

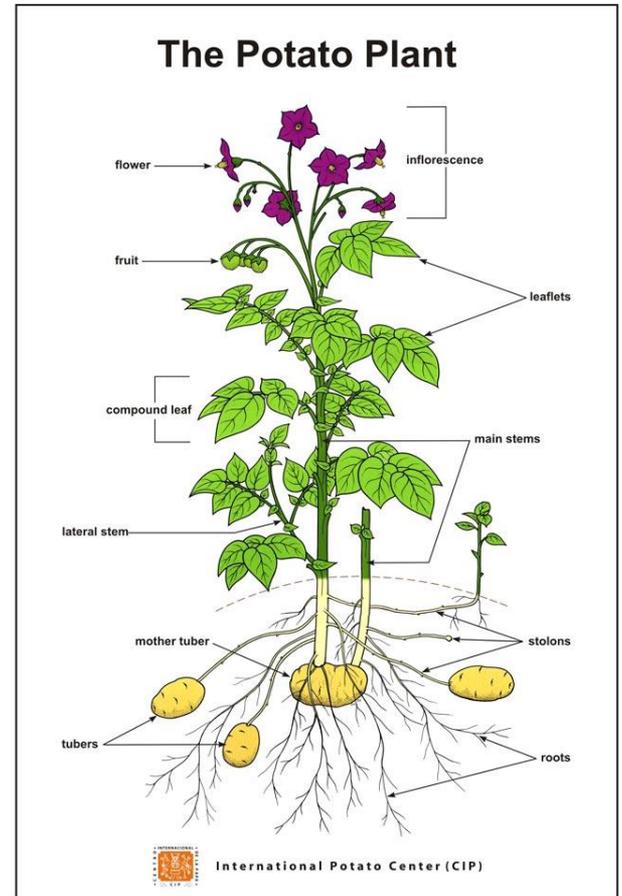
# Papa Criolla Potatoes - Introducing a South American Favorite to NM

- *Dr. Stephanie Walker*
- *Extension Vegetable Specialist*



# Introduction to Potatoes

- Potatoes are members of the Solanaceous family, closely related to chile peppers, tomatoes, and eggplant
- Grown for their tubers that are formed by the swelling of the terminal end of a stolon (technically rhizomes)
- Asexually propagated



# Planting Potatoes

- Use of seed potato most common for planting ('true seed' planting rare)
- Seed potato = small potatoes for planting, or potato piece with at least one eye between 1.5 – 2.5 oz
- Use of certified seed potatoes ensures healthy plants
- Use of store-bought potatoes for planting risky
  - potential treatment with sprout inhibitors
  - Diseases easily spread through asexually reproduced seed pieces



# Production Considerations

- Best temperature range for vine growth 68 – 77°F
- Vines emerging from soil can tolerate temperatures as low as 28°F
- Best temperature range for tuber development is 59 – 68°F
- At temperatures above 80°F, tubers do not grow and may reduce in size



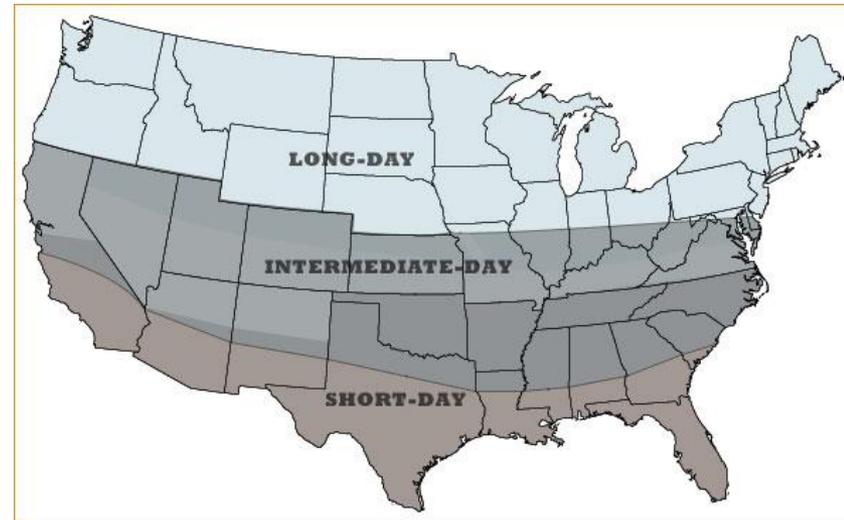
# Production Considerations

- Tuber formation occurs about 5-7 weeks after planting
- Tubers form at the end of stolons (modified stems) that are below the soil line
- Hilling (covering with soil) as the plants grow encourages tuber formation
- Loose, well-worked soil encourages tuber formation
- Optimum irrigation during tuber formation critical for good yield



# Critical Day Length (CDL)

- Tuber formation is dependent on critical day length (CDL)
- Tubers will develop only when the day length is less than the CDL for a particular potato variety
- Potatoes grown closer to the equator are short day varieties
- Varieties have been bred for long day growing areas
- **Papa criolla** potatoes tend to be short day varieties



