NORTH AMERICA POTATO STORAGE ORGANIZATION

NAPSO

www.napso.info

Welcome to Webinar # 3

"Storing for Success: Protecting Potato Seed & Preventing Disease"

- Kasia Duellman-University of Idaho
- James Alford- Alford Custom Ag/Premier Seed LLC

NORTH AMERICA POTATO STORAGE ORGANIZATION
NAPSO
www.napso.info

Anti-Trust Statement

• “The anti-trust laws apply to individuals, just as they apply to any individual group or group of competitors. Competitors may not restrain competition among themselves with reference to the price, quality or the marketing of their services and goods, and they may not agree or act together to restrict the competitive capabilities or opportunities of other competitors, their suppliers or their customers. Therefore, it is agreed and understood that there will be no discussions whatsoever at any meetings (whether part of structured formal meeting sessions or informally at breaks among members or otherwise) involving areas in which any of the parties compete, including: pricing, product pricing policies or terms, product marketing strategies, customer territories or locations, or other competitive aspect of a company’s operations. Meeting participants have an obligation to terminate any discussion, seek counsel, or if necessary, terminate the meeting if discussions might be construed to raise any anti-trust issues.”

Kasia Duellman-University of Idaho

- Kasia Duellman is the Extension Seed Potato Specialist with University of Idaho, and she is based out of the Idaho Falls Research and Extension Center.
- She has been with the University of Idaho for 9 years, and her work with potatoes, either directly or peripherally, extends back to the early 1990s.
- he specializes in tuber-borne diseases of potatoes.

Shipping, handling, and preparing seed potatoes for planting

Kasia Duellman

Extension Seed Potato Specialist

University of Idaho

Outline
(Questions submitted ahead of time are highlighted in yellow)

1. Storing seed and getting it ready to ship
    1. Preparing seed for shipment – temperature and humidity adjustments
2. Proper shipment and care during transit
    1. How should seed be handled during transit and upon arrival?
    2. What impact does long vs short distances have on seed quality
3. Receiving and handling seed
4. Consider physiological age
5. Cutting
    1. What temperature and humidity is recommended before and after cutting?
6. Fungicide treatments
7. Planting

Storing seed and getting it ready to ship

- After gentle harvest and wound healing,
  - Ramp down slowly to prevent condensation
  - 3-4°F per week (very slow – can increase physiological age)
  - More rapid cooling may be better (3-4°F per day), but only if good airflow is achieved
- Store seed cold (34-39°F)
- At shipping time, load gently – seed is very cold!
  - Minimize damage while loading
- During shipping:
  - Continue to warm gradually
  - Provide good airflow/ventilation
  - Be sure the driver

Shipping seed potatoes

(borrowed from: “Top 10 Packing & Shipping Best Practices” – Potato Grower, published online: Mar 08, 2019, by Nora Olsen and Mike Thornton)

1. Monitor temperature in storage

Keep pulp temperatures >45°F during removal to minimize bruising

2. Avoid large drops

> 6 inches

3. Pad all impact points

Use padding, replace when worn out

4. Run conveyors at capacity

Running at capacity reduces relative drop height between pieces of equipment

5. Remove excess moisture

6. If shipping long distances, consider using a refer – Maintain temperature en route

Maintain at a constant temperature; provide adequate ventilation to help prevent soft rot

7. For refers, check (and re-check) truck/railcar temperature

Confirm truck temperature prior to loading, and make sure the set point is accurate. Avoid set points that may encourage condensation.

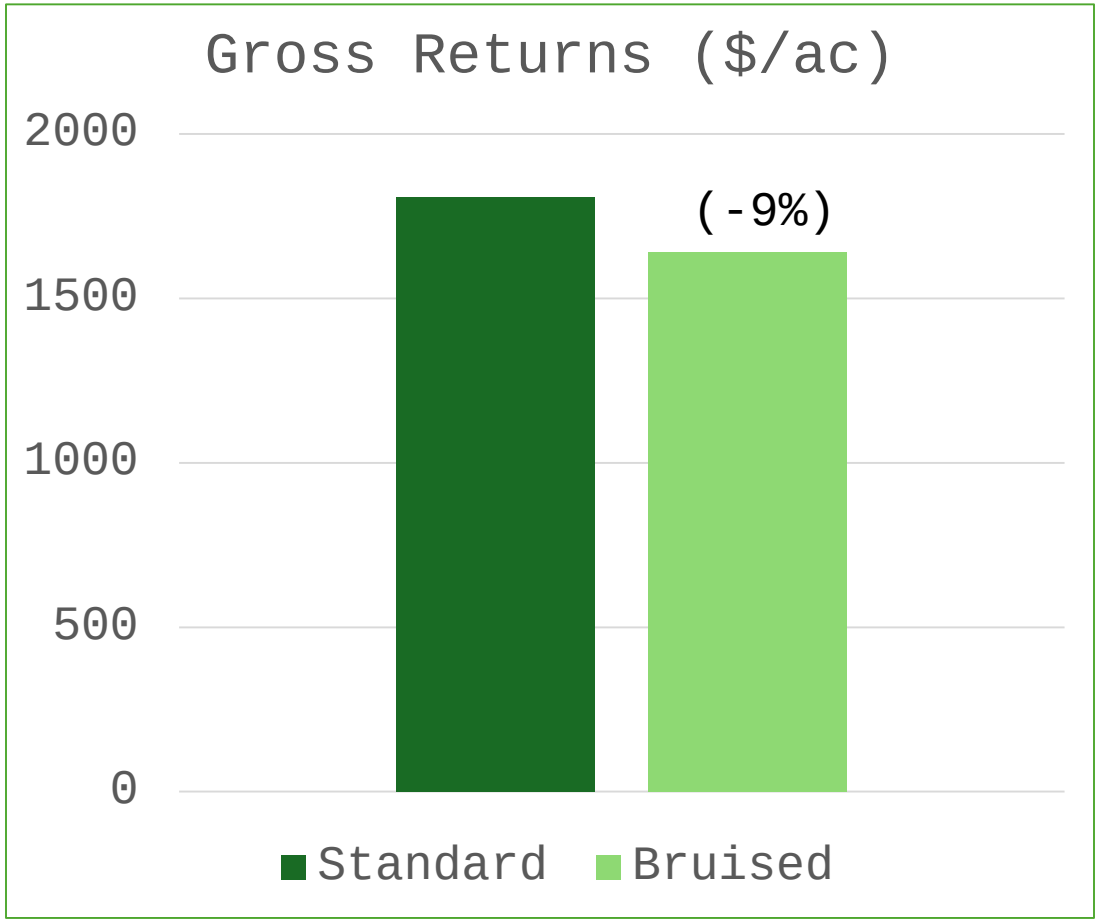
8. Educate equipment operators, educate the driver

