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Control of Volunteer Enlist Corn in Enlist E3 Soybean

Abstract

Recent development of Enlist corn allows the use of 2,4-D choline (Enlist One), glyphosate (Roundup PowerMax), glufosinate (Liberty), and aryloxyphenoxypropionate (FOPs) herbicides for controlling grass and broadleaf weeds. However, volunteer Enlist corn plants can cause infestation in subsequent Enlist E3 soybean (resistant to 2,4-D, glyphosate, and glufosinate) in areas where a corn-soybean rotation is commonly practiced. The main objective of this research was to determine the effectiveness of cyclohexanedione (DIMs) herbicides alone or in tank-mixtures with Enlist One for Enlist corn control in Enlist E3 soybean. A field study was conducted in the 2020 growing season at the Kansas State University Agricultural Research Center (KSUARC) near Hays, KS. Enlist corn hybrid DKC62-53 was planted at 17,420 seeds/a on May 13, 2020. Enlist E3 soybean variety P30T92E was planted at 152,000 seeds/a in a perpendicular direction to corn on May 20, 2020. Herbicide treatments, including clethodim (Select Max) and sethoxydim (Poast Plus) were tested alone or in tank-mixtures with Enlist One as early POST (EPOST, 8- to 12-inch tall corn), or late postemergence (LPOST) (12- to 30-inch tall corn). Results indicated that Select Max applied EPOST alone provided an excellent, season-long control (95 to 99%) and highest biomass reduction (up to 100%) of volunteer Enlist corn in Enlist E3 soybean. However, volunteer corn control was significantly reduced when Enlist One was tankmixed with Poast Plus. Volunteer corn control was low to moderate (50–85%) with all late postemergence (LPOST) programs tested. Soybean grain yield did not differ among EPOST treatments (39 to 44 bu/a), while grain yield was significantly lower (~34 bu/a) for LPOST treatments. These results suggested that the EPOST application of Select Max and Poast Plus can effectively control volunteer Enlist corn infestation in Enlist E3soybean. However, adding Enlist One could compromise the efficacy of Poast Plus herbicide.

Keywords

Enlist One, Enlist soybean, Poast Plus, Select Max, volunteer corn

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Summary

Recent development of Enlist corn allows the use of 2,4-D choline (Enlist One), glyphosate (Roundup PowerMax), glufosinate (Liberty), and aryloxyphenoxypropionate (FOPs) herbicides for controlling grass and broadleaf weeds. However, volunteer Enlist corn plants can cause infestation in subsequent Enlist E3 soybean (resistant to 2,4-D, glyphosate, and glufosinate) in areas where a corn-soybean rotation is commonly practiced. The main objective of this research was to determine the effectiveness of cyclohexanedione (DIMs) herbicides alone or in tank-mixtures with Enlist One for Enlist corn control in Enlist E3 soybean. A field study was conducted in the 2020 growing season at the Kansas State University Agricultural Research Center (KSU-ARC) near Hays, KS. Enlist corn hybrid DKC62-53 was planted at 17,420 seeds/a on May 13, 2020. Enlist E3 soybean variety P30T92E was planted at 152,000 seeds/a in a perpendicular direction to corn on May 20, 2020. Herbicide treatments, including clethodim (Select Max) and sethoxydim (Poast Plus) were tested alone or in tank-mixtures with Enlist One as early POST (EPOST, 8- to 12-inch tall corn), or late postemergence (LPOST) (12- to 30-inch tall corn). Results indicated that Select Max applied EPOST alone provided an excellent, season-long control (95 to 99%) and highest biomass reduction (up to 100%) of volunteer Enlist corn in Enlist E3 soybean. However, volunteer corn control was significantly reduced when Enlist One was tank-mixed with Poast Plus. Volunteer corn control was low to moderate (50–85%) with all late postemergence (LPOST) programs tested. Soybean grain yield did not differ among EPOST treatments (39 to 44 bu/a), while grain yield was significantly lower (~ 34 bu/a) for LPOST treatments. These results suggested that the EPOST application of Select Max and Poast Plus can effectively control volunteer Enlist corn infestation in Enlist E3 soybean. However, adding Enlist One could compromise the efficacy of Poast Plus herbicide.

