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Effect of Tank-Mixing Glyphosate, Dicamba, and Graminicides on Grass Weed Control in Roundup Ready 2 Xtend Soybeans

Abstract

The adoption of Roundup Ready 2 Xtend soybean allows growers to use dicamba (Xtendimax or Engenia) in mixtures with glyphosate (Roundup PowerMax) or graminicides (Select Max or Assure II) for broad spectrum weed control. However, anecdotal evidence suggests that Xtendimax may cause antagonism when applied with Select Max and/or Assure II herbicides. The main objective of this study was to determine the effectiveness of Roundup PowerMax, Select Max, and/or Assure II alone or in tank-mixtures with Xtendimax for grass weed control in Xtend soybean. Field studies were conducted in 2020 at the Kansas State University Agricultural Research Center (KSU-ARC) near Hays, KS, and at the University of Nebraska, Lincoln, NE (UNL). The dominant grass species at the KSU-ARC site were southwest cupgrass and green foxtail. The dominant grass weed species at the UNL site were giant foxtail, hairy cupgrass, and fall panicum. Treatments, including Select Max, Assure II, and Roundup PowerMax applied as early post-emergence (EPOST; V3-V4 soybean growth stage) alone, or in combination with Xtendimax were tested (see Table 1 for details). Results from the KSU-ARC site indicated that Roundup PowerMax applied alone and in sequential treatments at 5 days prior to or after the application of Xtendimax provided $\geq 85\%$ control of both grass species, whereas the rest of the treatments provided $\leq 71\%$ control. The highest soybean grain yield (13 to 17 bu/a) was observed with Roundup PowerMax alone or in tank-mixtures with Select Max, Assure II and/or Xtendimax. In contrast, tank-mixing Xtendimax to Select Max or Assure II, or Xtendimax applied 5 days prior to the application of Select Max or Assure II, reduced giant foxtail (64 to 82%), and hairy cupgrass (71 to 82%) control at the UNL site. The addition of Roundup PowerMax to tank-mixtures of Xtendimax with Select Max or Assure II restored the efficacy of both Select Max and Assure II on all three grass species. Soybean grain yield (64 to 77 bu/a) did not differ for the majority of treatments at UNL site. These results suggest that addition of Xtendimax with Select Max or Assure II can potentially compromise the efficacy of graminicides, and Roundup PowerMax should be added in these mixtures to optimize grass control in Roundup Ready 2 Xtend soybean.

Keywords

Assure II, dicamba, glyphosate, graminicide, herbicide interaction, Roundup Ready 2 Xtend soybeans

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R. Liu, I. Effertz, T. Lambert, A. Jhala,¹ and V. Kumar

Summary

The adoption of Roundup Ready 2 Xtend soybean allows growers to use dicamba (Xtendimax or Engenia) in mixtures with glyphosate (Roundup PowerMax) or graminicides (Select Max or Assure II) for broad spectrum weed control. However, anecdotal evidence suggests that Xtendimax may cause antagonism when applied with Select Max and/or Assure II herbicides. The main objective of this study was to determine the effectiveness of Roundup PowerMax, Select Max, and/or Assure II alone or in tank-mixtures with Xtendimax for grass weed control in Xtend soybean. Field studies were conducted in 2020 at the Kansas State University Agricultural Research Center (KSU-ARC) near Hays, KS, and at the University of Nebraska, Lincoln, NE (UNL). The dominant grass species at the KSU-ARC site were southwest cupgrass and green foxtail. The dominant grass weed species at the UNL site were giant foxtail, hairy cupgrass, and fall panicum. Treatments, including Select Max, Assure II, and Roundup PowerMax applied as early post-emergence (EPOST; V3-V4 soybean growth stage) alone, or in combination with Xtendimax were tested (see Table 1 for details). Results from the KSU-ARC site indicated that Roundup PowerMax applied alone and in sequential treatments at 5 days prior to or after the application of Xtendimax provided $\geq 85\%$ control of both grass species, whereas the rest of the treatments provided $\leq 71\%$ control. The highest soybean grain yield (13 to 17 bu/a) was observed with Roundup PowerMax alone or in tank-mixtures with Select Max, Assure II and/or Xtendimax. In contrast, tank-mixing Xtendimax to Select Max or Assure II, or Xtendimax applied 5 days prior to the application of Select Max or Assure II, reduced giant foxtail (64 to 82%), and hairy cupgrass (71 to 82%) control at the UNL site. The addition of Roundup PowerMax to tank-mixtures of Xtendimax with Select Max or Assure II restored the efficacy of both Select Max and Assure II on all three grass species. Soybean grain yield (64 to 77 bu/a) did not differ for the majority of treatments at UNL site. These results suggest that addition of Xtendimax with Select Max or Assure II can potentially compromise the efficacy of graminicides, and Roundup PowerMax should be added in these mixtures to optimize grass control in Roundup Ready 2 Xtend soybean.

