

Seed Certification 2025



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A NPC sanctioned effort to review current seed certification practices and procedures and make recommendations that could enhance the programs to ensure the U.S. potato industry has continued access to quality seed potatoes in an evolving farming environment

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Why Do We Care?

- Plants make up 80 percent of the food we eat, and produce 98 percent of the oxygen we breathe. Yet, they are under constant and increasing threat from pests and diseases.
- Every year, up to 40 percent of global food crops are lost to plant pests and diseases
- It all starts with the seed, its the financial driver for all businesses at the EXPO



Seed Certification 1913-2020

Yesterday



1913 – visual inspection of the crop for varietal purity
Later for disease incidence



Today



In the late 1990s laboratory assays (1970s technology) for disease detection were added to supplement visual inspections



Tomorrow?



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How do we adopt 2020 technology to modernize seed certification?



Seed Certification has been very successful at eliminating or controlling many biotic and abiotic problems that affect potato production, quality and trade.



Spindle tuber



Leafroll



Ring rot



Virus X



Variety mix



Chemical damage



Virus Y (old)

HOWEVER

Pathogens are emerging and changing creating new challenges for seed certification because of its reliance on visual inspection of the growing crop.

Several chronic diseases reduce seed quality and vigor but induce limited foliar symptoms, e.g. PVY (new), PMTV, TRV. **Some have gone undercover.**

Several acute diseases and physiological attributes limit production and crop quality, e.g. Dickeya, Verticillium, Zebra chip, physiological age.



Summer inspections estimate the health of the planted crop The post harvest test estimates the health of the crop that was harvested



Summer inspections will continue to provide valuable data on variety mix, physiological issues, and observable foliar disease issues.

But presently they **have limits in the ability to** identify, predict, or quantify issues in the harvested crop.

What new Post Harvest Testing will be developed.

High-Throughput Sequencing (HST) has the potential to allow Seed Certification programs to expand their evaluation of the crop to include more diseases and physiological attributes.

Process in under review by the National Plant Protection Organizations

Danger, It could detect non-viable organisms

Internationally harmonized approaches are required

Collaboration with other crops will be required



Can Potato Seed Certification benefit from Human Health diagnostic advancements

- It's already happened
 - AIDS virus in humans resulted in the need for new methods of testing the human population quickly for AIDS.
 - Enzyme Link Embodied Assay (ELISA) test for AIDS virus was applied
 - The process was quickly adapted and put into use for plants diagnostic
- Two customers of Sklarczyk Seed Farm have 100's of their lines electrophoresis annually for variety identification.
 - A few years ago it was considered too costly
- **WHATS NEXT???**
- 2007 Sequencing a human genome cost a million dollars \$1,000,000
- 2009 a company launched Personal Full Genome Sequencing, \$48,000 per genome
- 2019 price was \$500
- **How can Seed Potato Certification again benefit from new testing methods?**
- **What partnerships must be developed and with other crops?**
- **Could drones with heat sensors be used not only for inspection but to eliminate diseased plants???**



Outcomes desired: a Potato Industry Perspective

How seed certification can improve the commercial potato crop

- **Avoid introducing new diseases onto a farm – especially long-lived soil-borne pathogens**
 - Mop top virus – Powdery scab
 - Tobacco rattle virus – nematodes
- **Minimize cost of disease spreading from seed into the commercial crop**
 - Direct effect on daughter tubers
 - Indirect effect on crop productivity, e.g. Stand loss, Crop vigor reduction
- **Adopt new technologies to better ascertain risk or security of different seed lots**
- **Improve the value of commercial crops beyond disease - can this potential be realized?**

Seed is the most expensive input for the commercial crop – the more information a buyer has, the better.