Poor shipping conditions can cause problems

- Poor temperature regulation
- Lack of protection from freezing temperatures
- Poor ventilation
- Condensation that leads to soft rot

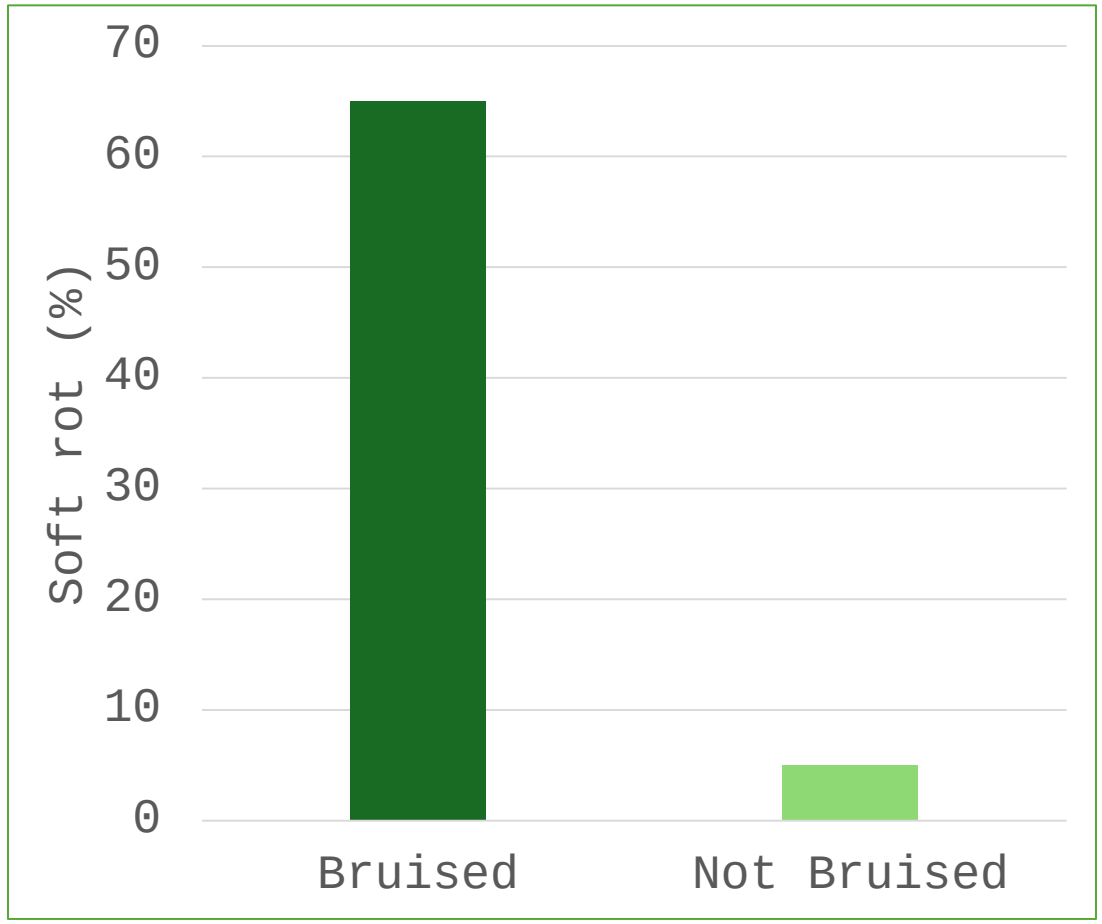
Receiving and handling seed

- Clean and sanitize storages and equipment before seed arrives
  - Avoid storing in facilities where CIPC was used
- Handle seed gently to minimize bruising
- Bruise increases respiration and speeds up physiological aging