# Potato Dormancy

- Dependent on growing conditions, variety, storage conditions
- Tubers will initiate sprouting at end of dormancy period; varieties with long dormancy allows for longer storage
- ‘Russet Burbank’ exhibits long dormancy
- In South America, **papa criolla** potatoes have been selected for very short dormancy so that they can be immediately planted after harvest



# Potato Greening

- Excessive exposure of tubers to sunlight causes 'greening'
- Tuber pieces with greening, potato sprouts, leaves, flowers and fruit have excessive levels of poisonous alkaloids – do not eat



# Potato Breeding

- Potatoes produce *perfect* flowers that contain both male (stamen) *and* female (pistil) parts
- Most commercial varieties are sterile and rarely produce viable seed; propagation is entirely asexual



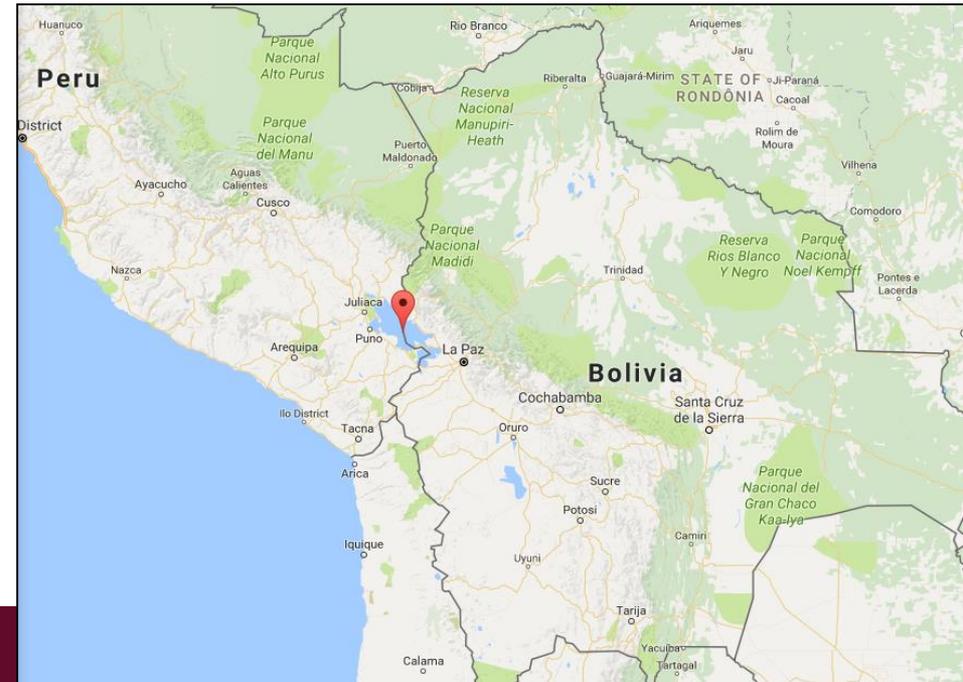
# Potato Berries

- The formation of ***potato berries*** indicates a variety with fertile flowers
  - Similar to small tomato fruit in appearance, but highly toxic!
- Breeders rely on lines with fertile flowers that produce viable seed



# Introduction to Potatoes

- First domesticated in area of southern border of Peru and western Bolivia at high elevations (12,500') in the Andes Mountain Range
- Important food source for indigenous populations for at least 10,000 years
- New world crop – one of the true treasures discovered by early European explorers



# Introduction to Potatoes

- Potatoes are 4<sup>th</sup> in worldwide consumption (following corn, wheat and rice)
- Most potatoes grown in US:
  - Genus species - *Solanum tuberosum*

-Most are white fleshed

-‘Russet Burbank’ variety has long dominated commercial production

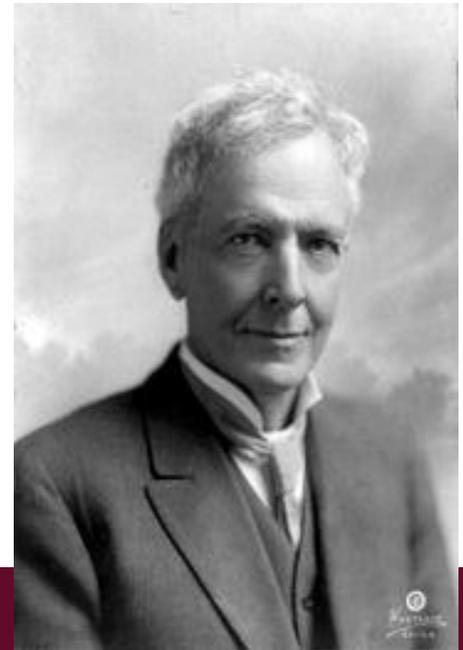


# 'Russet Burbank' Potato Variety

- Genus and species: *Solanum tuberosum* represents approx. 70% of processing potatoes
- Large tubers, russet skin and white flesh
- Popular because of high yield; good for long French fries; good storability
- Derived from 'true seed' line selected by plant breeder Luther Burbank



