EARLY STORAGE MANAGEMENT: Role of Sanitation

Nathan Gelles

Decco Post-Harvest

Objectives of Storage

Preserve tuber quality for as long as possible

- Manage weight loss/shrink
- Control sprout development
- Maintain end-use qualities
  - Color, sugar content, starch content, skin appearance
- Control disease
- Minimize decay

What tools are there to manage quality in storage?

Sanitizers and disinfectants

- Peroxyacetic acid, chlorine dioxide
  - Clean storages before loading
  - Reduce pathogen load in storage

Proper storage management

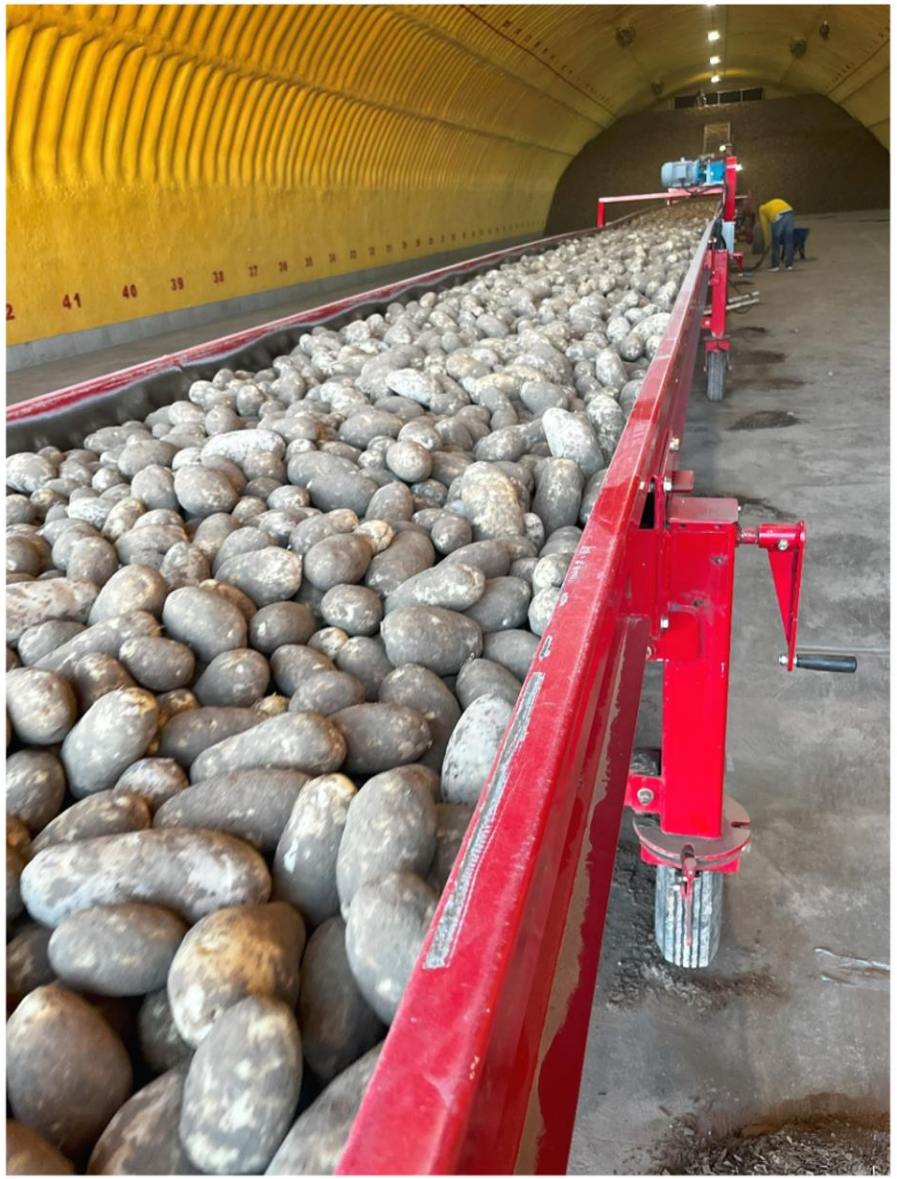
- Manage temperature, moisture/humidity, CO2, Oxygen
- Provide adequate airflow

