



Interseeding Cover Crops in Michigan Corn Rotations

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Introduction

- Time constraints following corn harvest limit the opportunity to seed fall cover crops in Michigan.
- Interseeding cover crops during corn vegetative growth stages may increase cover crop biomass, suppress weeds, and provide soil health benefits.
- Cover crops seeded at V1 to V4 may become competitive with corn and may also limit weed control options.

Objectives

- Evaluate the establishment and competitiveness of annual ryegrass, crimson clover, and Tillage Radish® interseeded into corn from V1 to V7.
- Evaluate the effects of interseeded cover crops on weed suppression and soil health.

Materials and Methods

- Field experiments were conducted in 2015 and 2016 at Michigan State University in East Lansing, MI.
- In 2015, corn (Pioneer 9807) was planted in 76-cm rows at 79,000 seeds/ha. In 2016, corn (Dekalb 4972) was planted in 76-cm rows at 74,100 seeds/ha.
- Annual ryegrass, Tillage Radish®, and crimson clover were broadcast interseeded into V1-V6 corn in 2015 and V2-V7 corn in 2016. At R6, annual ryegrass and Tillage Radish® were also interseeded in 2016 only.

Table 1. Cover crop seeding rates.

Seeding rate (kg/ha)			Seeds/0.25m ²		
Annual ryegrass	Tillage Radish®	Crimson clover	Annual ryegrass	Tillage Radish®	Crimson clover
9	9	16.8	207	19	89

Table 2. Cover crop interseeding dates for 2015 and 2016.

Year	Corn Plant Date	Corn Stage at Interseeding							
		V1	V2	V3	V4	V5	V6	V7	R6
2015	Apr 29	May 13	May 21	May 28	Jun 3	Jun 9	Jun 16	---	---
2016	May 9	---	May 31	Jun 3	Jun 7	Jun 10	Jun 15	Jun 22	Oct 10

- Glyphosate was applied at 0.84 kg ae/ha + ammonium sulfate at 2% w/w just prior to interseeding for the V1-V6 timings.
- Two 0.25m² quadrats were flagged in each plot for season-long measurements. Cover crop and weed densities were measured 30 days after cover crop planting (DACP). Cover crops and weeds were harvested at peak cover crop biomass prior to corn harvest; density and dry biomass measurements were taken.
- Cover crops and weeds were harvested from the 2015 experiment in April 2016 from two 0.25m² quadrats. Weed and cover crop density and dry biomass were measured, and 5-cm x 10 cm soil cores were collected for soil health measurements.
- Corn was planted as an indicator crop in 2016; soil cores were collected again in July.
- To date, soils have been analyzed for nitrate (NO₃⁻) and ammonium (NH₄⁺) content via colorimetric methods.
- Soils will be analyzed for phosphate concentrations and extracellular enzyme activities related to N and P acquisition.

Statistical Analysis

- Data were analyzed using Proc Mixed in SAS at a significance of $\alpha=0.05$.