Luther Burbank (1849-1926)



# Nutritional Value of 'Russet Burbank'

- Excellent source of fiber, 3 g in one medium-sized potato
- Vitamin C, 45% of the recommended daily value
- Potassium (more potassium than bananas)
- ***White fleshed potatoes lack Vitamin A and carotenoids***



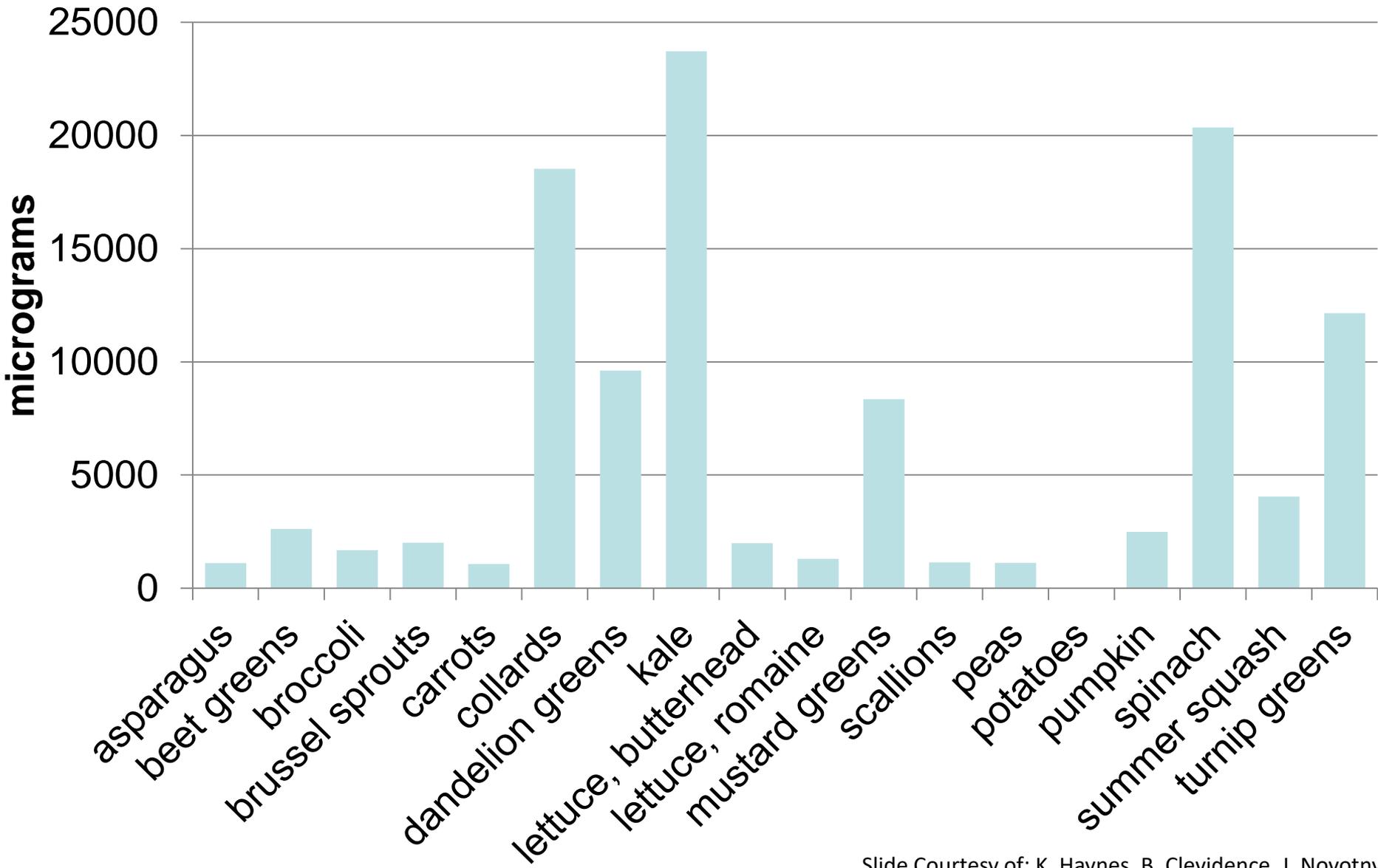
# Human Nutrition

- “Eat a colorful diet!”
- Fruits and vegetables are rich in carotenoids and other healthful pigmented compounds

