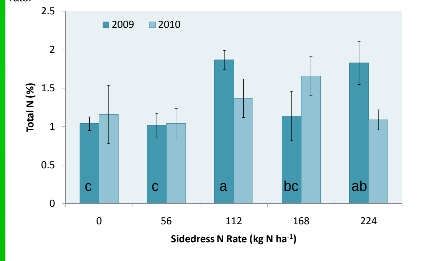


Figure 4. Nitrogen removed by common lambsquarters as affected by sidedress N rate.

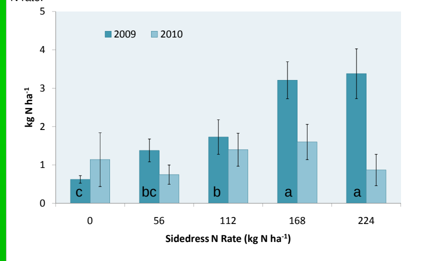


Figure 5. Grain yield as affected by common lambsquarters presence..

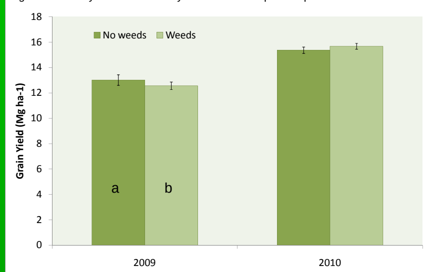
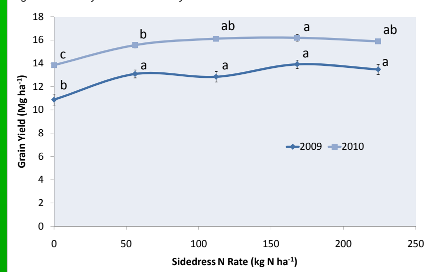


Figure 6. Grain yield as affected by sidedress N rate.



Common lambsquarters transplanted on June 26, 2009.

Common lambsquarters in early July 2009.

Common lambsquarters at corn silking in 2009.

RESULTS AND DISCUSSION

Effect of N Rate on Common Lambsquarters

- In 2009, there were significant differences in common lambsquarters biomass and total N content.
- Common lambsquarters biomass was greatest when 168 and 224 kg N ha^{-1} was applied (Fig. 2).
- Percent total N was greatest in common lambsquarters when 112 and 224 kg N ha^{-1} was applied and lowest when 0 and 50 kg N ha^{-1} was applied (Fig. 3).
- Nitrogen removed by common lambsquarters is a function of both biomass and total N content. In 2009, N removed on a hectare basis increased with N application rate (Fig. 4).
- In 2010, there were no significant differences in common lambsquarters biomass, percent total N content, and N removed.

Effect of Common Lambsquarters & N Rate on Yield

- In 2009, below average temperatures and growing degrees days (Fig. 1) resulted in lower grain yield when than in 2010 (Fig. 5 & 6).
- In 2009, there were significant differences in grain yield due to the presence of common lambsquarters and N rate; however, there was no significant interaction. The presence of common lambsquarters resulted in a 0.23 Mg ha^{-1} grain yield difference in 2009 (Fig. 5). Grain yield increased when 56 kg N ha^{-1} was applied (Fig. 6), but there was no yield response when 56-223 kg N ha^{-1} was applied.
- In 2010, grain yield was significantly different due to N rate, but was not influenced by the presence of common lambsquarters (Fig. 5 & 6). Grain yield was greatest when 168 kg N ha^{-1} was applied.

CONCLUSIONS

- In 2009, corn grain yield was influenced by both the presence of common lambsquarters and N rate; however, there was no interaction. This may indicate that while grain yield was reduced by the presence of weeds, it was not caused by N competition.
- In 2010, grain yield was not affected by the presence of common lambsquarters, which may have been a result of a better growing season and more competitive crop than in 2009.
- This study indicates that at 5 weeds m^{-1}, corn grain yield may be reduced in a less competitive crop. Under more optimum growing conditions, weed pressure is less likely to reduce corn grain yield.

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