Results and Discussion

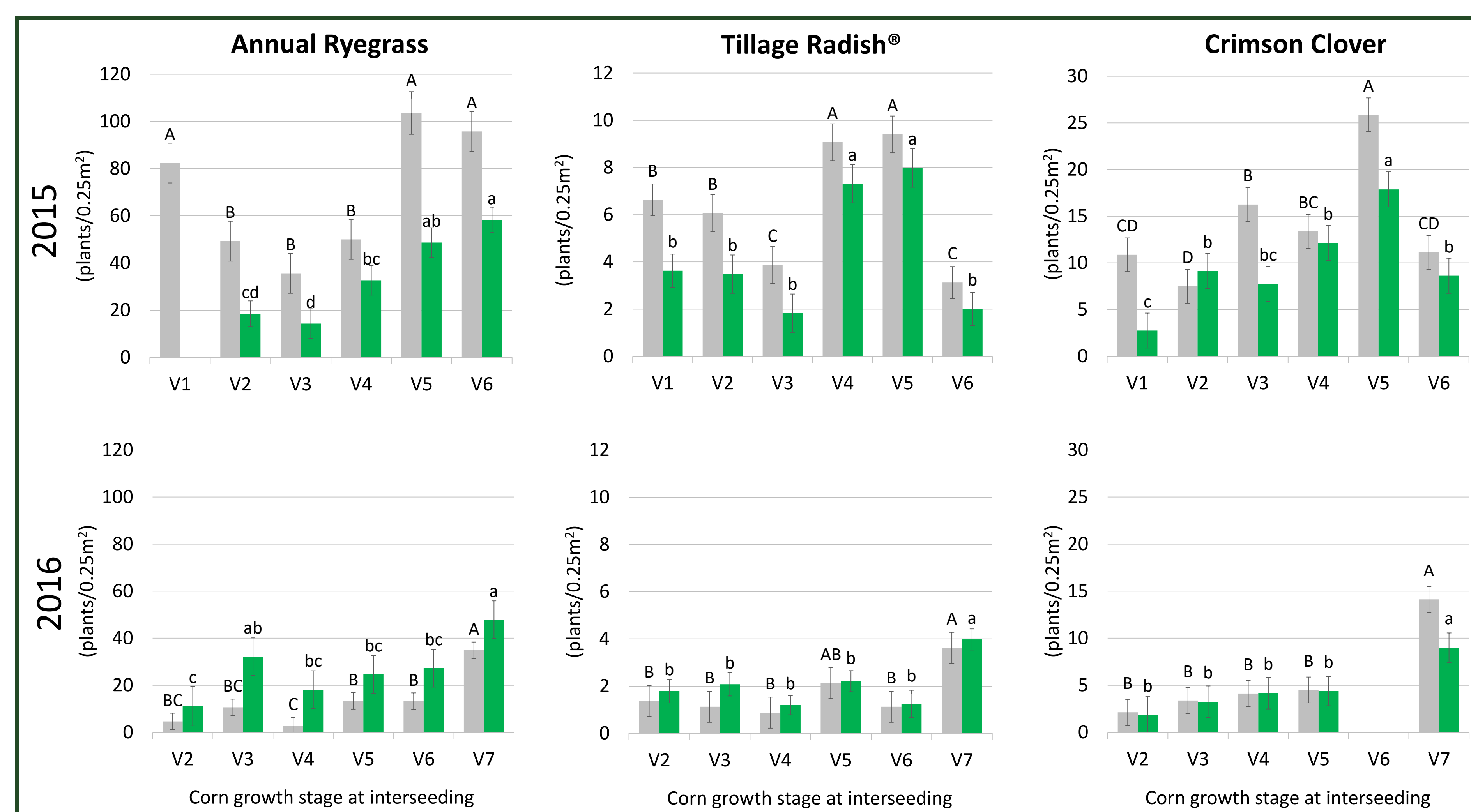


Figure 1. Annual ryegrass, Tillage Radish®, and crimson clover densities 30 DACP (■) and at harvest (■) at each interseeding timing in 2015 and 2016.

Establishment of Cover Crops

- Overall, cover crop densities were greater in 2015 compared with 2016 (Figure 1).
- 2015 annual ryegrass densities declined from 30 DACP to harvest. V5 and V6 interseedings had greater densities. 2016 densities were greater at harvest compared with 30 DACP (Figure 1).
- 2015 Tillage Radish® densities declined from 30 DACP to harvest. V4 and V5 interseedings had the greatest harvest density (Figure 1).
- 2015 crimson clover densities usually declined from 30 DACP to harvest. The V5 interseeding timing had the greatest density (Figure 1).
- V7 interseeding had the highest harvest density for all cover crops in 2016 (Figure 1).
- In 2016, Tillage Radish® and crimson clover densities were similar 30 DACP and at harvest (Figure 1).
- Only annual ryegrass overwintered. Density was greatest for the V4-V6 timings (data not shown).
- Cover crop biomass was greater for late interseedings (V4-V6) compared with early timings (V1-V3) in 2015. There was no significant effect of interseeding timing on biomass in 2016. For both years, annual ryegrass produced the greatest biomass and crimson clover the least biomass at the seeding rates in this experiment (data not shown).
- Rainfall in 2015 was much greater during the V1-V6 interseeding timings compared with V2-V7 timings in 2016 (Figure 2).