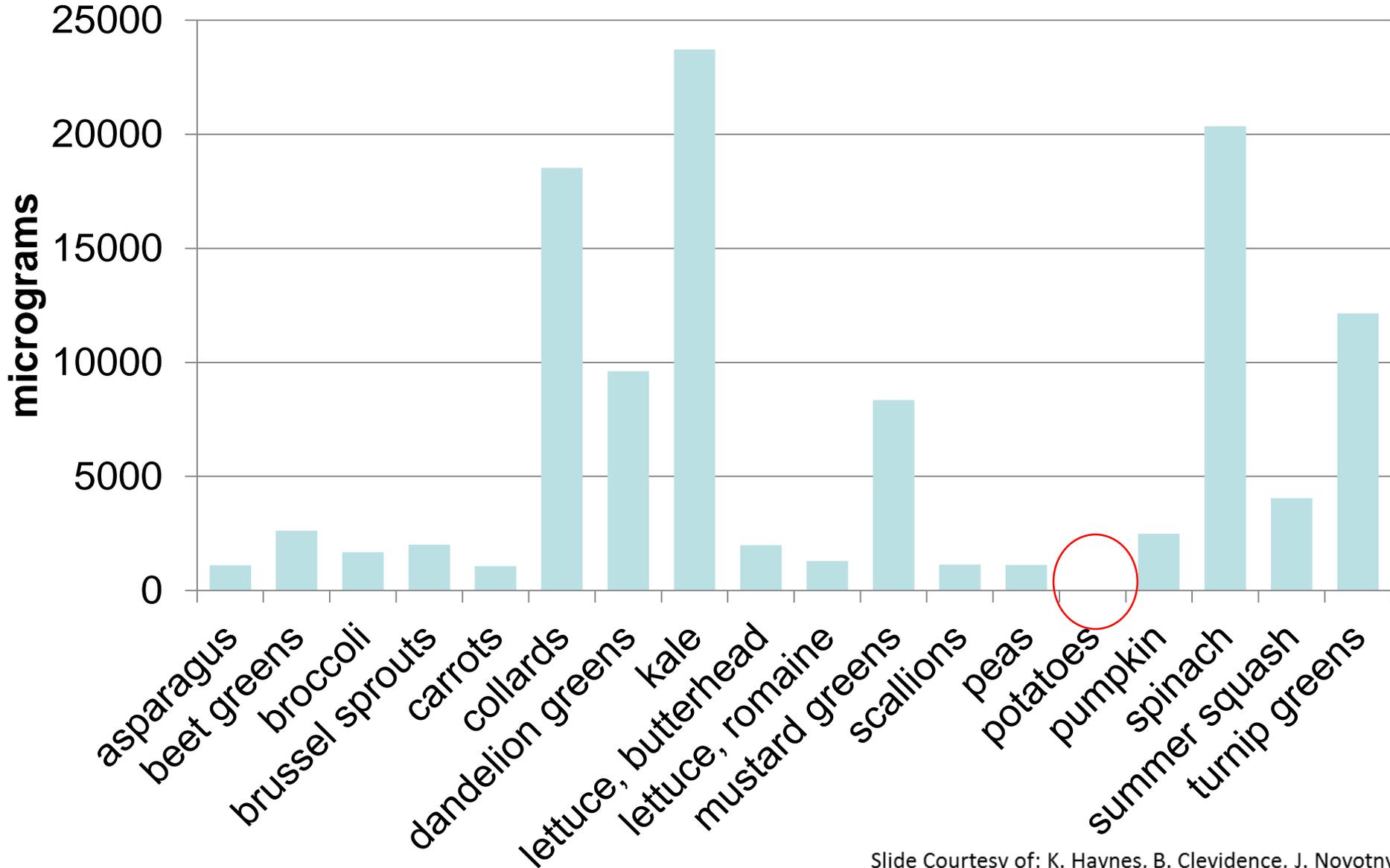




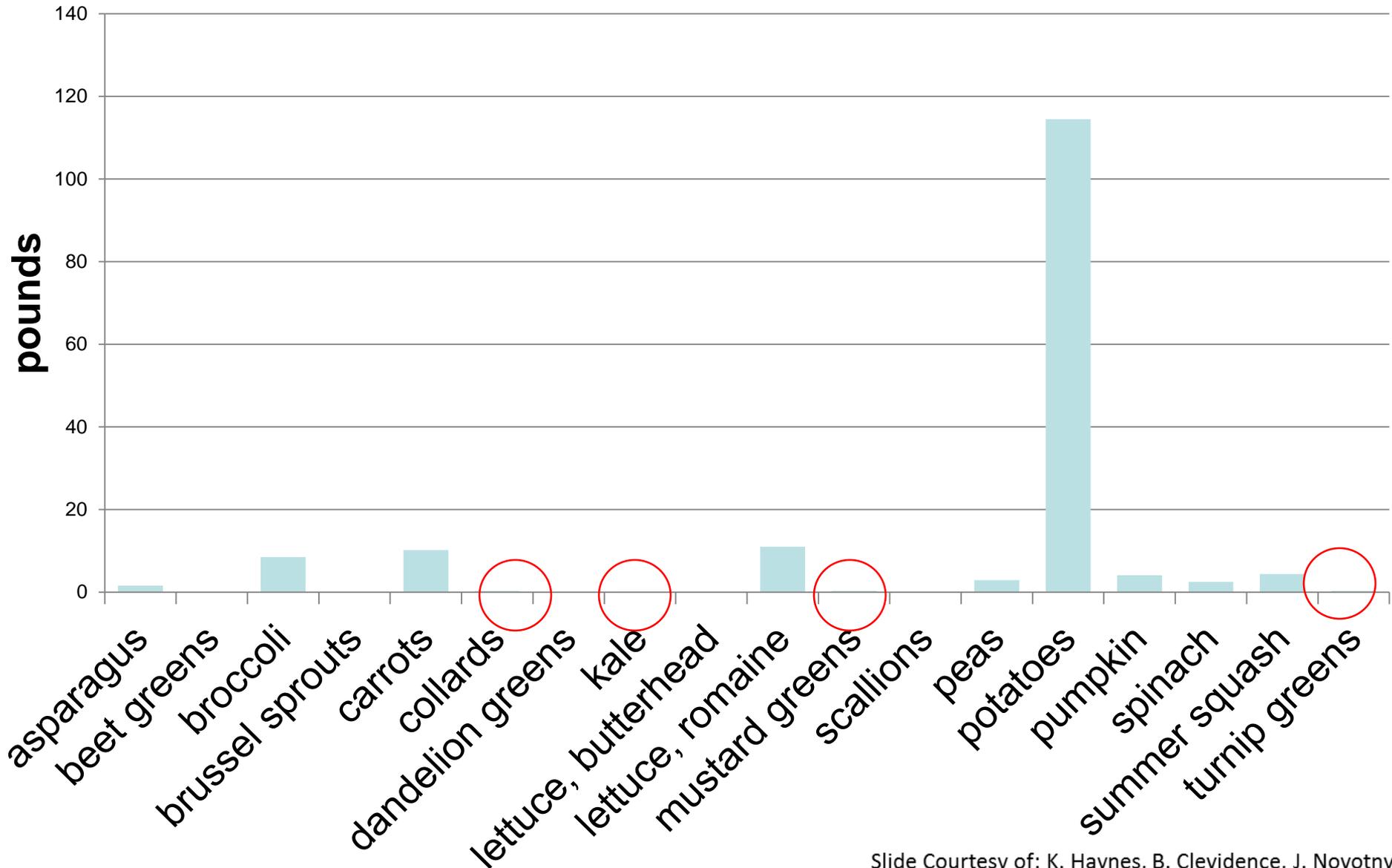
# Lutein + Zeaxanthin Content of 1 Cup Fresh, Boiled Vegetables



