



University of Idaho

College of Agricultural
and Life Sciences

UNIVERSITY OF IDAHO PHOSPHORUS AND POTASSIUM RESPONSE TRIALS

Dr. Jared Spackman

Idaho Barley Commission Endowed

Barley Agronomist

Aberdeen R&E Station

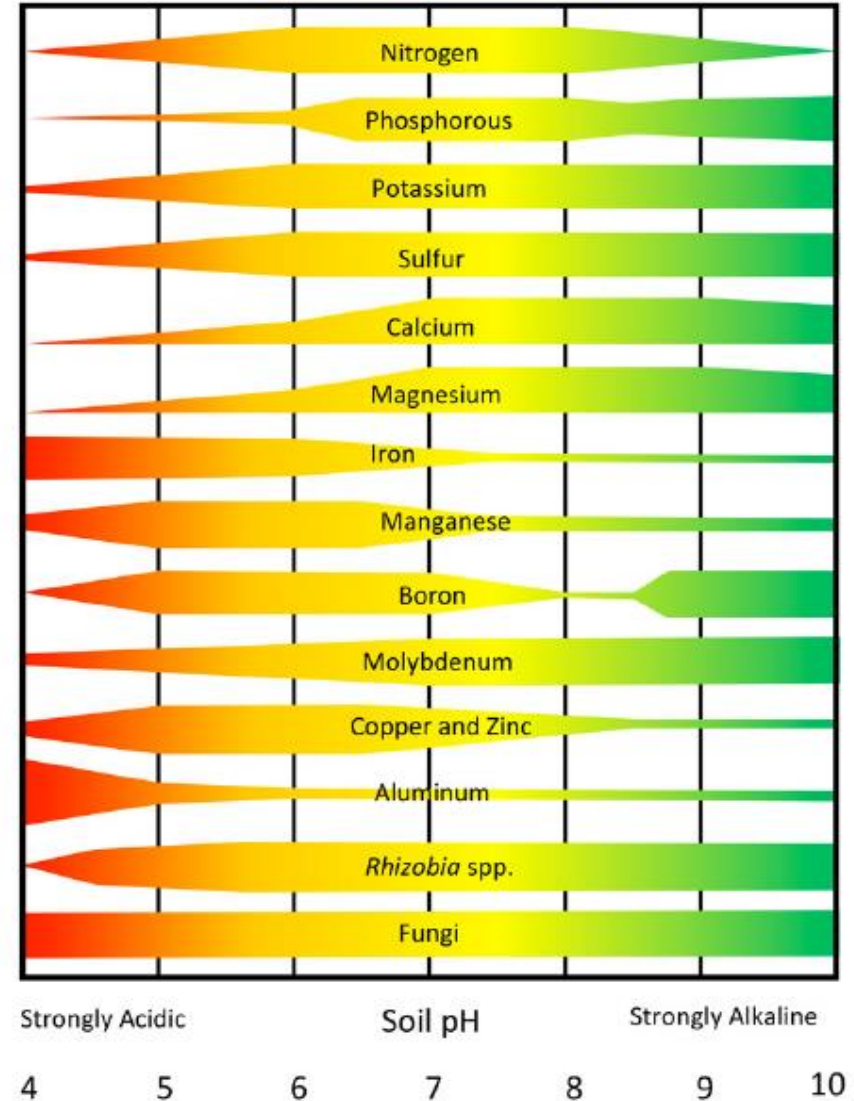
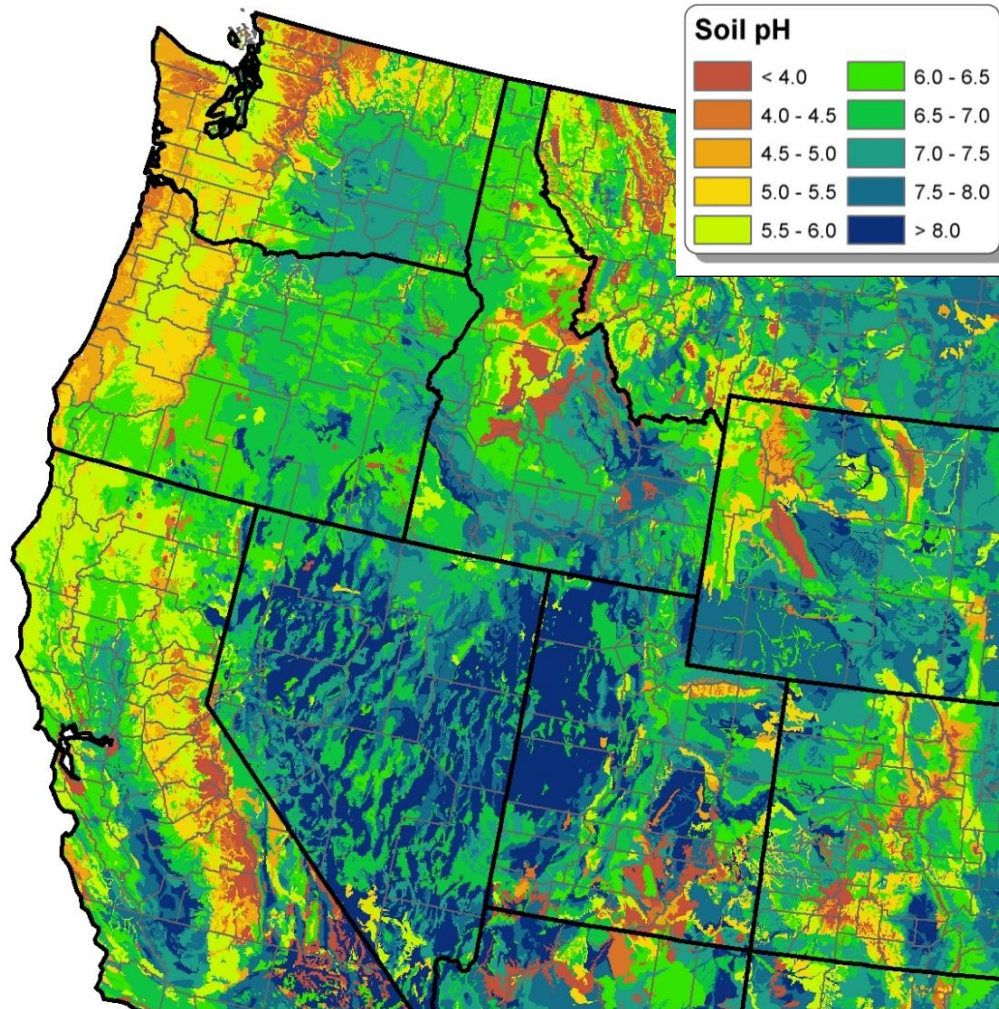
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Malt Barley Nutrient Studies

