

INTRODUCTION

- Historically, the University of Nebraska method for making P fertilizer recommendations is to determine the soil test value where the probability of a profitable yield increase from adding P is very low
- An alternative approach is to build P level well above the critical value then maintain that value by applying P to match removal
- Experimentally, the 'build and maintain' method has been shown to be less profitable for farmers in Nebraska, thus Nebraska uses the deficiency correction approach

OBJECTIVE

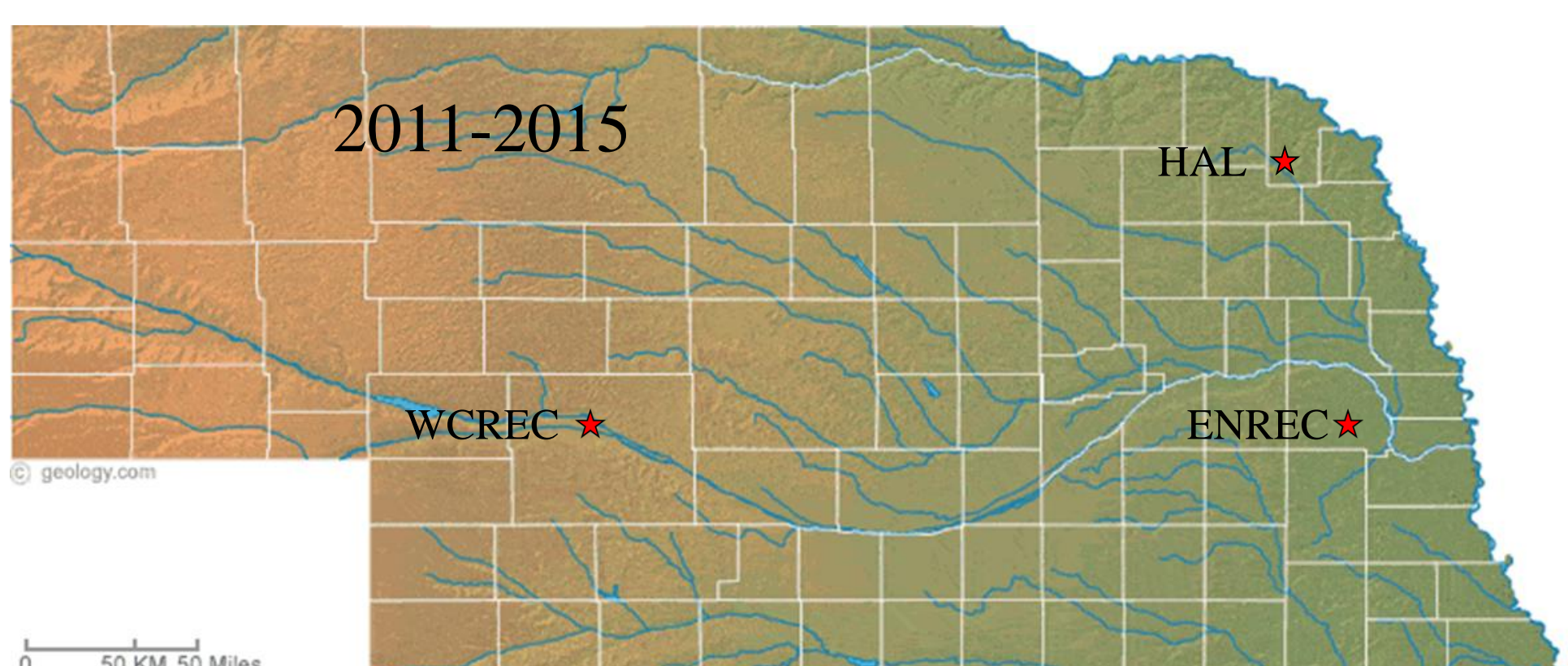
Is this approach relevant in high yielding situations, with current varieties and tillage systems?

- To determine if an alternative target soil test P level would increase yields and profitability for Nebraska farmers with current varieties, tillage systems and in exceptional years.

