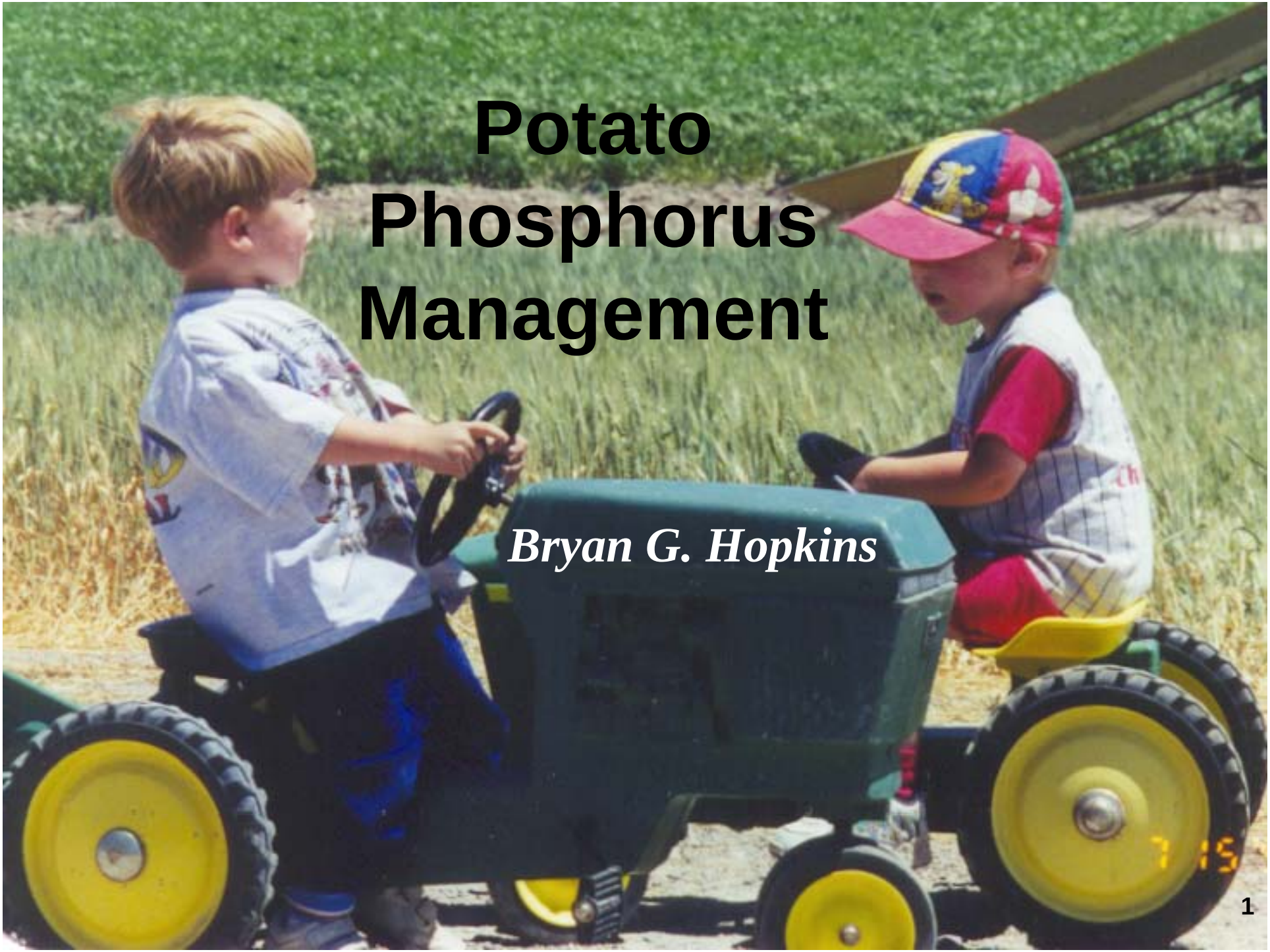


Potato Phosphorus Management

Bryan G. Hopkins

Acknowledgements

- Fluid Fertilizer Foundation
- Simplot
- MDS Harris Laboratories
- BYU Soil Testing Lab
- Our staff
- Idaho Bureau of Prisons

Spud Facts

- Potatoes are one of the main six crops that provide 80% of the caloric intake worldwide.
- In the US, mostly grown in . . .
  - sand to loam soils
  - warm days, cool nights
  - dry climate (low disease and better control of water supply)

Spud Facts

- Over 70% of US potatoes (ID, WA, OR, CO, CA, TX, NE, ND, MN) grown in arid and semi-arid zone soils
  - Alkaline pH
  - Calcareous
  - Low Organic Matter

Spud Facts

- As a result, poor availability of:
  - P, Zn, Mn, etc.
- Very sensitive to nutrient deficiencies

Spud Facts

- Potatoes = relatively high nutrient demand
  - Shallow, inefficient rooting system.
  - High tissue conc. of P, K, Zn, Mn, B, etc.
- Broadcast fertilizer (except majority of N) is applied prior to final tillage and row formation or "mark-out" in fall or spring.

Spud Facts

- Most growers apply banded fertilizer at row formation, rather than with the planter.
  - Generally, 10-34-0 with humic acid (10:1)
  - Some also apply K and micros.
- Seed generally planted 5-6 inches deep in hills 34-38 inches apart with 9-13 inch in-row seed spacing.