- Phosphorus rate and placement (band vs broadcast)
- Potassium rate



Soil pH impacts nutrient availability



Adjusting P Fertilization Rates for Calcareous Soils

- To provide a crop growing in calcareous soils with the same amount of P as a crop grown in a non-calcareous soil, the University of Idaho recommends that an **additional 10 lb P₂O₅/ac be applied for every 1% increase in soil lime**

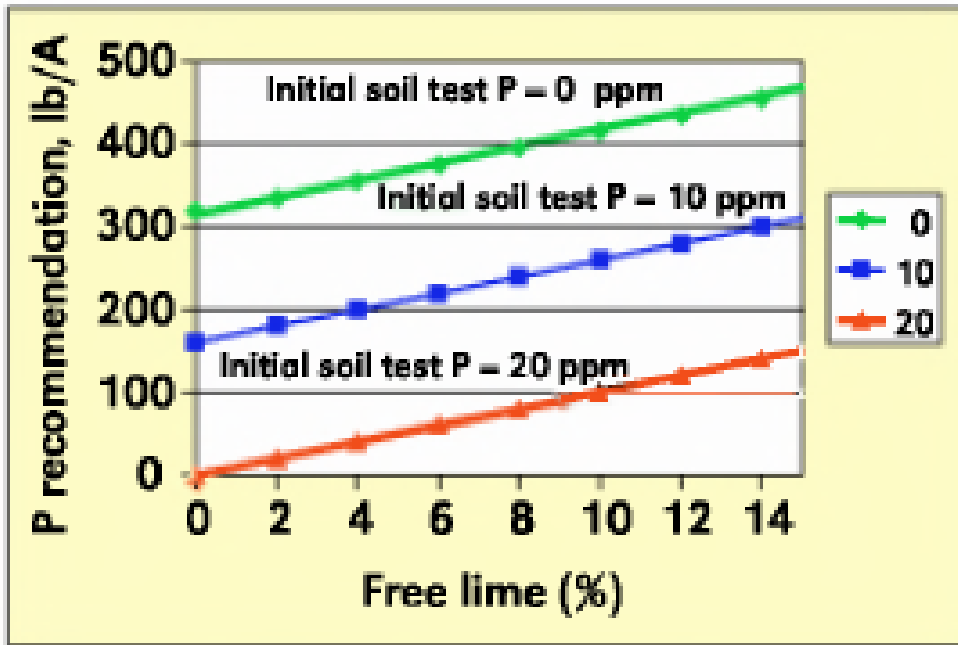


