

Laura Bast¹, Andrew Chomas¹, James Kells¹, and Wesley Everman²

¹Department of Crop and Soil Sciences, Michigan State University & ²Department of Crop Science, North Carolina State University

Introduction

Weeds and crops compete for space, nutrients, light, and moisture. This competition affects corn (*Zea mays* L.) growth and development and may reduce grain yield. Several studies have investigated weed control methods including herbicide application timing, the use of a residual herbicide, or compared postemergence (POST) herbicide applications of glyphosate and glufosinate. However, there has been no single, comprehensive study that has evaluated all of these factors.

Objectives

To evaluate weed control and corn grain yield for:

- Three herbicide programs which consisted of a residual herbicide followed-by a POST herbicide (residual fb POST), a residual herbicide tank-mixed with a POST herbicide (residual + POST), and a non-residual POST herbicide (POST).
- Two POST herbicides of glyphosate (gly) and glufosinate (glu).
- Three POST herbicide application timings of early-POST (EP), mid-POST (MP) and late-POST (LP).

Methods

- A field study was conducted in 2007, 2008, and 2009 in East Lansing, MI.
- A randomized complete block design was used with three replications. Study factors consisted of:
 - Herbicide programs consisting of residual fb POST, residual + POST, or a non-residual POST.
 - POST herbicide of glyphosate (0.84 kg ae ha⁻¹) or glufosinate (0.47 kg ai ha⁻¹).
 - Herbicide application timings of EP, MP, or LP when the average weed canopy height was 7, 14, and 21 cm, respectively.
- The residual herbicide used was a pre-mix of acetochlor (0.87 kg ai ha⁻¹) + atrazine (0.70 kg ai ha⁻¹).
- Weed-free and non-treated controls (full-season weedy plots) were included for comparison.
- Common lambsquarters (*Chenopodium album* L.) and giant foxtail (*Setaria faberi* Herrm.) control was visually estimated 28 d after the LP application. Weed control was compared to the non-treated control using a scale of 0 (no control) to 100% (all plants dead).
- Corn grain yield was corrected to 15% moisture content.
- Data was analyzed using Proc MIXED in SAS. Factors were considered statistically significant at $\alpha=0.05$. If factors were found significant, paired t-tests were used to separate treatments means.

Table 1. Monthly rainfall and cumulative growing degree days (GDD) using a 10°C base.

	Rainfall (cm)			Monthly cumulative GDD		
	2007	2008	2009	2007	2008	2009
May	9.7	2.95	10.9	196	113	153
June	8.92	11.25	12.62	298	287	276
July	1.24	9.63	6.07	328	358	283
Aug	14.02	1.65	10.46	354	331	317
Sept	5.31	20.68	2.41	241	226	222

Table 2. Common lambsquarters control.

Residual herbicide program	Application timing	2007		2008		2009	
		gly	glu	gly	glu	gly	glu
		-----% control-----					
residual fb POST	EP	99	100	100	98	80	76
residual fb POST	MP	100	99	98	99	79	76
residual fb POST	LP	97	100	100	90	79	82
residual + POST	EP	100	100	100	99	97	99
residual + POST	MP	100	100	100	96	100	100
residual + POST	LP	100	100	100	99	100	100
POST	EP	81	74	99	81	81	74
POST	MP	87	84	97	67	82	79
POST	LP	96	91	98	70	91	82

Table 3. Giant foxtail control.

Residual herbicide program	Application timing	2007		2008		2009	
		gly	glu	gly	glu	gly	glu
		-----% control-----					
residual fb POST	EP	96	97	98	98	93	91
residual fb POST	MP	98	96	98	97	92	93
residual fb POST	LP	94	99	98	97	98	95
residual + POST	EP	97	98	98	98	100	100
residual + POST	MP	100	98	97	97	99	99
residual + POST	LP	100	99	98	99	98	99
POST	EP	89	85	98	94	91	90
POST	MP	91	86	98	93	96	94
POST	LP	98	95	97	94	100	99