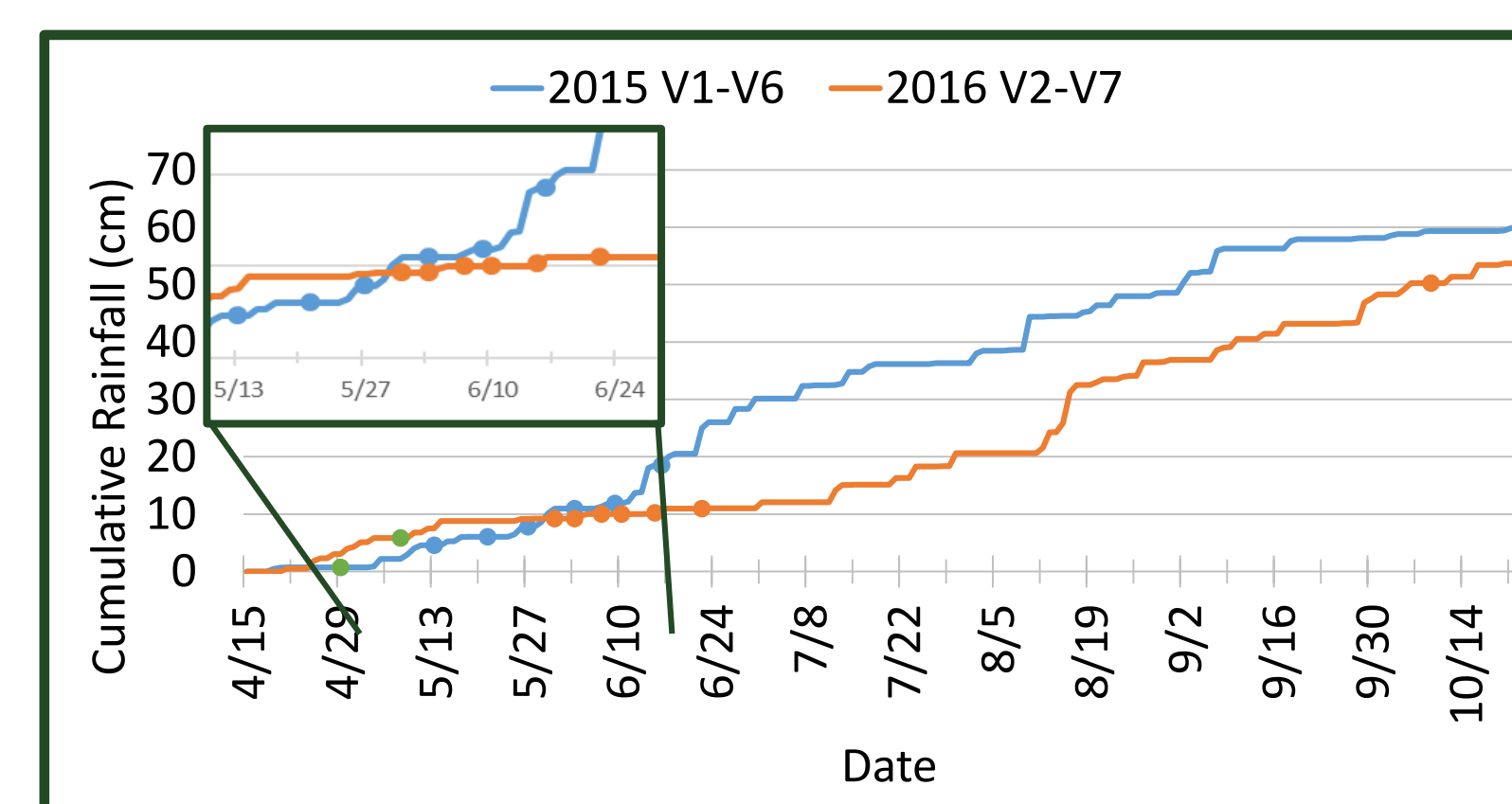


Figure 2. 2015 and 2016 cumulative rainfall. Green circles represent corn planting each year. Blue and orange circles represent interseeding dates.