Figure 4. University of Idaho P fertilizer recommendations for potatoes grown in calcareous soil take into account the free lime content of the soil (Tindall and Stark, 1997).

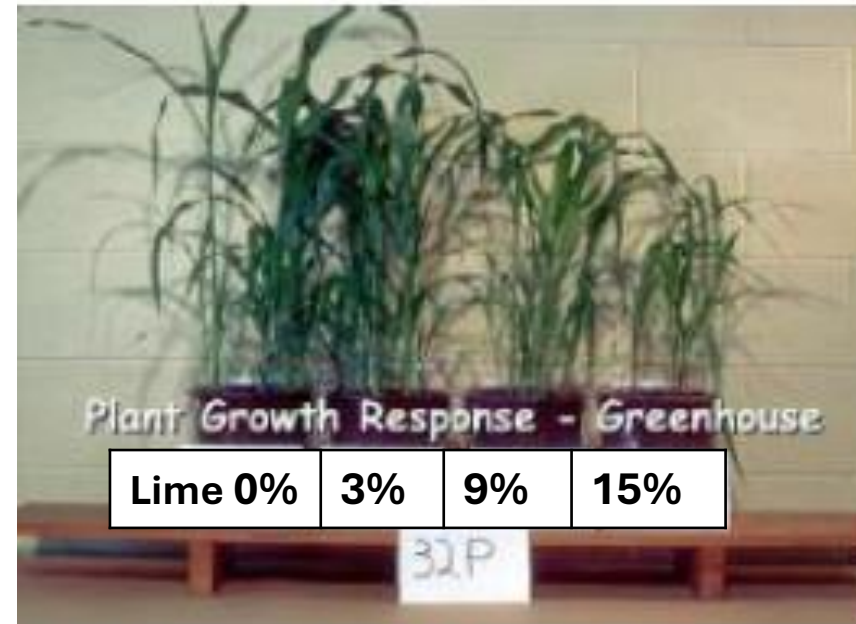


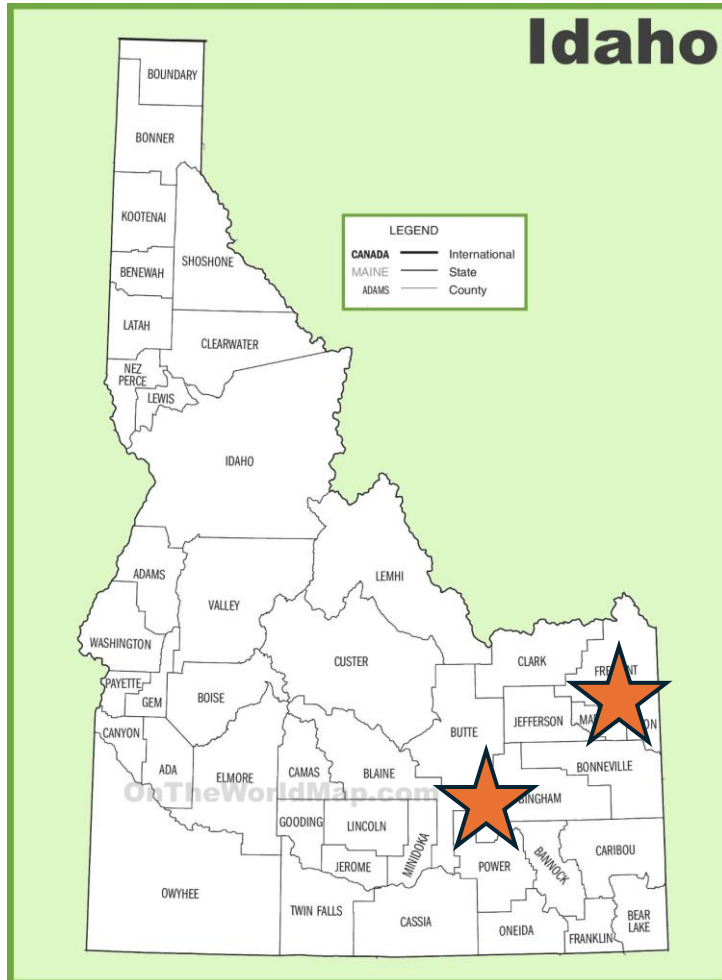
Figure 2. Sudangrass growth with increasing lime concentrations. P uptake decreased from 53 mg P/plot to 32, 21, and 8 mg P/plot as the percentage of lime increased from 0% to 3, 9, and 15%, respectively. (Photo courtesy of D. T. Westermann and A. B. Leytem, from the USDA-ARS Kimberly, 2003.)