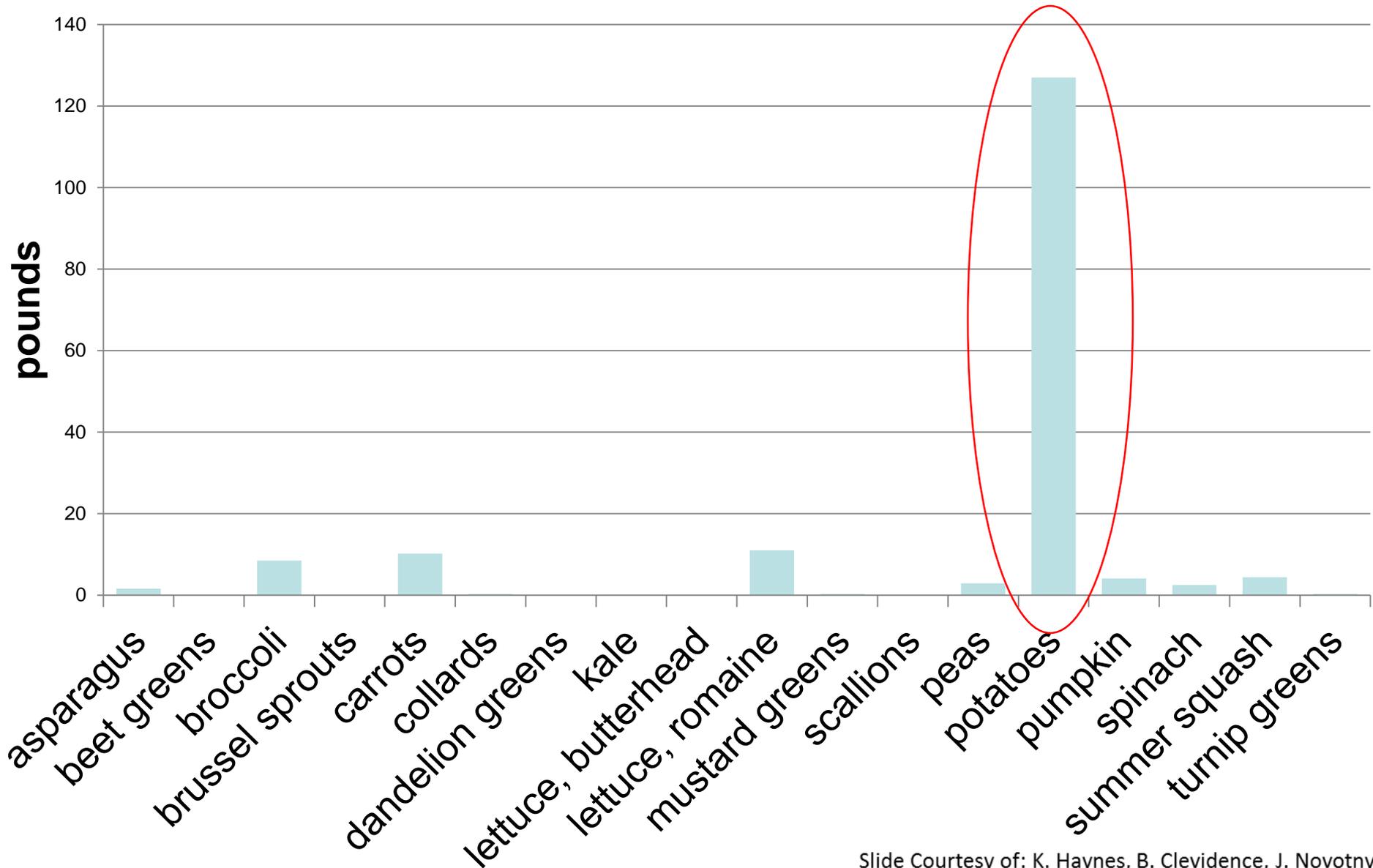
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# Annual Per Capita Consumption of Vegetables



