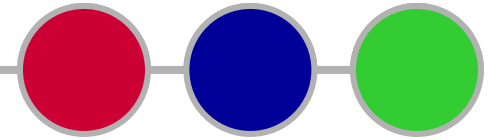


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Fertility aspects of green pea production

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Some context

- **Little published green pea fertility research**
 - **Short season crop so nutrient access and timing is important**
 - **Relatively low nutrient demand**
 - **Some important nutrients**

Topics

- **Benefits of peas in a rotation**
- **Fertilizing peas**
 - **Survey of recommendations**
 - Soil testing
 - Tissue testing
 - **Data from recent green pea studies in the Milton-Freewater area**

Nitrogen fertility benefits

Small nitrogen credit attributed to grain legume residues

Previous crop and dry yield	Credit (lb N/acre)
Peas >2500 lb/acre	20
Peas 1500 to 2500 lb/acre	15
Peas <1500 lb/acre	10
Lentils >1000 lb/acre	10
Alfalfa	50

Rotational benefits (dry peas)

- Recent studies at the Cook Agronomy Farm (data from Dave Huggins, USDA-ARS Pullman)
- Altering the standard 3-year rotation
 - Winter wheat – spring wheat – spring pea
 - Winter wheat – spring pea – spring wheat
- Hard red winter and spring wheat – emphasize protein
- No-till system where erosion is minimal over winter in pea residue

Rotational benefits (dry peas)

Beyond nitrogen

	Hard Red Spring Wheat	
Previous crop*	Yield (bu/ac)	% Protein
Canola	68	13.5
Barley	73	13.0
Peas	75	14.0

*Nitrogen management adjusted for previous crop

Rotational benefits

- **Disease cycles**
- **Improved rooting and nutrient (nitrogen) uptake**
- **Residue issues – less when a spring crop follows peas**
- **Impacts on soil temperature**
- **Other (unexplained)**
- **Seriously underestimated**

Further rotational benefits

- **Green vs. dry peas**
 - **Dryland: estimated 20% higher yield of winter wheat after green pea compared to winter wheat after dry pea**
 - **Moisture effect**
 - **Additional nitrogen credit from green peas**
 - **More N left in the field with green peas – about 2x that of dry peas**

Fertilizing green peas

- **Caveat: little fertility research on green peas**

Dry pea fertility

- Oregon State University, Commercial Vegetable Production Guide for Processing Peas in Eastern Oregon.
 - <http://hort-devel-nwrec.hort.oregonstate.edu/pea-e.html>
- Emphasize
 - 15 to 20 lb N/A banded with P and possibly K at planting.
 - 40 to 75 lb P205/A can be drilled with the seed.
 - Soil test is 0-10 P = 40 to 120, 10-20 = 0-60 P, over 20 = none.
 - Potassium
 - Soil test 0-75 = 90-120 lb/A
 - 75-150 = 60-90 lb/A
 - 150-200 = 40-60
 - Over 200 = None
 - Sulfur 20-30 lb/A, in the form of sulfate at planting.
 - Responses of peas to other nutrients not observed.

Dry pea fertility

- **University of Idaho fertility guides authored by R. Mahler**
 - <http://www.uidaho.edu/wq/wqfert/wqfertls.html>
- **Emphasize**
 - **Inoculation for fields without a history of same legume in last 3 years, or pH below 5.7**
 - **Soil test for phosphorus, sulfur, zinc and boron**
 - **Molybdenum when pH < 5.7 (seed treatment)**

Phosphorus recommendations

Soil test P (ppm) 0 to 12-inch depth		Application rate lb P ₂ O ₅ /acre
Acetate method	Bicarbonate method	
0 to 2	0 to 8	60
2 to 3	8 to 10	40
3 to 4	10 to 12	20
4 to 6	12 to 18	10-20
Above 6	Above 18	0*

*Starter applications may still be beneficial for spring-seeded legumes (cold soils)

Sulfur recommendation

- Below 10 ppm $\text{SO}_4\text{-S}$, 15 to 20 lb S/acre

Boron and molybdenum

- High rainfall environments (>20 inches)
- Low pH (5.7 or below) soils
 - Boron soil test below 0.5 ppm
 - ½ to 1 lb boron/acre – broadcast, not banded
 - Molybdenum – 1 oz/acre as seed treatment

Tissue testing

“50 most recently developed leaflets at first bloom”

Element	Sufficiency range
Nitrogen	4 to 5%
Phosphorus	0.3 to 0.8%
Potassium	2.0 to 3.5%
Sulfur	0.2 to 0.3%
Zinc	25 to 400 ppm
Boron	5 to 60 ppm
Iron	50 to 300 ppm
Manganese	25 to 400 ppm
Molybdenum	>0.6 ppm
Copper	7 to 100 ppm