University of Idaho Olsen Phosphorus and Potassium Fertilizer Recommendations

Soil Test 0-12" NaHCO ₃ extraction (ppm)	Free Lime (%)						
	0	2.5	5	7.5	10	12.5	15
	lb P ₂ O ₅ /acre						
0	240	260	280	300	320	340	360
2.5	200	220	240	260	280	300	320
5	160	180	200	220	240	260	280
7.5	120	140	160	180	200	220	240
10	80	100	120	140	160	180	200
12.5	40	60	80	100	120	140	160
15	0	20	40	60	80	100	120
17.5	0	0	0	20	40	60	120
20	0	0	0	0	0	20	40

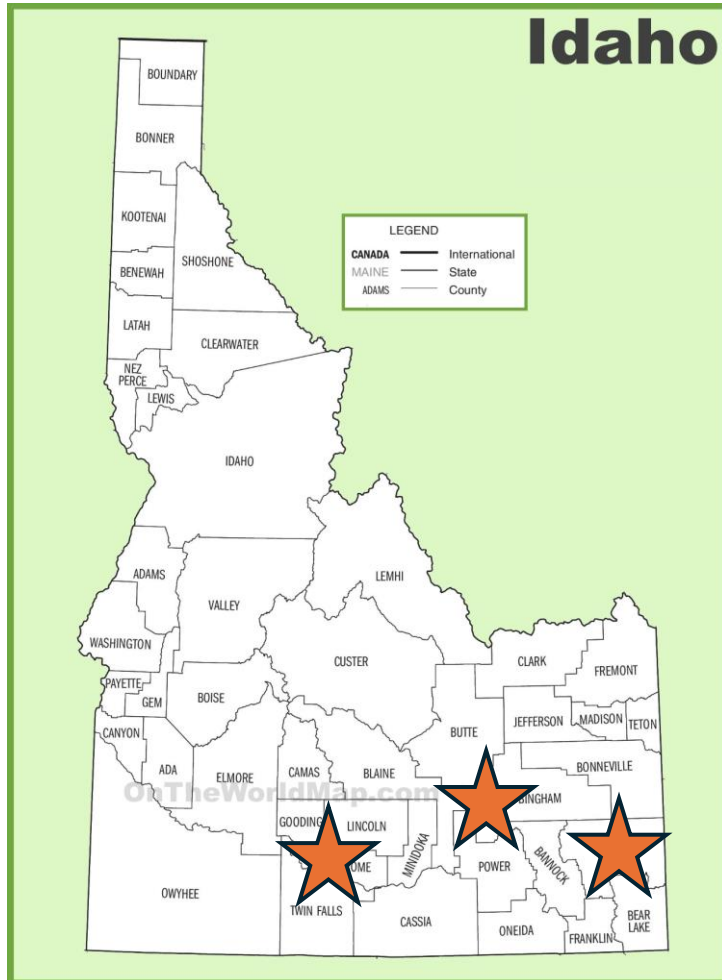
Soil test K 0-12" (ppm)	Potassium rates
	lb K ₂ O/acre
0	240
25	160
50	80
75	0

2023 Phosphorus Fertility Trial Details



- 2 Locations: Aberdeen, Tetonia
- P_2O_5 Rates: 0, 45, 90, 135, 180 lb ac⁻¹
 - Monoammonium phosphate
 - Banded or Broadcast applied
- K_2O Rates: 0, 30, 60, 90, 120 lb ac⁻¹
 - Potassium chloride
- Manganese sulfate: 4 lb ac⁻¹
- Zinc sulfate: 8 lb ac⁻¹
- *Each plot received 160 lb N ac⁻¹ and 90 lb P_2O_5 ac⁻¹ unless otherwise specified*