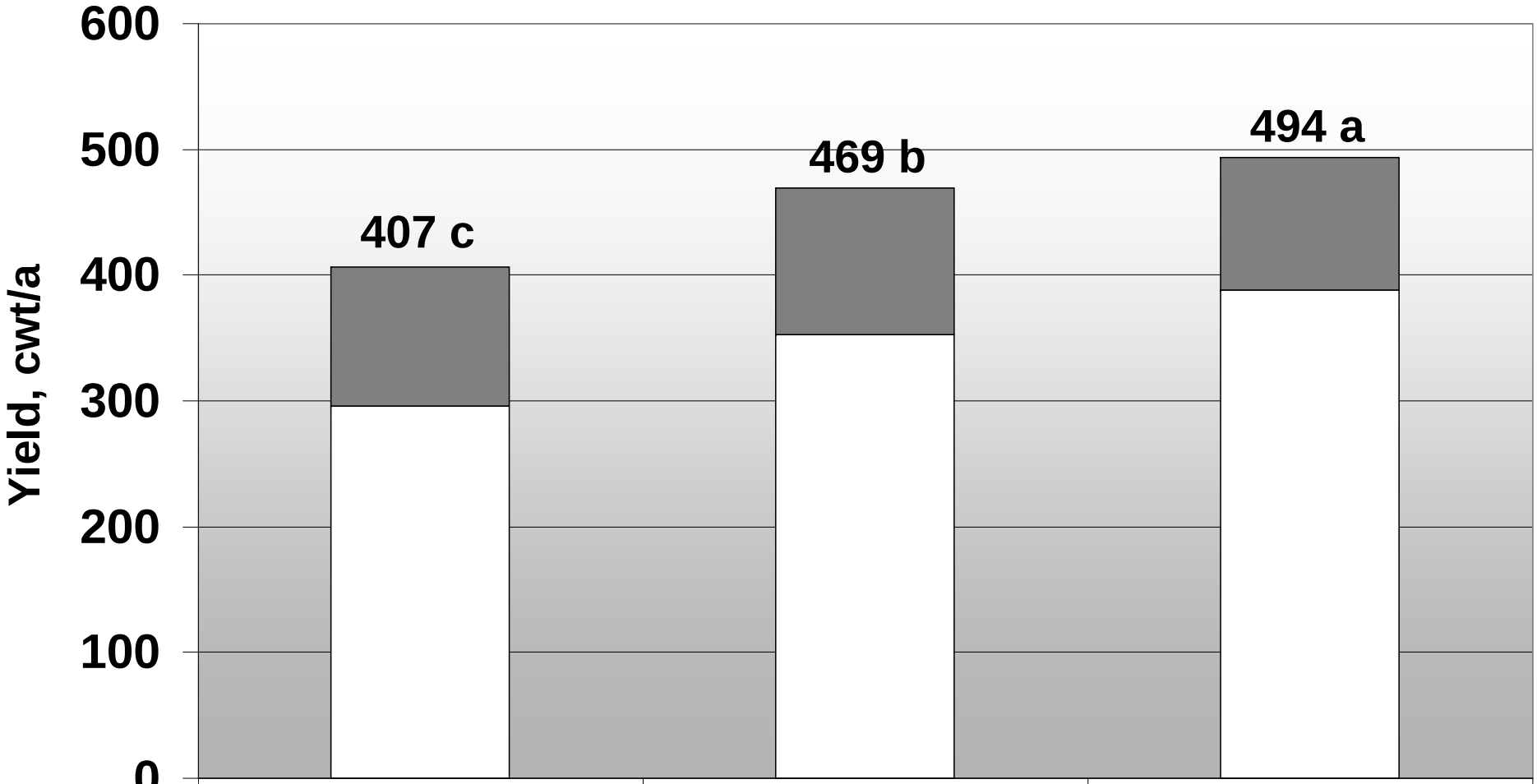
Spud Facts

- Seed is not a “true seed”, but rather small, whole tuber or larger cut tubers.
  - ideally seed is ~2 ounces each, which contains (lb/ac)
    - 40-50 N
    - 4-6 P_2O_5
    - 40-50 K_2O
    - 3-5 S
    - 1-3 Ca & Mg
    - 0.2-0.4 Fe
    - <0.04 Zn, Mn, Cu, & B

P Response

- Soil Test P = soils in Pacific Northwest are commonly medium-high or higher.
- Nevertheless, commonly get responses to both broadcast and banded P.

Phosphorus Band Trial: Potato Yield

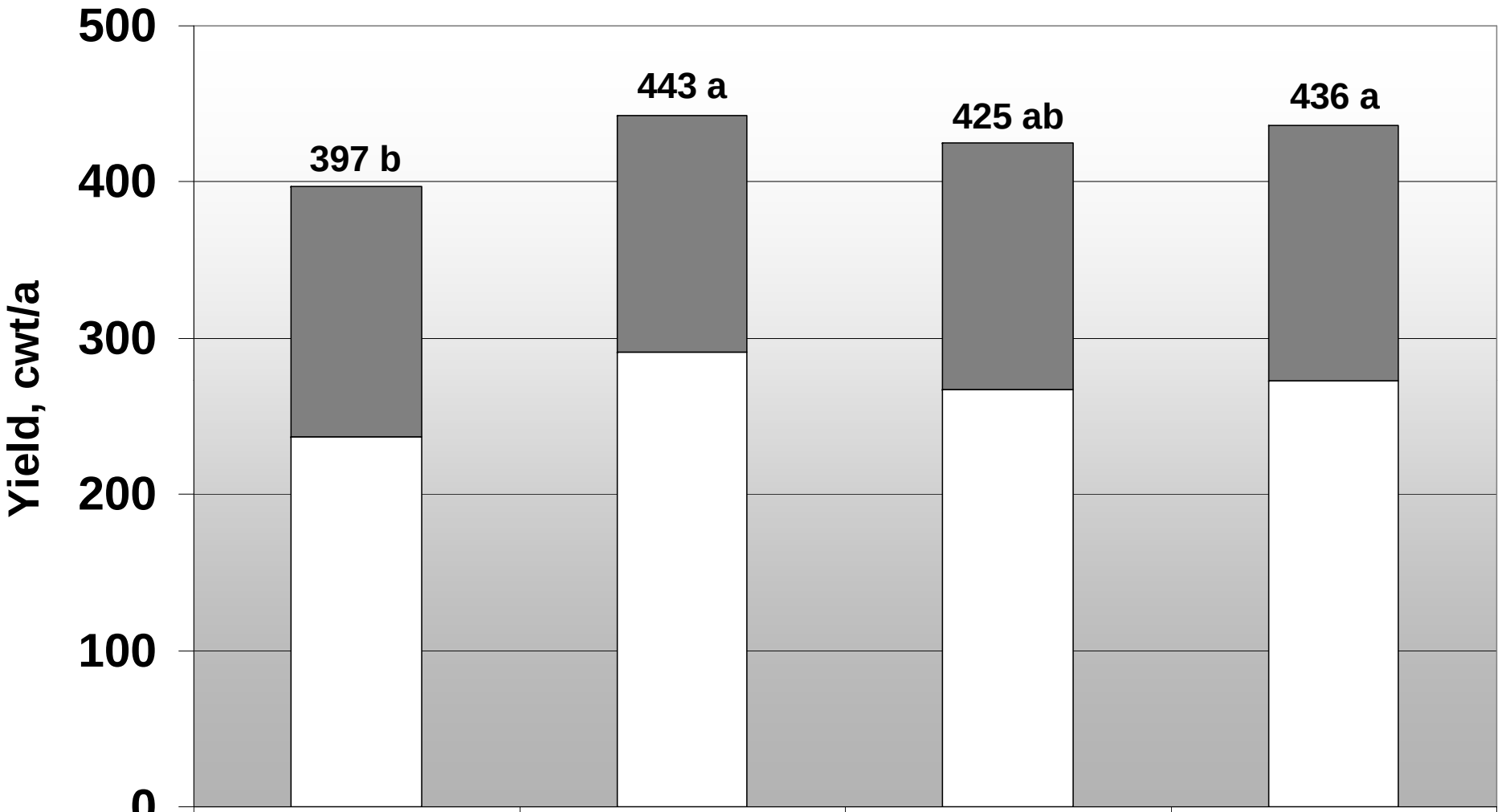


	Check (0 lb)	Broadcast P (200 lb)	Broadcast (200 lb) + Band (40 lb)
Other	111	116	106
US No. 1	296 c	353 b	388 a

P Response

- Soil Test P = soils in Pacific Northwest are commonly medium-high or higher.
- Nevertheless, commonly get responses to both broadcast and banded P.
- Growers commonly have petiole samples taken to

