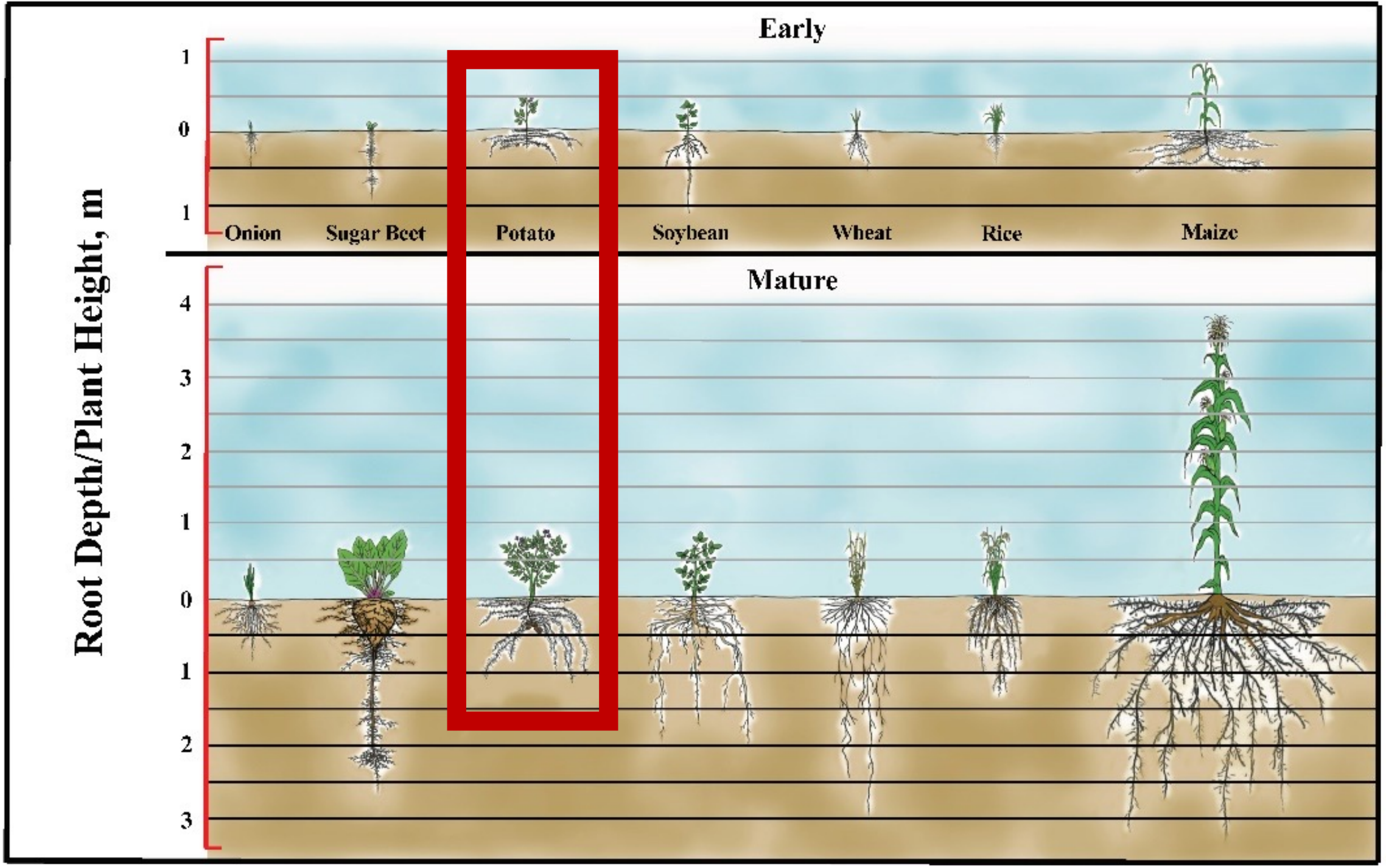
Phosphorus on Potato in the Pacific Northwest