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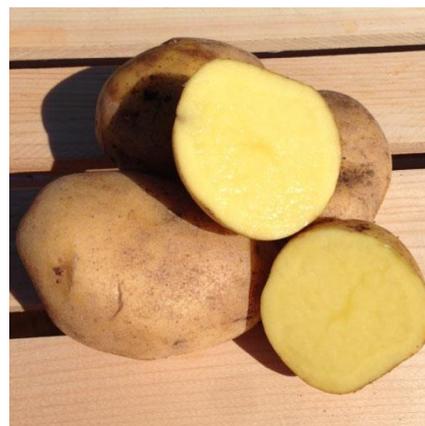
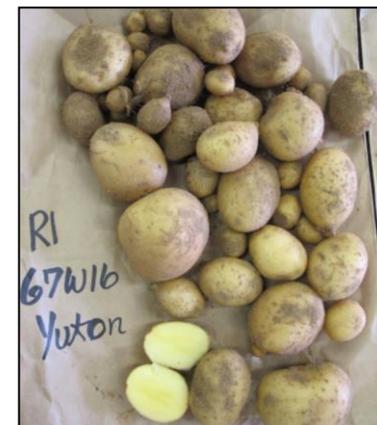
# 'Yukon Gold' Potato Variety

- Most widely grown yellow-fleshed potato in North America
- Round tubers with distinctive pink eyes, yellow skin and yellow flesh
- Widely adapted; great choice for novice potato growers
- Released in 1980 by Gary Johnston, Canadian potato breeding program, by crossing:  
    'Yema de huevo' (*Solanum phureja*)  
    X    'Norgleam' (*Solanum tuberosum*)



# Yellow-fleshed Potatoes

- 'Yukon Gold'
- 'Yellow Finn'
- 'Peter Wilcox'
- 'German Butterball'
- 'Bintje'



# Genetic Diversity of Potatoes

- Although *Solanum tuberosum* dominates production, estimate of 1,000 – 1,700 species of potatoes
- More than 4,500 potato varieties, mostly growing in the Andes Mountain region
- **Papa criolla potatoes** (*Solanum phureja* or *Solanum tuberosum* group *phureja*) are highly valued for their quality in South America



# Papa Criolla Potatoes (*S. phureja*)

- Closely related to *S. tuberosum* potatoes
- Preferred for quality in South America - virtually unknown in the US
- Smaller tubers (about golf ball size)
- Diploid plants (2 sets of chromosomes; most US commercial potatoes are tetraploids with 4 sets)
- Tuberize under short-day conditions
- Very short - or no - dormancy period
- Many with yellow to dark yellow flesh, indicating high **lutein** and **zeaxanthin** content

