



Weed Management in Dicamba-Tolerant Soybean

Debalin Sarangi^{*1}, Mayank S. Malik², and Amit J. Jhala¹

¹University of Nebraska–Lincoln, NE; ²Monsanto Company, St. Louis, MO

*debalin.sarangi@huskers.unl.edu



Introduction

- As of 2016, 32 weed species worldwide confirmed resistant to glyphosate (Heap 2016).
- Multiple herbicide-resistant weeds, such as common waterhemp, are now a challenge for the growers in the Midwestern United States (Sarangi et al. 2015).
- Roundup Ready 2 Xtend™** soybeans (dicamba and glyphosate-tolerant) will be offering growers a new weed management tool to control glyphosate-resistant and other hard-to-control weed species.
- Dicamba is labeled for control of more than 274 broadleaf weeds. So far, kochia and prickly lettuce have been reported resistant to dicamba in the United States.
- The **Roundup Xtend™** (dicamba + glyphosate), and **XtendiMax™** (dicamba) will contain a low-volatility salt of dicamba, along with the **VaporGrip™** Technology.
- Pending upon regulatory approval, this technology will be commercialized in near future.

Objectives

- To evaluate the herbicide programs in dicamba-tolerant soybean
- To compare the results with the glufosinate-based weed management system

Materials and Methods

- Field experiments were conducted in 2015 at Clay County and Seward County, NE.
- Experiments were laid out in the randomized complete block design with four replications.
- PRE herbicides were applied at soybean planting, whereas early- and late-POST herbicide applications were made at 15- and 30-d after PRE (DAPRE), respectively (Table 1).
- Visual weed control, density, soybean injury and yield were recorded.
- Data were subjected to ANOVA using PROC GLIMMIX in SAS.
- Environment-effect was significant; therefore, data from two experiment sites were presented separately.

Table 1: Details of herbicide treatments, and rates for weed management in dicamba- or glufosinate-tolerant soybeans

Treatment codes	Herbicide names		Rates (g ai ha ⁻¹)		Site info.
	PRE	E-POST	PRE	E-POST	
D1	—	—	—	—	Silt-loam soil pH 6.5 OM 2.5% Irrigated
D2	Rowel	MON 119096	72	560	
D3	Rowel + MON 119096	MON 76832	72 + 560	1,680	
D4	Rowel + MON 119096	MON 76832 + Warrant	72 + 560	1,680 + 1,270	
D5	Rowel FX + Roundup	Flexstar GT	113 + 1,260	1,610	
D6	Rowel	Cobra + Roundup	72	175 + 1,260	
D7	Rowel + Roundup	Cobra + Warrant	72 + 1,260	175 + 1,270	
G1	Rowel	Liberty	72	594	
G2	Rowel	Liberty (E- and L-POST)	72	594 + 594	
G3	Rowel	Liberty + Dual II Magnum	72	594 + 1,070	

- Cobra: **lactofen**
- Dual II Magnum: **S-metolachlor**
- Flexstar GT: **fomesafen + glyphosate**
- Liberty: **glufosinate**
- MON 119096: **LV dicamba**
- MON 76832: **LV dicamba + glyphosate**
- Roundup: **glyphosate**
- Rowel: **flumioxazin**
- Rowel FX: **flumioxazin + chlorimuron ethyl**
- Warrant: **acetochlor**



Figure 1: Weed control in dicamba-tolerant soybean at 35 DAEPOST (Clay County, NE; 2015)

Results and Discussion

- All herbicide programs resulted in > 80% control of common waterhemp and velvetleaf at Clay County, and > 95% control at Seward County at 21 DAPRE.