2024 Phosphorus Fertility Trial Details



- 7 Site-Years: Aberdeen, Kimberly, Soda Springs
- P_2O_5 Rates: 0, 10, 20, 30, 40, 50 lb ac⁻¹
 - Monoammonium phosphate
 - Banded or Broadcast applied

Preplant Soil Test Values

	Aberdeen 2023	Tetonia 2023	Ab110 2024	Ab523 2024	Kimberly 2024	Soda Springs 2024
	Preplant Soil test 0-12"					
pH	8.1	7.7	8.2	8.3	8.2	6.2
CEC (meq 100g ⁻¹)	13.8	14.3	16	13.2	23	14.1
Free Lime (%)	2.1	1.2	9.8	4.9	11.6	0
Organic Matter (%)	0.8	1.9	1.3	0.9	2.1	2.2
NH ₄ -N (mg kg ⁻¹)	2.9	2.4	2.4	4.7	4.1	5.5
NO ₃ -N (mg kg ⁻¹)	5.8	4	7	3	9.5	5
P ₂ O ₅ (mg kg ⁻¹)	14	19	20	20	25	30
K ₂ O (mg kg ⁻¹)	241	266	238	171	298	334
Ca (meq 100g ⁻¹)	9.8	8.5	11.8	10.7	18	9.0
Zn (mg kg ⁻¹)	0.9	0.8	1.9	1.4	3.9	1.5
Mn (mg kg ⁻¹)	4.6	2.7	5.4	4.9	10.0	8.4

Nutrient Recommendations

	Aberdeen 2023		Tetonia 2023		Ab110 2024	Ab523 2024	Kimberly 2024	Soda Springs 2024
Nutrient	Soil Amendment Recommendation lb ac ⁻¹							
	UI	Lab	UI	Lab	UI	UI	UI	UI
N	130	139	143	89	210	255	210	50
P ₂ O ₅	20	120	10	60	0	0	0	0
K ₂ O	0	0	0	0	0	0	0	0
Zn	NA	8	NA	4	NA	NA	NA	NA
Mn	NA	0	NA	4	NA	NA	NA	NA

Fertility Trial Details



- Random Complete Block Design
- ABI Eagle, ABI Voyager, Altorado, Copeland, Gemcraft, Moravian 179, LCS Odyssey
 - Spring 2 row barley
- SAS 9.4 Proc GLIMMIX
 - Assessed at $\alpha=0.05$ unless otherwise noted