Phosphorus Timing 2002-4: Potato Yield

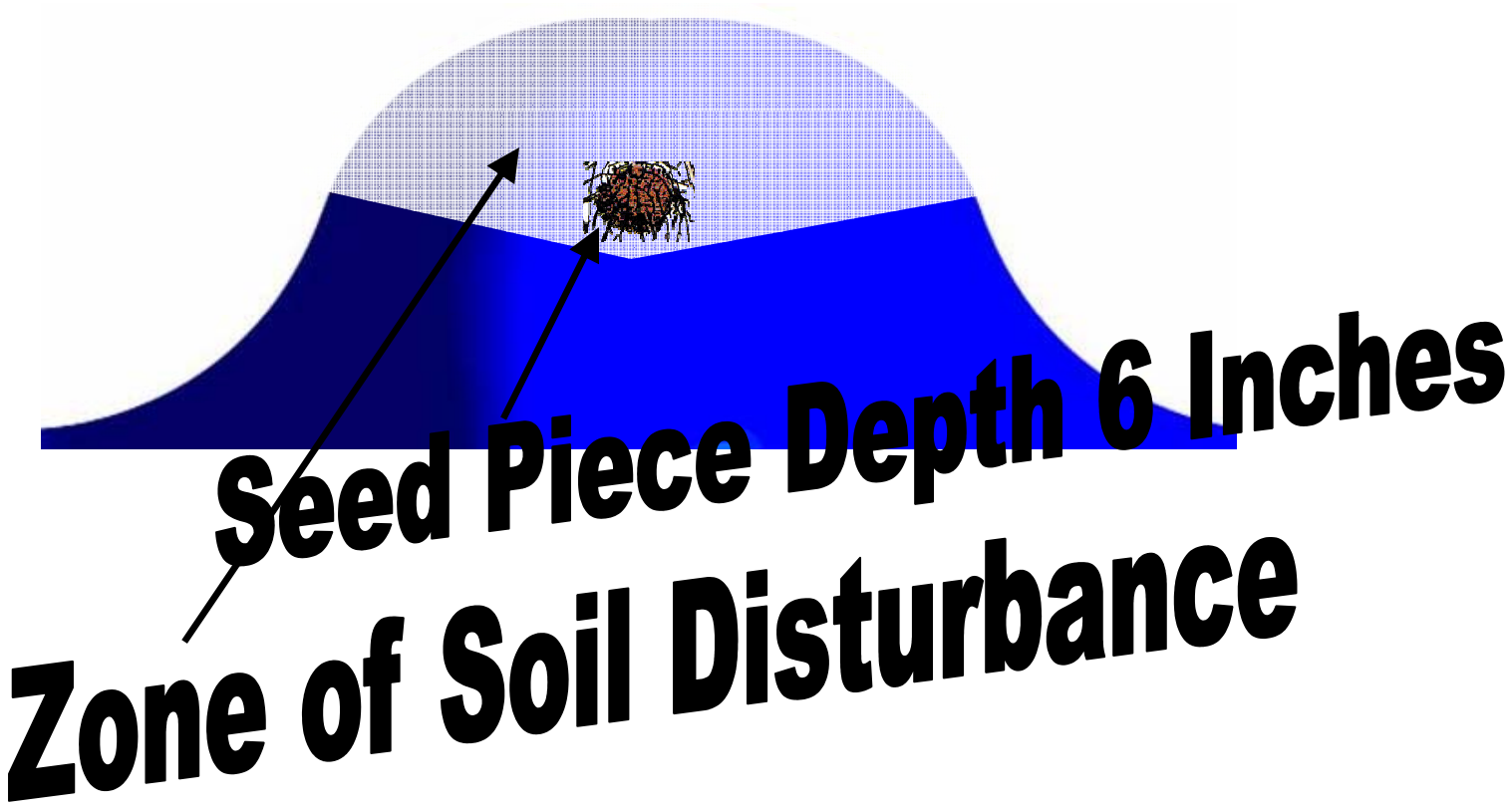


	check	pre-plant	water-run	split apply
Other	160	151	158	163
US No. 1	237 b	291 a	267 ab	273 a

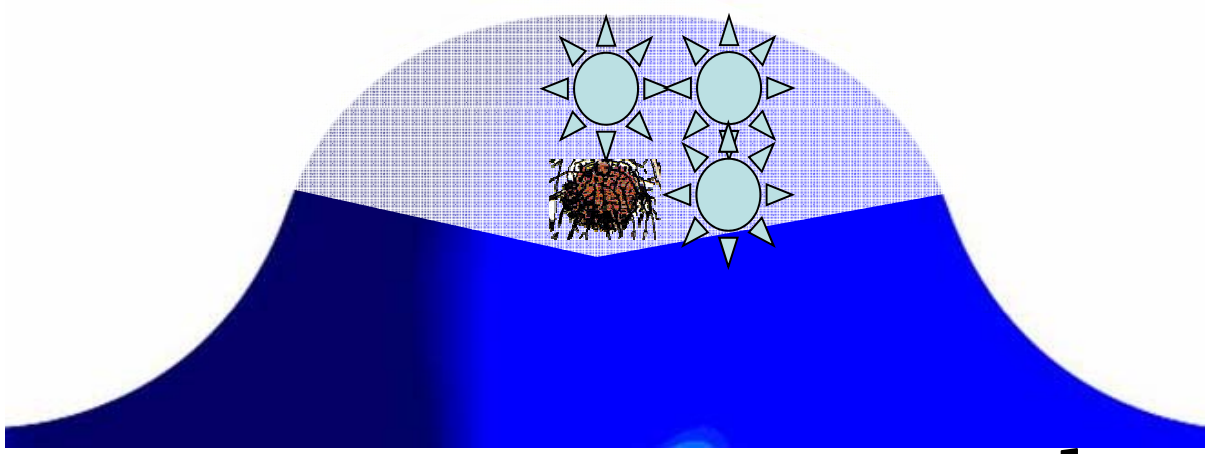
Question

- Growers and Custom applicators tend to place banded fertilizer shallow (fuel & time savings; less rocks)
  - Results in significant band disturbance at planting.
- What is the optimum fertilizer band placement?