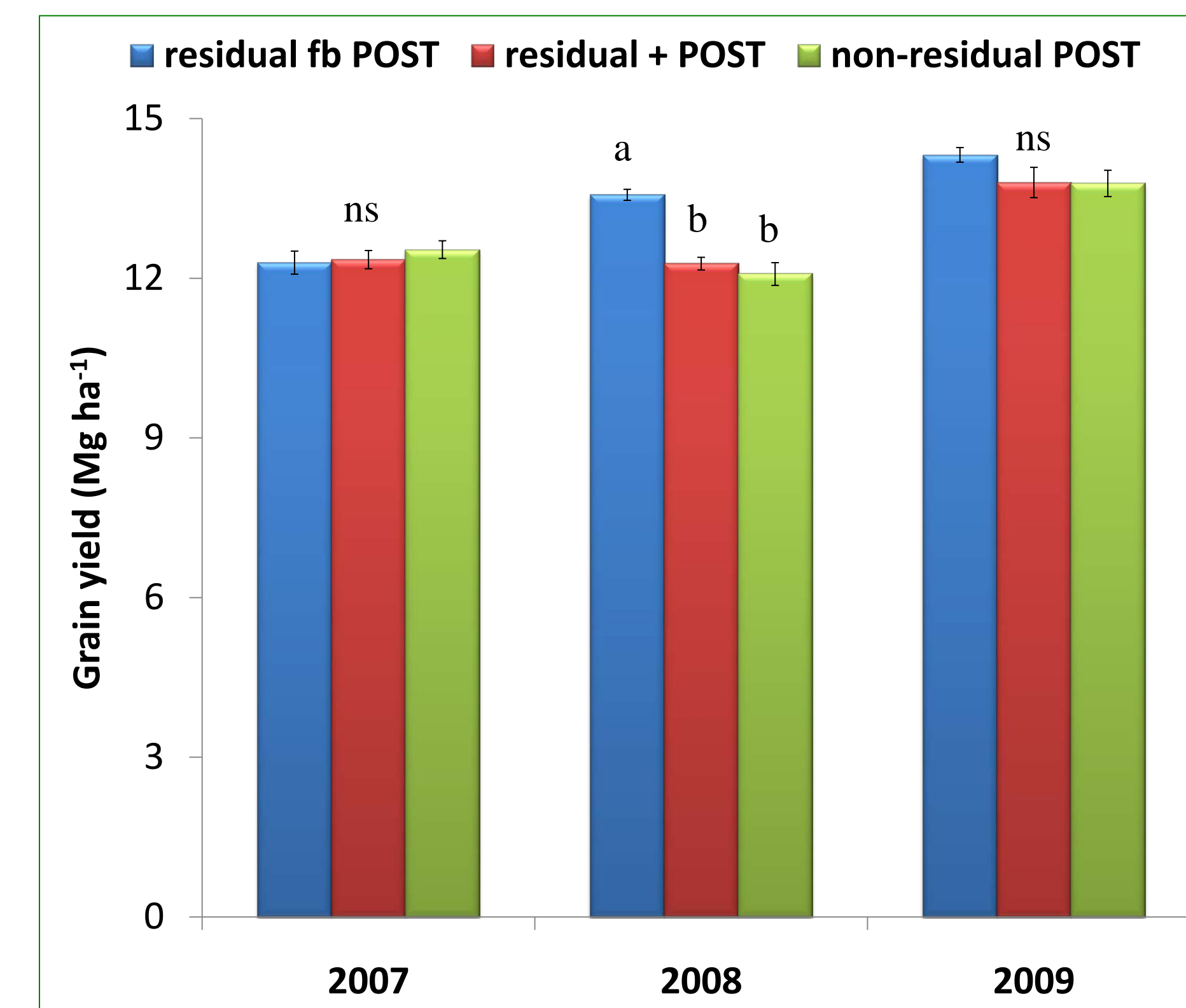


Figure 1. Grain yield by herbicide program.