Bryan G. Hopkins, Ph.D., CPSS, Brigham Young University

Coordinating Director – North American Proficiency Testing (NAPT) Program

Potato P

- 2-3 times the P than most other crops
- Responsive at relatively high soil test values
- Inefficient uptake, especially Russet Burbank cultivar (majority of potato in USA are this cultivar)
  - Few root hairs
  - Shallow root system



Hopkins, B.G. and N.C. Hansen. 2019. Phosphorus management in high-yield systems. *J. Environ. Qual.* 48:1265–1280. https://doi:10.2134/jeq2019.03.0130

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Trial ID	Trial Harvest Year (YYYY)	Rep	Soil Map Unit	Predominant Soil Series	Predominant Soil Series Order	Predominant Soil Texture	Soil Sample Collection Date (MM/DD/YYYY)	Soil Sample Depth (lower cm)	Soil Test P Method	Soil Test P Analytical Method	Soil Test P Extractant Solution to Soil Ratio ("10" for	Soil Test P Mass or Volume	Soil Test P (mgP/kg)	Soil Test K (mgK/kg)	Soil pH	Soil pH Method	Soil OM (gOM/kg)	Soil OM Method	Soil Ca (mgCa/kg)	Soil Ca Method	Soil Mg (mgMg/kg)	Soil Mg Method	Soil Na (mgNa/kg)	Soil Na Method	Soil Fe (mgFe/kg)	Soil Fe Method	Soil Mn (mgMn/kg)	Soil Zn (mgZn/kg)	Soil Cu (mgCu/kg)	Soil B (mg B/k	Soil B Method	Soil EC (s/m)	Soil EC Method	Soil CaCO3 (g/kg)	Soil CaCO3 Method	Soil NO3-N (mgNO3-N/kg)	Soil NO3-N Method
Pasco-21	2021	1	Burbank loamy fine sand, 0 to 5 percent slopes	Sandy-skeletal, mixed, mesic Xeric Torriorthents	Entisols	Loamy Fine Sa	4/2/2021	30	Olsen	ICP	20	Mass	20	110	7.6	paste	0.16	LOI	1020	paste	280	paste	50	paste	18	DTPA	3.6	0.9	0.4	1.5	Hot Water	1.0	paste	2.3	titration	12	Cd Reducti
Pasco-21	2021	2	Burbank loamy fine sand, 0 to 5 percent slopes	Sandy-skeletal, mixed, mesic Xeric Torriorthents	Entisols	Loamy Fine Sa	4/2/2021	30	Olsen	ICP	20	Mass	22	110	7.9	paste	0.20	LOI	1100	paste	360	paste	50	paste	9	DTPA	3.6	0.8	0.4	2.1	Hot Water	1.1	paste	1.0	titration	11	Cd Reducti
Pasco-21	2021	3	Burbank loamy fine sand, 0 to 5 percent slopes	Sandy-skeletal, mixed, mesic Xeric Torriorthents	Entisols	Loamy Fine Sa	4/2/2021	30	Olsen	ICP	20	Mass	23	110	7.5	paste	0.18	LOI	960	paste	360	paste	50	paste	21	DTPA	3.9	0.9	0.4	2.1	Hot Water	1.1	paste	1.8	titration	11	Cd Reducti