METHODS

Sites

- Eastern Nebraska Research and Extension Center (ENREC) Ithaca, NE (center pivot irrigated) (Yutan silty clay loam 2-6% slope, terrace loess; (fine-silty, mixed, superactive, mesic Typic Haplustoll)
- Haskell Agricultural Laboratory (HAL) Concord NE (rain fed) (Nora silty clay loam 6-11% slope; fine-silty, mixed, mesic Mollic Hapludalfs)
- West Central Research and Development Center (WCRC) North Platte, NE (furrow irrigated replaced with a lateral pivot in 2011) (alluvial Cozad silt loam 0-1% slope; course-silty, mixed, superactive, mesic, Typic Haplustolls)



Treatment and Experimental Design

- 5 P fertilization management strategies
 - No P applied (OP)
 - P applied according to the UNL recommendation (Shapiro et al., 2009; UNL-P)
 - P applied to replace P removed in harvest (Replace-P)
 - Bray-1 P raised and maintained at 25 mg kg⁻¹ (Bray-25)
 - Bray-1 P raised and maintained at 35 mg kg⁻¹ (Bray-35)
- 2 tillage systems
 - No-till
 - Annual disc tillage

Initial Soil Test Values, 0 – 20 cm

	pH	OM	P	K	Ca	Mg
	g kg ⁻¹		mg kg ⁻¹			
ENREC	6.23	24.0	7.2	184	2584	556
HAL	6.75	23.3	8.4	163	3086	496
WCRC	6.18	21.8	10.9	529		

- Split plot RCBD with the tillage as the main plot treatment and Bray-1 P management treatments as sub plot treatments

Plot Management

- Continuous Corn, Crop varieties and weed management were site specific and best management practices
- Plot Size (8-76 cm rows, 15 m long)

Statistical Analysis

- Analysis of Variance across locations and years with $\alpha = 0.05$
- Mean separation conducted for some variables and LSD 0.05 values are presented for some interactions