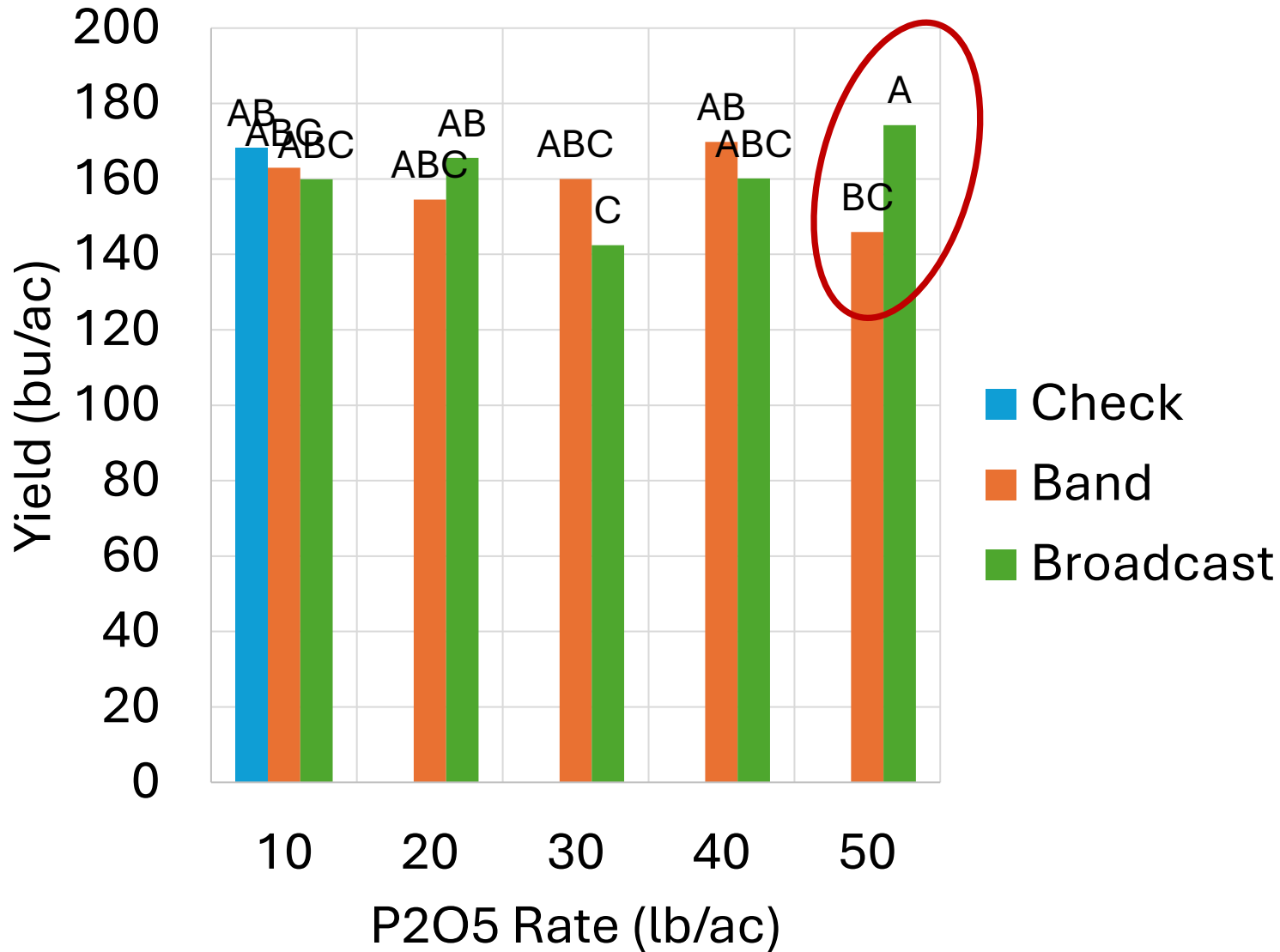
2023 Effect of Phosphorus Placement on Barley Grain Yield (bu/ac)

	P > F	Application Method	P₂O₅ lb ac⁻¹	Aberdeen 2023	Tetonia 2023
Location	0.8465				
Placement	0.3876	Band	45	177	119
L x P	0.905	Broadcast	45	164	125
		Band	90	165	132
		Broadcast	90	166	113
		Band	135	176	113
		Broadcast	135	177	104
Average Yield = 144					

2024 Effect of Phosphorus Rate and Placement on Barley Grain Yield (bu/ac)

	Ab110 Voyager	Ab110 Moravian 179	Ab523 ABI Eagle	Kimberly Altorado	Kimberly Odyssey	Soda Springs Copeland
	P > F					
Placement	0.29	0.59	0.04	0.75	0.27	0.36
Rate	0.69	0.82	0.08	0.45	0.82	0.48
P x R	0.50	0.55	0.12	0.04	0.19	0.88
Average Yield	219	231	133	160	150	25

Kimberly 2024 Altorado



Aberdeen Field 523	
Placement	Grain Yield (bu/ac)
Band	138A
Broadcast	127B

Phosphorus Starter Fertilizer in Winter Wheat

Research Bulletin 206
February 2023



2022 Small Grains Report

Southcentral and Southeast Idaho Cereals Research & Extension Program

Juliet Marshall, Belayneh A. Yimer, Tod Shelman, Linda Jones, Justin Hatch, and Sarah Windes

- Irrigated and Dryland Winter Wheat Variety Trials
- 20 lb P_2O_5 as MAP w/ seed

	Irrigated	Dryland
	P > F	
Starter	0.187	0.193
Average Yield (Bu/ac)		
None	157	41
Starter	153	42

2023 Effect of Potassium Rate on Barley Grain Yield (bu/ac)

	P > F
Location	0.0009
Rate	0.1618
L x R	0.6401

	Aberdeen 2023	Tetonia 2023
K ₂ O kg ha ⁻¹	Yield (bu ac ⁻¹)	
0	174	126
35	179	131
70	177	108
105	164	92
140	175	111
Average	174 A	114 B

Key Takeaways

- When free lime $<5\%$ and $P_2O_5 \geq 15$ ppm, no additional P is likely required for malt barley production
- Banding P fertilizer generally did not improve small grain yield relative to broadcast
- When $K_2O > 75$ ppm, no additional K is likely required for malt barley production