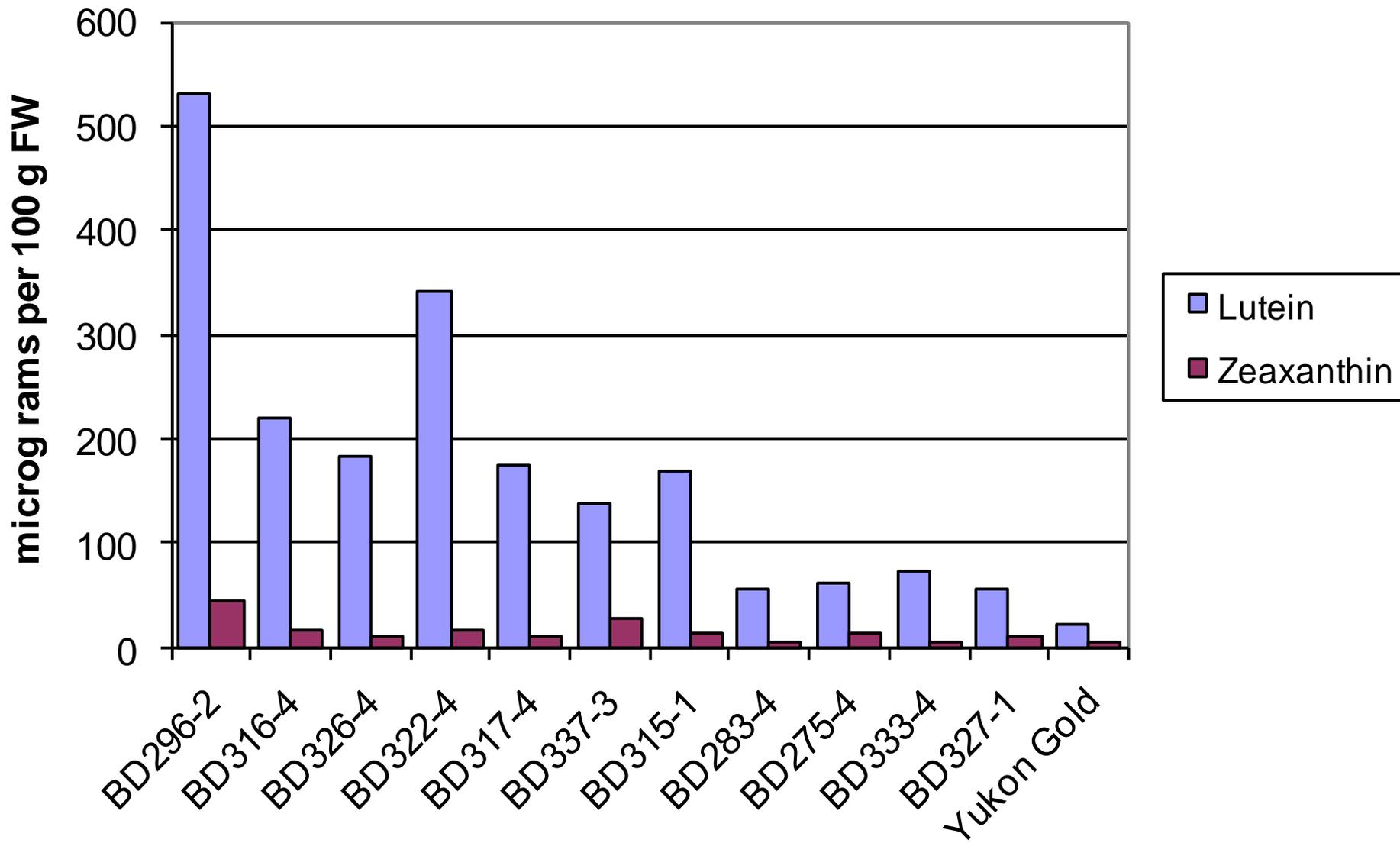


# Papa Criolla Project

- Led by Dr. Kathleen Haynes, USDA Potato Breeder; Co-PI, Dr. Lincoln Zotarelli at Univ. of Florida
- Obtained papa criolla germplasm from South American collaborators more than 20 years ago
- Long-term breeding efforts to select for high levels of carotenoids (dark yellow color); larger, uniform tubers; appropriate day length; longer dormancy



# Lutein and Zeaxanthin Content in Diploid Potatoes



# Papa Criolla Project in NM

- NM was invited to conduct trials of Dr. Haynes' advanced papa criolla lines in 2015
- Trials were conducted at the Los Lunas Agricultural Science Center (2015, 2016); the Leyendecker ASC (2016); and the Farmington ASC (2017)
- Objectives were to determine relative performance of the papa criollas and to identify best performing lines in NM
- ***Are the papa criolla potatoes a viable alternative crop for NM growers?***