Fertilizer Band Disturbance with Planting

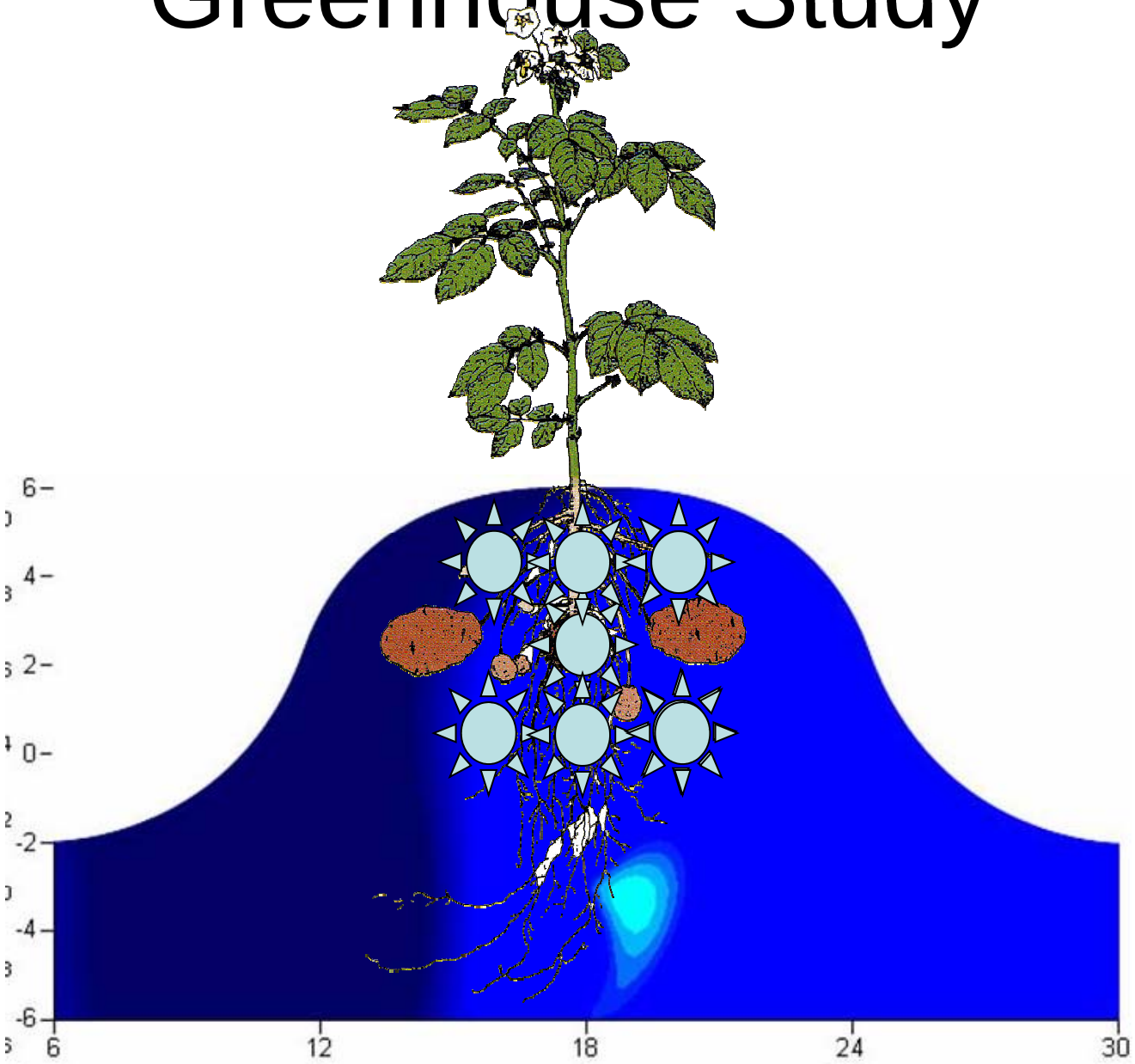


Fertilizer Band Disturbance with Planting



Common Fertilizer Band Locations

Fertilizer Band Placement: Greenhouse Study



Results: Greenhouse Study

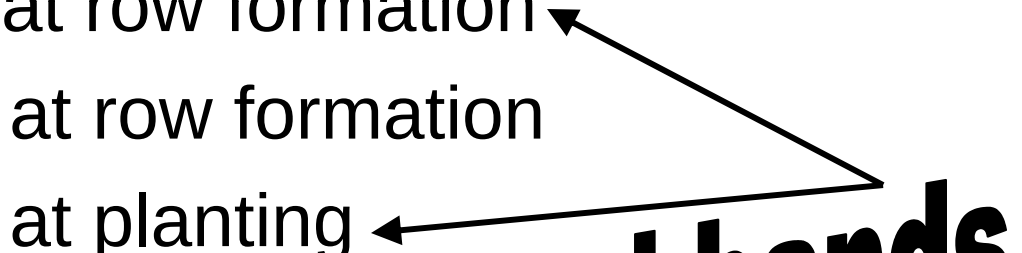
- Hoping to use the results of the greenhouse study to select a reduced number of field treatments.
- However, there were no differences in any measured parameter (stem number, stem height, vine vigor, leaf/vine dry matter, root dry matter, nutrient concentrations).

Materials and Methods: Field

- Single field locations each year
  - Blackfoot (2005)
  - Aberdeen (2006 & 2007)
  - Both locations = calcareous sandy loam
- RCBD with 5 replicates
- 12 feet wide (4 rows) x 40 foot length
- *Russet Burbank* cultivar

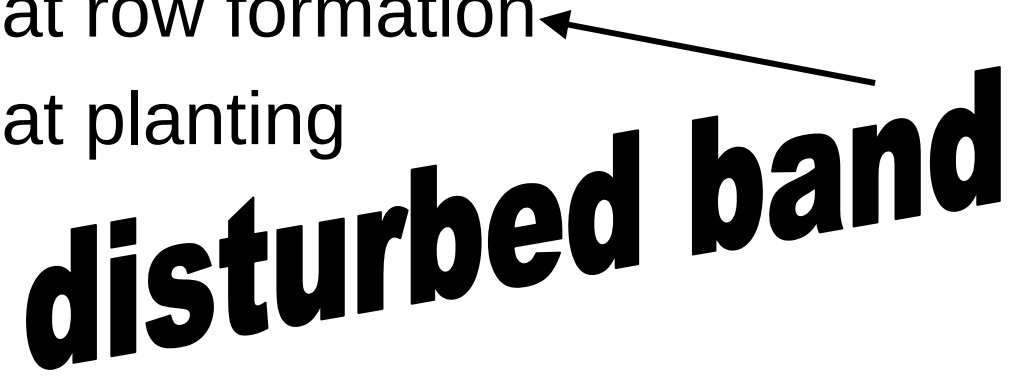
Materials and Methods: Field

- 4 fertilizer treatments
  - check (no banded fertilizer)
  - 3 x 3 below at row formation
  - 3 x 3 above at row formation
  - 3 x 3 above at planting

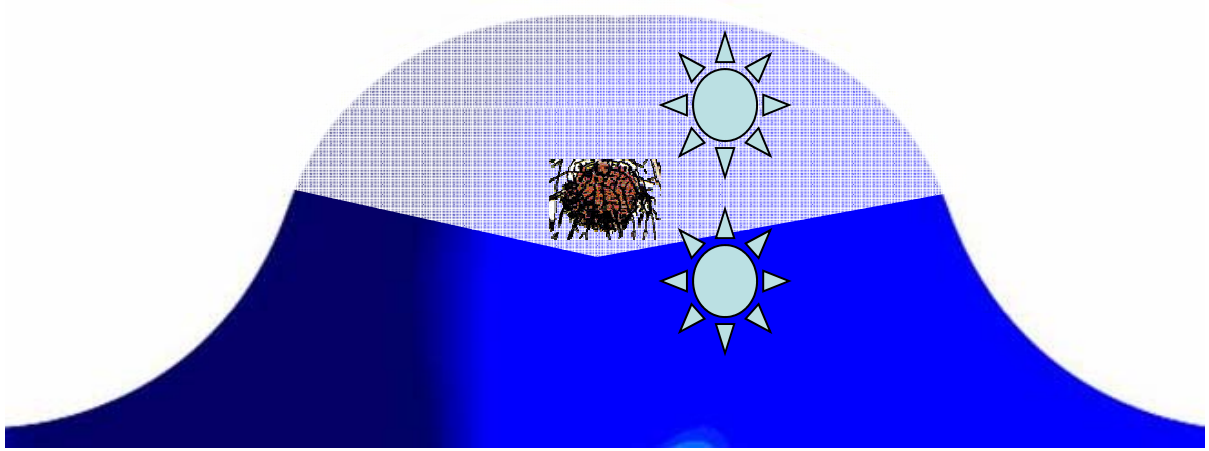


Materials and Methods: Field Study

- 4 fertilizer treatments
  - check (no banded fertilizer)
  - 3 x 3 below at row formation
  - 3 x 3 above at row formation
  - 3 x 3 above at planting