Introduction

Herbicide-resistant (HR) crops have provided growers flexibility for weed management. For instance, HR corn comprises 90% of the total corn production, and HR soybean comprises 94% of the total soybean production in the United States. However, the increased adoption of HR corn resulted in volunteer HR corn being a problem for soybean production in areas where a corn-soybean rotation is practiced. Enlist crop technologies are new stacked traits developed by Corteva Agriscience. Enlist E3 soybean can tolerate 2,4-D choline (Enlist One), glyphosate (Roundup PowerMax), and glufosinate (Liberty); whereas Enlist corn can also tolerate aryloxyphenoxypropionate (FOPs) herbicides in addition to 2,4-D, glyphosate, and glufosinate. The objective for this study

was to determine the effectiveness of Select Max and Poast Plus applied at two different timings for volunteer Enlist corn control in Enlist E3 soybean.

Procedures

A field study was conducted at the Kansas State University Agricultural Research Center (KSU-ARC) near Hays, KS. Enlist corn hybrid DKC62-53 was planted at 17,420 seeds/a on May 13, 2020, and Enlist E3 soybean variety P30T92E was planted at 152,000 seeds/a in a perpendicular direction to corn on May 20, 2020. The experiment was conducted in a randomized complete block design, with 4 replications. Two application timings included V3-V4 stage of volunteer corn (8- to 12-inch, EPOST) and V7-V8 stage (12- to 30-inch, LPOST). A total of 10 herbicide programs, including a nontreated weedy check and a handweeded check were tested (Table 1). All treatments were applied using a backpack sprayer equipped with Turbo Teejet TTI11003 nozzles using a spray volume of 15 gallons per acre. Data were recorded on percent visible control (%) of volunteer corn at 14, 28, 42, 56, and 98 days after treatment (DAT), corn aboveground shoot dry biomass at the end of season, and soybean grain yield (bu/a). All data were subjected to ANOVA using PROC MIXED in SAS v. 9.0 (SAS Inst. Inc., Cary, NC). Means were separated using Fisher's protected LSD test ($\alpha = 0.05$).

Results

Results indicated that Select Max applied EPOST alone provided an excellent, season-long control (95 to 99%) and the highest biomass reduction (up to 100%) of volunteer Enlist corn in Enlist E3 soybean (Figures 1 and 2). Volunteer corn control with Poast Plus and a tank-mixture of Select Max with Enlist One was moderate to excellent and ranged from 80 to 97% throughout the growing season (Figure 1). In contrast, volunteer corn control and shoot dry biomass was significantly reduced when Enlist One was tank-mixed with Poast Plus compared to the Poast Plus alone treatment (Figures 1 and 2). Volunteer corn control was low to moderate (50 to 85%) with all LPOST treatments (Figure 1). Soybean grain yield did not differ among EPOST treatments (39 to 44 bu/a), while grain yield was significantly lower (~ 34 bu/a) for LPOST treatments (Figure 3).

Conclusions

Select Max and Poast Plus alone applied EPOST can effectively control infestation of volunteer Enlist corn in Enlist E3 soybean. An addition of Enlist One in a tank-mixture with Poast Plus compromised the efficacy of Poast Plus on volunteer corn control. In addition, Select Max and Poast Plus should be applied early in the season in order to achieve better control of volunteer Enlist corn in Enlist E3 soybean.