RESULTS

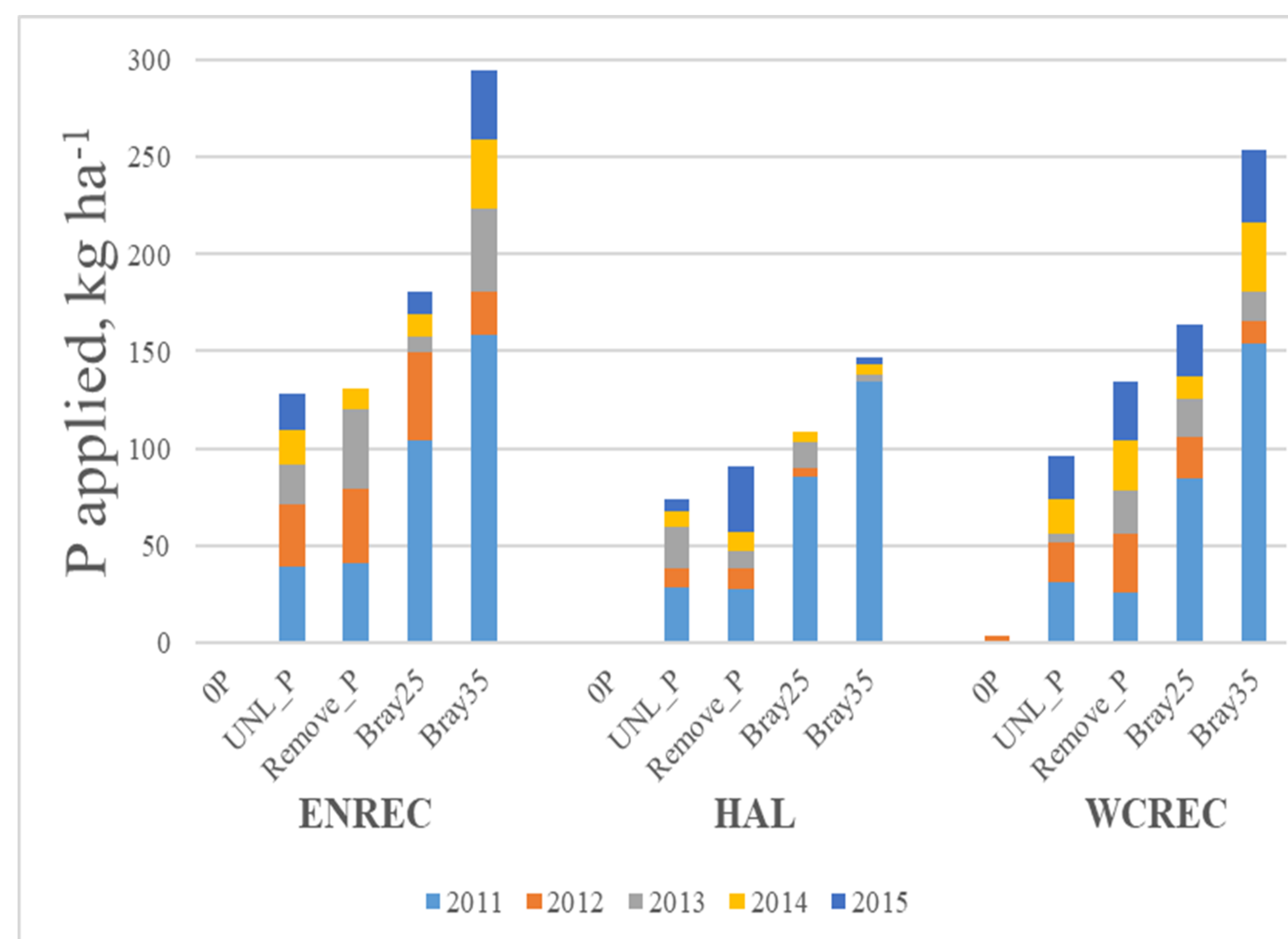


Figure 1. Phosphorus applied according to five P application practices for ENREC, HAL and WCRC in Nebraska over 5 years

Bray-1 P as affected by soil depth, P application, location and year (mg kg⁻¹)

Soil Depth	Initial		UNL-P rate		Bray-25	
	2011		2015			
			Disk	No-till	Disk	No-till
cm	ENREC					
0 to 5	6.0	34.0	30.3	52.1	44.9	
5 to 10	4.8	16.7	10.7	19.2	13.2	
10 to 20	9.1	9.4	13.5	9.6	12.6	
	HAL					
0 to 5	17.9	64.7	54.7	55.3	81.4	
5 to 10	7.0	18.3	9.2	23.3	13.5	
10 to 20	4.4	4.2	5.3	4.7	6.5	
	WCRC					
0 to 5	18.3	46.1	36.8	24.9	46.6	
5 to 10	10.6	15.7	13.4	11.0	23.2	
10 to 20	7.3	8.5	11.4	11.4	14.4	

Location x Year x Tillage Effect on Corn Grain Yield (Mg ha ⁻¹)						
	2011	2012	2013	2014	2015	Avg.
ENREC [†]						
Disk	14.3	10.4	12.2	11.2a	8.1	11.2
No-till	15.0	10.9	11.4	10.2b	8.1	11.1
HAL						
Disk	11.7a	2.5b	9.8	9.1a	11.6a	8.9
No-till	10.6b	3.8a	9.5	6.6b	11.0b	8.3
WCRC						
Disk	11.0	11.4	9.3	10.8	9.2l	10.3
No-till	11.1	11.2	9.5	10.6	9.3l	10.3

[†]Means with different letters for a location x year x tillage comparison are significantly different at a Prob. F < 0.05.