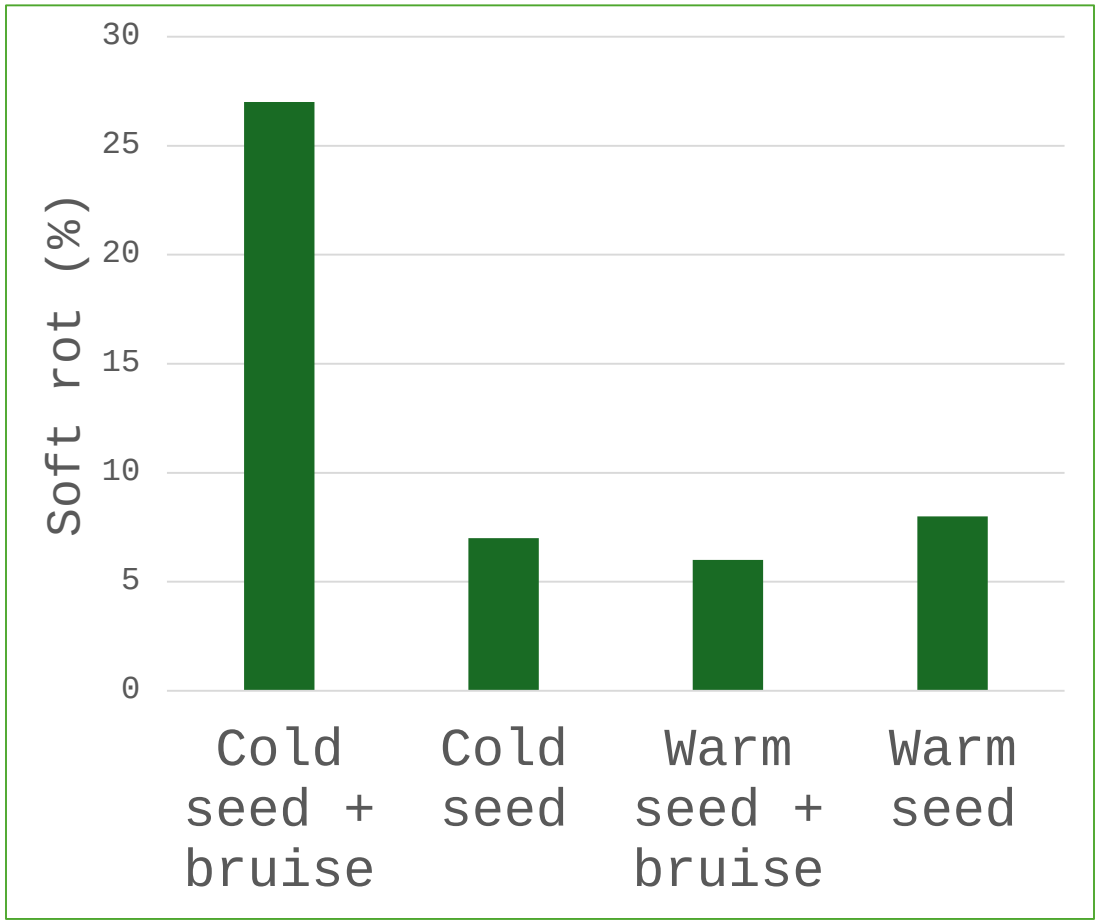


Gudmestad et al. - 1988

Bruise increases soft rot



Gudmestad et al. - 1988



(Norgold Russet)

Receiving and handling seed

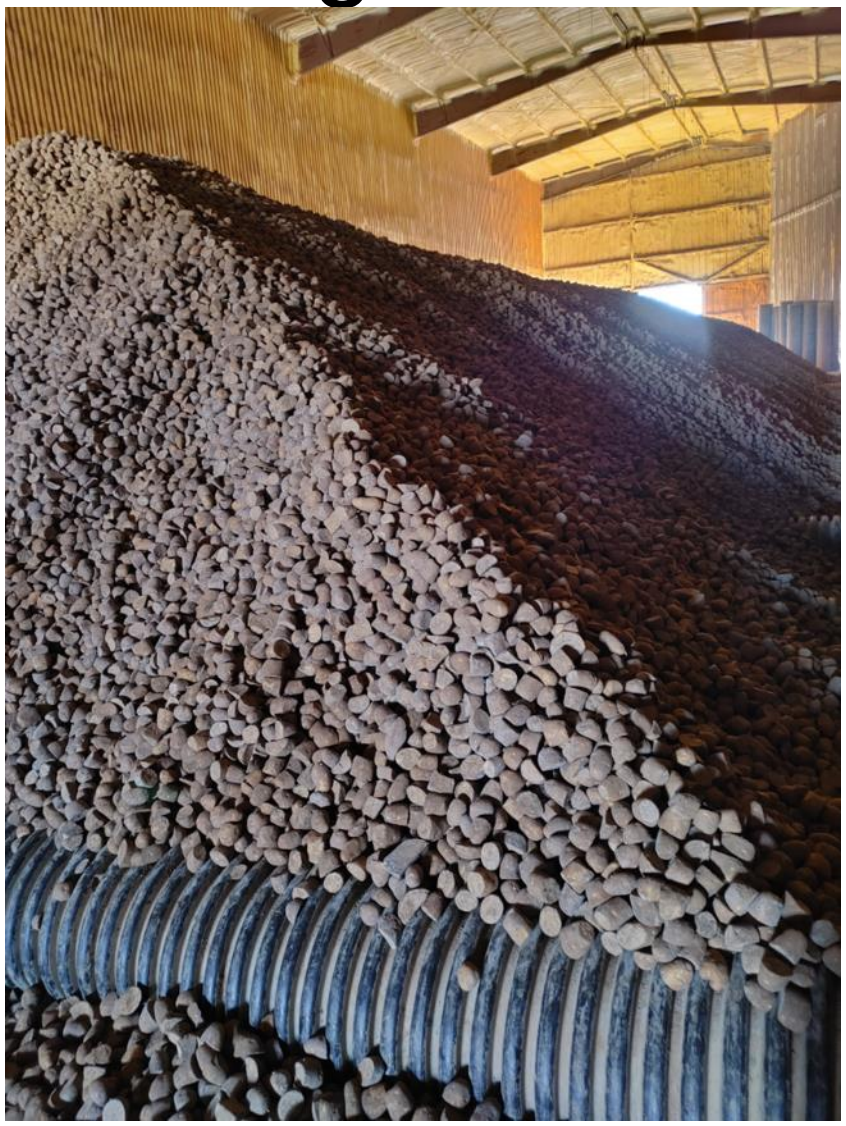
- Promote **wound healing (curing)**
  - Avoid piling >6 ft
  - 50-70°F
  - 85-95% RH
  - Good airflow = lots of oxygen
  - 1-2 weeks
- 3 days – to stop soft rot
- 1-2 weeks – to stop Fusarium dry rot
- 1-3 weeks – for completely new

Wound healing in relation to temperature (from Cunnington and Pringle, 2012)

Tuber temperature (°F)	Initial suberization (days)	Wound healing complete (days)
<41	7-14	21-42
50	4	7-14
68	1-2	3-6

Receiving and handling seed

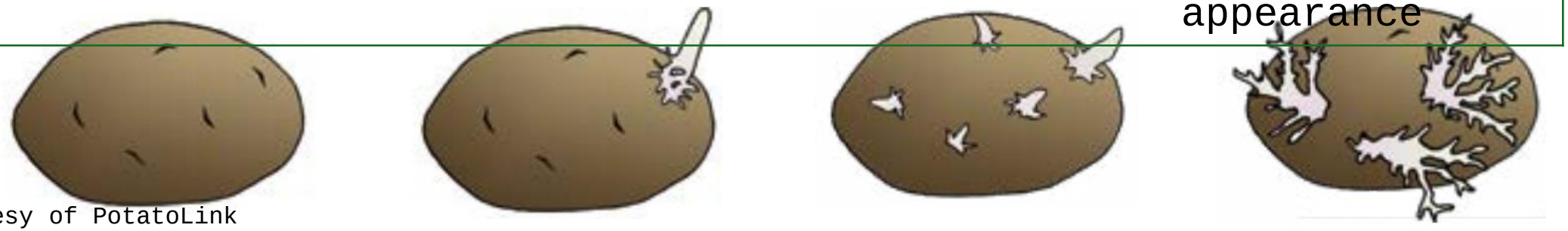
- After wound healing, store at appropriate temperatures based on physiological age (young: warmer; old: colder)
- Maintain high humidity (85% to 95%) with good airflow
- Minimize temperature fluctuations
- **Condensation** is the



Physiological age of potatoes

- Refers to how “old” the potato is in terms of function, not number of days since harvest
  - Influenced by environmental stress and storage conditions