Fungicides

- Azoxystrobin, Fludioxonil, Phosphite
  - Protect healthy tubers from being infected

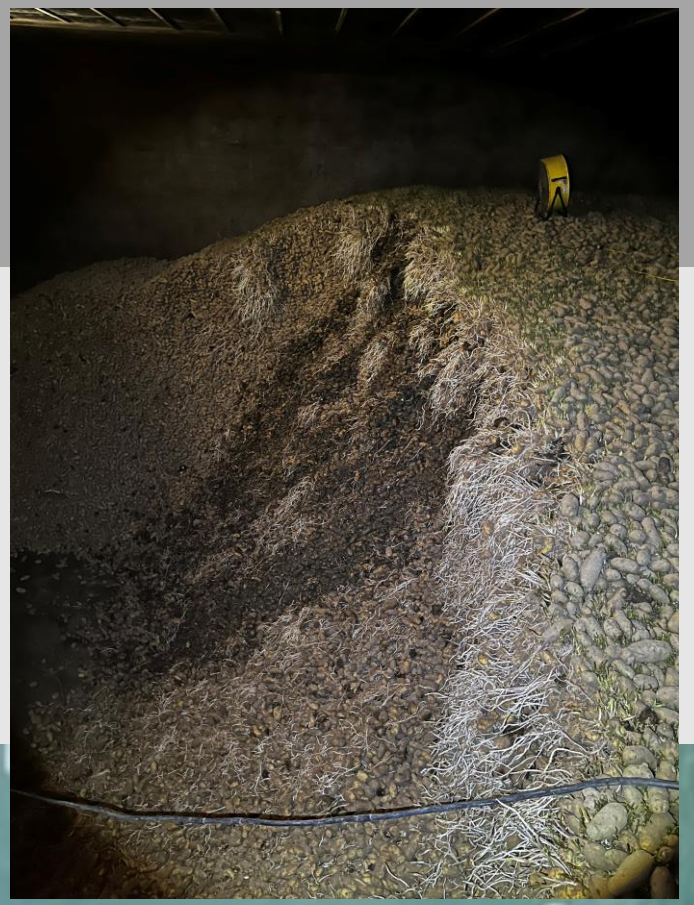
Sprout inhibitors

- Maleic Hydrazide, Essential oils, CIPC, DMN
  - Reduce sprout development
  - Slow storage losses