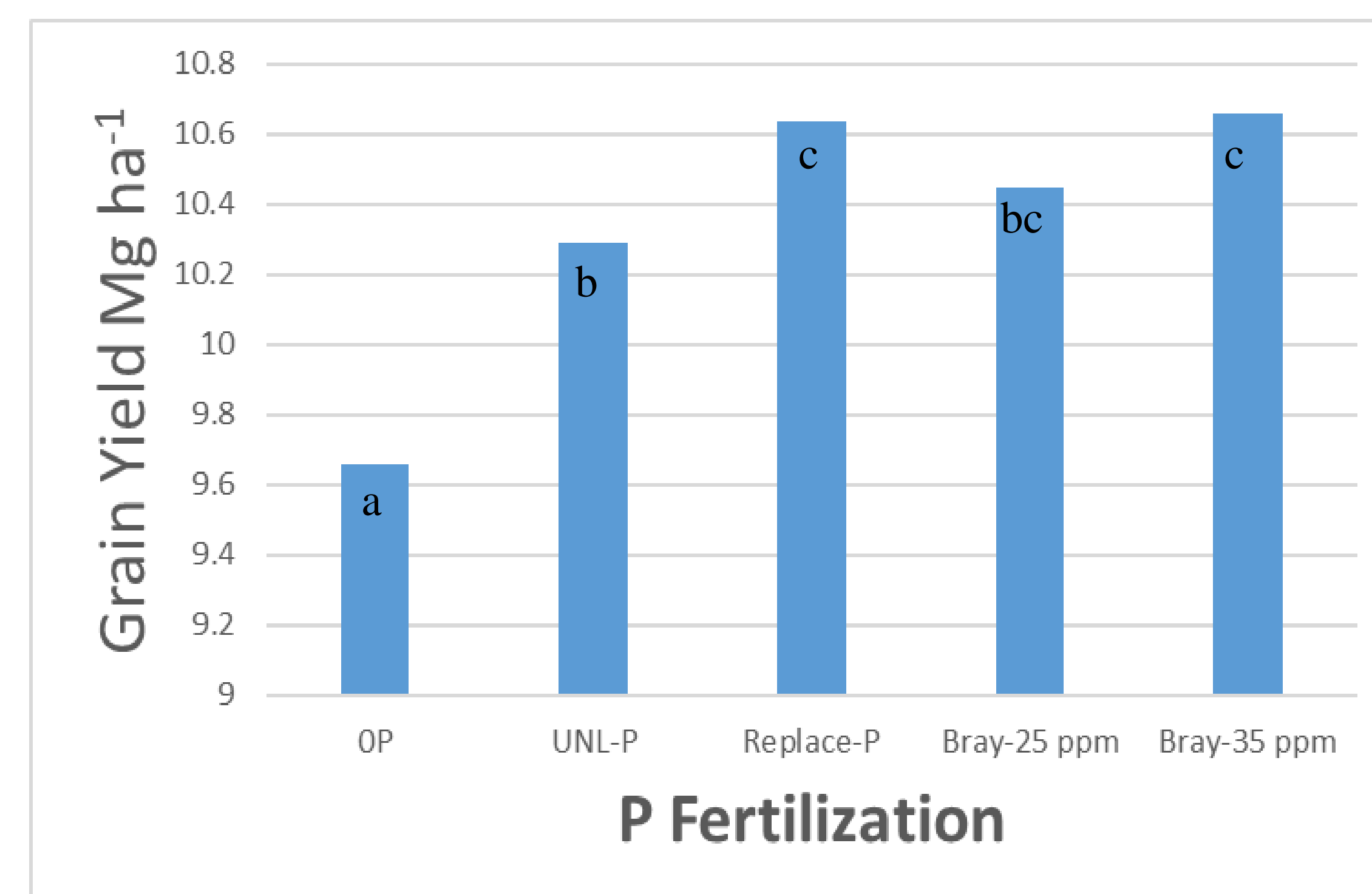


Figure 2. Overall main effect of P practice (No P x Site x Year interaction)

Applied P and marginal yield compared to the no applied P treatments

	P Applied kg ha ⁻¹ yr ⁻¹	Marginal Yield Mg ha ⁻¹
UNL	19.9	0.6
P replacement	23.7	0.9
Bray 25	30.2	0.8
Bray 35	46.4	1.0

CONCLUSIONS

- Tillage increased yield at the Concord site 11% but not the North Platte and Mead sites
- Tillage did not influence the P fertilization response
- The year x P interaction was not significant at all locations
- Overall grain yield was 9.3% greater with P applied compared to with no P
- P applied to replace P removed and Bray-1 P raised and maintained at 35 mg kg⁻¹ resulted in grain yields of 10.6 and 10.7 Mg ha⁻¹ respectively, which was significantly greater than P applied according to UNL recommendations (10.3 Mg ha⁻¹)
- P raised and maintained at 25 mg kg⁻¹ resulted in intermediate grain yields
- Recommendations other than UNL recommendations could result in greater grain yields, however, crop and P fertilizer cost should also be considered