Impact of Glyphosate-Resistant Volunteer Corn Density, Control Timing, and Late Season Emergence on Soybean Yield

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Introduction

- Volunteer corn is a problematic weed in corn and soybean
- It results from the left over seed of hybrid corn planted and harvested in the previous year or from a failed corn stand during corn replant (Steckel et al. 2009)



- It can reduce soybean yield up to 25% at volunteer corn density of 5,380 plants ha^{-1} (Beckett and Stroller 1988)
- Volunteer corn seeds contaminate the harvested soybeans and also reduce market quality
- It plays a role in survival and dispersal of corn rootworm and grey leaf spot disease
- Majority of growers control volunteer corn when it is visible above the soybean canopy and it could results in early season competition with soybean
- Even after being controlled early in the season, the late season emerging volunteer corn plants at particular density could also provide competition to soybean

Hypothesis

- Late emergence of volunteer corn plants at higher densities could provide competition to soybean
- Volunteer corn controlled at later soybean growth stages could result in reduced soybean yields

Objectives

- To evaluate the impact of different densities of glyphosate-resistant volunteer corn present as individual plant or clump when controlled at different timings
- To evaluate the impact of late season volunteer corn emergence after being controlled at different soybean growth stages on soybean yields

Materials and Methods

- Field experiments: Two locations a) South Central Agricultural Laboratory (SCAL), Clay Center, NE and b) Havelock Farm, University of Nebraska-Lincoln, Lincoln, NE in 2013 and 2014
- Split-split plot experimental design
  - Main Plot- Volunteer corn density
  - Split plot- Control timings
  - Split-split plot- Late season volunteer corn emergence
- Glyphosate-resistant soybean (Cv. 'Fontanelle 64R 20') was drilled in rows spaced 76-cm apart @ 375,000 seeds ha^{-1}
- Hand planted volunteer corn kernels and whole ears in plots to maintain desired volunteer corn isolated (1,250, 2,500, 5,000, and 10,000 plants ha^{-1}) and clumps densities (63, 125, 250, and 500 ha^{-1}), respectively (Figure 2)
- In split-plot, volunteer corn was allowed to compete with soybean until harvest or was controlled at V4, V6, or R2 soybean growth stages with clethodim application
- In the split-split plot, volunteer corn plants that emerged after clethodim treatments were allowed to grow in one split until harvest and in the second split, plants were removed two weeks later
- Soybean was harvested at maturity and yields were adjusted to 13% moisture content