Dormant	Young	Middle Aged	Old
No sprouts	Strong apical dominance, few sprouts	Apical dominance lost, multiple sprouts	Highly branched, weak sprouts with ‘hairy’ appearance

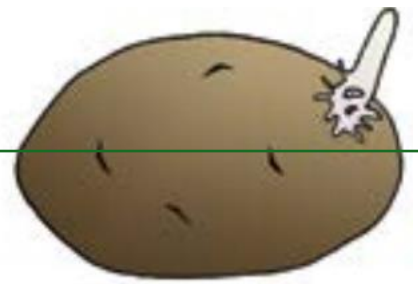


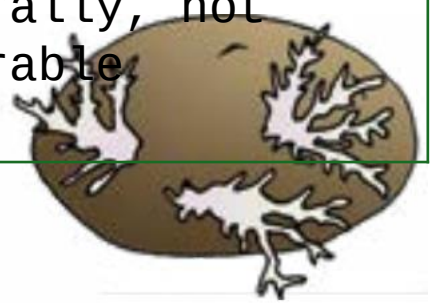
POTATO LINK
AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

Images courtesy of PotatoLink

Physiological age affects growth in the field

Young	Middle Aged	Old
✓ Slower emergence ✓ Few stems per plant, mor dense foliage ✓ Longer tuber bulking period ✓ Fewer, larger tubers ✓ High potential yield	✓ Faster emergence ✓ Multiple stems per plant, less dense foliage ✓ Shorter maturation period, suited for sites with limited time due to frost, disease incidence, market ✓ Uniform tuber set ✓ More, smaller tubers ✓ If de-sprouted, treat as “old” seed	✓ Rapid emergence ✓ Plants lack vigor ✓ Large number of small tubers that fail to bulk up ✓ May give rise to “little tuber disorder” – where small tubers form on sprouts ✓ Generally, not desirable





Estimate physiological age

Young	Middle Aged	Old

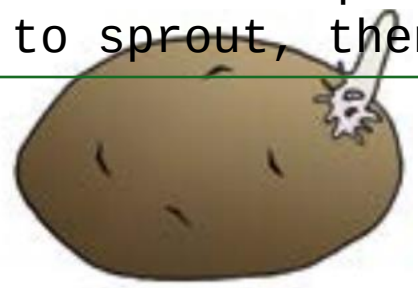
To estimate physiological seed age:

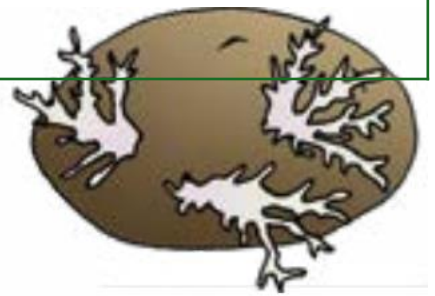
→ Learn as much as possible about growing and harvest conditions, handling procedures, storage environment

→ Scenario A: Seed produced under stress (temperature, moisture, or fertility), high disease pressure; bruised when handled; stored with fluctuating temperatures = probably **older**

→ Scenario B: Seed produced with no stress or disease pressure, stored under constant temperature (38° to 40°F) = probably **young**

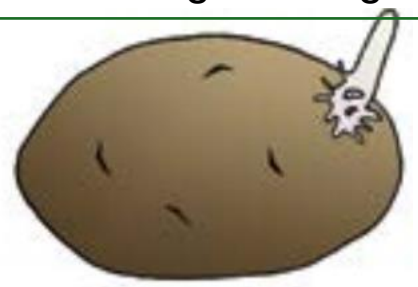
→ Place a sample of tubers in the dark at room temperature and allow to sprout, then compare with images below.

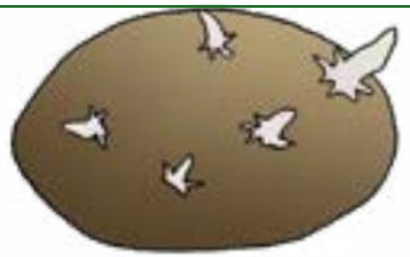




Knowing physiological age might help refine storage and planting decisions

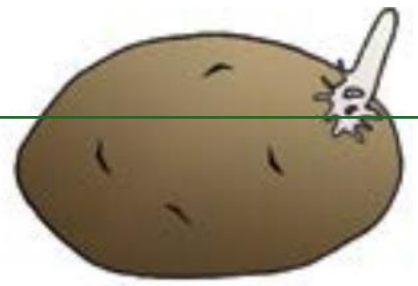
Young	Middle Aged	Old
Older seed – may need to be cooled more quickly at harvest time going into storage to further slow aging Older seed – may need to plant earlier Older seed – may need to be spaced further apart (to maintain the desired stem density per acre) Older seed – may need to use larger seed pieces to compensate for lower vigor Older seed – may benefit seed growers or commercial markets with short growing seasons and who desire smaller size profile		

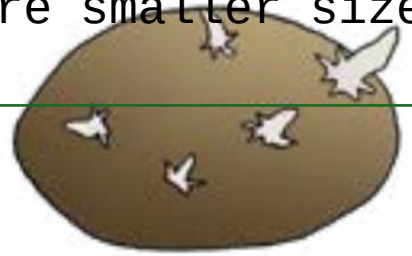


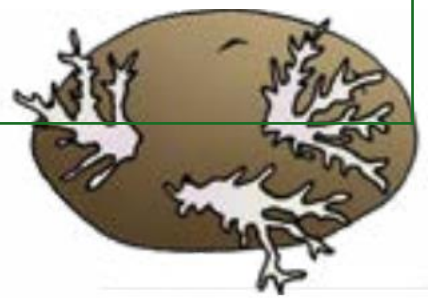


Physiological age may guide how to handle seed just prior to planting

Young	Middle Aged	Old
✓ To speed up emergence, hold at warmer storage temperature (50° F) until 2-3 eyes per seed piece have just begun to peep before planting	✓ Hold at (38° to 40°F), then warm to 45° F just prior to cutting and planting ✓ May need to plant earlier ✓ May need to be spaced further apart (to maintain the desired stem density per acre) ✓ May need to use larger seed pieces to compensate for lower vigor ✓ May benefit seed growers or commercial markets with short growing seasons and who desire smaller size profile	





