

# Bacterial Ring Rot of Potato

## Some key questions



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# Key Questions

1. What causes ring rot?
2. Where did the infection come from?
3. How does one get rid of ring rot?
4. What to expect from ring rot testing?

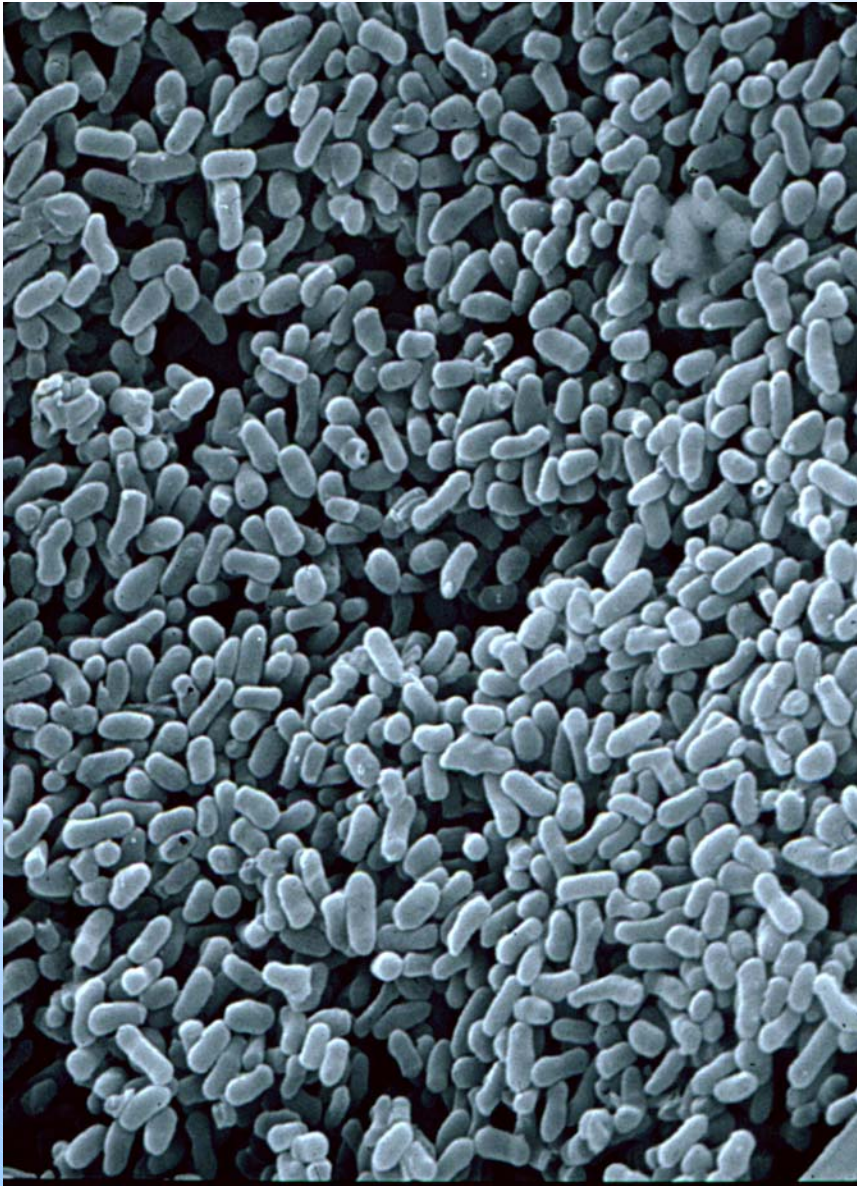
# What causes ring rot?

Ring rot is caused by a bacterium:

- its properties differ significantly from fungi and viruses.
- many fungi can be controlled by chemical sprays, bacteria generally cannot.
- many viruses can be controlled by controlling their vectors, bacteria cannot.

# Bacteria are very small

- A great many ring rot bacterial cells are present in even a very small infection.
- Ring rot bacteria can be spread about readily.
- The extent that ring rot has spread by the time it is detected is difficult to know.



Ring rot  
bacteria as  
seen with a  
scanning  
electron  
microscope

# Bacteria are persistent

- Under the right conditions ring rot bacteria persist for many years.
- Ring rot bacteria survive in infected potato plant and tuber tissue - wherever they may be.
- Ring rot bacteria survive particularly well under dry or cold conditions.

# Where did the infection come from?

There are two possible sources:

- It came from an off-farm source.
- It persists at a low level on the farm site.

# Off-farm sources of ring rot

- Infected seed potatoes bought from another farm.
- Infected culls brought on-site as cattle feed.
- Un-cleaned commercial trucks or other contaminated equipment brought on farm.
- By man or animals from neighbouring, infected tablestock or processing crops.