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Introduction

The introduction of Roundup Ready 2 Xtend soybean has provided stacked tolerance to both glyphosate and dicamba, which allows growers to use low-volatile formulations of dicamba (Xtendimax or Engenia) for in-season weed control, especially for controlling glyphosate-resistant weeds. Acetyl-CoA-Carboxylase (ACCase) (Group 1) inhibiting herbicides (Select Max or Assure II) are commonly used for effective control of a wide range of annual and perennial grass species. Xtendimax is usually tank-mixed with Roundup PowerMax or graminicides (Select Max or Assure II) for controlling both grass and broadleaf weed species in Roundup Ready 2 Xtend soybean. However, previous studies have shown that antagonism may occur between auxinic herbicides and graminicides when applied in tank-mixtures. For instance, it was reported that grass control was reduced by 7 to 38% when a tank-mixture of dicamba with sethoxydim (Poast) was applied. The main objective for this research was to determine the effectiveness of Roundup PowerMax, Select Max or Assure II alone, or in various combinations with Xtendimax on grass weed control in Roundup Ready 2 Xtend soybean.

Procedures

Field experiments were conducted in the 2020 growing season at the KSU-ARC near Hays, KS, and the UNL near Lincoln, NE. Roundup Ready 2 Xtend soybean variety AG34X7 was planted at 156,900 seeds/a on May 20, 2020, at the KSU-ARC site, and NK S29-K3X was planted at 140,000 seeds/a on May 11, 2020, at the UNL site. Grass weed species at the KSU-ARC site included southwest cupgrass and green foxtail. The dominant grass weed species at UNL site were giant foxtail, hairy cupgrass, and fall panicum. Experiments were established in a randomized complete block design with 3 replications. A total of 15 herbicide programs, including a non-treated weedy check, were tested (Table 1). All herbicide treatments were applied with a CO₂-operated backpack sprayer equipped with TTI11003 nozzles. Data were recorded on percent visual control of each grass weed species at 14, 28, and 54 days after treatments (DAT), and aboveground shoot dry biomass (g) at the end of the season, as well as 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

Grass Control

Results from the KSU-ARC site indicated that Roundup PowerMax applied alone or in sequential treatments at 5 days prior to or after Xtendimax applications provided $\geq 85\%$ control of both grass weeds at 28 DAT (Figure 1A). Control of both species did not exceed 72% with the rest of the treatments (Figure 1A). Tank-mixing Assure II with Xtendimax significantly reduced control of both grass species; however, an addition of Roundup PowerMax to this tank-mixture restored the efficacy of grass weed control (63 to 67%) at 28 DAT (Figure 1A). Results at the UNL site indicated that tank-mixing Xtendimax with Select Max or Assure II, and sequential treatment of Xtendimax followed by (*fb*) Select Max or Assure II had comparatively lower control of giant foxtail (64 to 82%), hairy cupgrass (71 to 82%), and fall panicum (72 to 88%) at 28 DAT compared to standalone treatments of Roundup PowerMax, Select Max and Assure II (Figure 1B). An addition of Roundup PowerMax to the tank-mixtures of

Xtendimax with Select Max or Assure II restored the efficacy of both graminicides on all the three grass species (Figure 1B).

Soybean Grain Yield

The highest grain yield (13 to 17 bu/a) at the KSU-ARC site was observed with Roundup PowerMax alone or in tank-mixtures with Select Max or Assure II and Xtendimax applied EPOST, or Roundup in sequential application at 5 days prior to or after Xtendimax application treatments (Figure 2). Soybean grain yield at UNL site did not differ for the majority of the treatments and ranged from 64 to 77 bu/a (Figure 2).

