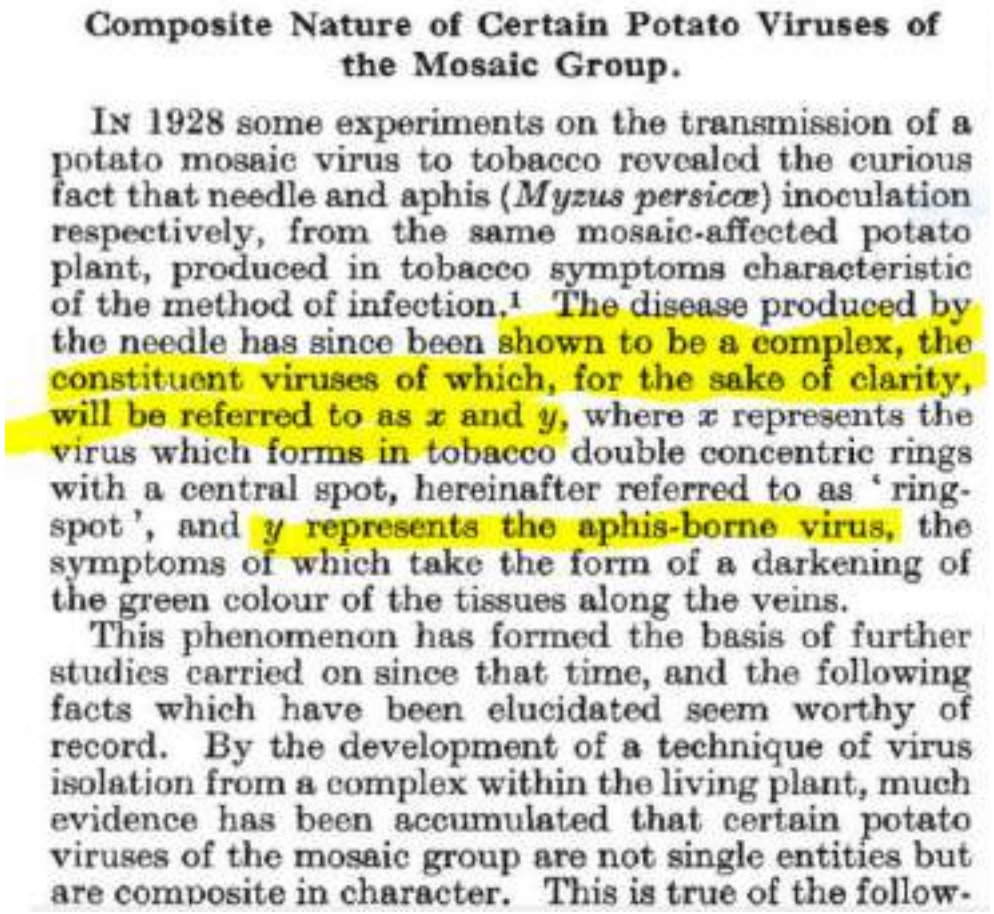
Date
25/11/25

Presenter
Adrian Fox

Potato virus issues

Fera

Why X and Y?



Composite Nature of Certain Potato Viruses of the Mosaic Group.

In 1928 some experiments on the transmission of a potato mosaic virus to tobacco revealed the curious fact that needle and aphis (*Myzus persicæ*) inoculation respectively, from the same mosaic-affected potato plant, produced in tobacco symptoms characteristic of the method of infection.[1] The disease produced by the needle has since been shown to be a complex, the constituent viruses of which, for the sake of clarity, will be referred to as *x* and *y*, where *x* represents the virus which forms in tobacco double concentric rings with a central spot, hereinafter referred to as 'ring-spot', and *y* represents the aphis-borne virus, the symptoms of which take the form of a darkening of the green colour of the tissues along the veins.