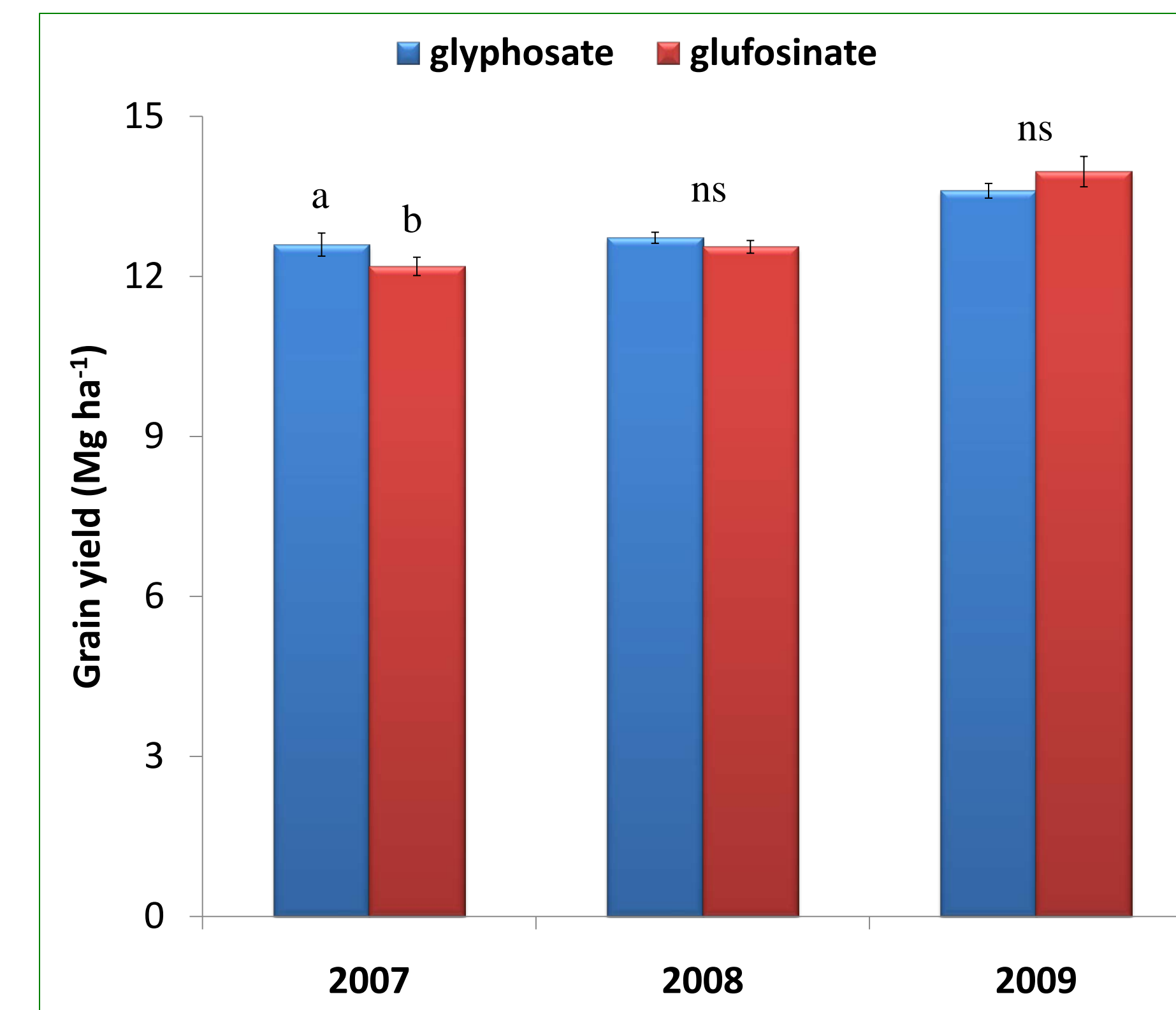


Figure 2. Grain yield by type of POST herbicide.