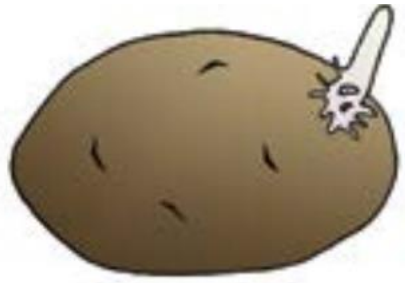


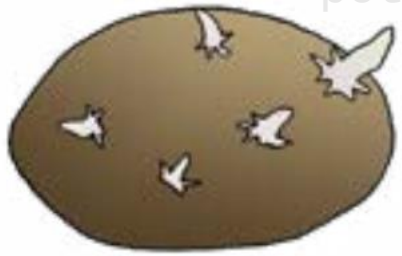
Physiological age may be important, but other factors are at play as well

- Variety
- Planting date
- Disease pressure
- Days to vine kill
- Harvest timing
- Environmental conditions

- Seed that looks like this (‘little tuber syndrome’) shouldn’t be planted:

https://www.ag.ndsu.edu/potatoextension/physiological-age-of-seed-potato





Cutting seed

- Warm to 45°F (old) to 50°F (young)
- Remove rotten seed
- Optimal size range for cutting:
  - 3-10 oz
  - Avoid >10 oz to minimize blind seed
  - Plant 1.5-3 oz tubers whole
- Adjust seed cutter for desirable size profile and tuber shape
- The best seed piece size depends on cultivar, availability, cost,
- Pay attention to size distribution of cut seed pieces
  - Eliminate small seed pieces (<1.5 oz) – less productive
  - Reduce proportion of larger seed pieces (>3 oz) – increase seed costs, may reduce planter accuracy
- Keep blades sharp
  - Dull cuts increase wound healing time, promoting faster aging and allowing more opportunity for soft rot
- Sanitize blades

Pre-cut seed and wound healing

- Pre-cut seed only if you have the ability to **promote wound healing**
- Liquid fungicides are available, and some may be used right after cutting – follow the label
- If mancozeb is used: For pre-cut seed, some researchers advise

Fungicide seed trea

- Know what your disease pressure is likely to be
- Mancozeb is one of the few that can protect against late blight
  - Broad-spectrum, no known resistance
  - Con: worker safety issues for dust formulations
- Liquid seed treatments
  - Pros: More uniform, more precisely applied, safer than dusts
  - Apply as a mist, usually no more than 2-4 oz mixture per cwt
  - Cons:
    - Need to monitor flow of seed on conveyor:
      - Too fast = non-treated seed
      - Too slow = wasted product sprayed on conveyor and not potatoes
    - If no dust carrier is used, may have flowability problems in planter box

Know your fungicide seed treatment

- Fungicide seed treatments can protect against
  - Fusarium dry rot (DR)
  - Rhizoctonia diseases (R)
  - Silver scurf (SS)
  - Late blight (LB)
- They do not protect against
  - Verticillium, common scab, powdery scab, bacterial ring rot
- They can indirectly protect against
  - Bacterial soft rot

- Fungicide seed treatment might not be needed if:
  - Seed appears to be very clean
  - Field in which it will be planted has low disease pressure
  - Fast emergence is expected
    - Soil is at least 50-55°F and not excessively wet
    - Variety is known to emerge quickly
- Some seed is not cut, but even if whole seed is planted, it may benefit from a fungicide seed treatment if disease pressure is high

FRAC Group	Active Ingredient	Products	Disease target	Resistance Risk
27 – Cyanoacetamide-oxime	**Cymoxanil**	Curzate 60DF	LB	Low to medium
40 – Carboxylic Acid Amides	**Mandipropamid**	Revus	LB	Low to medium
11 – Strobilurins (QoI)	Azoxystrobin **Fenamidone**	Dynasty Reason (only in Canada)	R, SS, BD LB, EB, BD	High
M03	**Mancozeb**	Various, Moncoat MZ, Maxim MZ	DR, R, LB	Low
7 – SDHI	Sedaxane **Flutolanil** Penflufen	CruiserMaxx Vibrance Potato Moncoat MZ Emesto Silver	R, SS, DR	Medium to high
12 – Phenyl Pyrroles	**Fludioxonil**	Maxim 0.5%/4FS/MZ, Spirato, Dyna-Shield, CruiserMaxx (Vibrance, Potato), STartUP FLUDI	DR, R, SS	Low to medium*
3 –	**Difenoconazo**	CruiserMaxx Vibrance	DR,	Medium

Make the best of seed treatments

- Implement careful shipping and handling practices
- Promote wound healing
- Remove rotten tubers before cutting
- Use the right seed treatment for the job
- Rotate fungicide modes of action
- Promote wound healing after cutting when

Planting

- Avoid large temperature differences between soil and seed pieces when planting
- Avoid leaving cut/treated seed in the hopper over night
- Avoid planting under any kind of precipitation
- Promote fast emergence (based on variety, field, planting time, planting depth)
- Use fungicide seed treatments if Fusarium dry rot, Rhizoctonia diseases, or silver scurf are concerns
- Managing Fusarium dry rot indirectly reduces bacterial soft ro

Resources

Potato Seed Certification and Selection in Idaho (University of Idaho)

Potato Seed Management: Seed Size and Age (University of Idaho)

Seed storage and physiological age (PotatoLink, Australia)

Potato Facts: Selecting, Cutting and Handling Potato Seed (University of Maine)

Top 10 Packing & Shipping Best Practices (Potato Grower Magazine)

Physiological Age of Seed Potato (North Dakota State University)

Potato Seed and soil Treatments(University of Main)

Potato store managers' guide (AHDB)

Literature:

Duellman, K.M., Price, W.J., Lent, M.A., Christian, C.L., Bertram, M.C., and Nolte, P. 2021. Fungicide Seed Treatment Improves Performance of Single-Drop Whole and Cut Seed Potatoes. American Journal of Potato Research 98:315-327.

Gudmestad, N.C., Nolte, P., and G.A. Secor. 1988. Factors affecting the severity of seed-piece decay, incidence of blackleg, and yield of Norgold Russet potato in North Dakota. Plant Disease 72:418-421.

Westermann, D.T., and G.E. Kleinkopf. Potato management for optimum yield and quality. Proceedings of the University of Idaho Winter Commodity Schools, 1982.

University
of Idaho

James Alford- Alford Custom Ag/Premier Seed LLC

- Based in Pasco, WA
- 20 years experience growing potatoes, along with many specialty seed crops.
- Custom seed potato operation since 2008, cutting close to 1 million cwt of seed per year, much of it suberized.
- Own and operate nearly 200,000 tons of potato and onion storage.