This phenomenon has formed the basis of further studies carried on since that time, and the following facts which have been elucidated seem worthy of record. By the development of a technique of virus isolation from a complex within the living plant, much evidence has been accumulated that certain potato viruses of the mosaic group are not single entities but are composite in character. This is true of the follow-

Smith, KM (1931) *Nature*

Fera

Potato virus #101

- Aphid transmitted viruses – a constraint for seed inputs
  - PVY – historically been the “main threat”
  - PLRV – Increasing in concern

- Soil borne viruses - a constraint for production
  - TRV

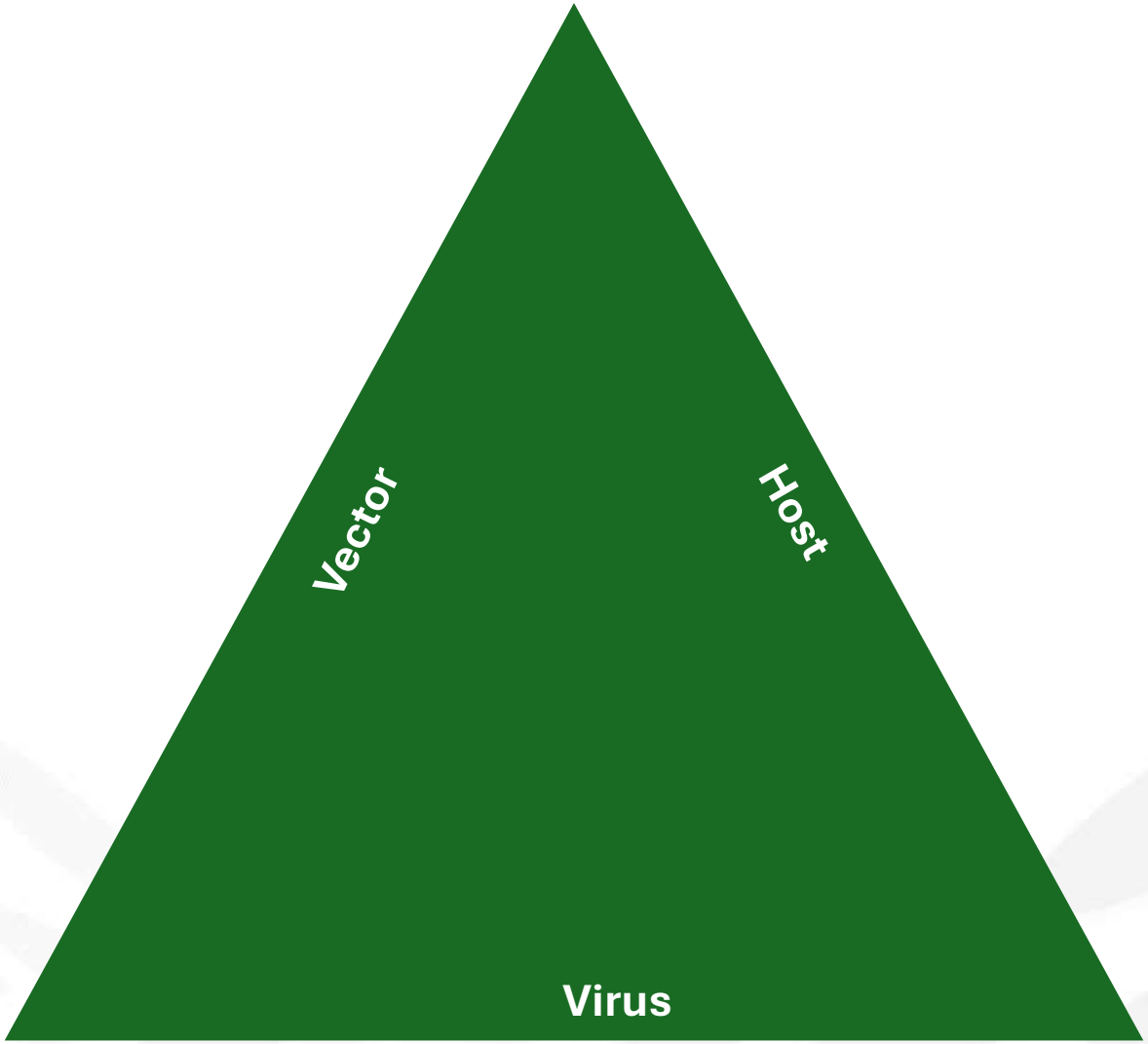
Fera

The impact of viruses

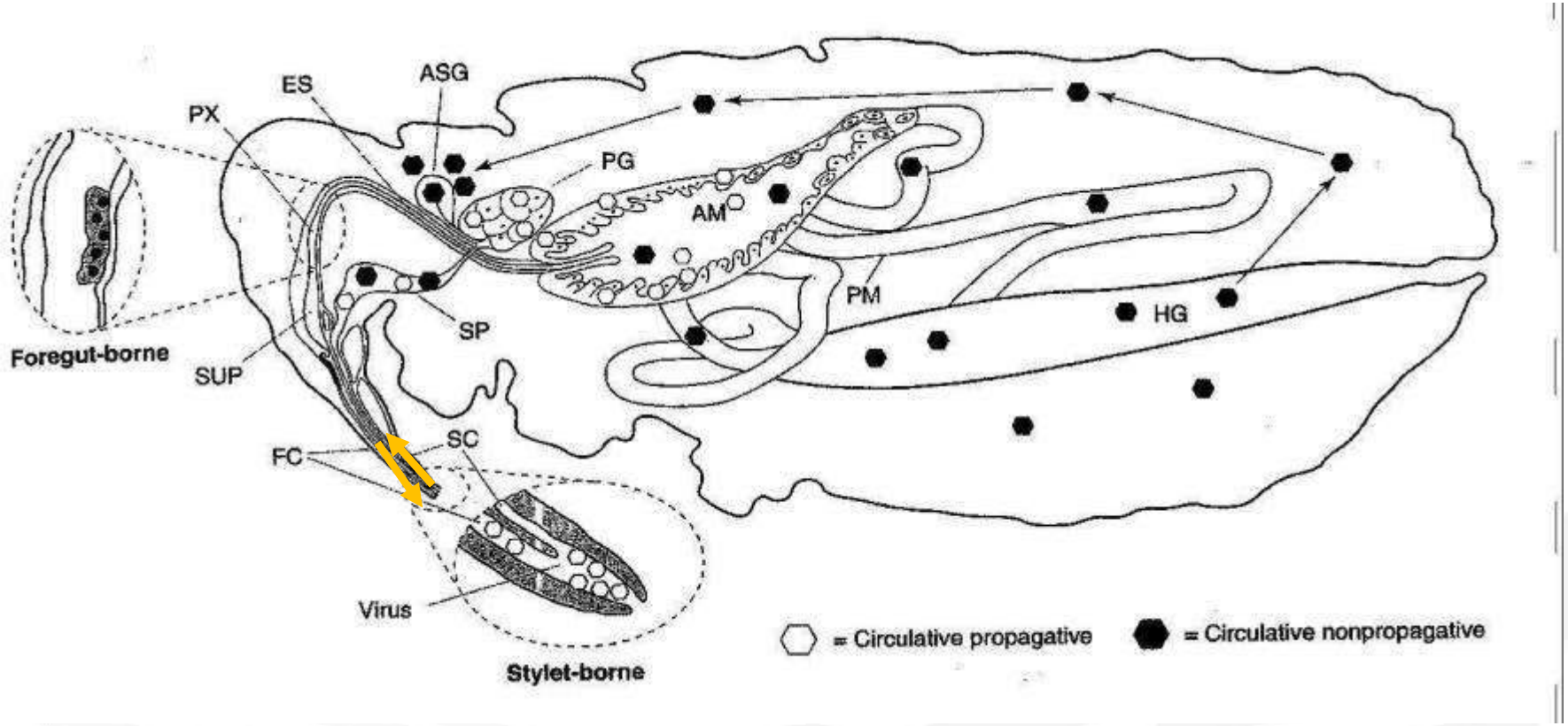
- Potato viruses can lead to both yield and quality loss.
- “Mosaics” (PVY or PVA giving visible symptoms)
    - Cracking
- PVY strains
    - Potato tuber necrotic ring disease (NTN)
    - Yield loss
        - “up to 85% yield loss”
        - Approx. 0.2 t/ha per % virus
- PVA
    - Yield loss
- PLRV
    - Yield
    - Processing quality