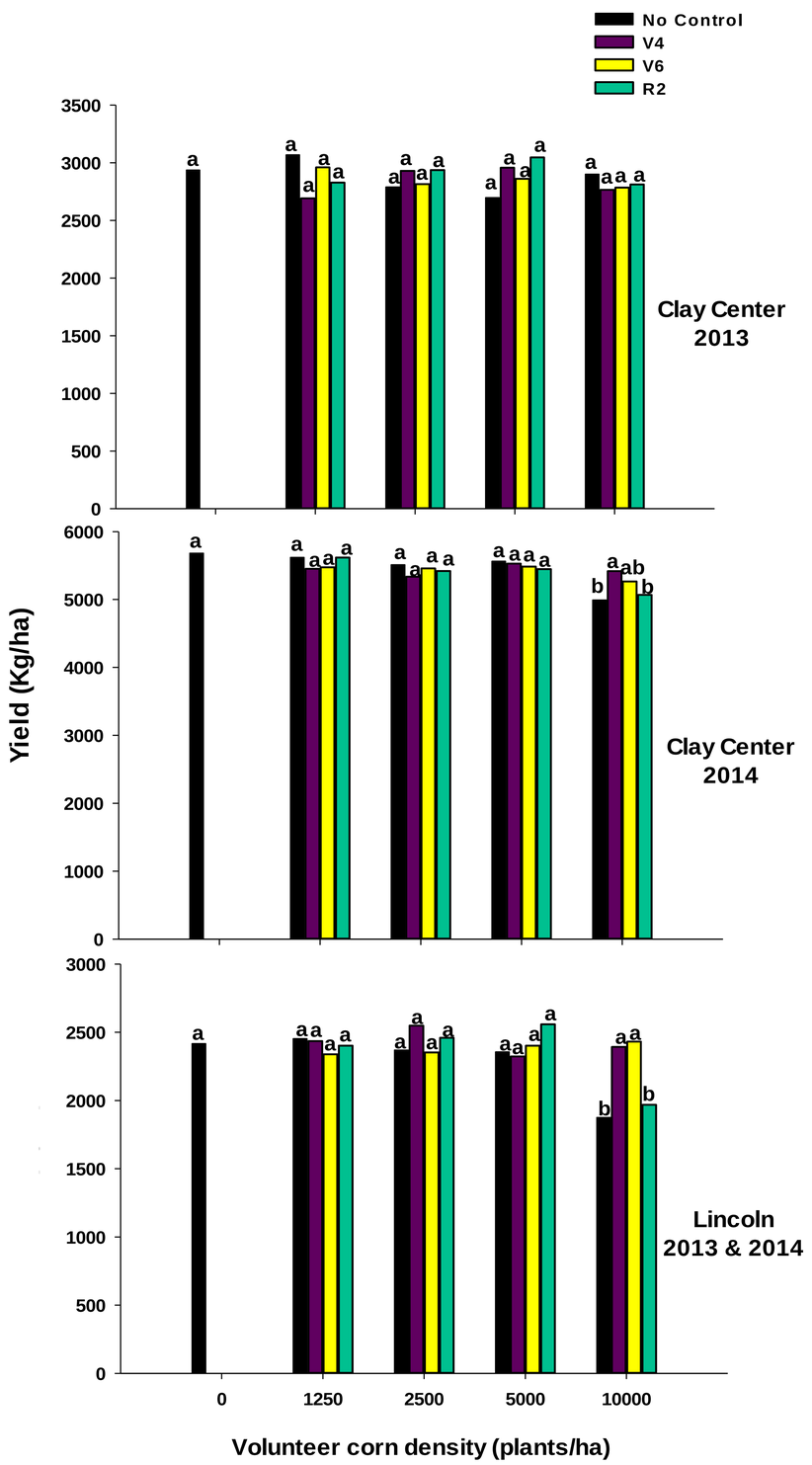

Figure 1. Effect of glyphosate-resistant volunteer corn densities, control timings, and late-season emergence on glyphosate-resistant soybean yield

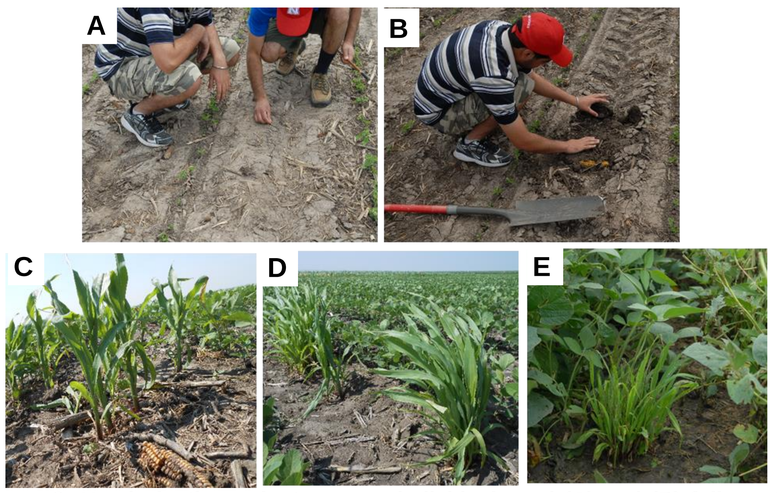

Figure 2: Hand planting volunteer corn individual seed (A) and (B) full ear to maintain desired volunteer corn density, (C) isolated and (D) clumps of volunteer corn plants, (E) late season emergence of volunteer corn

Results

- Late season volunteer corn emergence had no effect on soybean yield at Clay Center (P-value = 0.2228) and Lincoln (P-value = 0.2018) in 2013 and 2014
- No significant effect of different volunteer corn densities and control timings was observed on soybean yield at clay center in 2013 (Figure 1)
- Lower soybean yield was observed at the highest isolated volunteer corn individual plants (10,000 plants ha^{-1}) plus clump density (500 clumps ha^{-1}) left uncontrolled or controlled at R2 soybean growth stage during the second (2014) and both years of study at Clay Center and Lincoln, respectively

Conclusions

- Most of the late emerging volunteer corn plants after being controlled at different control timings were comprised of clumps rather than individual plants
- Volunteer corn clump densities maintained in this study were ≤ 500 clumps ha^{-1}, not enough to cause a yield reduction when emerging later in the season
- The actual volunteer corn individual plant density in the field was less than the theoretical or expected experimental density (Table 1)

Planted volunteer corn density (Pl ha^{-1})	Observed volunteer corn density (Pl ha^{-1})			
	Clay Center		Lincoln	
	2013	2014	2013	2014
1250	687-750	875-1,000	810-938	850-1,025
2,500	1,375-1,500	1,750-2,000	1,625-1,875	1,700-2,050
5,000	2,750-3,000	3,500-4,000	3,250-3,750	3,400-4,100
10,000	5,500-6,000	7,000-8,000	6,500-7,500	6,800-8,200

Table 1: Planted versus observed volunteer corn individual plant density at both the locations in 2013 and 2014

- Volunteer corn control timings did not have an impact on soybean yield at lower volunteer corn densities (≤ 5,000 plants ha^{-1})
- Still there is a need to control volunteer corn even if it does not present risk of soybean yield loss in order to reduce:
  - the risk of corn rootworms
  - interference of volunteer corn during harvesting
  - contamination of harvested soybeans
- ACCase-inhibitors should be tank mixed with different modes of action herbicides to reduce the potential for evolution of herbicide-resistant weeds
- Integrated volunteer corn management program could be adopted that may include tillage, crop rotation, and improved cultural agronomic practices

Future Research

- The effect of higher volunteer corn clump density on the late season volunteer corn emergence needs to be observed

References

- Beckett T. H. and E. W. Stoller. 1988. Volunteer corn (*Zea mays*) interference in soybeans (*Glycine max*). Weed Sci. 36:159-166
- Steckel L. E., M. A. Thompson, and R. M. Hayes. 2009. Herbicide options for controlling glyphosate-tolerant corn in a corn replant situation. Weed Technol. 23:243-246