

Nitrogen Consumption in Weed Species as Influenced by Application Rate and Weed Removal Timing



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INTRODUCTION

Nitrogen Management

- Nitrogen is often the most limiting nutrient in corn production.
- Nitrogen use efficiency needs to be optimized due to:
 - Increasing environmental concerns surrounding surface and groundwater pollution.
 - Recent increases in fertilizer costs.
 - New nitrogen recommendations based on economic optimum N rate may be lower than in past.

Weed Control

- Michigan State recommends weed control prior to 10 cm weed height to avoid yield reduction (Dalley et al. 2003).
- At higher N rates, the critical time of weed control may increase (Evans et al. 2003)
- Previous studies indicate response to N supply is species dependent (Blackshaw et al. 2003; Harbur and Owen 2004), which may be due to differences in photosynthetic pathways (Brown 1985).

OBJECTIVES

- To measure nitrogen assimilation by giant foxtail, Powell amaranth, velvetleaf, common ragweed, and common lambsquarters
- To evaluate the effect of nitrogen rate and weed removal timing on corn grain yield.

METHODS

- A study was conducted in 2009 at MSU Agronomy Farm in East Lansing.
- A split plot, randomized complete block design was used.
 - Main plot:** N rate (0, 67, 134, and 202 kg N ha⁻¹).
 - Subplot:** Weed control timing defined by weed height (0, 5, 10, 15, 20 cm, and weedy). Plots were maintained weed free after each removal timing.
- Weed biomass collected from 0.25 m² quadrats at each weed removal timing. Fresh and dry weights recorded.
- Giant foxtail, Powell amaranth, velvetleaf, common ragweed, and common lambsquarters were collected at each weed removal timing. Samples were dried, ground, and analyzed for total N using an elemental combustion system.
- Grain yield at 15% moisture was determined at harvest.
- PROC GLM and Fisher's Protected LSD in SAS used to determine significance and separate means.

Table 1. N removed by weeds at the 134 kg N ha⁻¹ application rate

Weed Height (cm)	giant foxtail	Powell amaranth	common ragweed	common lambsquarters	total
	Nitrogen Removed (kg N ha ⁻¹)				
5	4	0.3	0.3	6	10.6
10	17	3	3	34	57
15	20	16	15	55	96
20	38	31	55	17	93

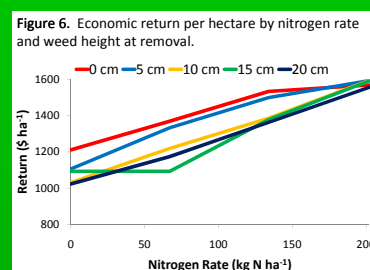
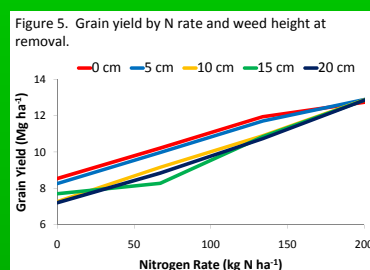
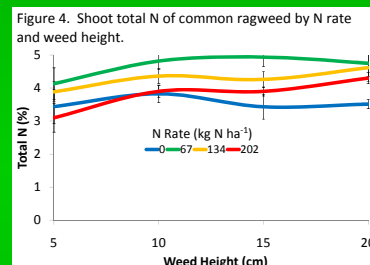
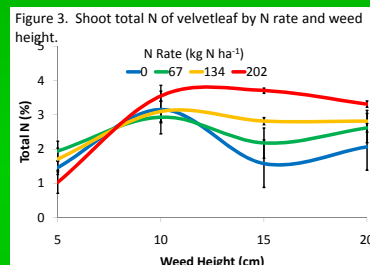
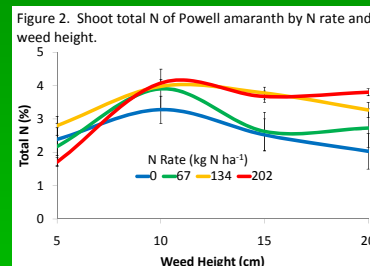
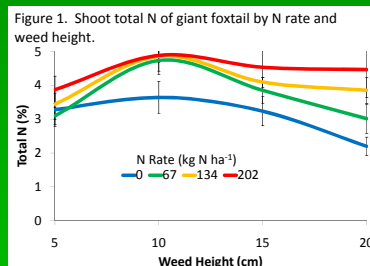


Figure 7. Common ragweed roots by weed shoot height at the 0 kg N ha⁻¹ rate.



Figure 8. Common ragweed roots by nitrogen rate at 15 cm shoot height.



RESULTS AND DISCUSSION

Nitrogen Assimilation by Weeds

- Giant foxtail: Total N content increased with N application rate. Nitrogen uptake increased from 5-10 cm weed height at all N application rates except for 0 kg N ha⁻¹ (Figure 1).
- Powell amaranth: Total N content was greatest when 134 and 202 kg N ha⁻¹ was applied. Nitrogen uptake increased from 5-10 cm weed height at all N application rates (Figure 2).
- Velvetleaf: Total N content increased with N application rate. Nitrogen uptake increased from 5-10 cm weed height at all N application rates (Figure 3).
- Common ragweed: Total N content was only significantly different between the 0 kg N ha⁻¹ rate and 67, 134, and 202 kg N ha⁻¹ application rates. Only a slight increase in N content between 5-10 cm weed height (Figure 4).
- Common lambsquarters: No significant difference in total N content by N rate, but there was an increase in N content between 5-10 cm weed height (data not shown).

Nitrogen Removed by Weeds

- When 134 kg N ha⁻¹ was applied, there was an increase in N assimilation by weed species on a hectare basis from 5-15 cm shoot height (Table 1).

Corn Grain Yield

- Grain yield was greatest when weeds were controlled 0-5 cm, except for when 202 kg N ha⁻¹ was applied (Figure 5). At 202 kg N ha⁻¹, grain yield was the same among weed removal timings, indicating that grain yield loss due to delayed weed removal can be reduced with N applications.
- The greatest yield was achieved when 202 kg N ha⁻¹ was applied.

Economic Return

- Economic return was greatest when weeds were removed by 0 cm, except for when 202 kg N ha⁻¹ was applied (Figure 6). The largest economic loss due to the presence of weeds occurred between the 5 and 10 cm height removal timing.
- Economic return increased with nitrogen application rate.

CONCLUSIONS

- Nitrogen assimilation differed among weed species; however, it generally increased with N application rate and from 5-10 cm shoot height.
- Grain yield and economic return decreased when weed removal timing was delayed to 10 cm, except for at the highest N rate.
- Nitrogen use efficiency of corn decreased as weed removal timing increased.

FUTURE STUDIES

- Field study examining effect of sidedress N application rate on late-emerging weeds.
- Greenhouse study examining effect of N application rate and weed density on nitrogen assimilation of several weed species.

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