Conclusions

These preliminary results suggested that adding Xtendimax with Select Max or Assure II can compromise the grass weed control in Roundup Ready 2 Xtend soybean. Roundup PowerMax should be added in these tank-mixtures to optimize grass weed control.

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Table 1. List of herbicide programs tested in Roundup Ready 2 Xtend soybean at the Kansas State University Agricultural Research Center near Hays, KS, and the University of Nebraska near Lincoln, NE, sites

Trt	Herbicide programs ¹	Rate	Timing
		fl oz/a	
1	Non-treated	-	-
2	Select Max ²	16	EPOST
3	Assure II ²	8	EPOST
4	Roundup PowerMax ³	32	EPOST
5	Select Max + Xtendimax ⁴	16 + 22	EPOST
6	Assure II + Xtendimax ⁴	8 + 22	EPOST
7	Roundup PowerMax ³ + Xtendimax ⁴	32 + 22	EPOST
8	Roundup PowerMax ³ + Select Max ² + Xtendimax ⁴	32 + 16 + 22	EPOST
9	Roundup PowerMax ³ + Assure II ² + Xtendimax ⁴	32 + 8 + 22	EPOST
10	Xtendimax ⁴ <i>fb</i> Roundup PowerMax ³	22 <i>fb</i> 32	EPOST <i>fb</i> 5 DAEP
11	Xtendimax ⁴ <i>fb</i> Select Max ²	22 <i>fb</i> 16	EPOST <i>fb</i> 5 DAEP
12	Xtendimax ⁴ <i>fb</i> Assure II ²	22 <i>fb</i> 8	EPOST <i>fb</i> 5 DAEP
13	Roundup PowerMax ³ <i>fb</i> Xtendimax ⁴	32 <i>fb</i> 22	EPOST <i>fb</i> 5 DAEP
14	Select Max ² <i>fb</i> Xtendimax ⁴	16 <i>fb</i> 22	EPOST <i>fb</i> 5 DAEP
15	Assure II ² <i>fb</i> Xtendimax ⁴	8 <i>fb</i> 22	EPOST <i>fb</i> 5 DAEP

¹All treatments were applied using a CO₂-operated backpack sprayer equipped with Turbo Teejet TTI11003 nozzles.

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

³Ammonium sulfate (AMS) at 2% v/v was included

⁴Intact at 0.5% v/v was included.

EPOST = early postemergence. *fb* = followed by. DAEP = days after early postemergence.