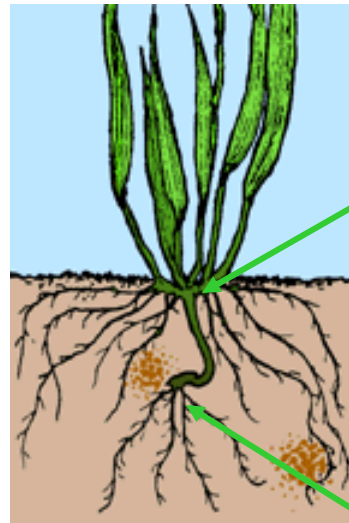
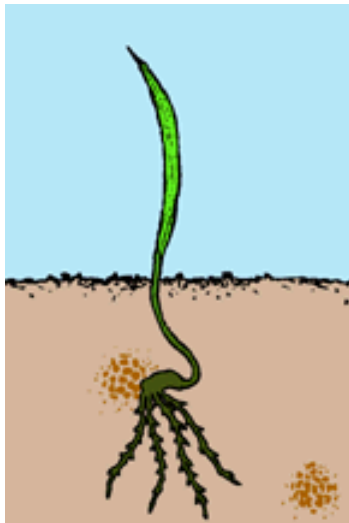
Source: Plant Analysis Handbook II (1996) Micro-Macro Publishing

Fertilizer placement for legumes

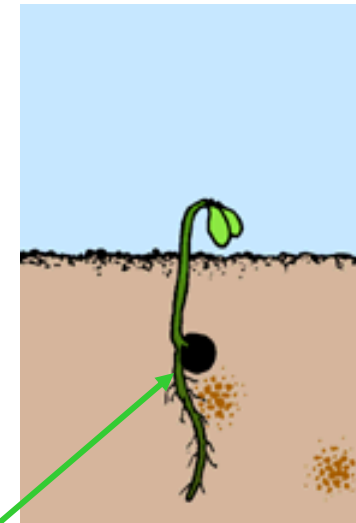
- No nitrogen, potassium or sulfur with the seed (soluble fertilizers reduce germination)
- Small amounts of phosphorus (<10 lb P₂O₅/ac) with the seed are okay
- Ideal placement is below or below and beside the seed

Rooting patterns and starter and deep band fertilizer placements

Wheat



Peas



Secondary root system

Primary root systems

Recent fertility studies

- Dryland green peas in Milton-Freewater area
- 2005, 2007 study years (2006 crop failed)
- Pre-plant soil tests collected
 - Representative of dryland green pea fields
- N, P, S, B, Zn treatments

2005 green pea fertility trial soil test results (1 foot depth)

Parameter	Average of 4 samples	Interpretation
Soil pH	5.5	Borderline for peas (>5.5)
Phosphorus	22 ppm	Adequate for peas (>18)
Potassium	360 ppm	Adequate for peas (>100)
Sulfur	3 ppm	Very low for peas (>10)
Zinc	1.7 ppm	Adequate for peas (>1.0)
Boron	0.18 ppm	Very low for peas (>0.5)
Iron	49 ppm	Adequate for peas (>5)
Manganese	27 ppm	Adequate for peas (>1)
Copper	1.5 ppm	Adequate for peas (>0.2)

2007 green pea fertility trial soil test results (1 foot depth) – no-till site

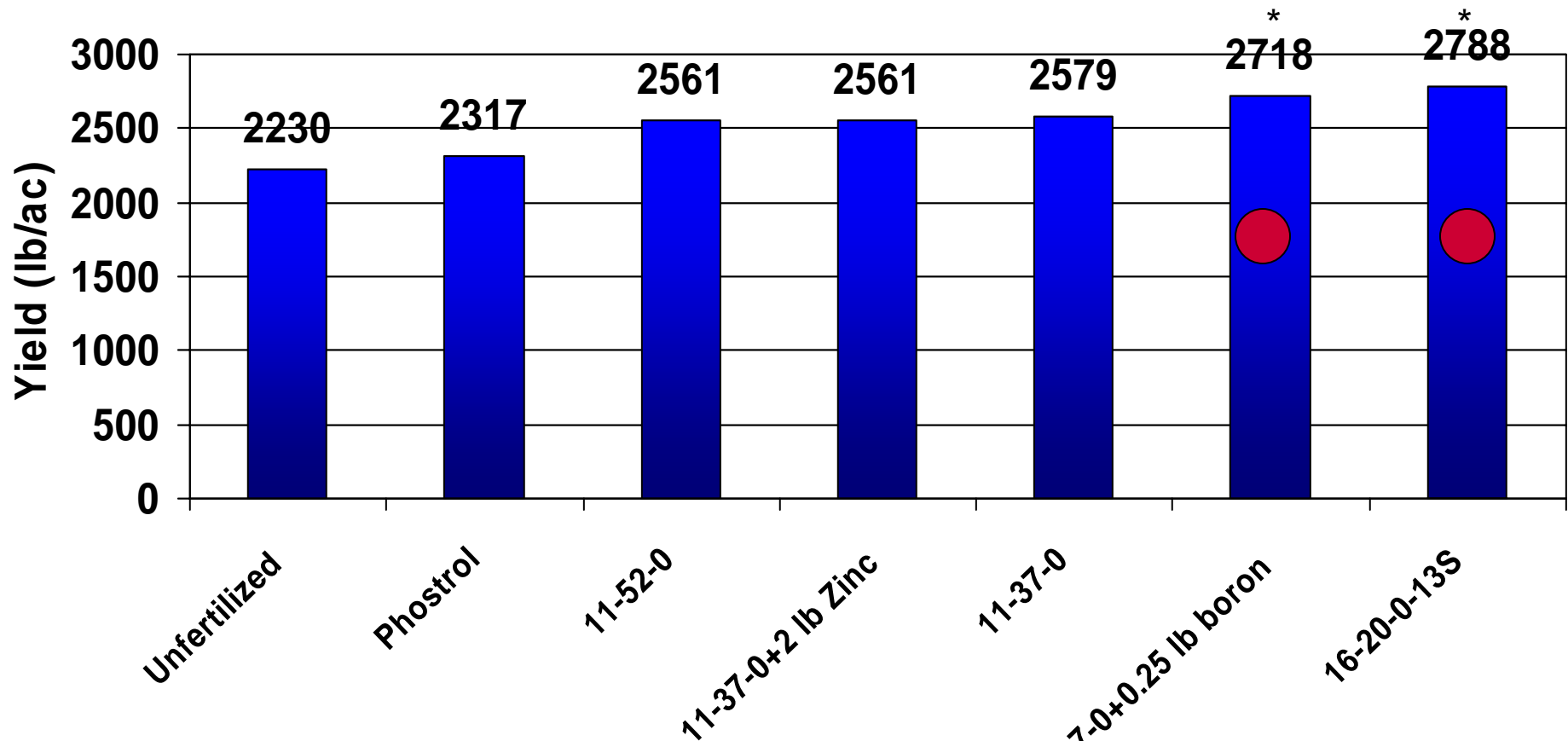
Parameter	Average of 4 samples	Interpretation
Soil pH	5.6	Borderline for peas (>5.5)
Phosphorus	16 ppm	Adequate for peas (>18)
Potassium	492 ppm	Adequate for peas (>100)
Sulfur	4 ppm	Very low for peas (>10)
Zinc	1.15 ppm	Adequate for peas (>1.0)
Boron	0.29 ppm	Very low for peas (>0.5)
Iron	43 ppm	Adequate for peas (>5)
Manganese	36 ppm	Adequate for peas (>1)
Copper	1.3 ppm	Adequate for peas (>0.2)