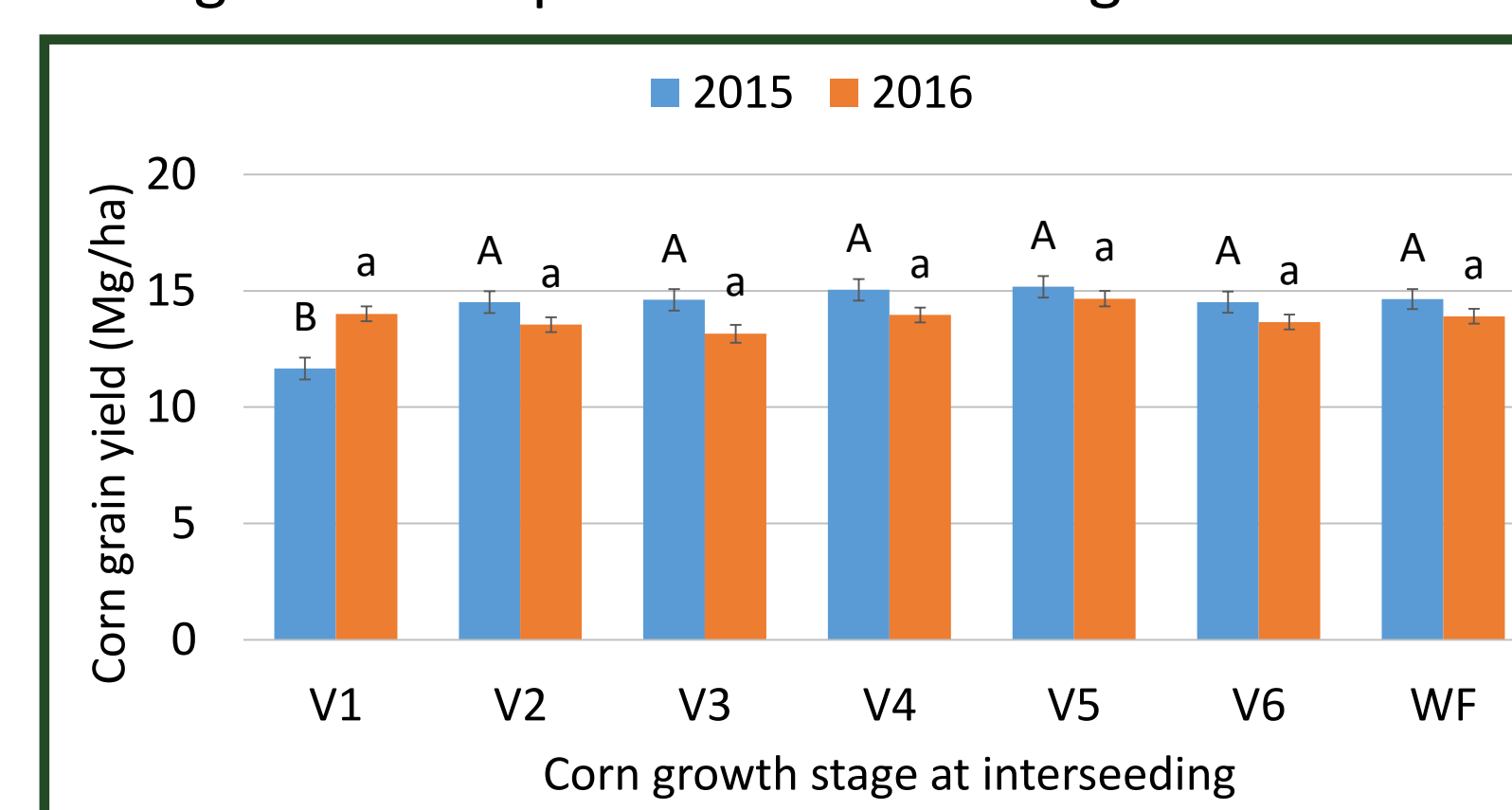


Figure 3. Corn grain yield in 2015 and 2016, combined over cover crops.