# Persistence on farm site

- Insufficient clean-up after ring rot occurrence - gradually builds up again - spread by equipment.
- Maintenance of a low level of infection (latent) on farm - short generation time - flush through but back infection - spread by equipment.

# Getting rid of ring rot

- TOTAL clean up.
- Remove ALL potatoes from operation.
- “Flush-through system” do not keep seed on farm for several years subsequent to BRR.
- Clean all potentially contaminated surfaces.
- Disinfect completely all cleaned surfaces.
- Get rid of, or sterilize, all potentially contaminated disposables eg. gloves, knives, overalls, etc.

# Finding ring rot on a farm

- Visual inspection - limited sensitivity due to latent infections, success varies with variety and growing conditions.
- Lab tests - better sensitivity than visual, but still limited sensitivity due to sample size and test factors.

# Underlying assumption in determining probability of detection

- Ring rot is randomly distributed in a lot; each plant is equally likely to be infected.
- Is the assumption more true for small lots than it is for big lots ??????

# Some reasons for non-randomness of ring rot

- One lot planted with seed from different sources.
- Different equipment was used for harvesting, planting, etc. of a portion of the lot
- Seed stored in different places.
- One lot planted in different fields.
- Seed lot grown adjacent to non-seed field.
- Low incidence of BRR, seed cutters inoculates adjacent seed -NOT RANDOM.

# What to expect from lab tests

Greatest limitation is sample size:

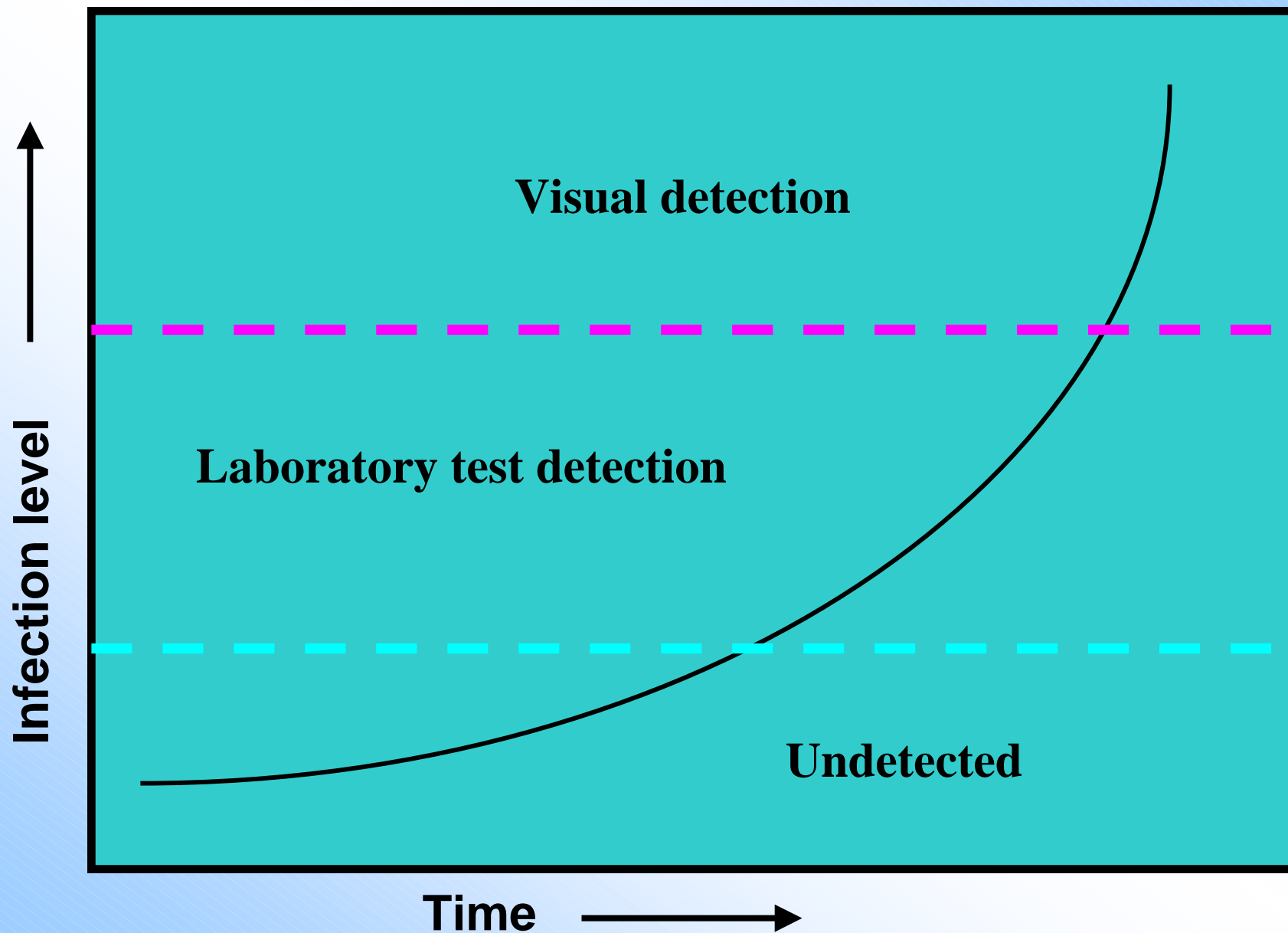
<b>Sample size</b>	<b>Disease incidence</b>	<b>Probability of detection</b>
<b>400</b>	<b>0.1%</b>	<b>33%</b>
<b>1000</b>	<b>0.1%</b>	<b>63%</b>
<b>2000</b>	<b>0.1%</b>	<b>86%</b>
<b>5000</b>	<b>0.1%</b>	<b>99%</b>