Potato Seed Receiving, Handling, and Storage

- An overview of best practices

and potential issues.

- James Alford:
- Alford Custom Ag/Premier

Seed LLC.

Seed Potatoes/Cutting/

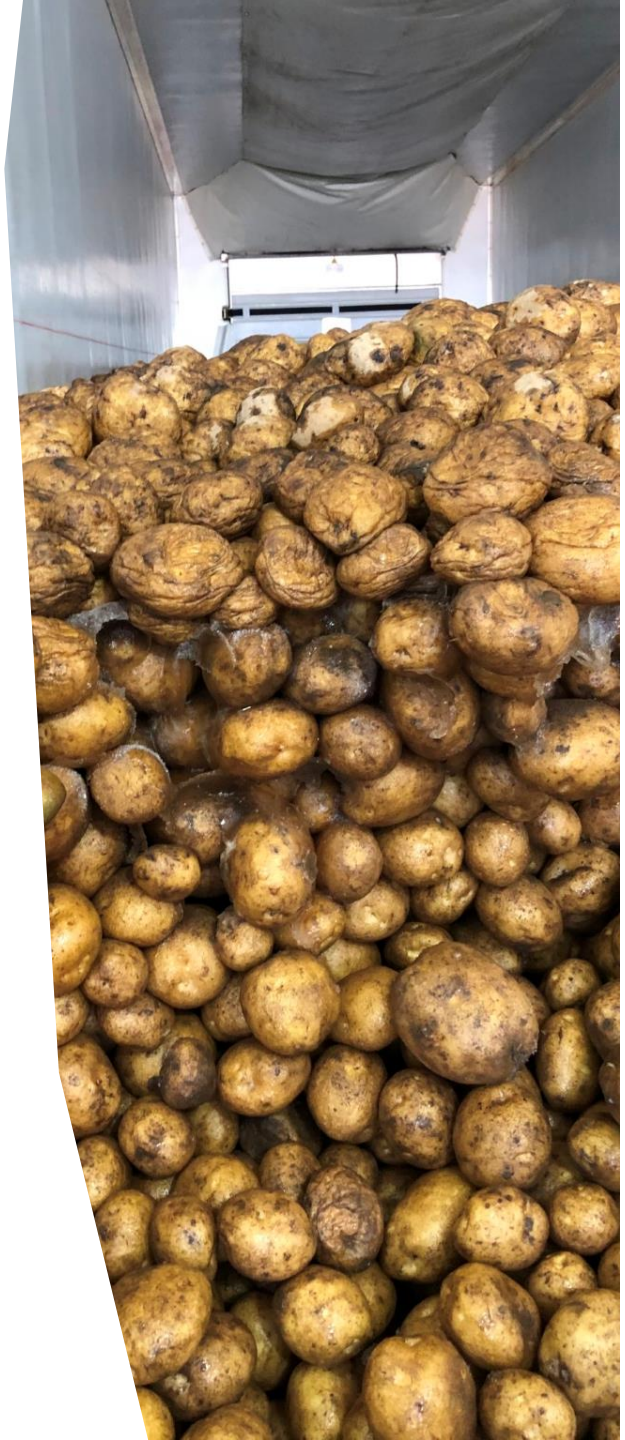
Suberizing since 2007.

Receiving Potato Seed

- Inspect loads for quality and disease
- Verify paperwork and traceability
- Initial temperature checks and airflow considerations
- Current Soil Temps

Issues at Receiving

- Frost
- Debris (rocks, other contamination)
- Rots (Fusarium, Pink, and Soft Rot)
- Mechanical Damage
- Sprouting