Pasco-21	2021	4	Burbank loamy fine sand, 0 to 5 percent slopes	Sandy-skeletal, mixed, mesic Xeric Torriorthents	Entisols	Loamy Fine Sa	4/2/2021	30	Olsen	ICP	20	Mass	18	110	7.5	paste	0.21	LOI	950	paste	300	paste	40	paste	9	DTPA	2.4	0.9	0.4	1.1	Hot Water	1.3	paste	1.6	titration	10	Cd Reducti
Pasco-21	2021	5	Burbank loamy fine sand, 0 to 5 percent slopes	Sandy-skeletal, mixed, mesic Xeric Torriorthents	Entisols	Loamy Fine Sa	4/2/2021	30	Olsen	ICP	20	Mass	17	110	7.6	paste	0.18	LOI	960	paste	310	paste	60	paste	15	DTPA	2.1	1.1	0.5	1.2	Hot Water	0.9	paste	0.9	titration	11	Cd Reducti
Pasco-21	2021	6	Burbank loamy fine sand, 0 to 5 percent slopes	Sandy-skeletal, mixed, mesic Xeric Torriorthents	Entisols	Loamy Fine Sa	4/2/2021	30	Olsen	ICP	20	Mass	20	110	7.7	paste	0.19	LOI	870	paste	330	paste	60	paste	15	DTPA	3.2	0.8	0.4	1.4	Hot Water	1.0	paste	3.0	titration	12	Cd Reducti
Rexburg-21	2021	1	Pocatello variant silt loam, 2 to 4 percent slopes	Coarse-silty, mixed, calcareous, frigid Typic Xerorthents	Entisols	Silt Loam	4/28/2021	30	Olsen	ICP	20	Mass	35	110	8.1	paste	0.30	LOI	1500	paste	330	paste	50	paste	25	DTPA	2.5	1.0	0.4	1.4	Hot Water	1.1	paste	6.0	titration	25	Cd Reducti
Rexburg-21	2021	2	Pocatello variant silt loam, 2 to 4 percent slopes	Coarse-silty, mixed, calcareous, frigid Typic Xerorthents	Entisols	Silt Loam	4/28/2021	30	Olsen	ICP	20	Mass	38	110	8.0	paste	0.15	LOI	2450	paste	400	paste	40	paste	11	DTPA	2.8	1.2	0.4	1.6	Hot Water	0.8	paste	4.1	titration	12	Cd Reducti
Rexburg-21	2021	3	Pocatello variant silt loam, 2 to 4 percent slopes	Coarse-silty, mixed, calcareous, frigid Typic Xerorthents	Entisols	Silt Loam	4/28/2021	30	Olsen	ICP	20	Mass	32	150	8.0	paste	0.20	LOI	1300	paste	420	paste	50	paste	15	DTPA	3.4	1.2	0.6	1.8	Hot Water	0.8	paste	5.5	titration	11	Cd Reducti
Rexburg-21	2021	4	Pocatello variant silt loam, 2 to 4 percent slopes	Coarse-silty, mixed, calcareous, frigid Typic Xerorthents	Entisols	Silt Loam	4/28/2021	30	Olsen	ICP	20	Mass	35	140	8.2	paste	0.29	LOI	1750	paste	330	paste	40	paste	16	DTPA	3.3	1.3	0.5	1.6	Hot Water	1.1	paste	5.9	titration	24	Cd Reducti
Rexburg-21	2021	5	Pocatello variant silt loam, 2 to 4 percent slopes	Coarse-silty, mixed, calcareous, frigid Typic Xerorthents	Entisols	Silt Loam	4/28/2021	30	Olsen	ICP	20	Mass	36	160	8.1	paste	0.18	LOI	1800	paste	300	paste	60	paste	20	DTPA	2.7	1.4	0.6	1.7	Hot Water	0.8	paste	4.6	titration	18	Cd Reducti