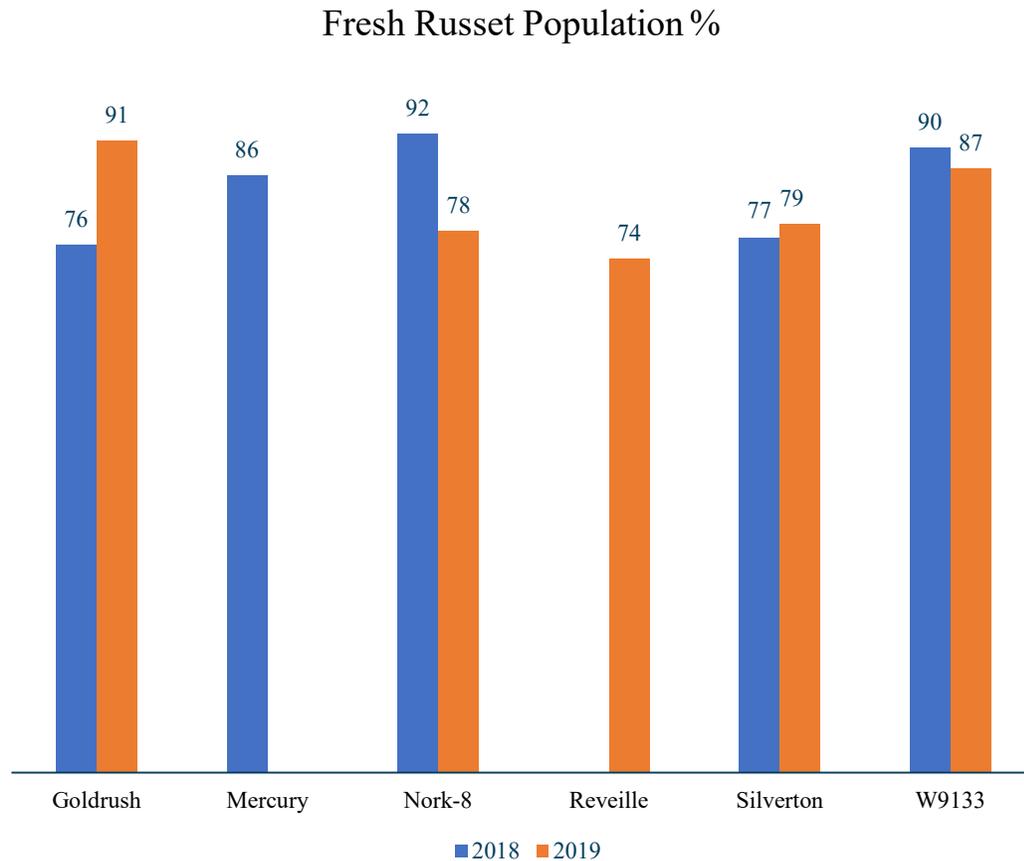
Direct effect on daughter tubers



- Transmission of bacterial pathogen from mother tuber to daughter tubers
 - *Dickeya dianthicola*
 - Does not persist in soil – transmitted from living tissue to living tissue
- Tubers decay prior to harvest
 - 5% infection can decrease yield 20%
 - 0.5% infection prior to cutting
- Storage impacts
 - Lowers recovery
 - Shelf-life reduction in fresh potatoes



Indirect effect on crop production



- Several pathogens can influence stand of subsequent crop
 - Fusarium spp.
 - Pectobacterium spp.
- Seed size
- Seed Dormancy
- Bud distribution on the seed