2007 green pea fertility trial soil test results (1 foot depth) – conventional site

Parameter	Average of 4 samples	Interpretation
Soil pH	5.5	Borderline for peas (>5.5)
Phosphorus	18 ppm	Adequate for peas (>18)
Potassium	422 ppm	Adequate for peas (>100)
Sulfur	5 ppm	Very low for peas (>10)
Zinc	0.38 ppm	Very low for peas (>1.0)
Boron	0.27 ppm	Very low for peas (>0.5)
Iron	43 ppm	Adequate for peas (>5)
Manganese	38 ppm	Adequate for peas (>1)
Copper	1.5 ppm	Adequate for peas (>0.2)

● Pre-season soil test showed below adequate levels

2005 green pea yields

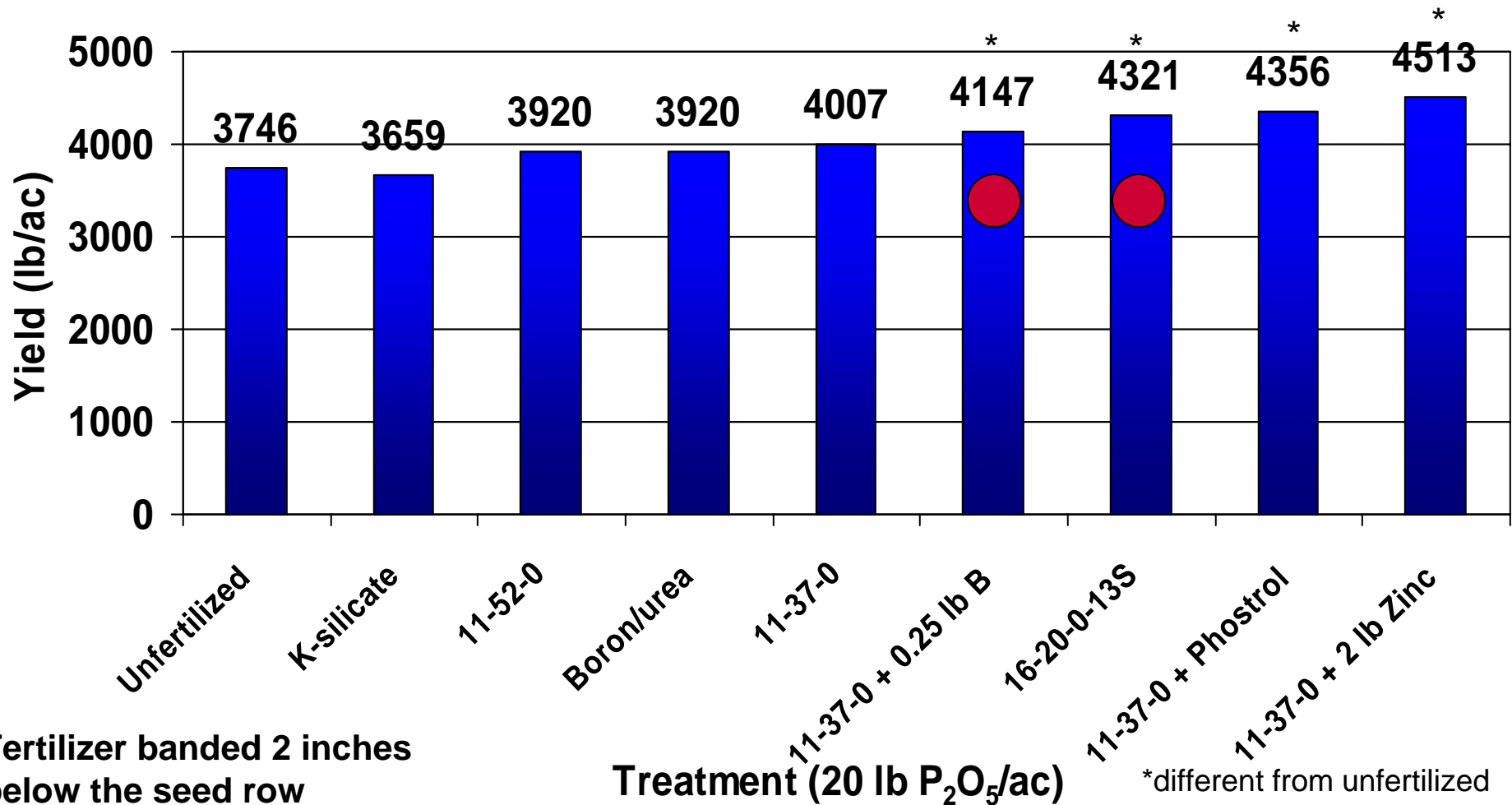


Fertilizer banded 2 inches below the seed row

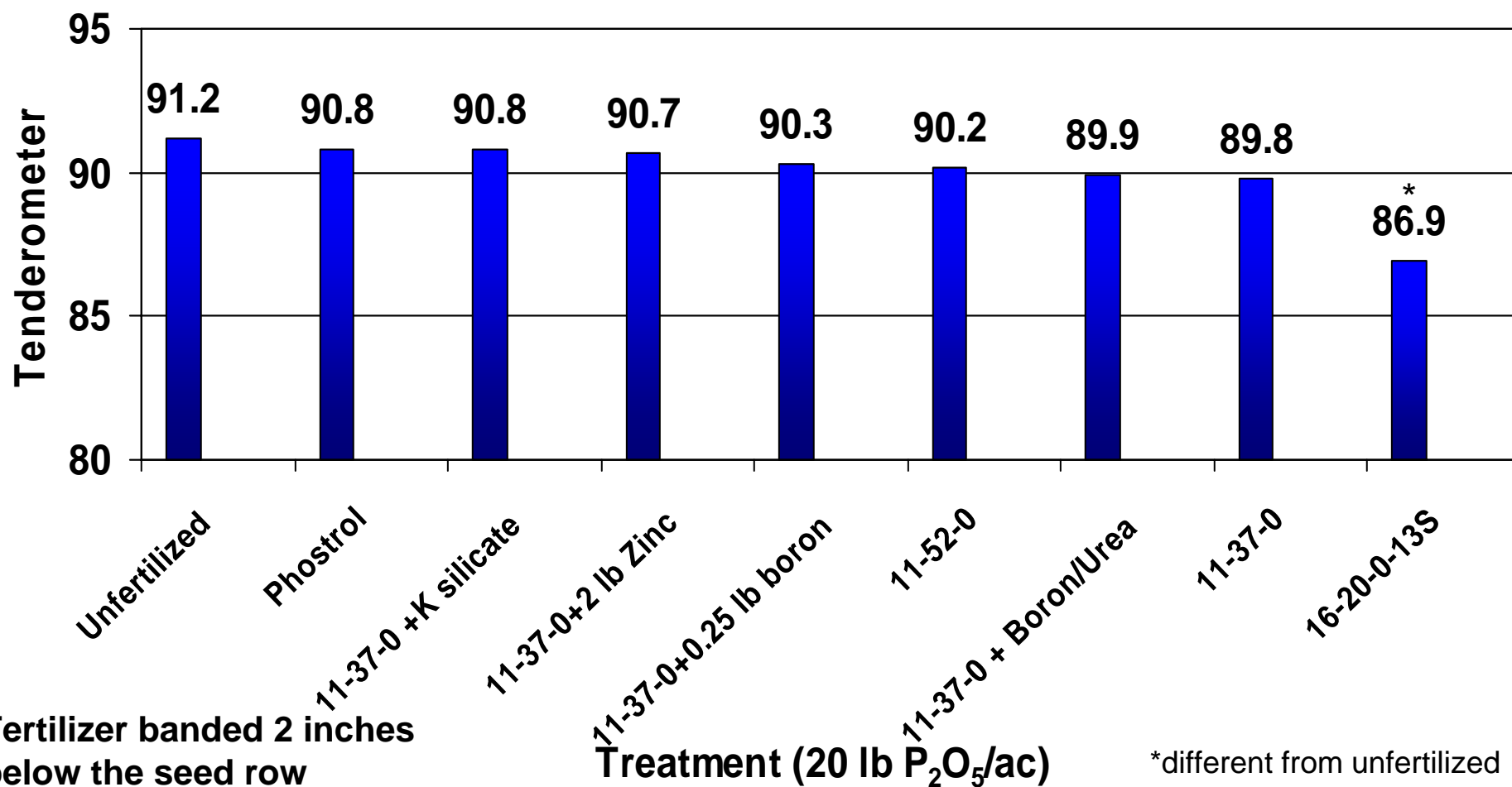
Treatment (20 lb P₂O₅/ac)