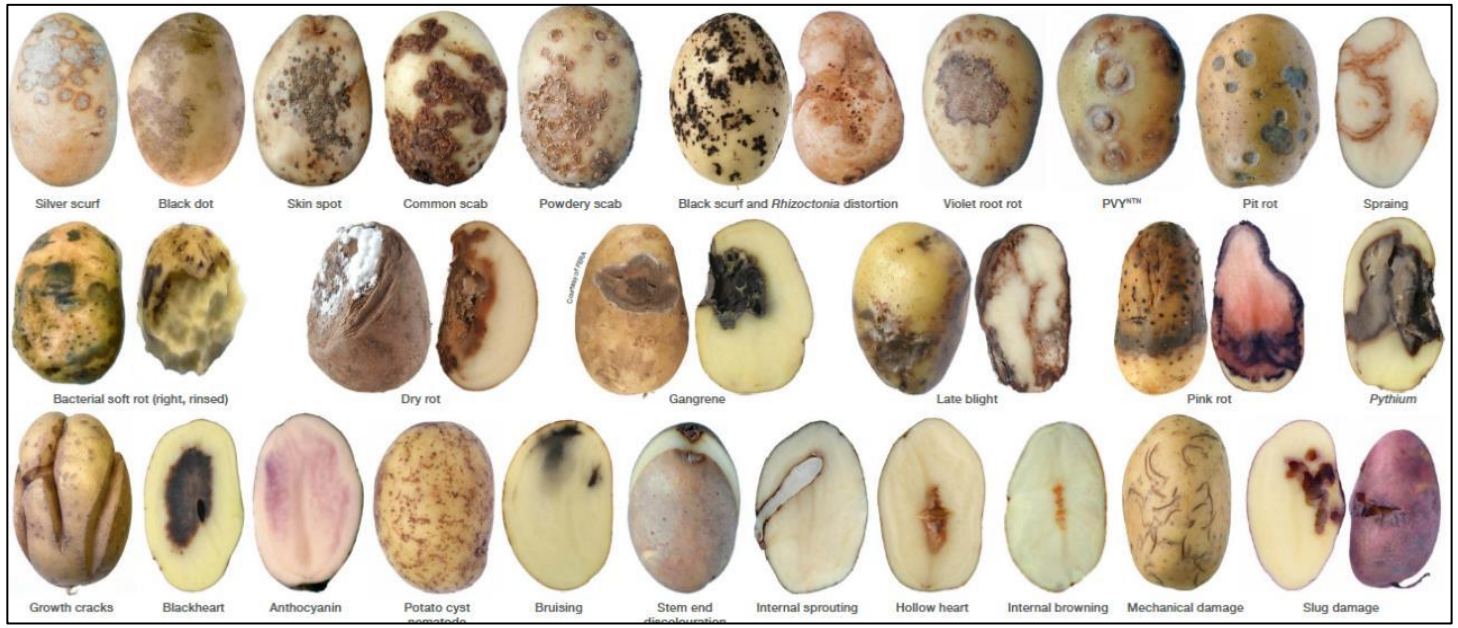
Importance of Storage Sanitation

- Clean the slate from last season
- Offer current crop best opportunity possible
- Good Agricultural Practices (GAP)
- Good Handling Practices (GHP)



Where would you put your money?