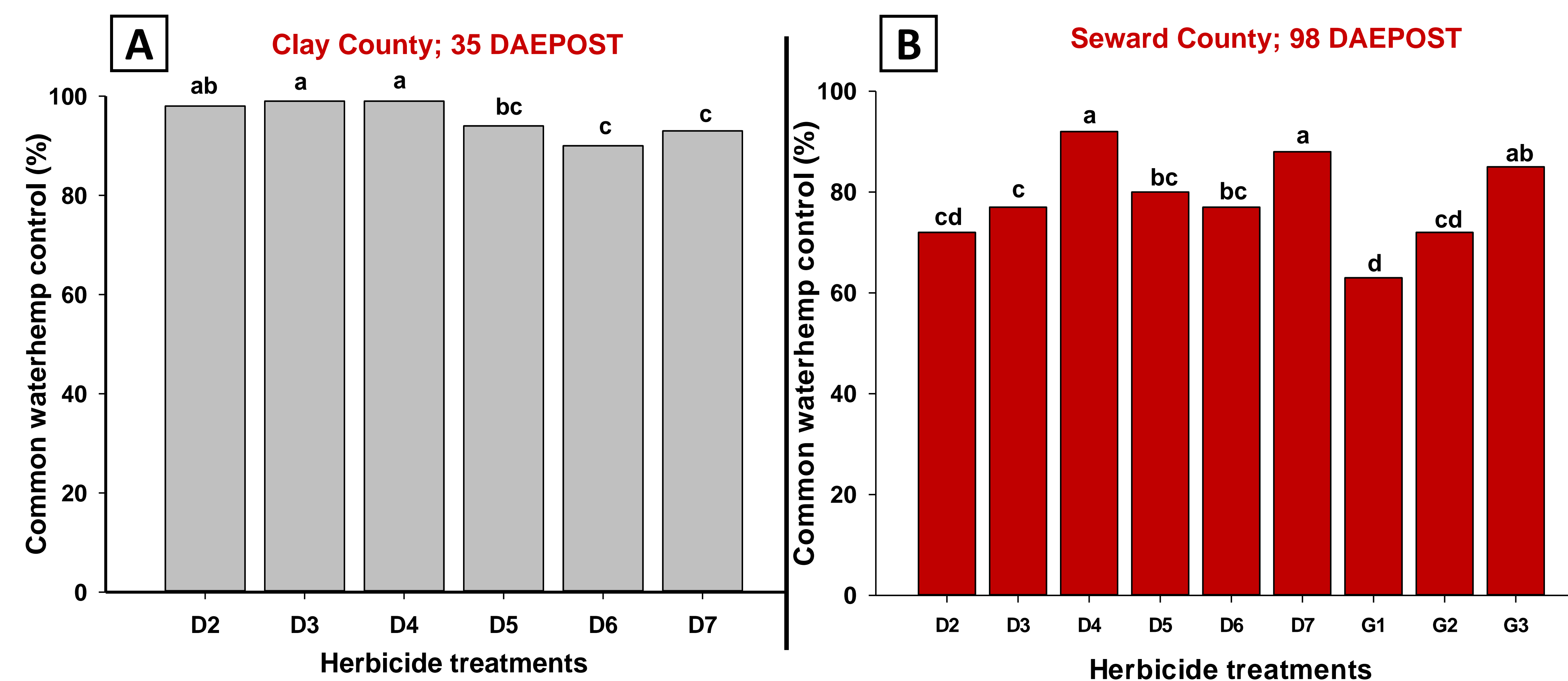


Figure 2: Effect of herbicide treatments on common waterhemp control in dicamba-tolerant soybean