*different from unfertilized

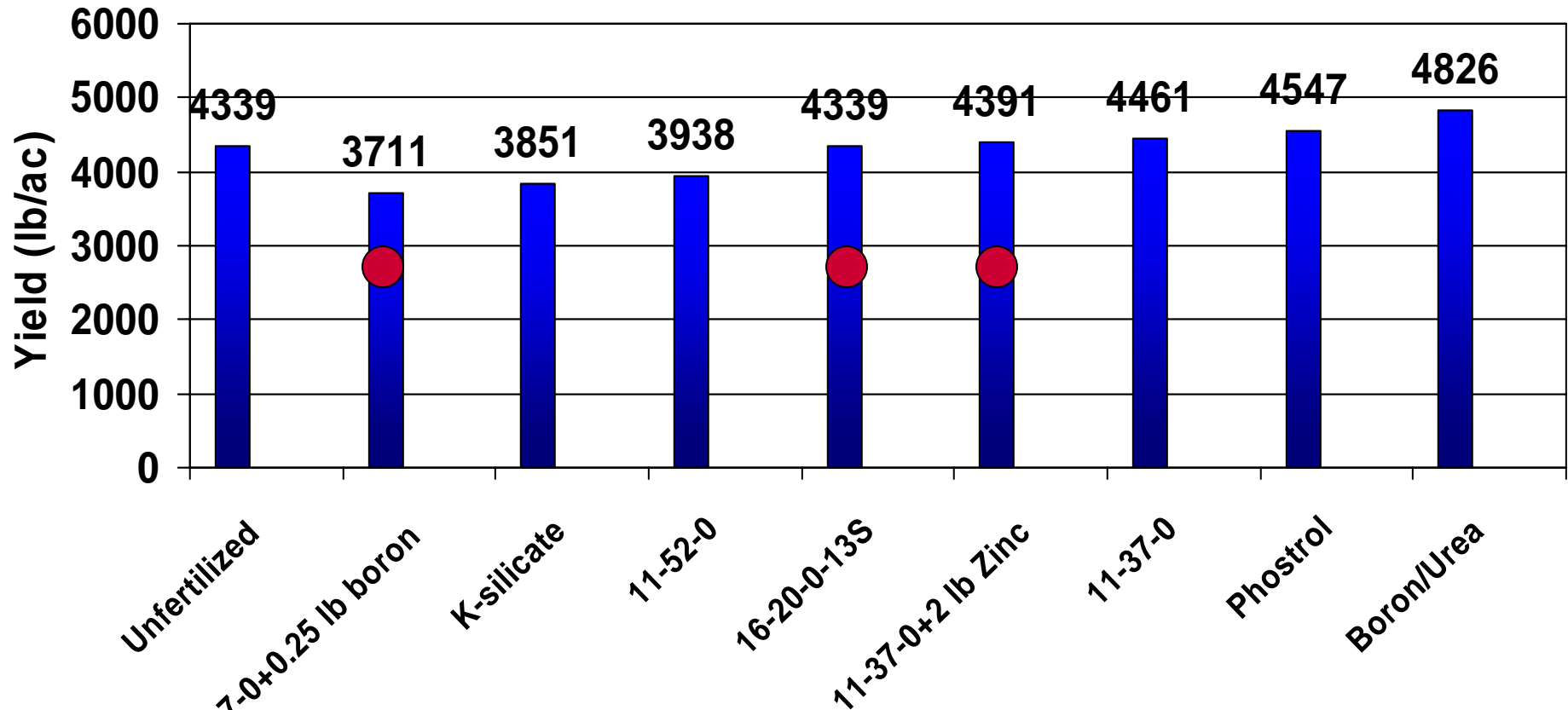
2007 green pea yields (no-till)



2007 green pea tenderometer (no-till)



2007 green pea yields (conventional till)