Randomness of ring rot is assumed.

Disease incidence of 0.1% is 1 plant or tuber in 1000,  
or about 30 plants/hectare, or about 8 tubers/tonne.

# What can testing do?

- Testing CANNOT prove that a potato lot is free from ring rot.
- Testing is an extension of visual inspection.
- Testing sensitivity is limited by sample size and the laboratory test.
- Positive test result indicates, with a high level of certainty, that ring rot is present.
- Negative test result indicates that the level of infection is below detection level.



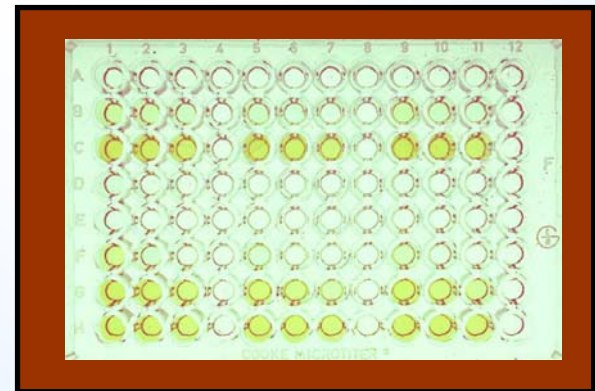


# The Lab Tests

- ELISA - tests for presence of slime produced by the bacteria.
- IMF - tests for the presence of cells of the ring rot bacterium.
- PCR - tests for the presence of DNA of the ring rot bacterium.

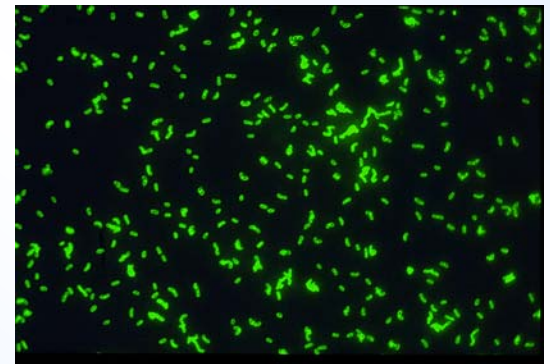
# ELISA TEST

- Excellent screening test.
- Subject to false positives.
- Sensitivity limited by testing in composite samples.



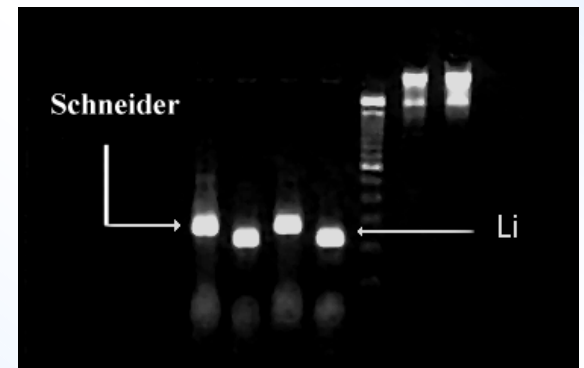
# IMF

- Eliminates false positives of ELISA and confirms true positives.
- Discerns typical bacterium cell structure.
- Indicates level of infection in the plant or tuber.



# PCR

- Extremely sensitive.
- Risk of contaminating sample from infected neighbouring lot.
- It's a tricky test prone to test problems.
- Costly do do.
- Patent-protected method.



# Sensitivity of Lab Tests

- Sensitivity is decreased by testing in composites.
- Sensitivity is decreased by using a positive/negative threshold to avoid **false** positive results.
- In addition to the nature of the test, sensitivity is affected by sample concentration, dilution, and volume of sample extract actual used in the test.

# CFIA Testing Strategy

## Positive test result:

- Err on the side of caution.
- A positive is only called when there is no doubt.
- This approach prevents a false BRR diagnosis.
- This approach favors the seller over the buyer.

## Negative test result:

- Can never be certain that there is no BRR infection below test sensitivity or outside of sampled units.