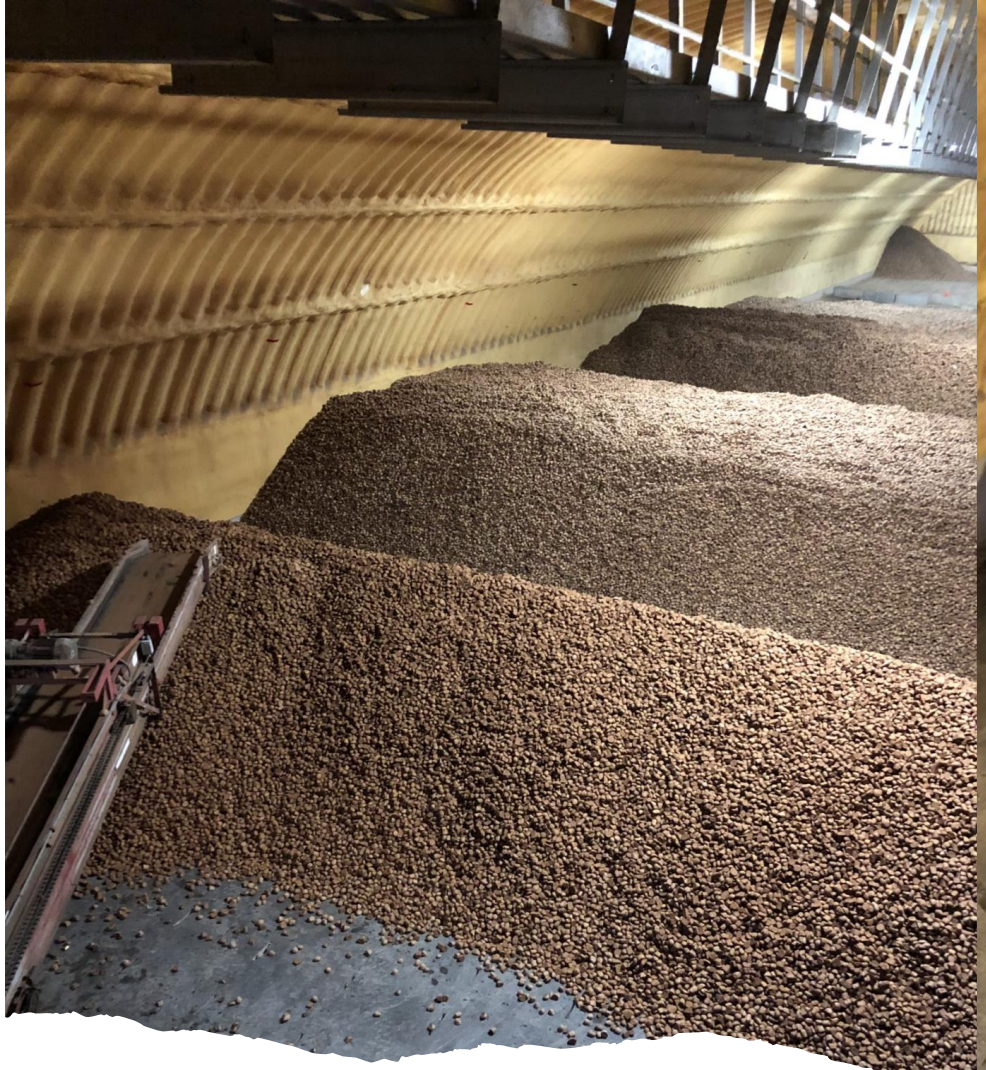
Handling and Storage

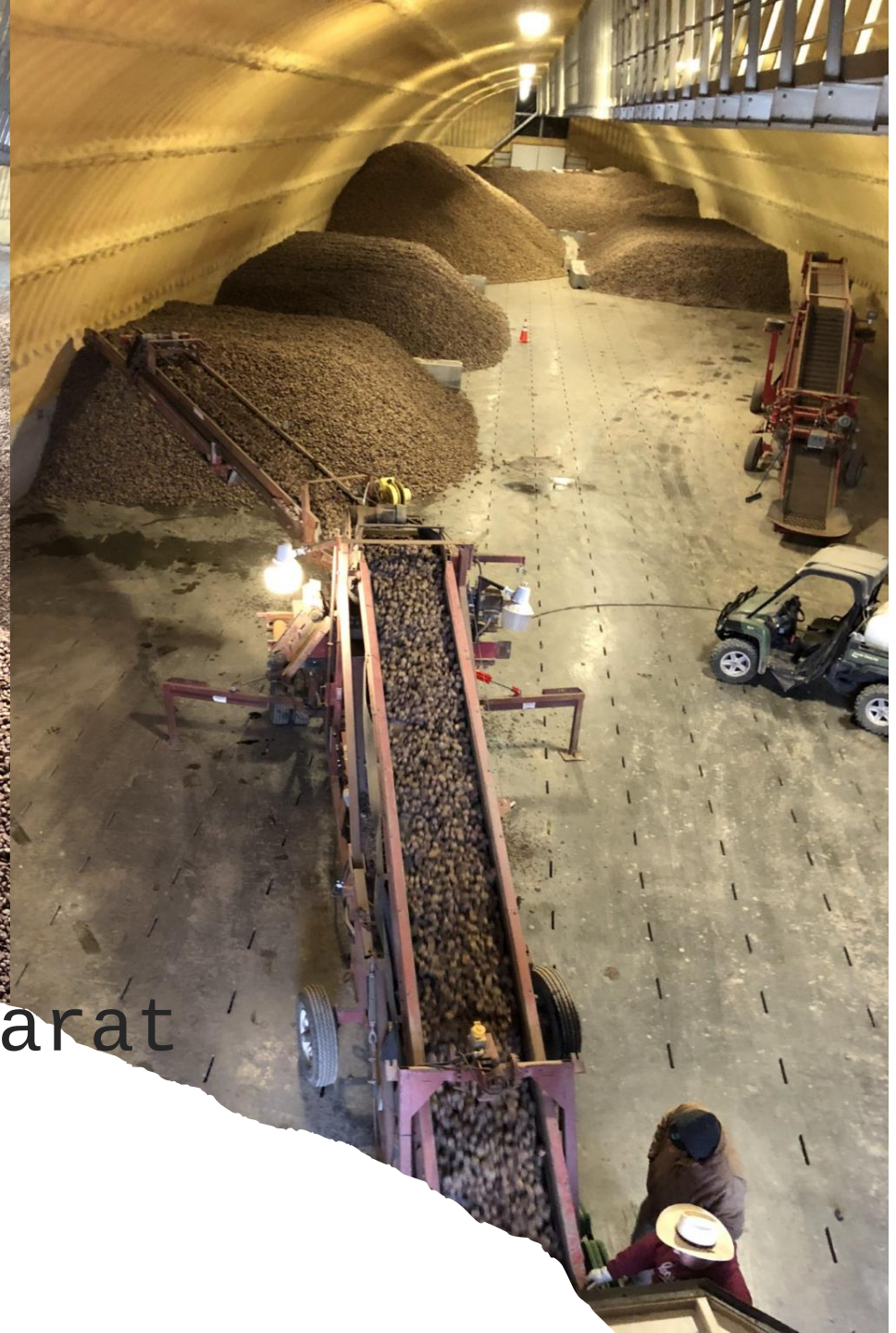
Maintain appropriate temperature and humidity levels ~90%+

Proper airflow to prevent condensation, disease spread, and oxygenate the pile.