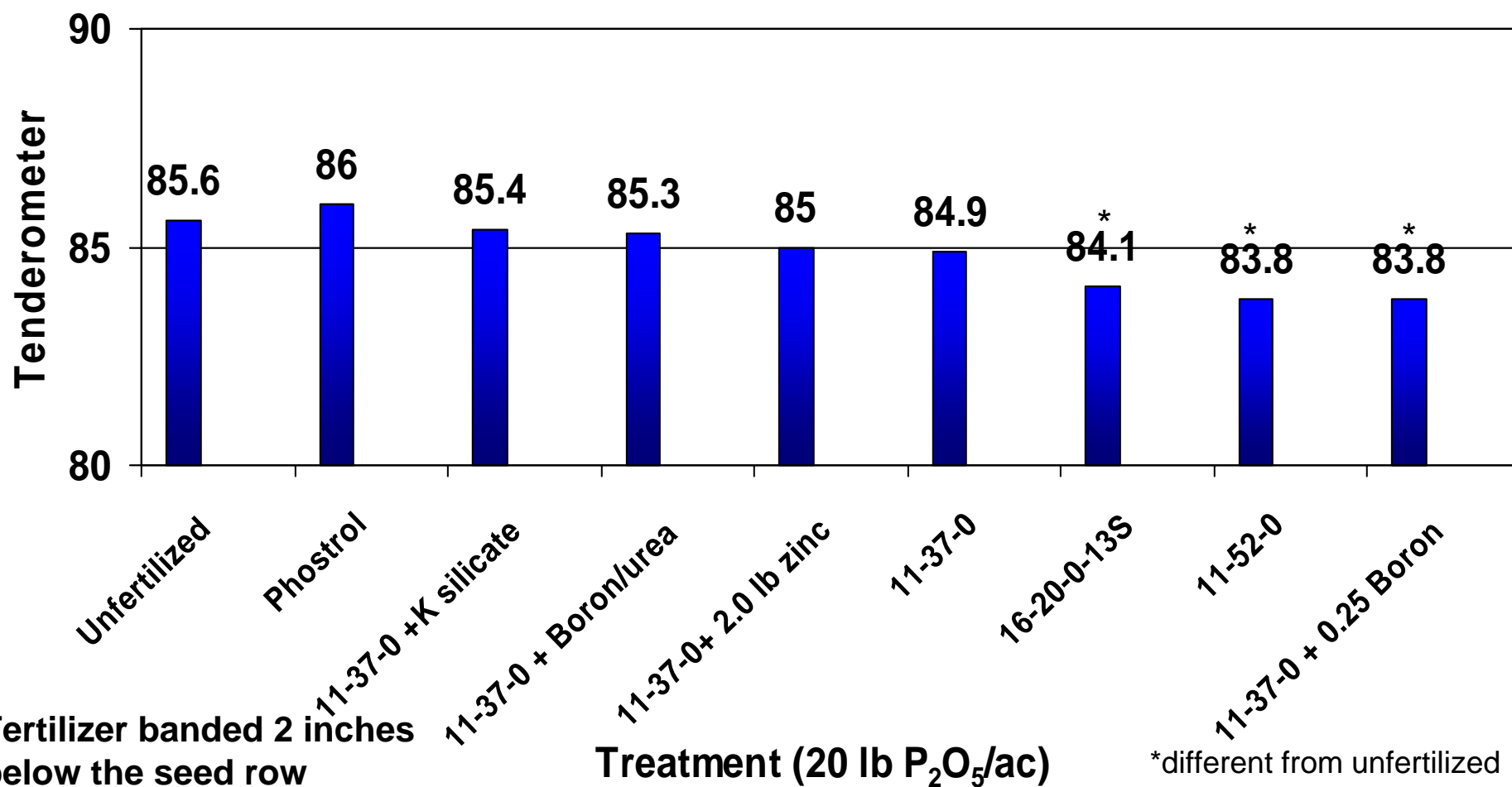


Fertilizer banded 2 inches below the seed row

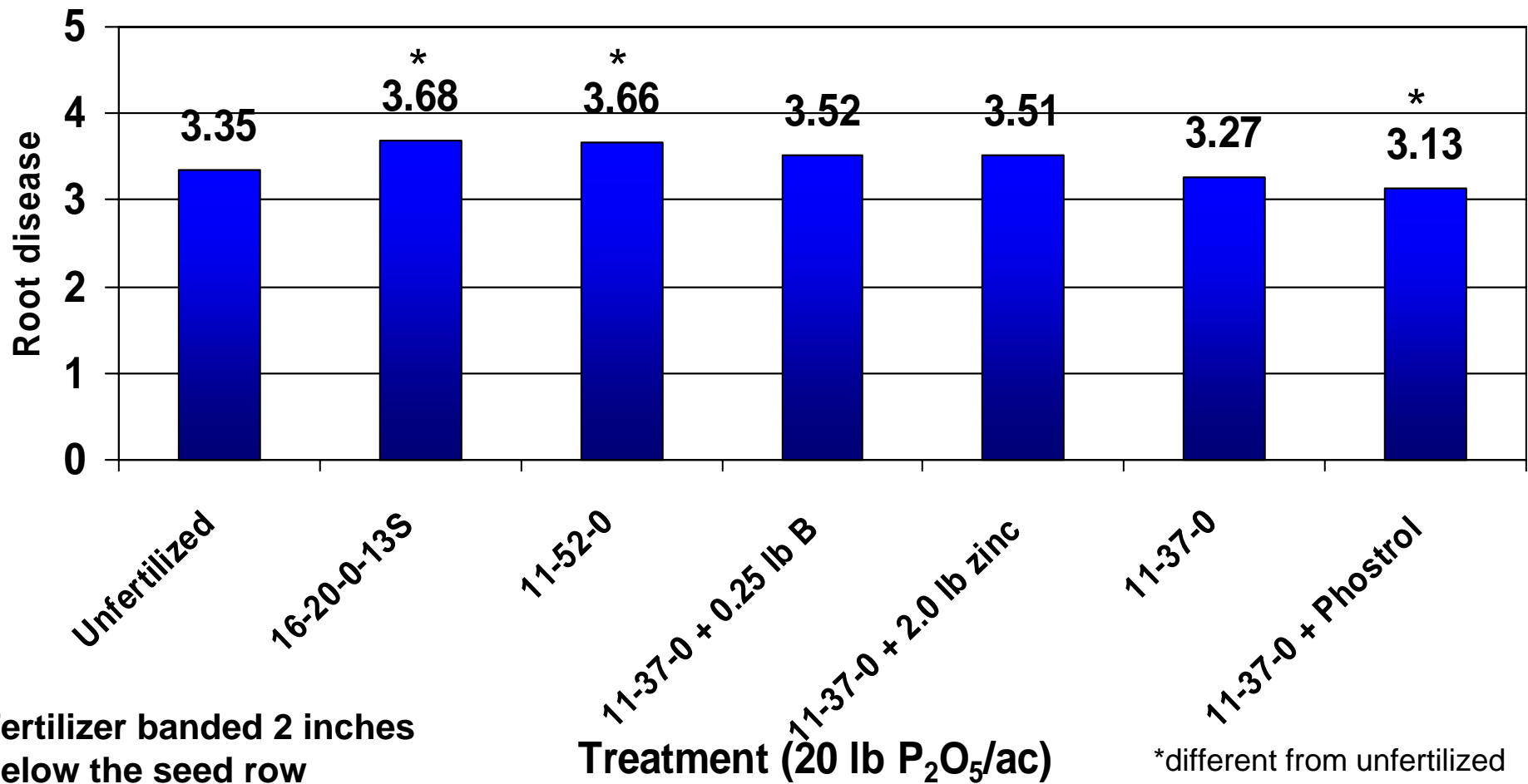