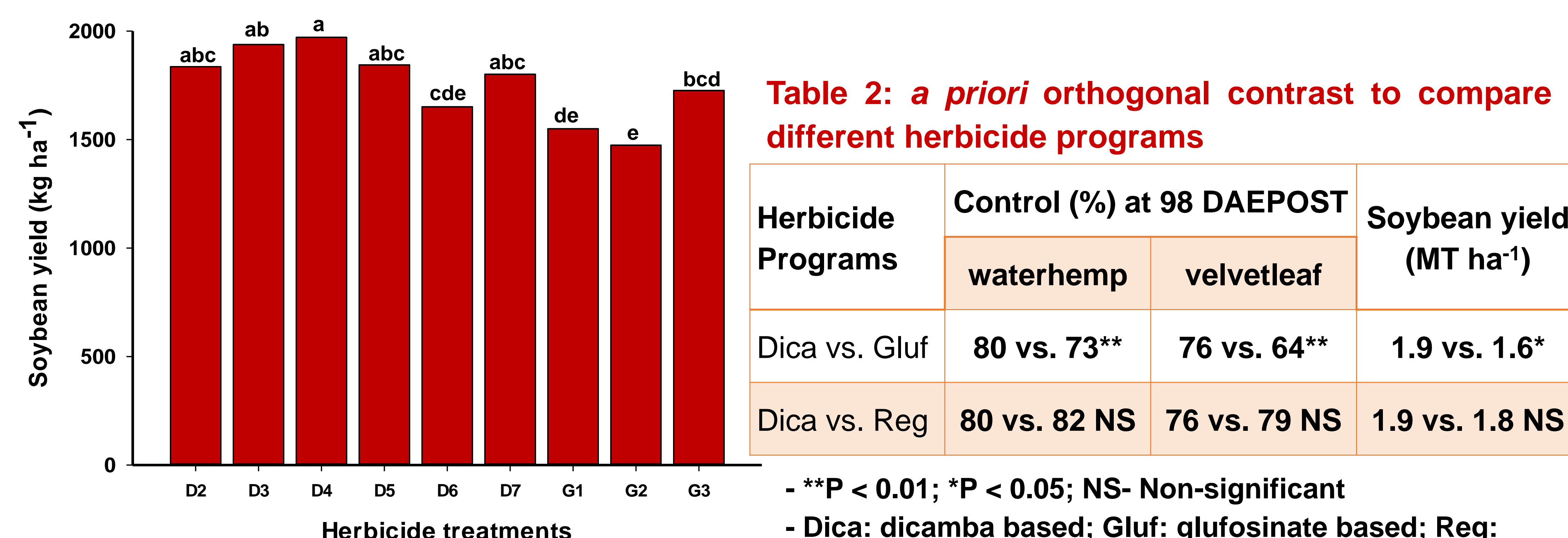


Figure 3: Soybean yield as affected by the herbicide treatments at Seward County, NE

Table 2: a priori orthogonal contrast to compare different herbicide programs

Herbicide Programs	Control (%) at 98 DAEPOST		Soybean yield (MT ha ⁻¹)
	waterhemp	velvetleaf	
Dica vs. Gluf	80 vs. 73**	76 vs. 64**	1.9 vs. 1.6*
Dica vs. Reg	80 vs. 82 NS	76 vs. 79 NS	1.9 vs. 1.8 NS

- **P < 0.01; *P < 0.05; NS- Non-significant
 - Dica: dicamba based; Gluf: glufosinate based; Reg: non-dicamba or -glufosinate based herbicide programs
 - DAEPOST: d after early-POST

- Micro-encapsulated acetochlor, or S-metolachlor applied POST along with other foliar-active herbicides provided higher (≥ 85%) weed control at 98 DAEPOST (Figure 2B). Similarly, Jhala et al. (2015) reported that common waterhemp control was up to 97% at 80 DAEPOST when flumioxazin plus chlorimuron (PRE) were applied followed by micro-encapsulated acetochlor (E-POST).
- Dicamba based herbicide programs resulted in higher soybean yield (1.9 MT ha⁻¹) compared to the glufosinate based programs (1.6 MT ha⁻¹) (Table 2).
- The proposed dicamba application window will be from preplant application to the R1 (beginning of flowering) stage of soybean.
- Low-volatility dicamba formulation will increase the deposition of herbicides, by reducing the off-target movement of dicamba-acid.

Conclusions

- POST herbicide programs that include dicamba with other soil- and foliar-active herbicides can enhance the control of problem weed species like common waterhemp, compared to the POST programs of glufosinate alone.
- Practical implications:**
 - PRE herbicides are essential for effective control of small-seeded broadleaf weed species.
 - Dicamba should be used along with other sites-of-action to gain its full-benefit in agriculture and avoid evolution of additional weeds resistant to dicamba.

Literature Cited

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- Sarangi D, Sandell LD, Knezevic SZ, Aulakh JS, Lindquist JL, Irmak S, Jhala AJ (2015) *Weed Technol* 29:82-92