Fertilizer Band Placement: Field Study



Materials and Methods: Field Study

- Same rates as greenhouse study
  - 24 N, 80 P_2O_5, 15 K_2O, 11 S, 1 Zn, 1 Mn, 0.2 B lb/a
    - 20 gal/a 10-34-0
    - 5 gal/a 0-0-25-17S
    - 1 gal/a micro solution (0-0-0-10Zn-10Mn-2B)

Materials and Methods: Field

- Broadcast rates for all plots
  - ~ 60-150-100-50S

Bookmark

- Contents
- Index
- Preface
- Title Page, Cre
- User Guide

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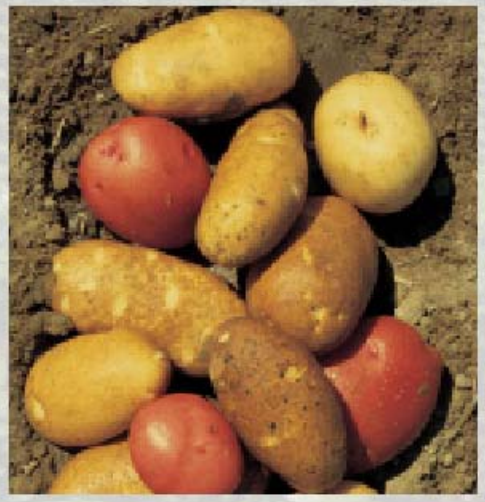
POTATO PRODUCTION *Systems*



UI Phosphorus Fertilizer Rec. (p.128)

TABLE 8.4. *Phosphorus fertilizer recommendations for Russet Burbank potatoes.*

Soil test P (0- to 12-inch depth) (ppm)	% free lime 0	4	8	12
0	320	360	400	440
5	240	280	320	360
10	160	200	240	280
15	80	120	160	200
20	0	40	80	120
25	0	0	0	40
30	0	0	0	0

Apply an additional 40 to 80 lb P_2O_5/acre as a starter at planting for soil test P levels below 30 ppm.

Add 25 lb P_2O_5/acre for each additional 100 cwt/acre above 400 cwt/acre.

UI Recommendations (lb-P_2O_5/a):

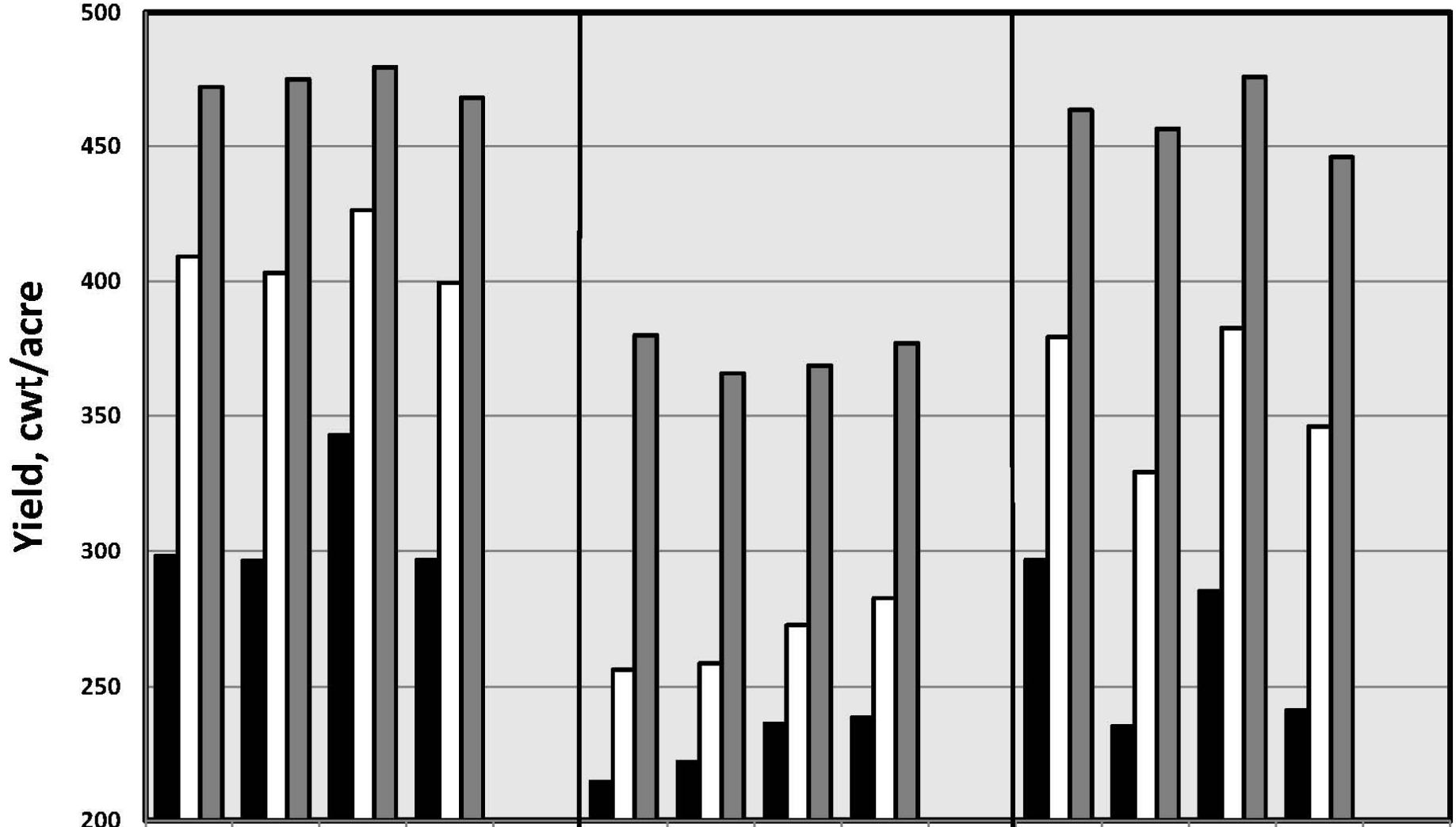
8 ppm Bicarb P & 4% excess lime
= 230 lb/a + band of 40-80 lb/a

(we applied 150 lb/a in this study)