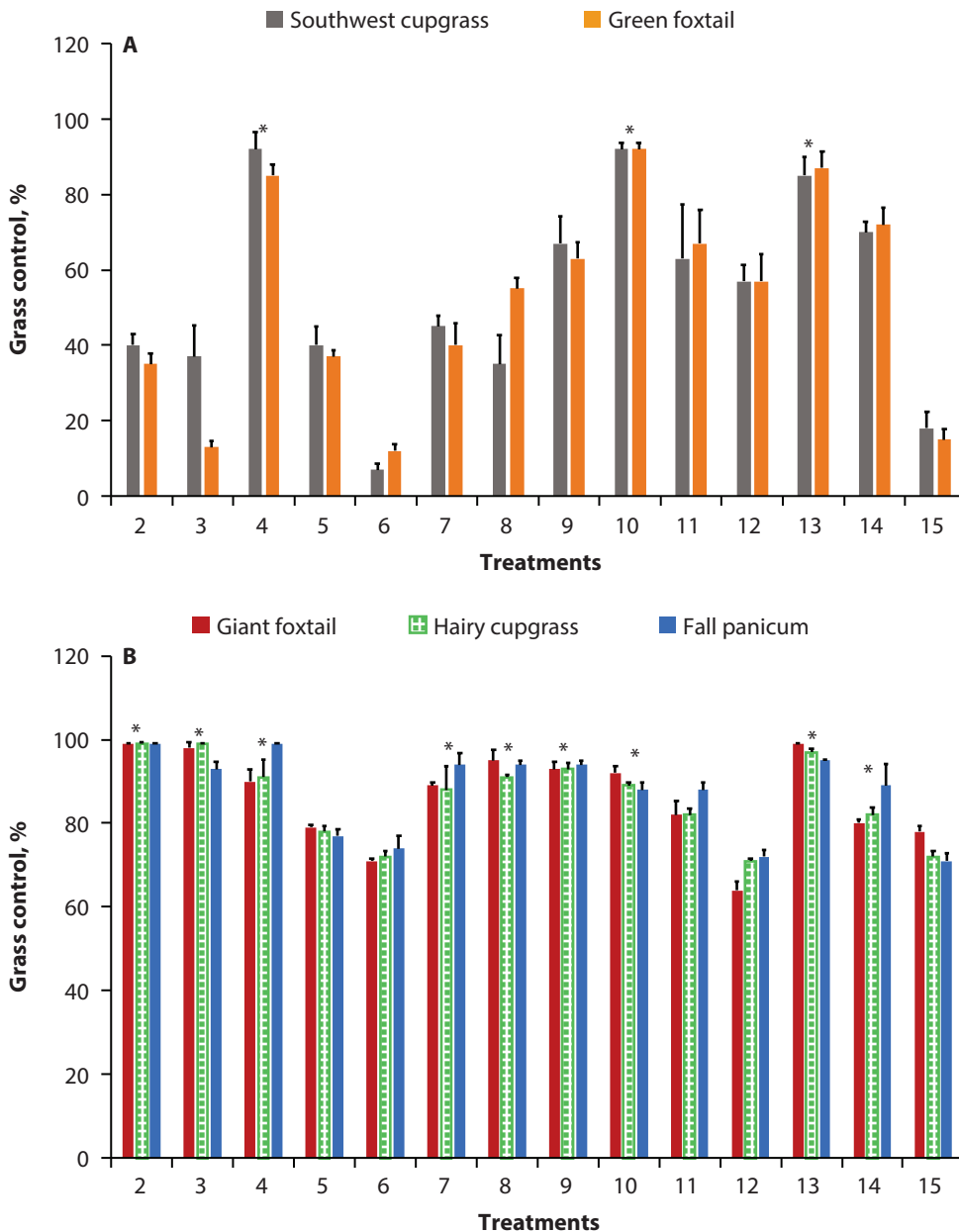


Figure 1. Effect of selected herbicide treatments on grass weed control (%) at 28 days after treatment (DAT): a) Kansas State University Agricultural Research Center near Hays, KS; b) University of Nebraska near Lincoln, NE. * Indicate best performing herbicide treatments.

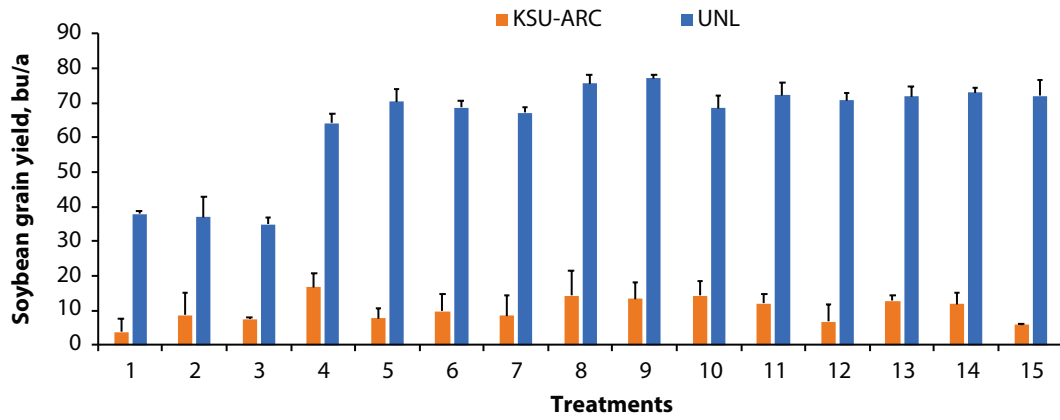


Figure 2. Effect of selected herbicide programs on Roundup Ready 2 Xtend soybean grain yield at the Kansas State University Agricultural Research Center (KSU-ARC) near Hays, KS; and at the University of Nebraska, Lincoln, NE (UNL).