Rexburg-21	2021	6	Pocatello variant silt loam, 2 to 4 percent slopes	Coarse-silty, mixed, calcareous, frigid Typic Xerorthents	Entisols	Silt Loam	4/28/2021	30	Olsen	ICP	20	Mass	34	130	8.1	paste	0.15	LOI	1860	paste	280	paste	30	paste	30	DTPA	2.3	1.2	0.5	1.6	Hot Water	0.8	paste	6.1	titration	18	Cd Reducti
Aberdeen-2	2021	1	DcA—Declo fine sandy loam, 0 to 2 percent slopes	Coarse-loamy, mixed, mesic Xerollic Calciorthids	Aridisols	Fine Sandy Lo	4/15/2021	30	Olsen	ICP	20	Mass	17	200	7.8	paste	0.25	LOI	2150	paste	340	paste	100	paste	22	DTPA	18.0	1.5	0.7	2.5	Hot Water	1.0	paste	9.0	titration	3	Cd Reducti
Aberdeen-2	2021	2	DcA—Declo fine sandy loam, 0 to 2 percent slopes	Coarse-loamy, mixed, mesic Xerollic Calciorthids	Aridisols	Fine Sandy Lo	4/15/2021	30	Olsen	ICP	20	Mass	21	110	8.2	paste	0.21	LOI	1950	paste	350	paste	110	paste	21	DTPA	15.0	1.4	0.8	1.9	Hot Water	1.0	paste	4.5	titration	4	Cd Reducti
Aberdeen-2	2021	3	DcA—Declo fine sandy loam, 0 to 2 percent slopes	Coarse-loamy, mixed, mesic Xerollic Calciorthids	Aridisols	Fine Sandy Lo	4/15/2021	30	Olsen	ICP	20	Mass	18	140	8.2	paste	0.27	LOI	1780	paste	450	paste	110	paste	20	DTPA	14.6	1.4	0.5	1.9	Hot Water	0.8	paste	5.6	titration	5	Cd Reducti
Aberdeen-2	2021	4	DcA—Declo fine sandy loam, 0 to 2 percent slopes	Coarse-loamy, mixed, mesic Xerollic Calciorthids	Aridisols	Fine Sandy Lo	4/15/2021	30	Olsen	ICP	20	Mass	20	150	8.1	paste	0.19	LOI	2300	paste	470	paste	120	paste	23	DTPA	12.3	1.4	0.5	1.5	Hot Water	0.9	paste	5.7	titration	6	Cd Reducti
Aberdeen-2	2021	5	DcA—Declo fine sandy loam, 0 to 2 percent slopes	Coarse-loamy, mixed, mesic Xerollic Calciorthids	Aridisols	Fine Sandy Lo	4/15/2021	30	Olsen	ICP	20	Mass	18	130	8.0	paste	0.23	LOI	2350	paste	320	paste	130	paste	18	DTPA	18.0	1.2	0.6	2.0	Hot Water	0.8	paste	8.3	titration	8	Cd Reducti
Aberdeen-2	2021	6	DcA—Declo fine sandy loam, 0 to 2 percent slopes	Coarse-loamy, mixed, mesic Xerollic Calciorthids	Aridisols	Fine Sandy Lo	4/15/2021	30	Olsen	ICP	20	Mass	20	140	7.9	paste	0.23	LOI	2110	paste	400	paste	80	paste	13	DTPA	18.1	1.3	0.5	1.7	Hot Water	0.9	paste	4.3	titration	7	Cd Reducti