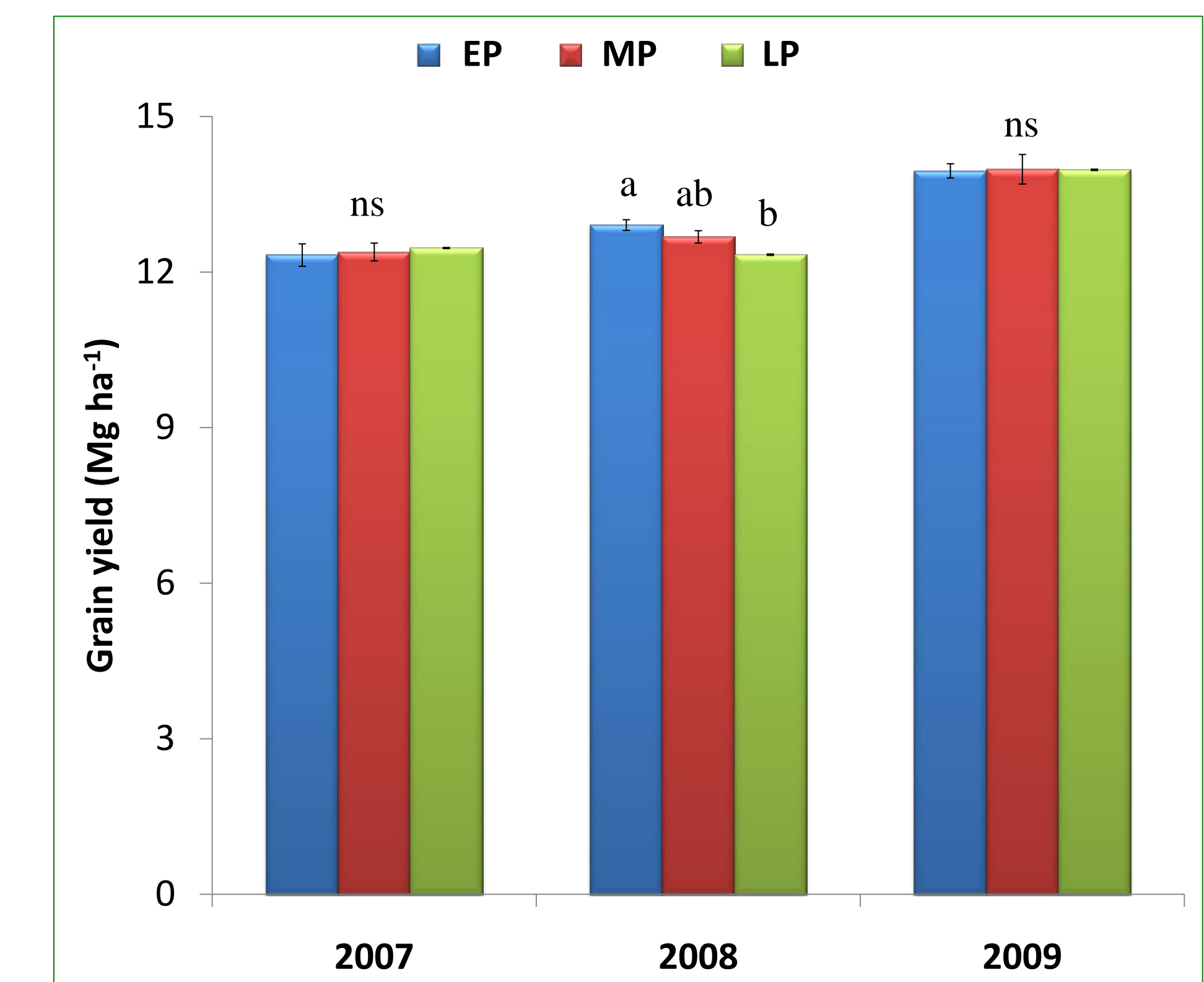


Figure 3. Grain yield by POST application timing.

Results and Discussion

Common lambsquarters control (Table 2)

- Common lambsquarters control was greater when a residual herbicide was applied (residual fb POST or residual + POST) compared to the non-residual POST program.
- Glyphosate and glufosinate with a residual herbicide provided 90 to 100% control except in 2009. In 2009, the PRE fb POST program resulted in 76 to 83%. Two days after the residual (PRE) herbicide application, there was 2.5 cm of rain, which may have reduced the residual herbicide efficacy.

Giant foxtail control (Table 3)

- The residual + POST program provided 97 to 100% giant foxtail control and greater control compared to the residual fb POST and non-residual POST programs.
- Control was most variable (85 to 99%) in the non-residual POST program.

Corn grain yield

- The residual fb POST program resulted in the greatest grain yield in 2008 (Fig. 1). There was no difference among the residual herbicide programs in the other years.
- Grain yield was greatest when glyphosate was used as the POST herbicide in 2007 (Fig. 2). There was no difference between type of POST herbicide in the other years.
- POST herbicide application at EP and MP (7 and 14 cm tall weeds) resulted in the greatest grain yield in 2008 (Fig. 3). There was no difference among POST herbicide application timings in the other years.

Conclusion

Weed control was greatest when a POST herbicide was applied in combination with a residual herbicide. Weed control with glyphosate was greater than glufosinate when applied without a residual herbicide. LP applications generally resulted in greater weed control due to the control of late-emerging weeds. The effect of residual herbicide program, POST herbicide, and POST application timing on grain yield varied by year. In 2007, the use of glyphosate resulted in greater grain yield when compared to glufosinate. In 2008, grain yield was the greatest in the residual fb POST program and with POST applications at EP and MP. A residual fb POST program applied at MP would provide the most consistent weed control and minimize grain yield reductions.