Monitoring for rot, disease, and temperature fluctuations

Soil Temp, Plant date vs. Set Point

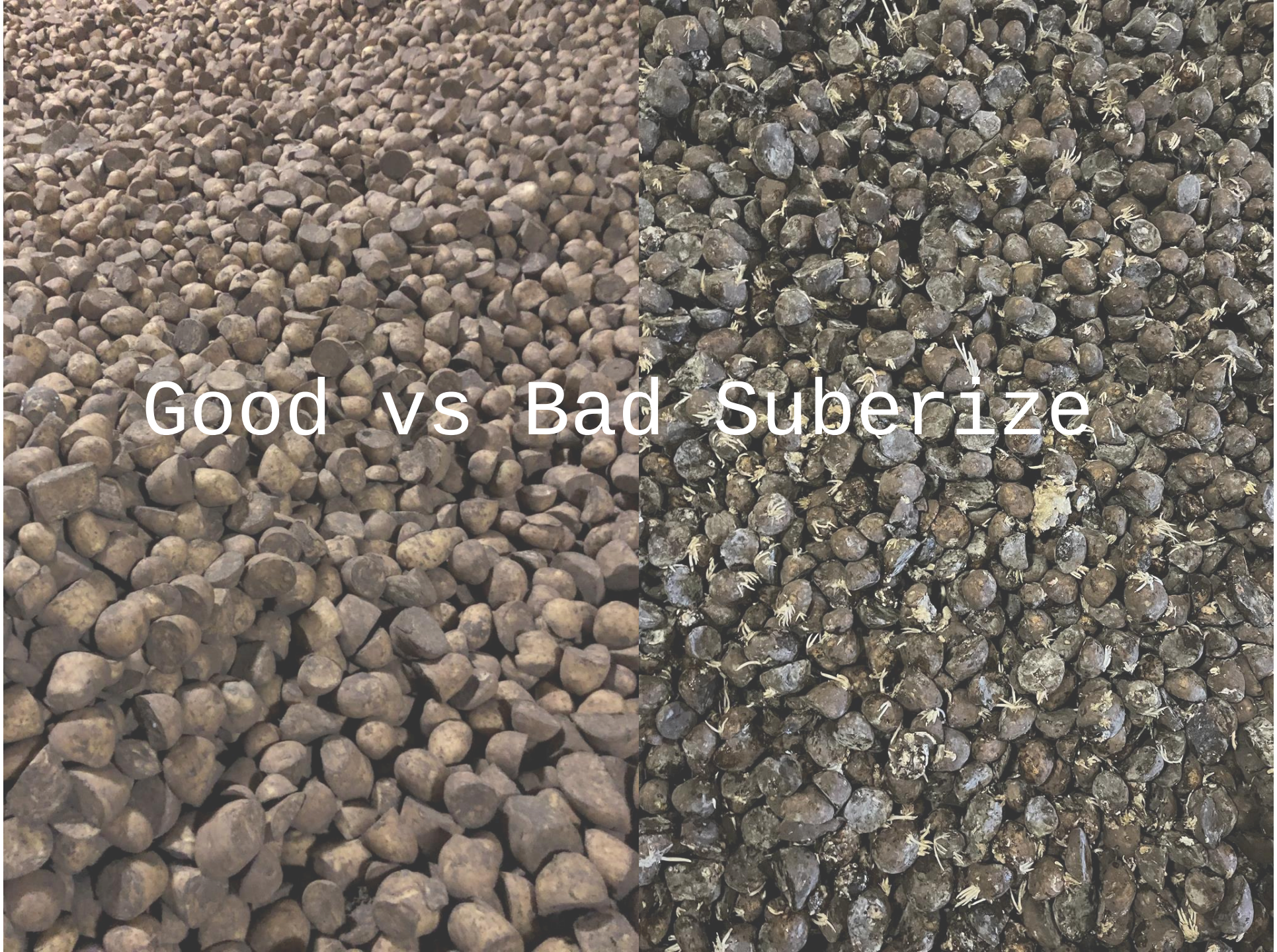




Piles/Airflow/Separation

Suberization Process

- Importance of wound healing/bark before cutting
- Ranges from 47-55 degrees, based on time of year.
- Proper air circulation (but not too much) to avoid CO2 buildup. Do not dry out seed!
- Typical duration: 10-14 days Colder temps take longer
- Do not suberize over 60 degrees +/-


Good vs Bad Suberize

Common Issues and Troubleshooting

- Fusarium dry rot
- Soft rot: Avoid excess moisture

and improve ventilation

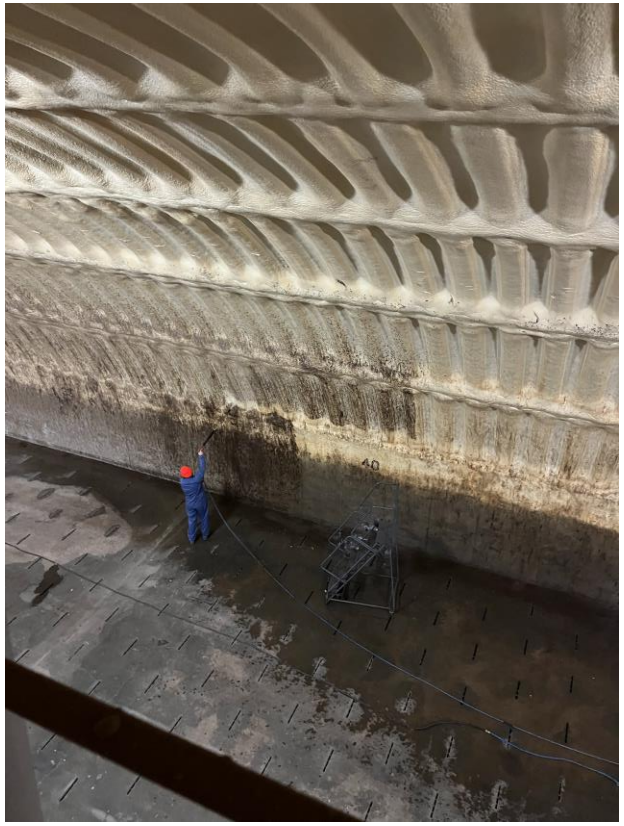
- Silver scurf: Minimize

prolonged storage at high humidity

- Cold injury: Prevent temperature drops below 38 degrees.

Building Disinfection Procedures

- Cleaning with high-pressure water and removing debris
- Using approved disinfectants (Jet-Ag and PQ-80)
- Ensuring full drying before loading new seed
- Routine maintenance and ongoing cleaning



Cleaning/Disinfecting

Conclusion

- Following these best practices ensures high-quality seed potatoes and minimizes losses.
- Questions?

THANK YOU!

- Thank you to our speakers, Kasia and James! We want to highlight that NAPSO is an all-volunteer organization dedicated to providing valuable information. We deeply appreciate everyone who supports our vision!

NAPSO website resources

- Safety Resources – NAPSO
  - Safety videos, articles, toolbox talks
- https://napso.info/job-openings/
  - Job openings within the potato industry
- NAPSO Newsletters – NAPSO
  - Newsletters will switch to quarterly after February.
- NAPSO Webinars – NAPSO
  - Access to all previous webinars

Upcoming events

- Newsletter-End of this week
  - Will be a re-cap of today's webinar.
- Webinar #4 between March-June
  - Storage management-long term management strategies to manage risk, shrink, disease
  - Anyone have any ideas about topics or timing that might work best?
- PAA Symposium Madison, WI June 21st, 2025 @ 1pm

1. "Managing Disease in-field for a Successful Storage Season"- Jeff Miller & Nora Olsen
2. Storage Panel- Comprehensive look at storage management through an applicator, processor and grower perspective
3. Engineering of Storages – Mark Rice
   a. Purpose of air system to move energy
   b. Air Quality versus Air Quantity
4. International Guest Speaker – Kurt Demeulemeester, InAgro, Belgium (Confirmed)
   a. Topic 1 – Storing Potato in a Post-CIPC World
   b. Topic 2 – Comparison of EU buildings and storages methods to NA

- Webinar #5 August (TBD): pre-harvest storage considerations

NORTH AMERICA POTATO STORAGE ORGANIZATION
NAPSO
www.napso.info