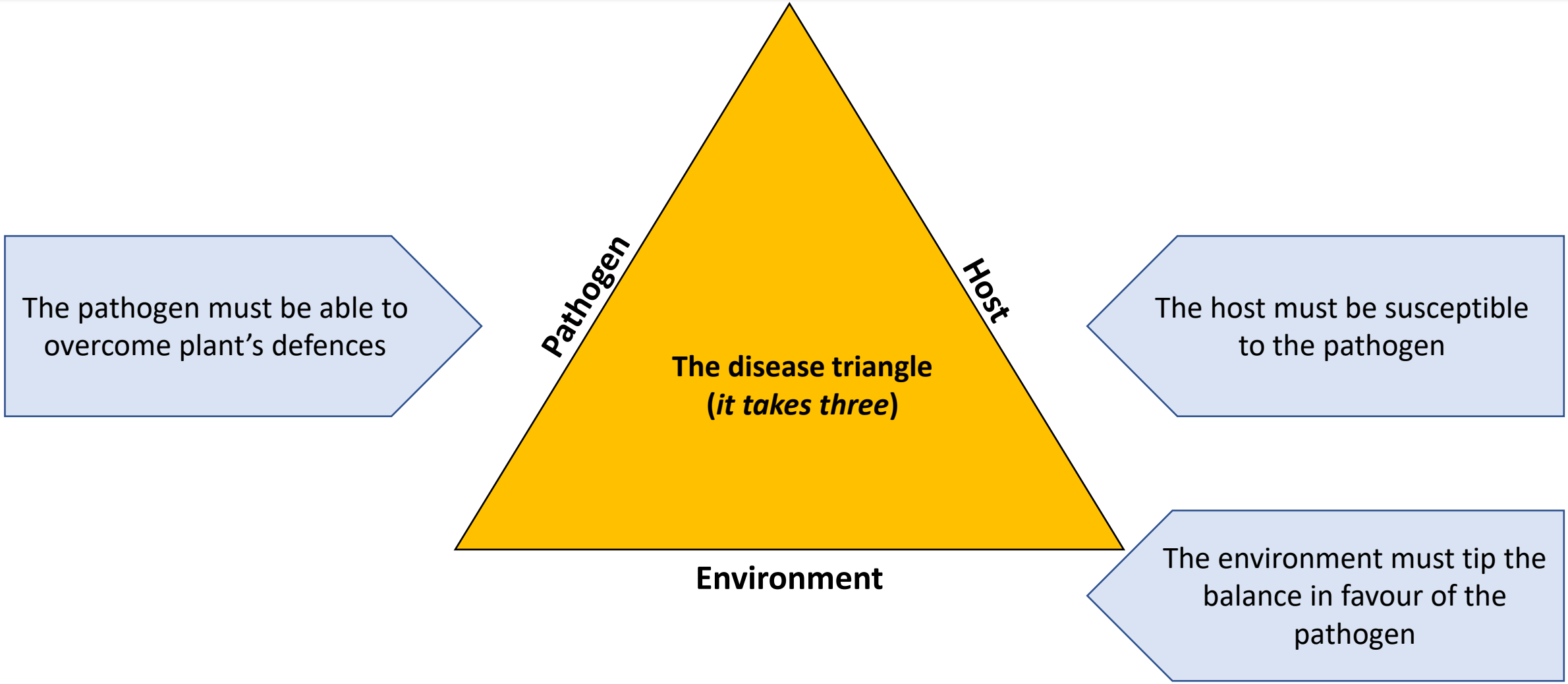
Target Pathogens for Storage Sanitation



AHDB. 2018. Diseases and Defects of Potatoes

- Bacterial Ring Rot (BRR)
  - Survival- 3 years on hard surfaces
  - Survival- 7 years on wood surfaces
- Silver Scurf
  - Survival- 9 months on foam insulation and soil
  - Survival- 3 months on wood and metal
- Soft Rot, Dry Rot, Pink Rot, Blight
  - Not typically major issue for <u>storage building</u> sanitation

Potatoes are exposed to countless microbes, but very few of these interactions lead to disease. Why?



Storage Sanitation Steps

1. Remove gross material
   - Old potatoes, dirt, foreign material, rodents
2. High pressure wash- Soap/detergent application
   - Remove stuck on dirt and debris
   - Begin breaking down bacterial barriers
3. High pressure rinse and/or steam
   - Remove soap and sap residues
4. Disinfectant
   - Kill bacteria, fungus, clean surfaces