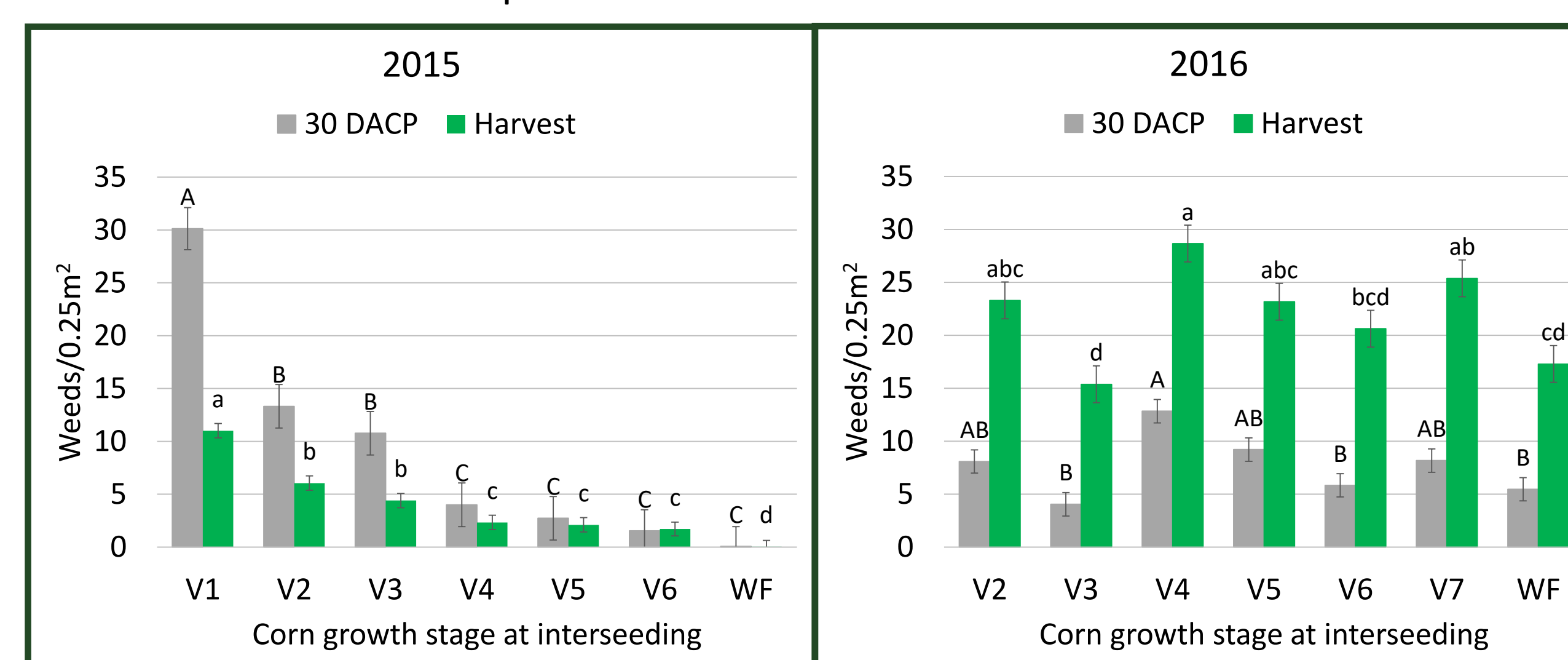


Figure 4 (left). 2015 weed densities at 30 DACP and harvest for each interseeding timing.

Figure 5 (right). 2016 weed densities at 30 DACP and harvest for each interseeding timing.



Left. V5 annual ryegrass, V5 Tillage Radish®, and V6 crimson clover. Right. V5 annual ryegrass, V5 Tillage Radish®, and V6 crimson clover.

Competitiveness of Interseeded Cover Crops

- 2015 corn yield was reduced only in the V1 interseeding timing. There were no yield differences across interseeding timings in 2016 (Figure 3).
- The V1 interseeding timing had the greatest weed density in 2015. Weed densities decreased with later interseedings, and densities decreased from 30 DACP to harvest. (Figure 4).
- Weed densities were greater and more variable in 2016 compared with 2015. 2016 densities increased from 30 DACP to harvest (Figure 5).

Interseeding Effects on Soil Health

- There was no influence of cover crop species or interseeding timing on soil NO₃⁻ and NH₄⁺ levels collected in April, the year after interseeding.

Conclusions

- Low cover crop density in 2016 was likely caused by lack of rainfall following interseeding in May, June, and early July. Further research is needed to determine the implications of environmental conditions in broadcast interseeding systems.
- 2015 cover crop densities were generally lower for V1-V3 timings compared to V4-V6 timings across all covers. This may have resulted from interspecific competition with weeds at earlier timings, intraspecific competition with the crop, or a combination of both. Further research is needed on interseeding timing, seeding rates and weed control practices.
- In 2015, corn yield was only reduced in the V1 interseeding timing. Weed density was greatest at V1 interseeding, suggesting that weeds reduced yield at the V1 interseeding timing.
- Interseeded cover crops can establish successfully in corn in MI. More information is needed on how cover crop species differ in their establishment, shade tolerance, soil health benefits, and interactions with weeds in corn production systems.