Treatment (20 lb P₂O₅/ac)

*different from unfertilized

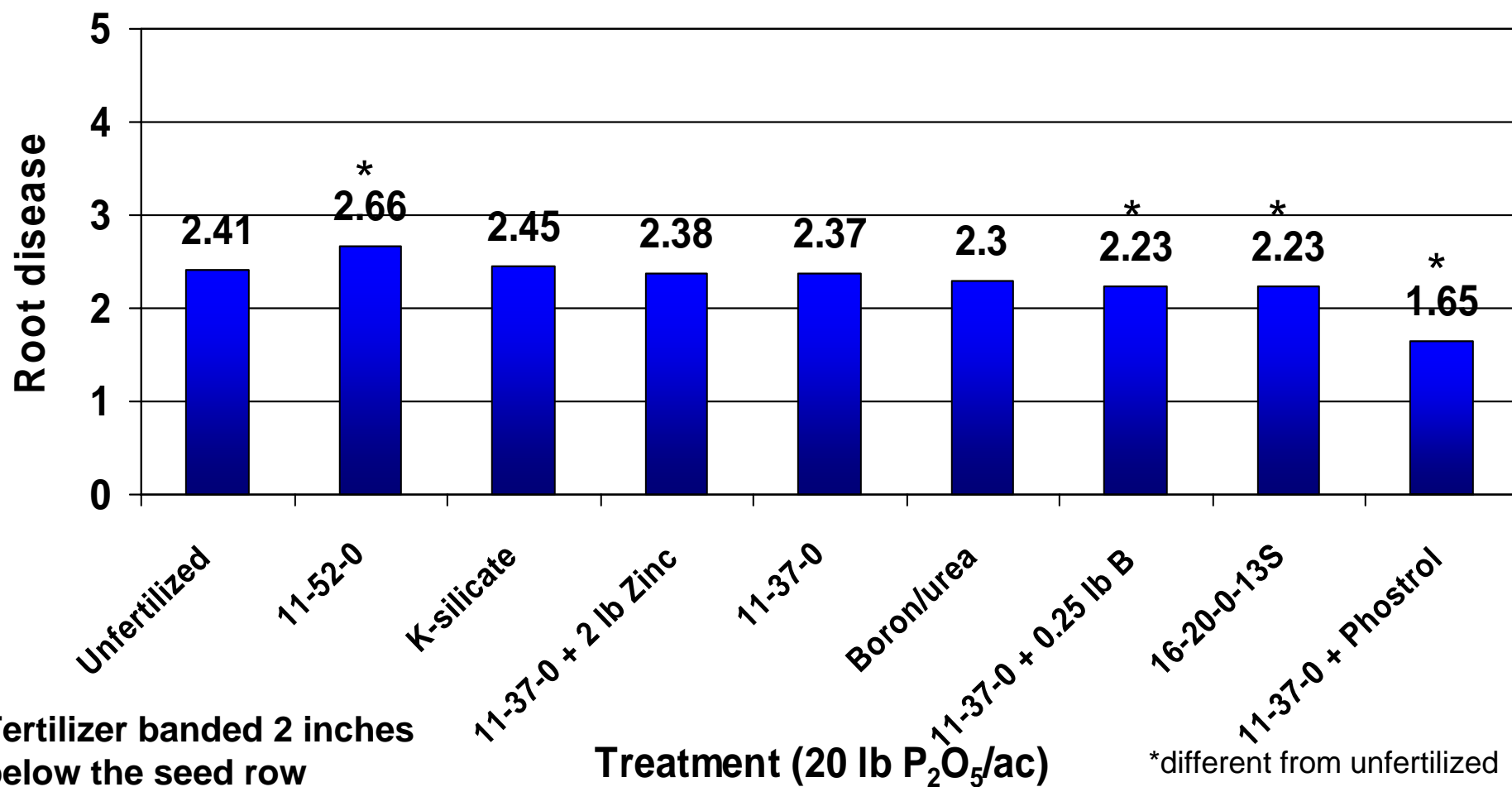
2007 green pea tenderometer (Conventional)