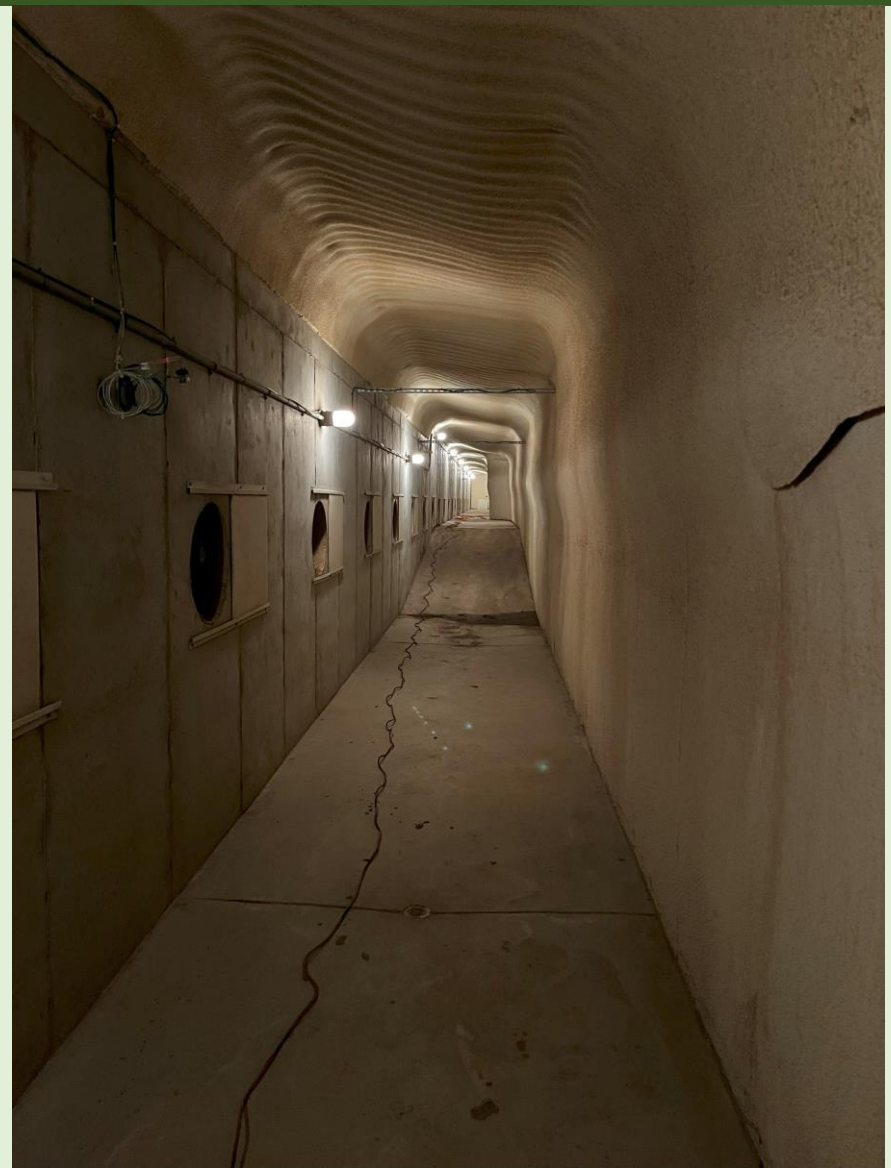
Step 1: Removing Gross Material

- Remove large foreign objects
  - Chunks of insulation, wood, rodents
- Remove dirt piles and potatoes
  - Vacuum, scrape, shovel, sweep
    - Organic material gives bacteria a place to survive
  - If dirt floors, scrape them
- Clean around outside of storage
  - Remove excess potatoes or cull piles
  - Pick up trash or any other material wind may have blown in
- Always a good idea to run a magnet over storage areas