Materials and Methods: Field

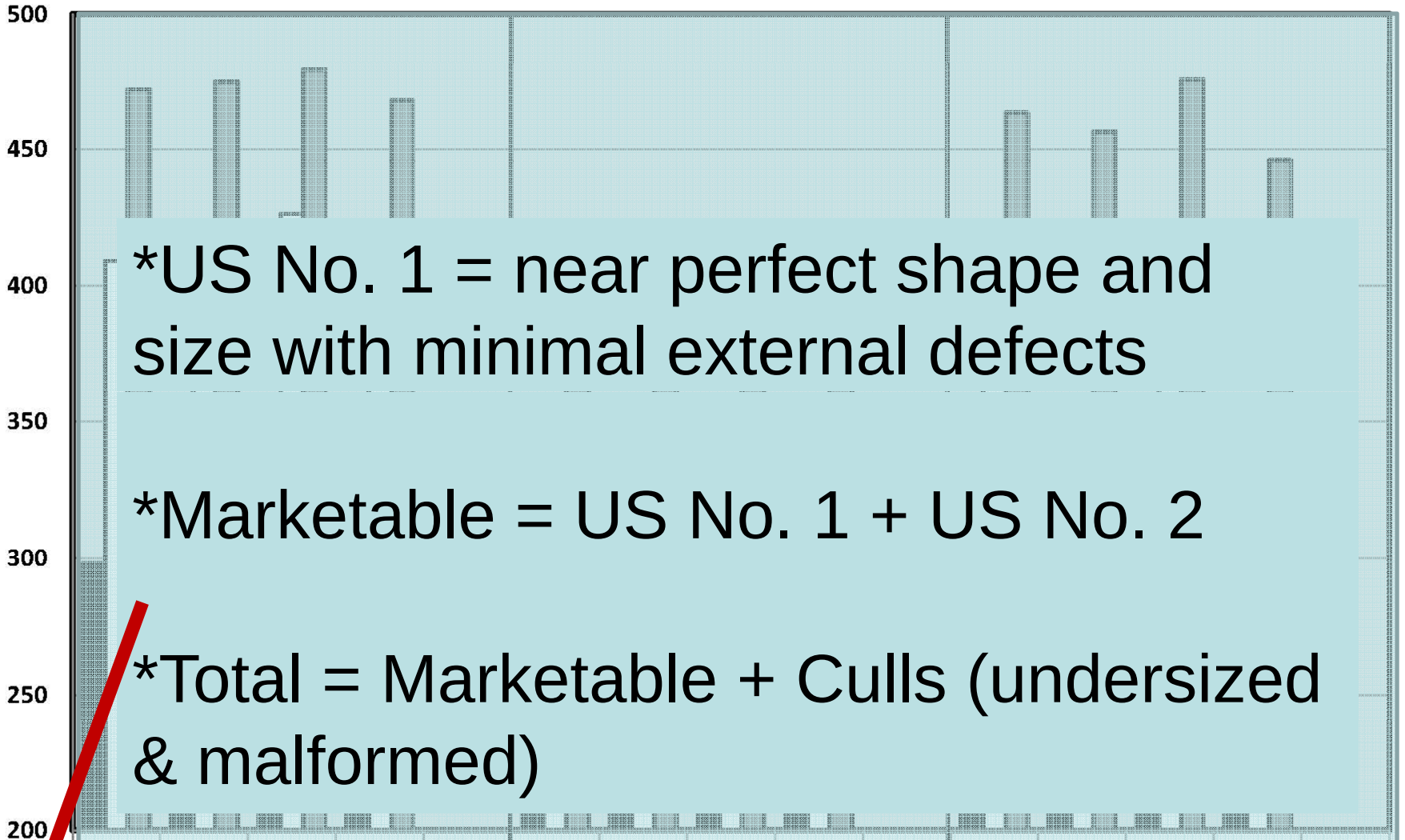
- Broadcast rates for all plots
  - 60-150-100-50S
- In-season rates for all plots (based on petiole analysis)
  - ~ 100-0-0
- Harvest: grade, size, shape, specific gravity, internal/external defects
  - – 20 feet from middle of center two rows

Russet Burbank Potato: Fertilizer Band Placement 2005-2007



	UTC 05	MS 05	MD 05	PS 05	LSD 05 (0.10)	UTC 06	MS 06	MD 06	PS 06	LSD 06 (0.10)	UTC 07	MS 07	MD 07	PS 07	LSD 07 (0.10)
US No. 1	298	296	343	297	39	214	222	236	238	NS	297	235	285	241	48
marketable	409	403	427	399	NS	256	259	273	283	26	380	329	383	346	47
total	472	475	479	468	NS	380	366	369	377	NS	463	457	476	446	NS

Russet Burbank Potato: Fertilizer Band Placement 2005-2007



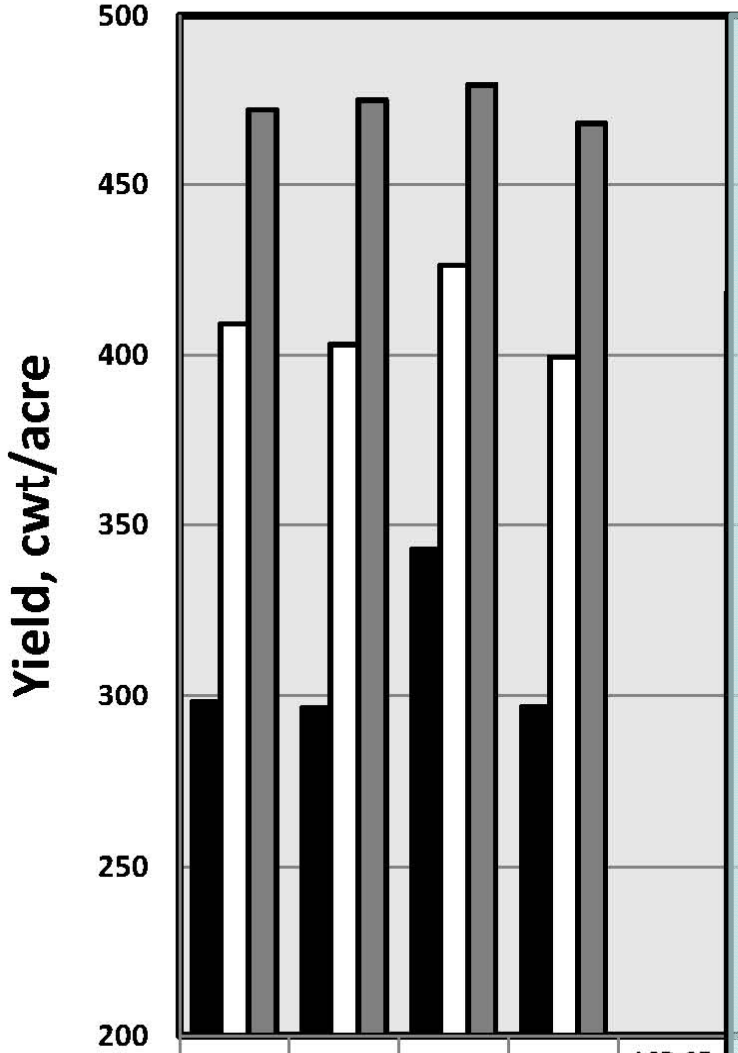
*US No. 1 = near perfect shape and size with minimal external defects

*Marketable = US No. 1 + US No. 2

*Total = Marketable + Culls (undersized & malformed)