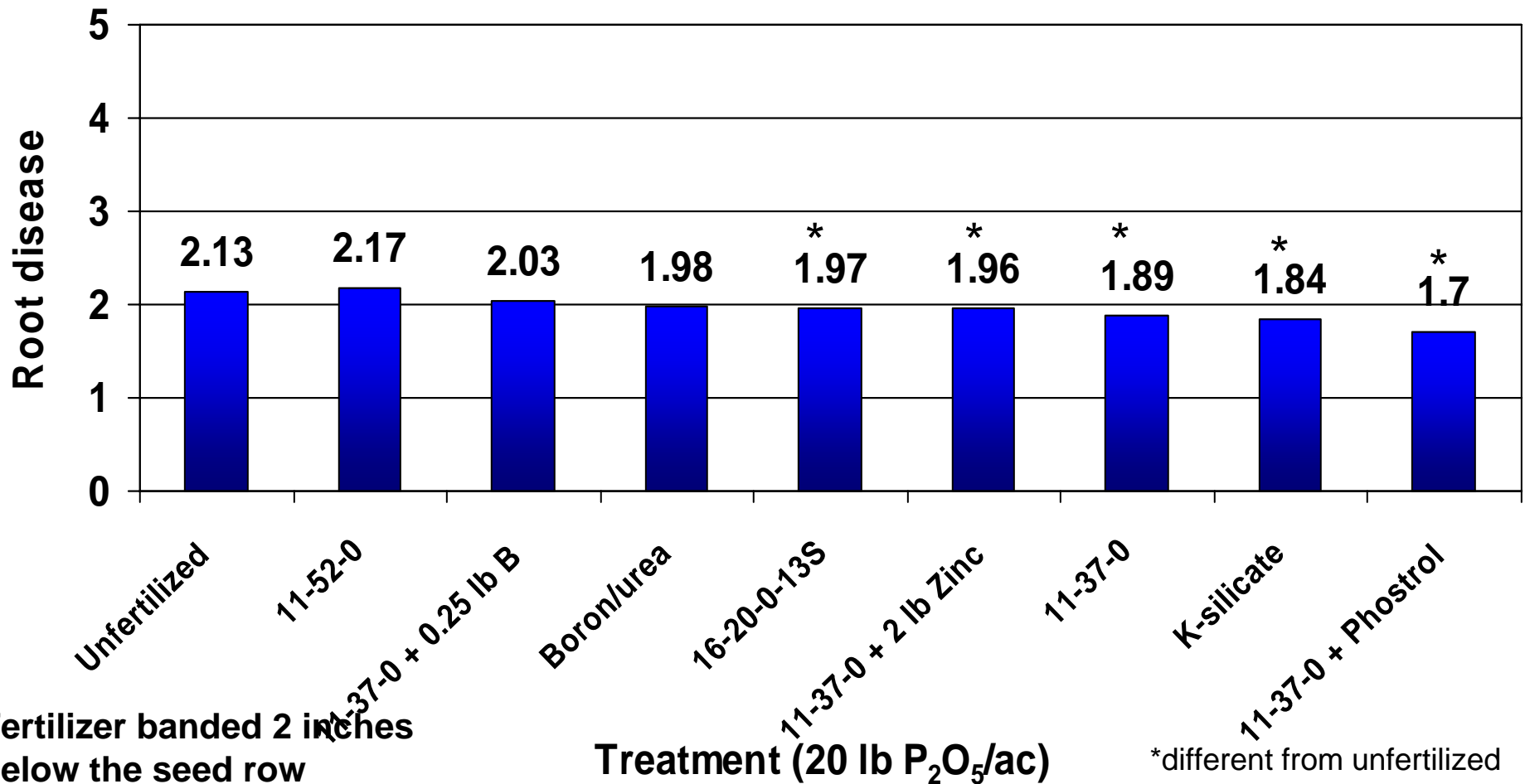
2005 Green Pea Root Disease (Conventional)



2007 Green Pea Root Disease (Conventional)



2007 Green Pea Root Disease (no-till)



Summary from fertility studies

- Evidence of responses to sulfur and perhaps boron; occasionally zinc and phosphorus
 - Broadcast applications of boron, not banded
- The preplant soil test predicted a fertilizer response in most situations
- Phostrol and 16-20-0-13S limited root disease