Potato Grower Magazine

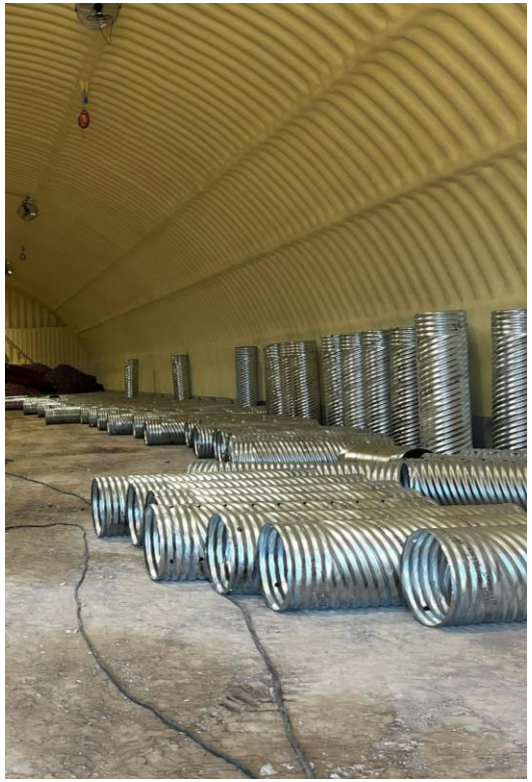
Step 2: High Pressure Soap/Detergent

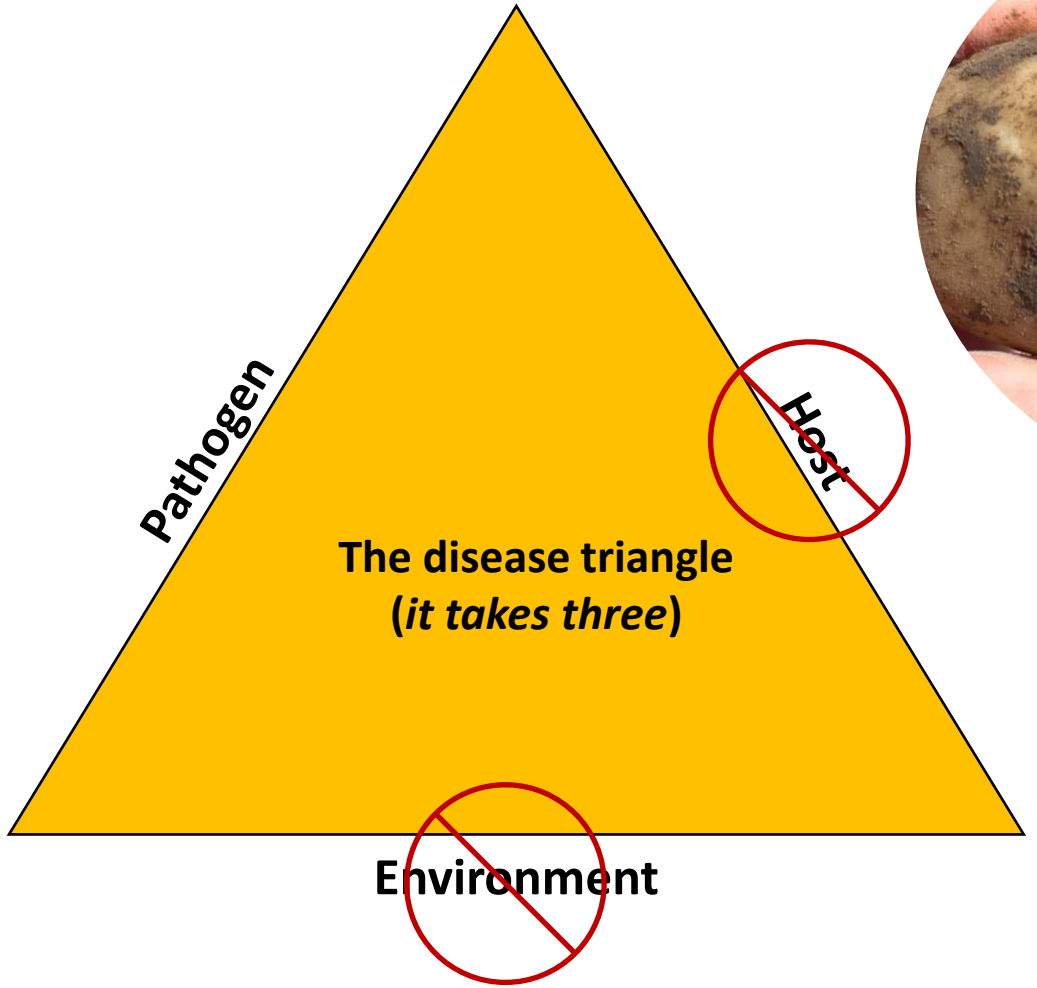
- Wash all surfaces with high pressure
  - Include an effective detergent
    - Begin breaking down biofilms
    - Remove dried plant sap/residue
  - Pressure wash all surfaces
    - Walls, ceilings, plenums, air ducts, floors if cement
- Start from the top and work your way down



Step 3: High Pressure Rinse

- Wash all surfaces with high pressure or steam
  - Remove remaining soap residue
  - Further reduce organic material on surfaces
    - Pathogens survive on soil and other debris
    - Soil can inactivate most disinfectants
  - Steam will help break down pathogens further
- Start from the top and work your way down




Pathogen
Host
The disease triangle
(*it takes three*)
Environment

Step 4: Sanitation

Which product is right for you?