	UTC 05	MS 05	MD 05	PS 05	LSD 05 (0.10)	UTC 06	MS 06	MD 06	PS 06	LSD 06 (0.10)	UTC 07	MS 07	MD 07	PS 07	LSD 07 (0.10)
US No. 1	298	296	343	297	39	214	222	236	238	NS	297	235	285	241	48
marketable	409	403	427	399	NS	256	259	273	283	26	380	329	383	346	47
total	472	475	479	468	NS	380	366	369	377	NS	463	457	476	446	NS

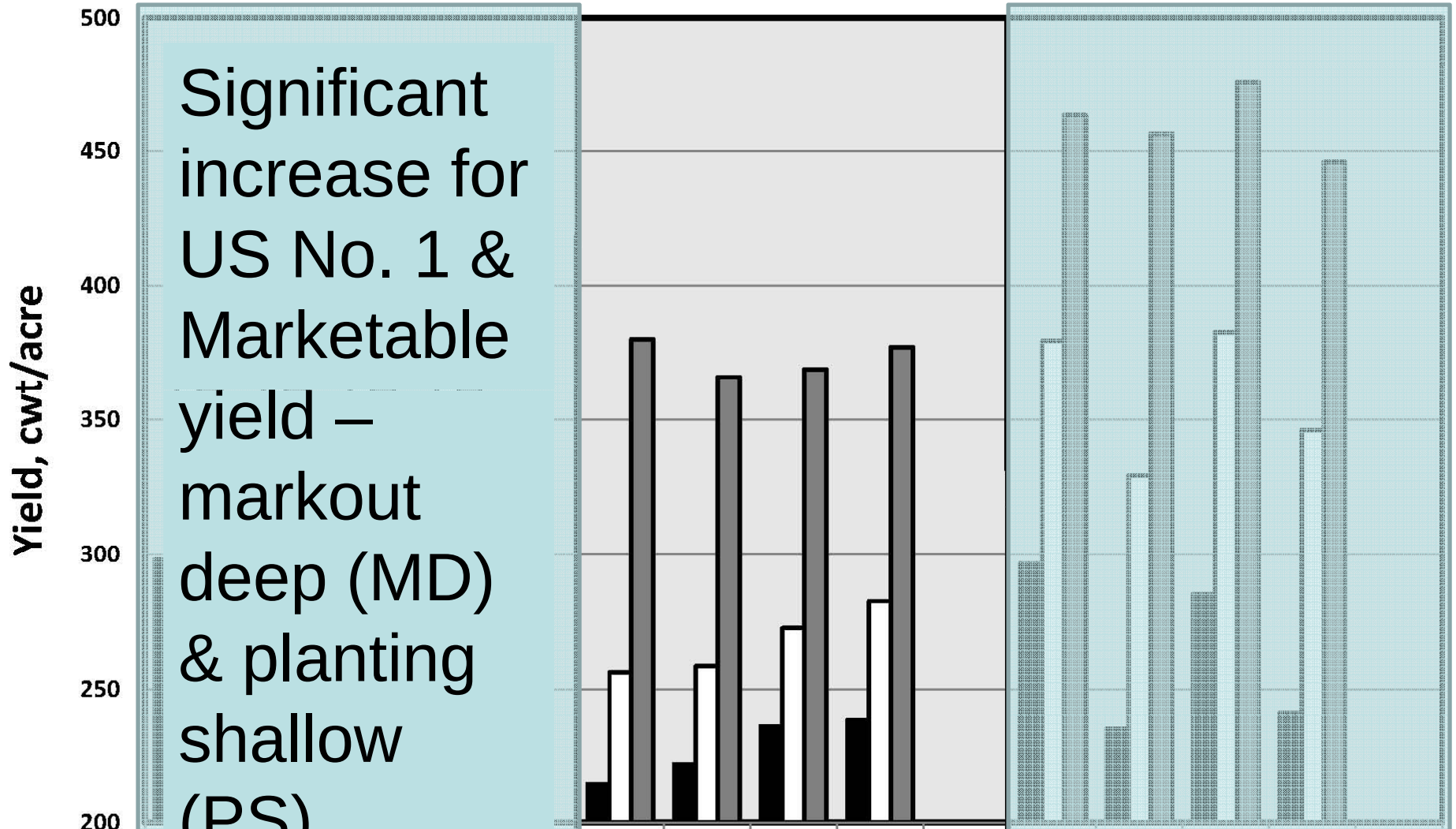
Russet Burbank Potato: Fertilizer Band Placement 2005-2007



Significant increase for US No. 1 & Marketable yield – deep application applied at markout (MD)

	UTC 05	MS 05	MD 05	PS 05	LSD 05 (0.10)	UTC 06	MS 06	MD 06	PS 06	LSD 06 (0.10)	UTC 07	MS 07	MD 07	PS 07	LSD 07 (0.10)
US No. 1	298	296	343	297	39	214	222	236	238	NS	297	235	285	241	48
marketable	409	403	427	399	NS	256	259	273	283	26	380	329	383	346	47
total	472	475	479	468	NS	380	366	369	377	NS	463	457	476	446	NS

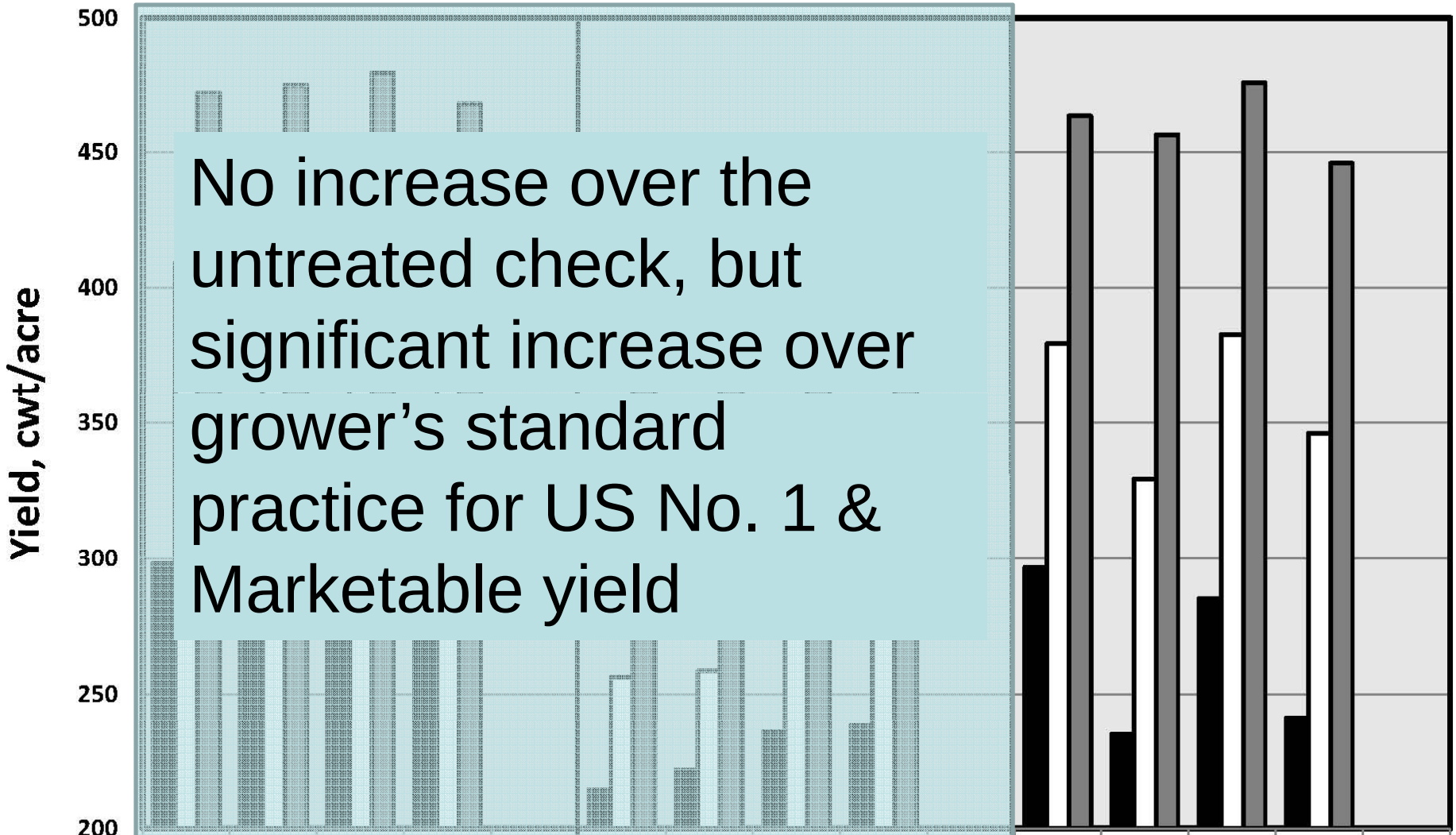
Russet Burbank Potato: Fertilizer Band Placement 2005-2007