Soil Data (2) | Instructions & Data Dictionary | User & Publication Information | Trial Information | Soil Methods | S ...

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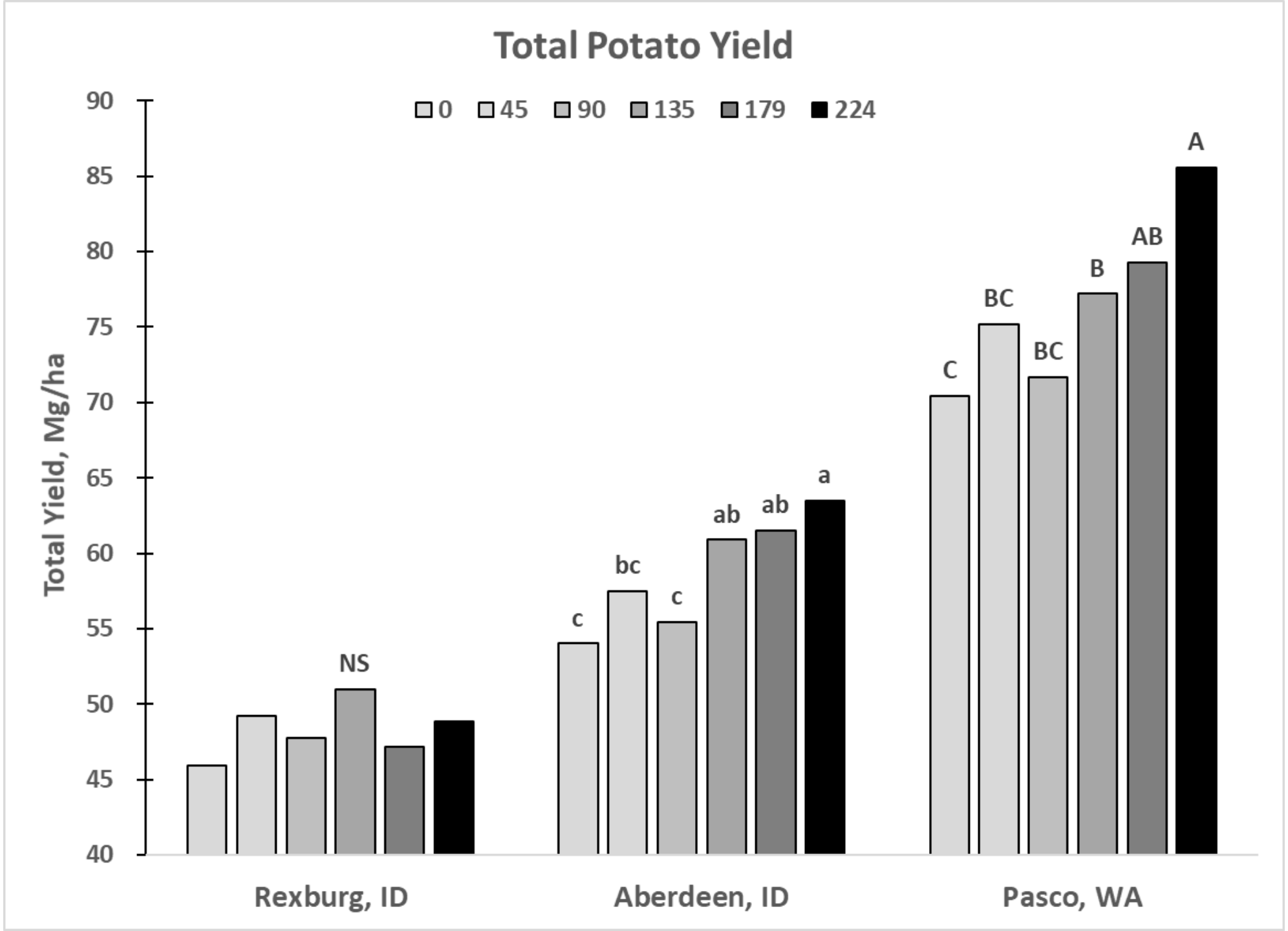
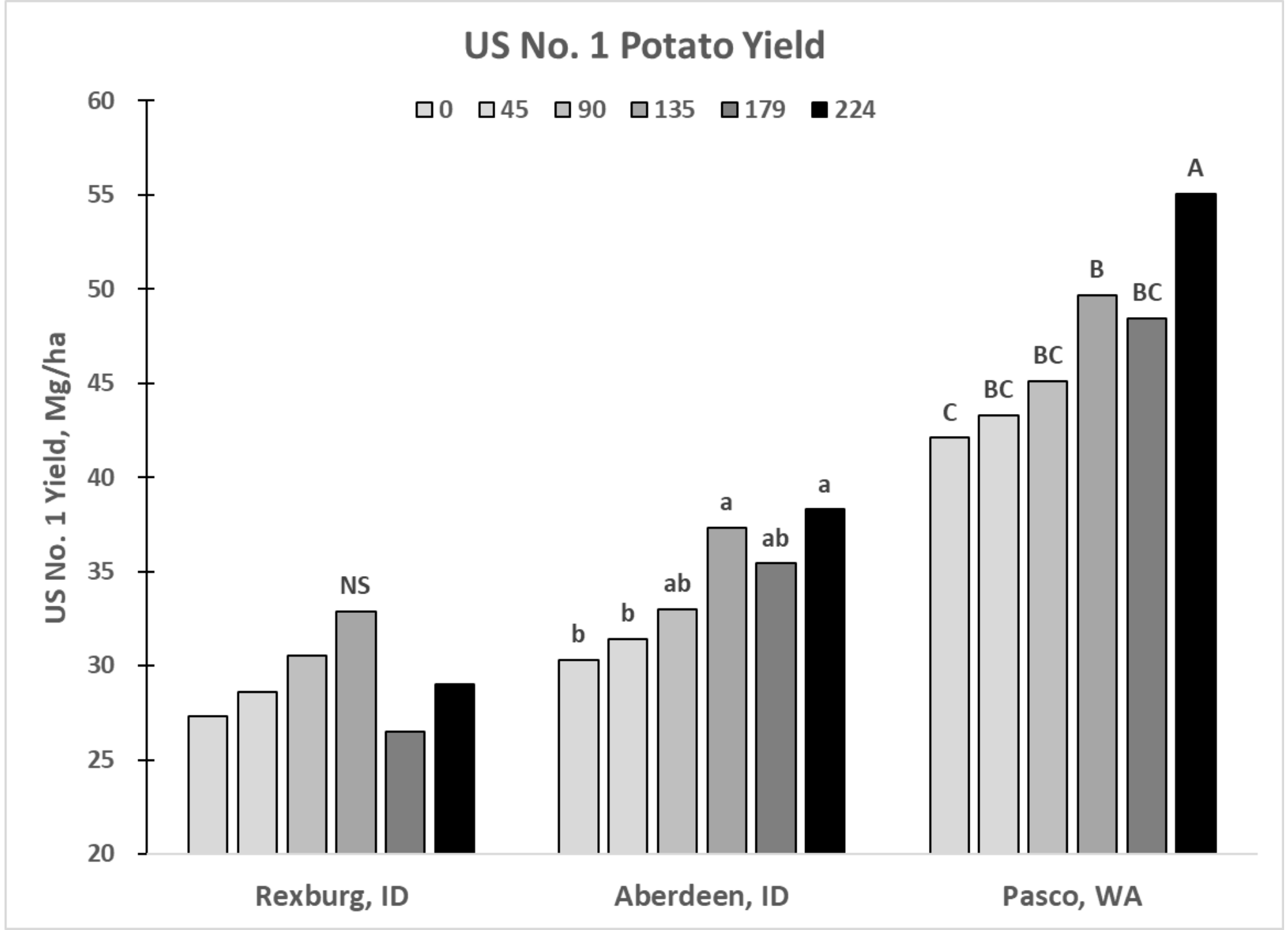
3 field locations – all calcareous loams

Location	Olsen Bicarbonate, ppm	$CaCO_3$, %	texture
Pasco, WA	20	1.8	loamy fine sand
Rexburg, ID	35	5.4	silt loam
Aberdeen	19	6.3	fine sandy loam

6 pre-plant incorporated rates

P_2O_5, lb/ac	P_2O_5, kg/ha
0	0
40	45
80	90
120	135
160	179
200	224


Total Potato Yield
0
45
90
135
179
224
Total Yield, Mg/ha
90
85
80
75
70
65
60
55
50
45
40
NS
c
bc
c
ab
ab
a
C
BC
BC
B
AB
A
Rexburg, ID
Aberdeen, ID
Pasco, WA


US No. 1 Potato Yield
0
45
90
135
179
224
US No. 1 Yield, Mg/ha
60
55
50
45
40
35
30
25
20
NS
b
b
ab
a
ab
a
C
BC
BC
B
BC
A
Rexburg, ID
Aberdeen, ID
Pasco, WA

Other findings

- Increase in petiole P concentrations by the last date in August as a function of P fertilization.
- Yield increase mostly due to an increase in tuber size and specific gravity (solids), and not tuber number.
- Trend (not significant) for less brown center and hollow heart.