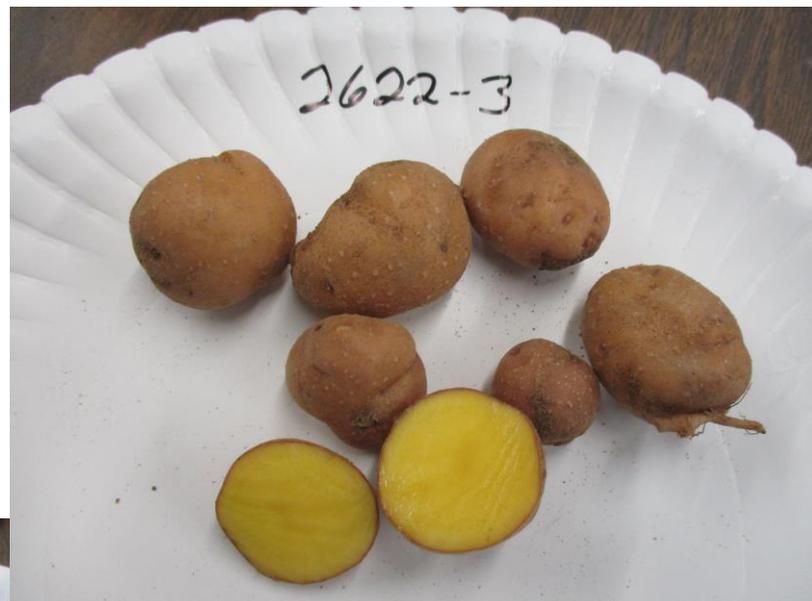


# Papa Criolla Project in NM

- Las Cruces and Los Lunas
  - Steep learning curve; potatoes were new crop for both Agricultural Science Centers
- Very low yields in Las Cruces (2016); crop was hurt by adverse soil conditions and heat
- Less than optimum yield and tuber size in Los Lunas (2015, 2016); some lines promising
  - Optimum crop timing, fertilization, and irrigation protocols need to be further investigated



- Papa Criolla Potatoes – Los Lunas



# Papa Criolla Potato Trials - Farmington

- Planted: April 25, 2017 and Harvested: September 11, 2017 (139 Days after planting)
- 173 breeding lines
- 6' plots
- 1' between plants
- Controls:
  - Peter Wilcox (stake #1235)
  - Yukon Gold (stake #1238)
- Measured:
  - Plot yield
  - Tuber characteristics

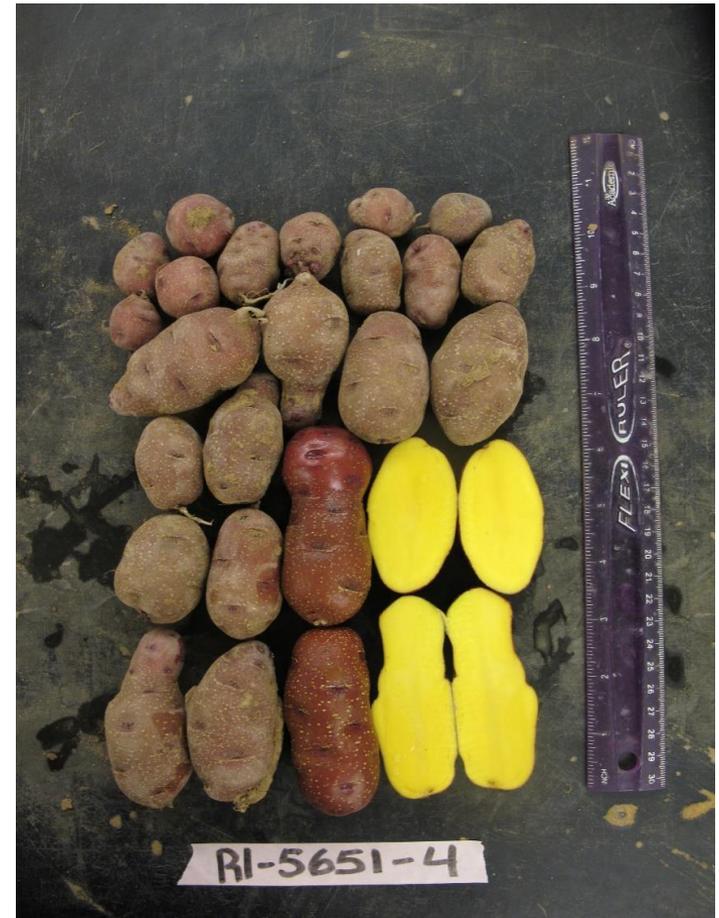
# Farmington Results: 2017 Top Ten Yielding Papa Criolla Varieties

Stake Number	Average Yield (kg per plot*)
3101	6.70
3151	6.37
3076	5.96
3102	5.80
3081	5.73
3093	5.62
3123	5.48
3002	5.47
1238**	5.46
3074	5.39

\* Plot = 1.16 m<sup>2</sup> (.76 m x 1.52 m) or 12.5 ft<sup>2</sup> (2.5 ft x 5 ft)

\*\* 1238 is Yukon Gold

# Results - Farmington 2017



# Results – Farmington 2017



# Results – Farmington 2017



# Results – Farmington 2017



# Summary & Observations

- The papa criolla potatoes perform well in areas that are also optimum for commercial *S. tuberosum* varieties; several lines provided higher yield than 'Yukon Gold'
- Production challenges will include harvest and dormancy; heat in southern NM
- Dr. Haynes is currently in the process of preparing the best performing papa criolla breeding lines for release to the public



# Acknowledgements

- NMDA Specialty Crop Block Grant Program
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- Valencia County Master Gardener volunteers
- Farmington, Los Lunas, and Leyendecker Agricultural Science Center (NMSU) personnel



# Thank you!

# Questions?

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