Significant increase for US No. 1 & Marketable yield – markout deep (MD) & planting shallow (PS)

	UTC 06	MS 06	MD 06	PS 06	LSD 06 (0.10)	UTC 07	MS 07	MD 07	PS 07	LSD 07 (0.10)
US No. 1	214	222	236	238	NS	297	235	285	241	48
marketable	256	259	273	283	26	380	329	383	346	47
total	380	366	369	377	NS	463	457	476	446	NS

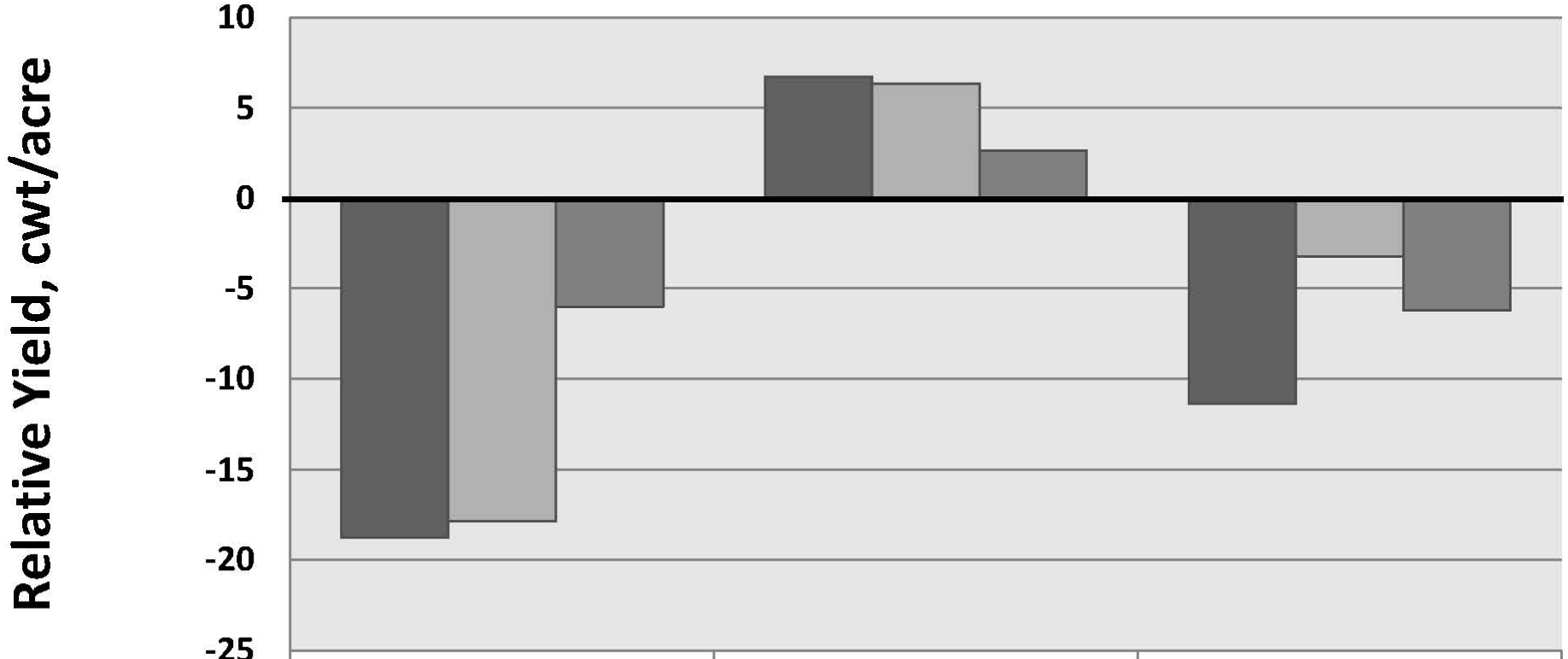
Russet Burbank Potato: Fertilizer Band Placement 2005-2007



No increase over the untreated check, but significant increase over grower's standard practice for US No. 1 & Marketable yield

	UTC 05	MS 05	MD 05	PS 05	LSD 05 (0.10)	UTC 06	MS 06	MD 06	PS 06	LSD 06 (0.10)	UTC 07	MS 07	MD 07	PS 07	LSD 07 (0.10)
US No. 1	298	296	343	297	39	214	222	236	238	NS	297	235	285	241	48
marketable	409	403	427	399	NS	256	259	273	283	26	380	329	383	346	47
total	472	475	479	468	NS	380	366	369	377	NS	463	457	476	446	NS

Russet Burbank Potato Yield Increase/Decrease for Fertilizer Banding Trials 2005-2007



	at row formation shallow	at row formation deep	at planting shallow
US No. 1	-19	7	-11
marketable	-18	6	-3
total	-6	3	-6

Conclusions

- The results of the greenhouse trial make one wonder if potatoes need much of an early season nutrition boost, especially when considering the amount of nutrition found in the seed piece.

Conclusions

- When compared to the grower's standard practice, deep placement of banded fertilizer resulted in significant improvements over the grower's standard practice for . . .
  - US No. 1 yield (37 cwt/a; 7%)
  - Marketable yield (30 cwt/a)
  - Gross Crop Value ($179.82/a)
  - More tubers (16%)
- Slight (non-significant) decrease in size
- No impact on petiole nutrition, solids, or internal defects

Direction

- P – Zn – Mn interaction?

Questions?