Material	Target pathogen	Inactivation			Corrosiveness to metal	Safety*	Recommended Exposure time
		Organic matter	Hard water	Effective on Surfaces			
Quaternary Ammonium compounds	[1]Bacterial ring rot	Some	No	Metal/ wood	Slight	Use caution	10 min
Hypochlorites (Sodium & Calcium) (5.25% bleach)	[2]Bacterial ring rot and other diseases	Yes	No (except Iron)	Metal	Yes	Irritant & Caustic	10 min
Peroxyacetic Acid	[3]Soft rot, bacterial ring rot, blackleg,	Yes	No (except Iron)	Metal/ wood	Yes	Irritant	10 min
Chlorine Dioxide	[4]Soft rot, dry rot, and silver scurf	No	No	Metal/ wood	No	Nontoxic	10 min
Phenolics Compounds	[5]Bacterial ring rot	Some	No	Metal/ wood/ burlap	No	Poison	15-20 min
Formaldehyde	[6]Ring rot, Brown rot	No	Yes	Metal/ wood/ burlap	No	Unsafe vapors	30 min
Copper Sulfate	[7]Bacterial ring rot	No	Yes	Metal/ wood /burlap	Yes	Caution	30-60 min

Jayanty, S. 2021. Cleaning and Disinfecting Potato Storages. Fact Sheet #0.711. *Colorado State University.*

Buffering and Testing

Hard water can neutralize many sanitizers

- Typically want a pH of ~7
  - Check label
- Use clean water
  - Organic mater neutralizes sanitizers

Test strips helpful for some sanitizers

- Determine pH- water, solution
- Sanitizer levels- Quat, Chlorine, PAA

Step 4: Storage Sanitation

Spray Sanitizers

- Critical to ensure spray comes in direct contact with all surfaces
- Need minimum of 10 minute contact time
  - Must stay wet and not dry for entire period
  - Foaming agents can help hold moisture
- High pressure application recommended
  - Break surface tension to penetrate cracks and crevices