Maximizing Agronomic Potential of Seed

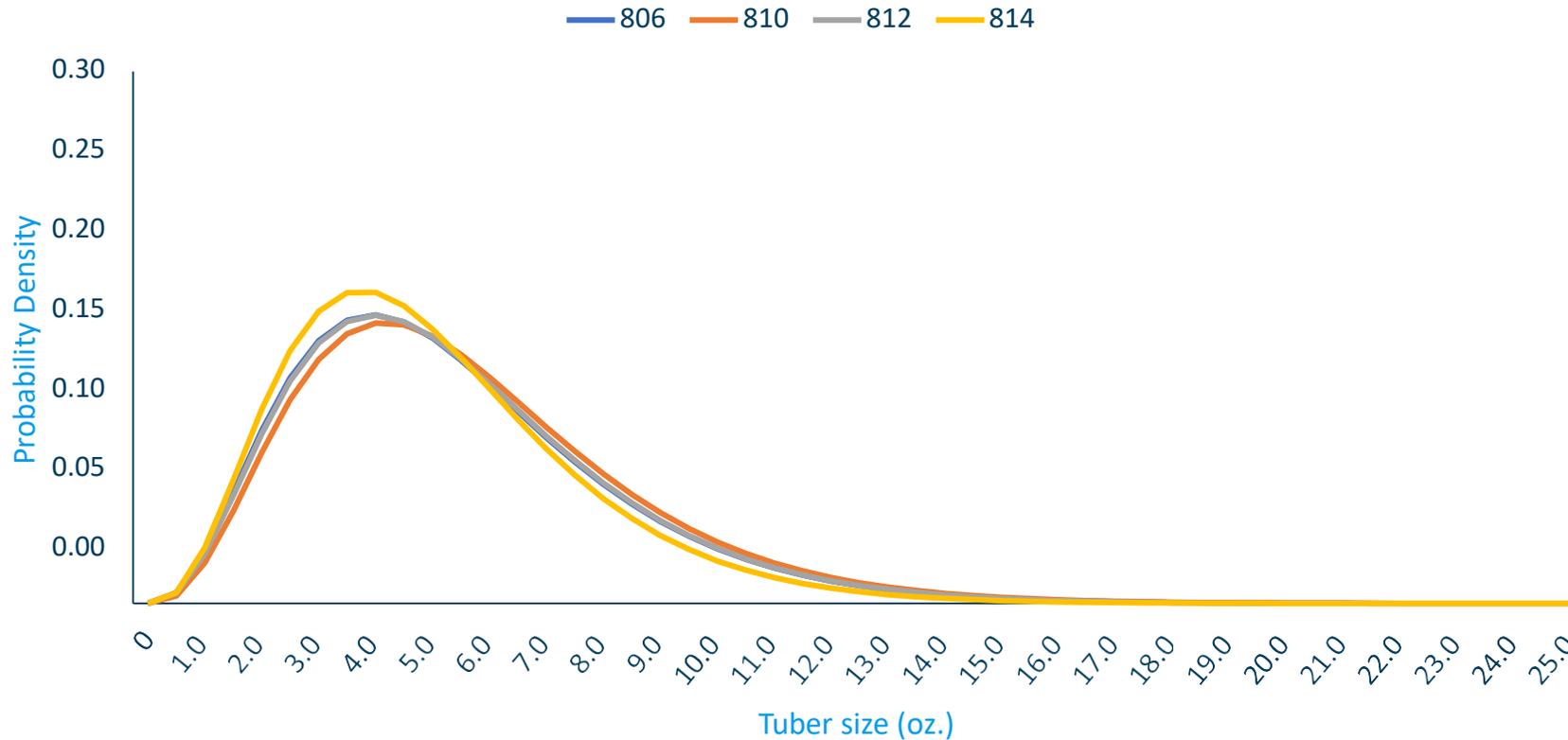
Once disease is managed

Potential involvement of seed certification?

- Manage the plant population
 - Emergence periodicity (summer inspection data)
 - Stem number (summer inspection data)
 - Tuber number
- Yield potential
 - Light interception
 - Plant uniformity (summer inspection data)
- Tight tuber size distribution (post harvest data?)
 - Influenced by yield, stem number, tuber number
 - Meet market demands/requirements
 - Minimize variation
 - Maximize value