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Table 1. List of herbicide treatments tested for controlling Enlist corn in Enlist E3 soybean at the Kansas State University Agricultural Research Center near Hays, KS

Treatments	Herbicide programs ¹	Rate (fl oz/a)	Timing
1	Select Max ²	16	EPOST
2	Poast Plus ³	24	EPOST
3	Select Max ² + Enlist One	16 + 32	EPOST
4	Poast Plus ³ + Enlist One	24 + 32	EPOST
5	Select Max ²	16	LPOST
6	Poast Plus ³	24	LPOST
7	Select Max ² + Enlist One	16 + 32	LPOST
8	Poast Plus ³ + Enlist One	24 + 32	LPOST
9	Nontreated	-	-
10	Handweeded	-	-

¹All treatments were applied using a backpack sprayer equipped with Turbo Teejet TTI11003 nozzles.

²Nonionic surfactant (NIS) at 0.25% v/v was included.

³Crop oil at 1% v/v, and ammonium sulfate (AMS) at 2% wt/v was included.

EPOST = early postemergence. LPOST = late postemergence.

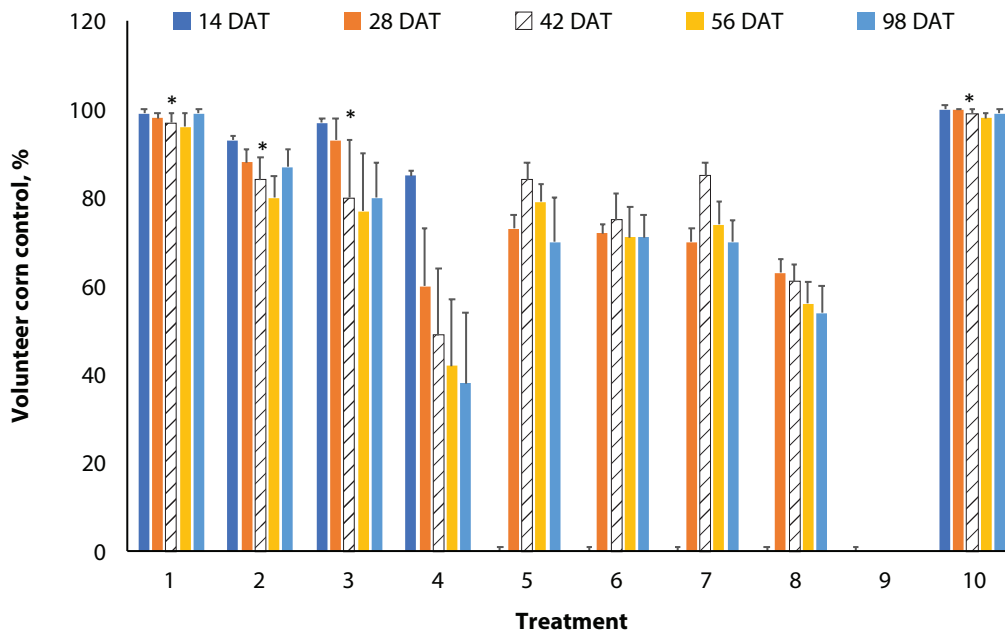


Figure 1. Effect of herbicide treatments on volunteer Enlist corn control in Enlist E3 soybean at the Kansas State University Agricultural Research Center near Hays, KS, at 14, 28, 42, 56, and 98 days after treatment (DAT). *Indicates significant differences from other treatments.