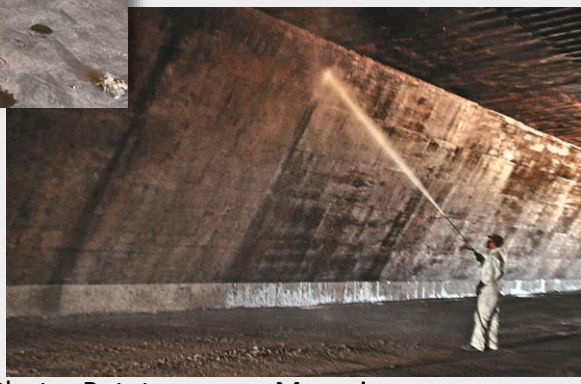


Photo: Potato grower Magazine

Step 4: Storage Sanitation

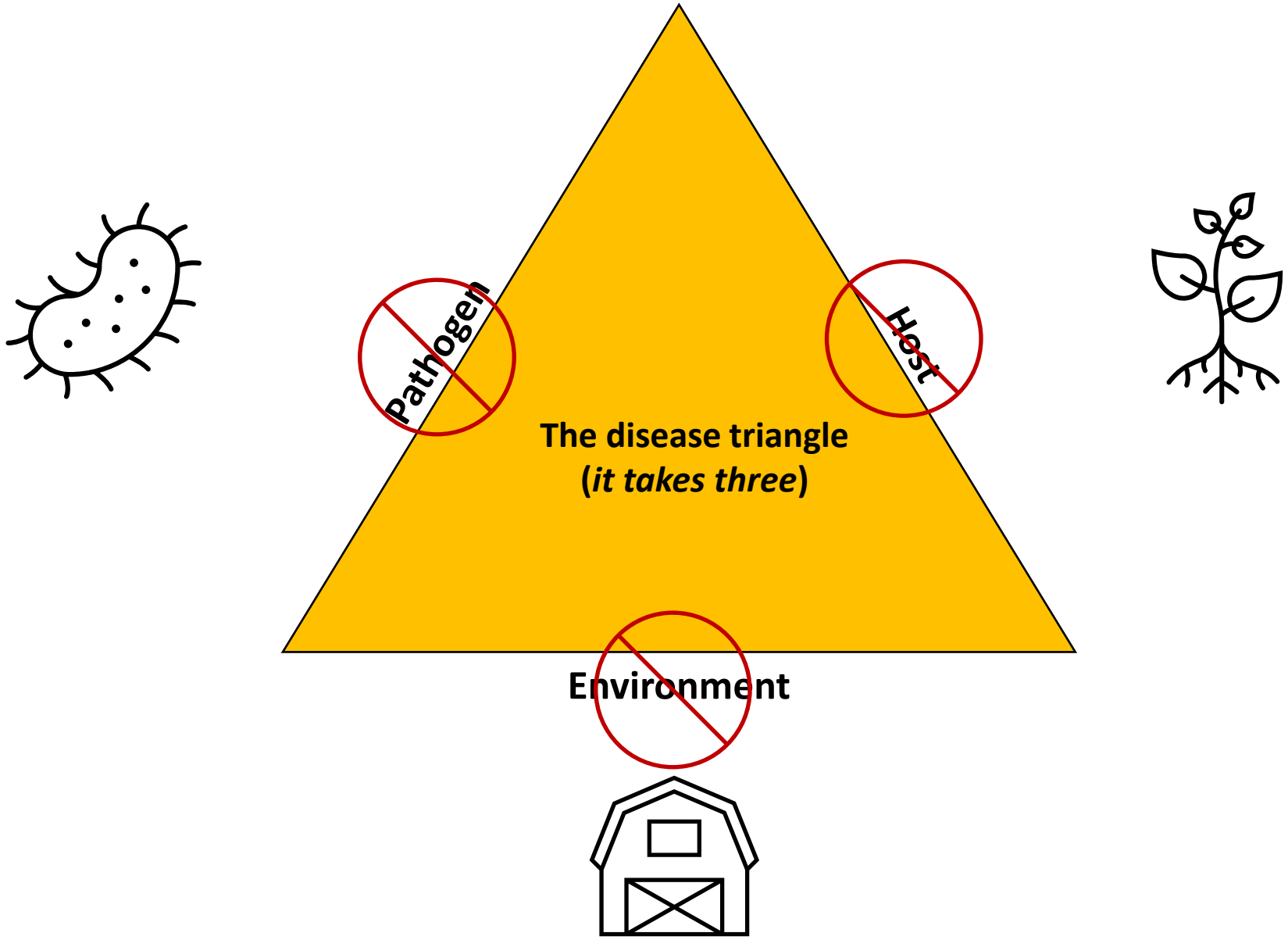
Fogging sanitizers

- Ensure fogging use is approved with selected sanitizer
  - PAA and Chlorine Dioxide most common
- Select appropriate fog generating equipment
- Ensure entire facility is completely filled with fog
  - Use higher rates to accomplish kill
- Pressure is critical to make sure product enters all areas
  - Minimum contact time is 4+ hours
  - Longer is better

Before Loading

- Keep storages closed up as long as feasible after sanitation
  - Optimum 2 weeks
  - Minimum a few hours
- Ensure storage airs out and is dry before loading potatoes

- With tight scheduling, it is important to not cut corners around sanitation
  - Have a lot higher chance of transmitting pathogens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Questions?

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