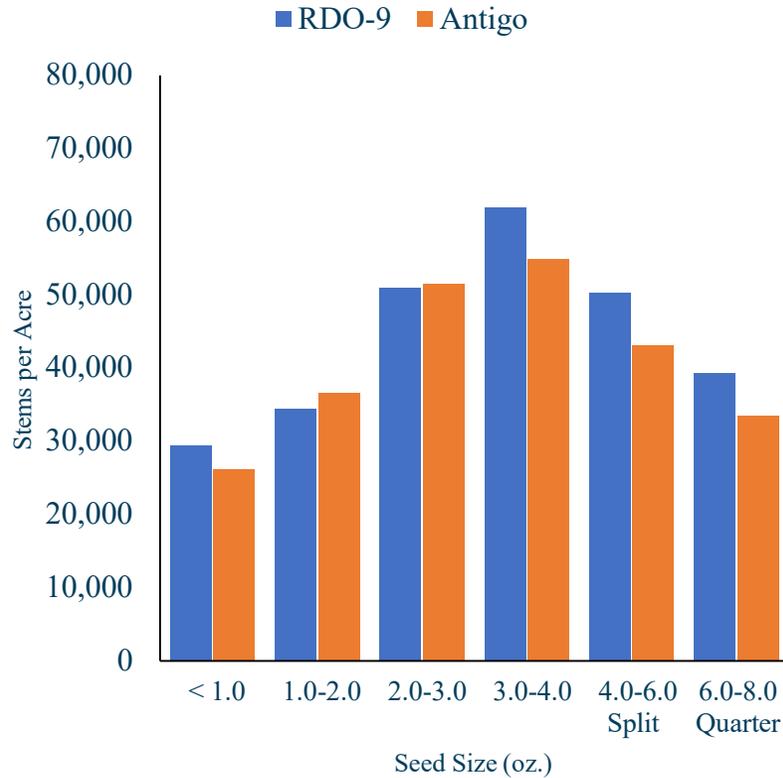


Managing Crop Value - Tuber Size Distribution

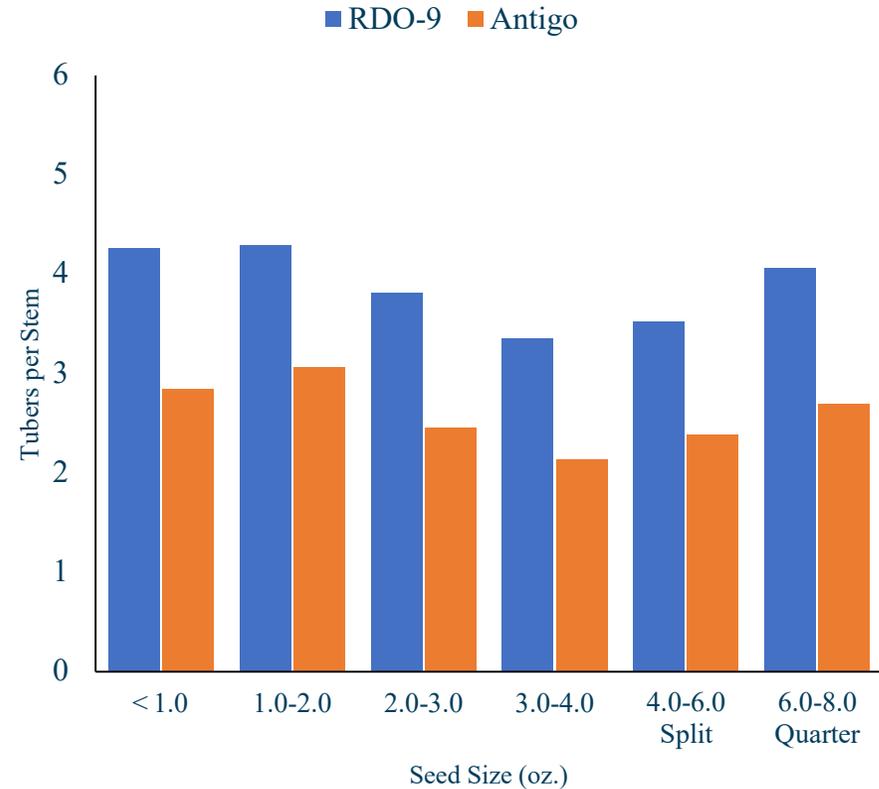


Stems per Acre as affected by Seed Size

2017 RPE Whole Seed Analysis:
Var A Stems per Acre by Seed Size

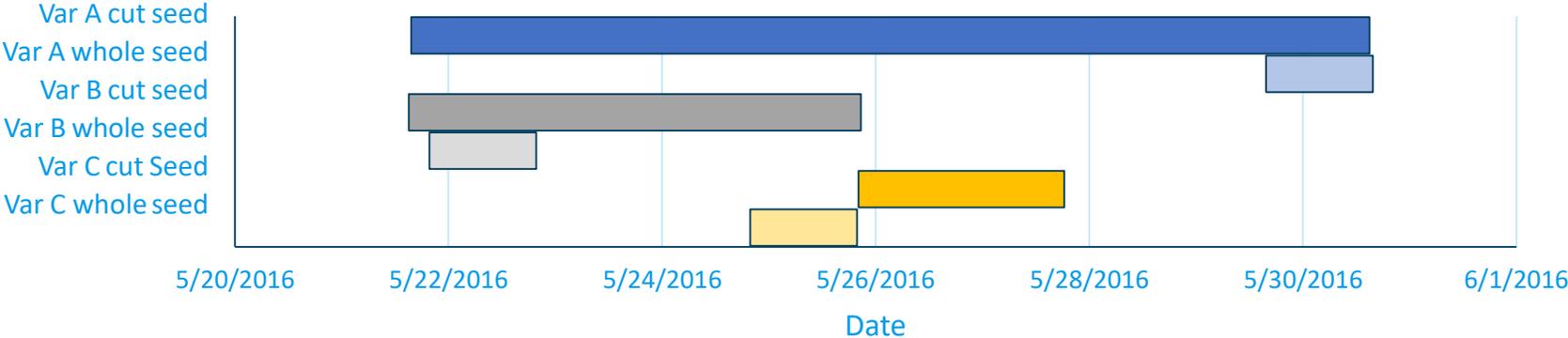


2017 RPE Whole Seed Analysis:
Var A Tubers per Stem by Seed Size



Improving Agronomic Performance through Seed

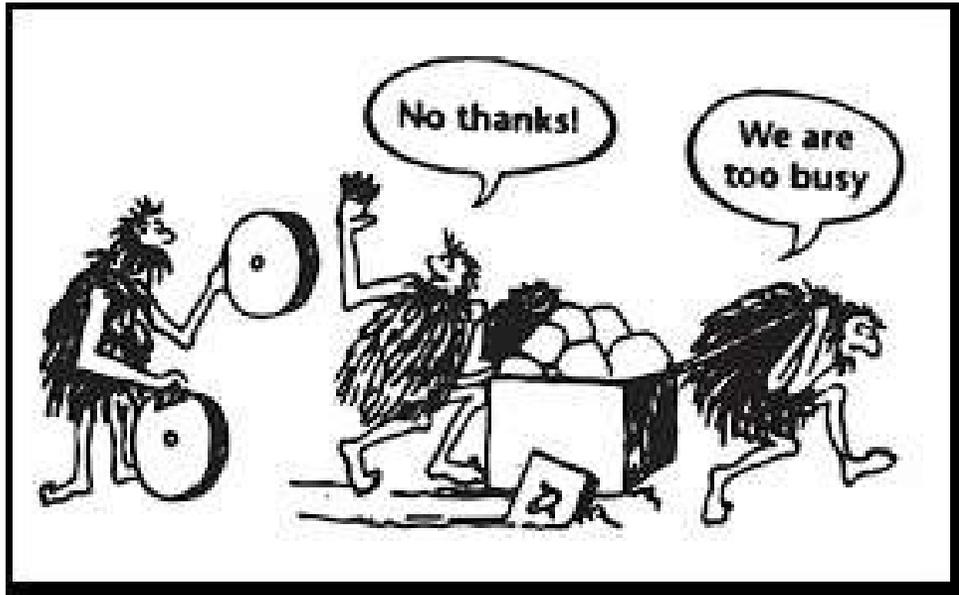
2016 Emergence Duration by Variety
Whole Seed vs. Cut Seed



| Variety | Seed | Average % Stand : Early Season | Average % Stand: Mid-Season |
|-----------|-------|--------------------------------|-----------------------------|
| Variety A | Cut | 88% | 75% |
| | Whole | 94% | 71% |
| Variety B | Cut | 82% | 93% |
| | Whole | 96% | 96% |
| Variety C | Cut | 82% | n/a |
| | Whole | 99% | n/a |



'You can't expect to see change if you never do anything differently.'