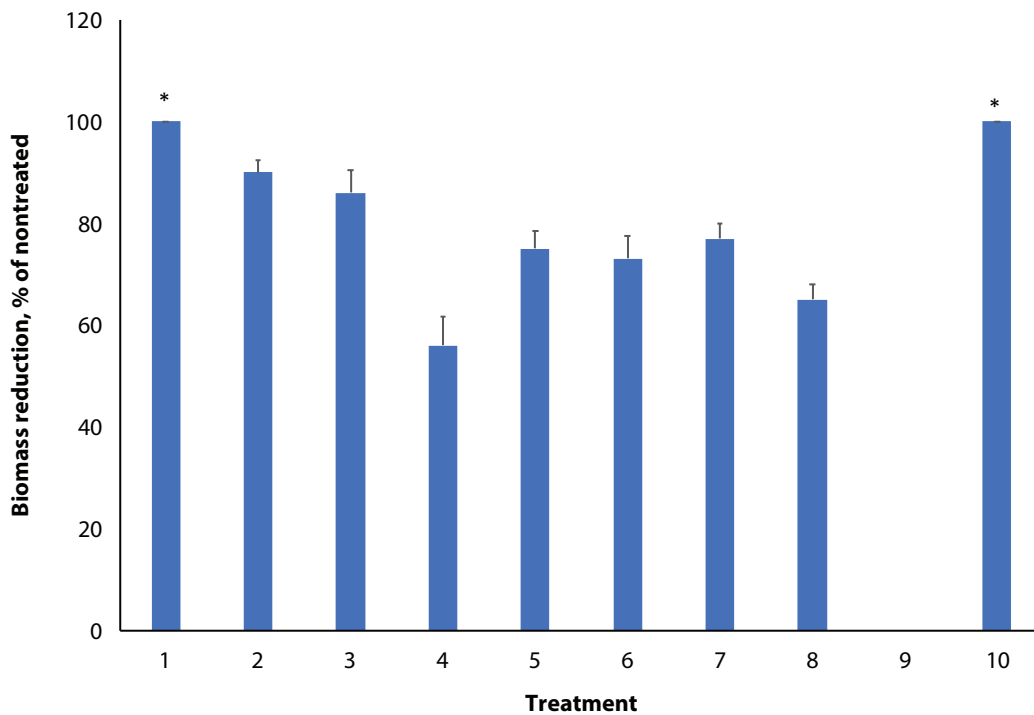


Figure 2. Effect of herbicide treatments on total shoot dry biomass reduction (% of nontreated) of volunteer Enlist corn in Enlist E3 soybean at the Kansas State University Agricultural Research Center near Hays, KS. *Indicates significant differences from other treatments.

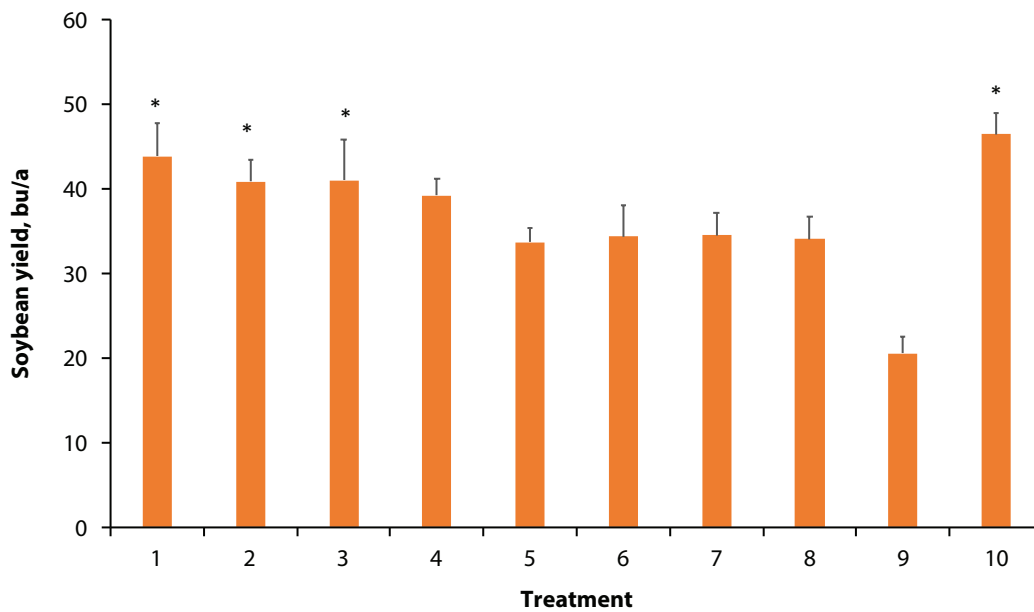


Figure 3. Effect of herbicide treatments on Enlist E3 soybean grain yield at the Kansas State University Agricultural Research Center near Hays, KS. *Indicates significant differences from other treatments.