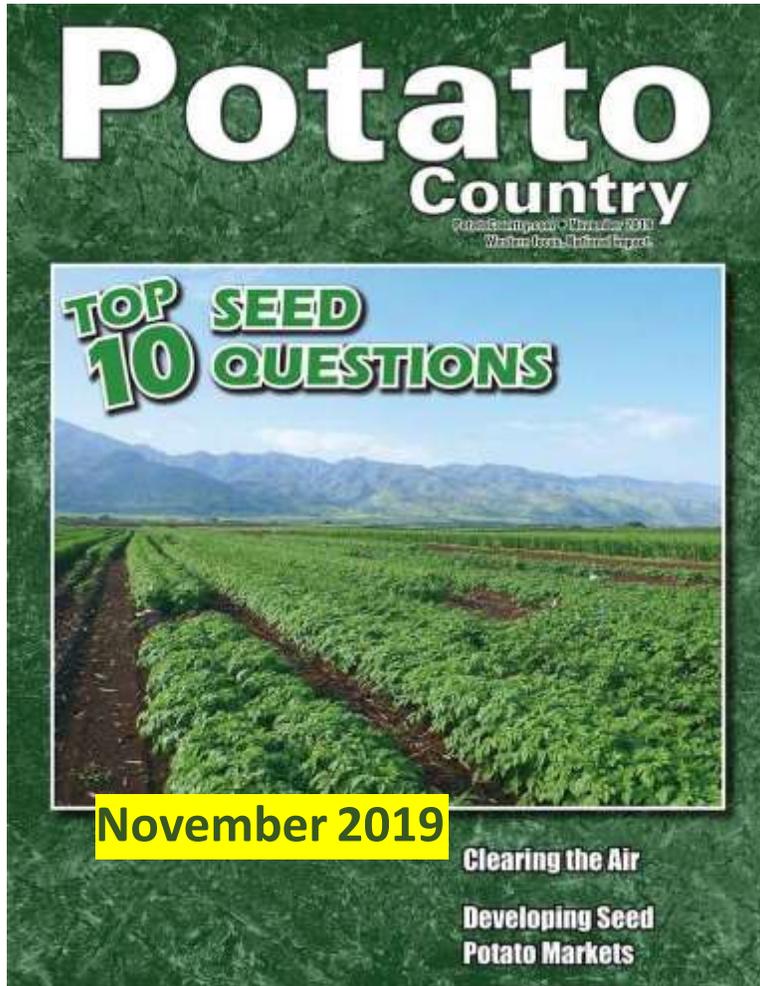
Seed certification is doing the best job possible given the directions dictated by the potato industry and by their state governments.

Seed certification cannot initiate change.

Growers need to drive the change and they need to guide the changes at the state and federal government levels.



What are some potential changes to Seed Certification



Sample, test and report based on end use – not one size fits all

More resources towards early generations

Current sampling strategies allow for detection of 1% disease

Report disease estimates for seed lot not the sample analyzed

Decide on tolerance limit and adjust sample size – plus/minus result

~400 tuber/plant sample = 1.0% tolerance

~1000 tuber/plant sample = 0.5% tolerance

~2000 tuber/plant sample = 0.25% tolerance

Adopt direct tuber testing for disease estimates (and more) in PHT

Comparable or less cost

Potential for on-farm sample preparation (no tuber shipment)

Potential for faster results

Potential to test for many types of disease/physiology

Investigate regional testing facilities