Fera

“The disease triangle”

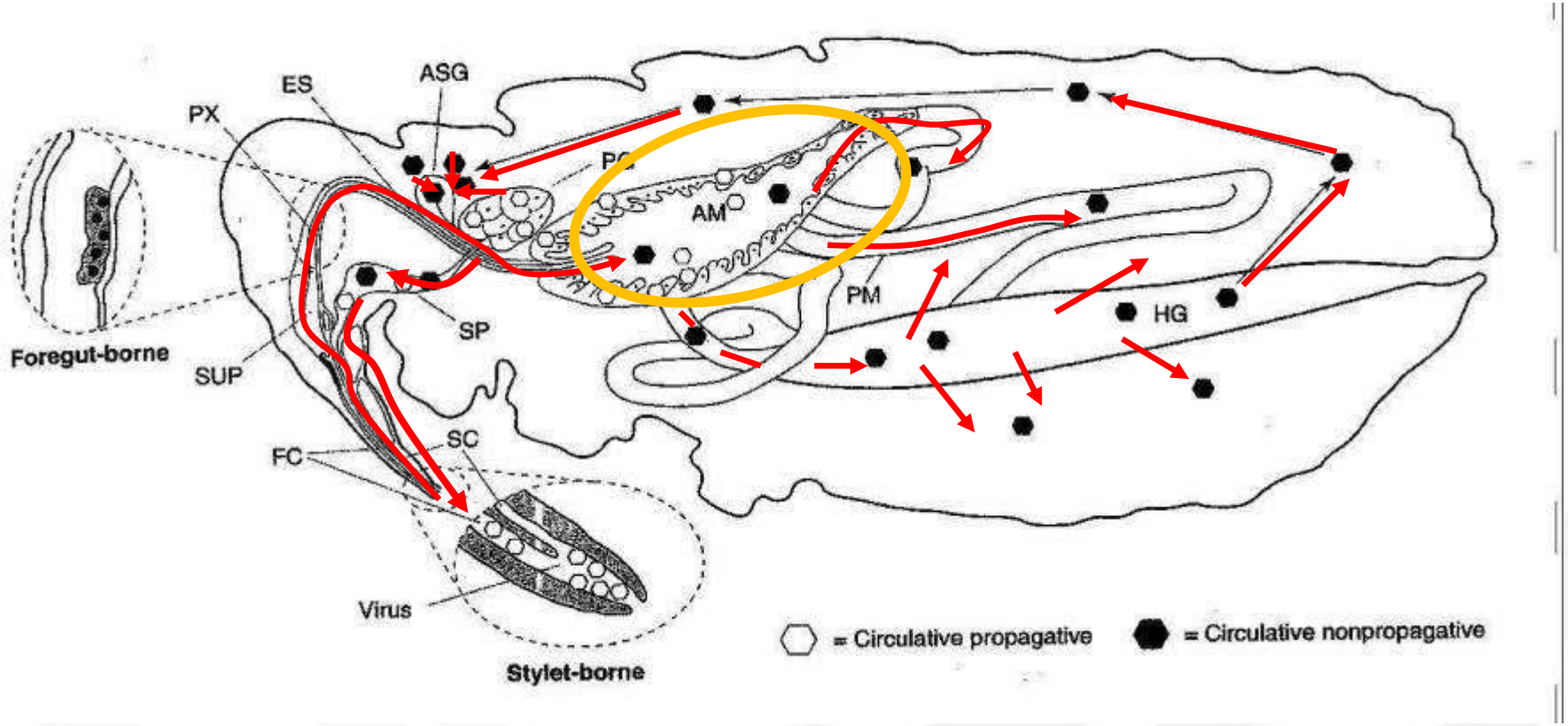


What are non-persistently transmitted viruses?



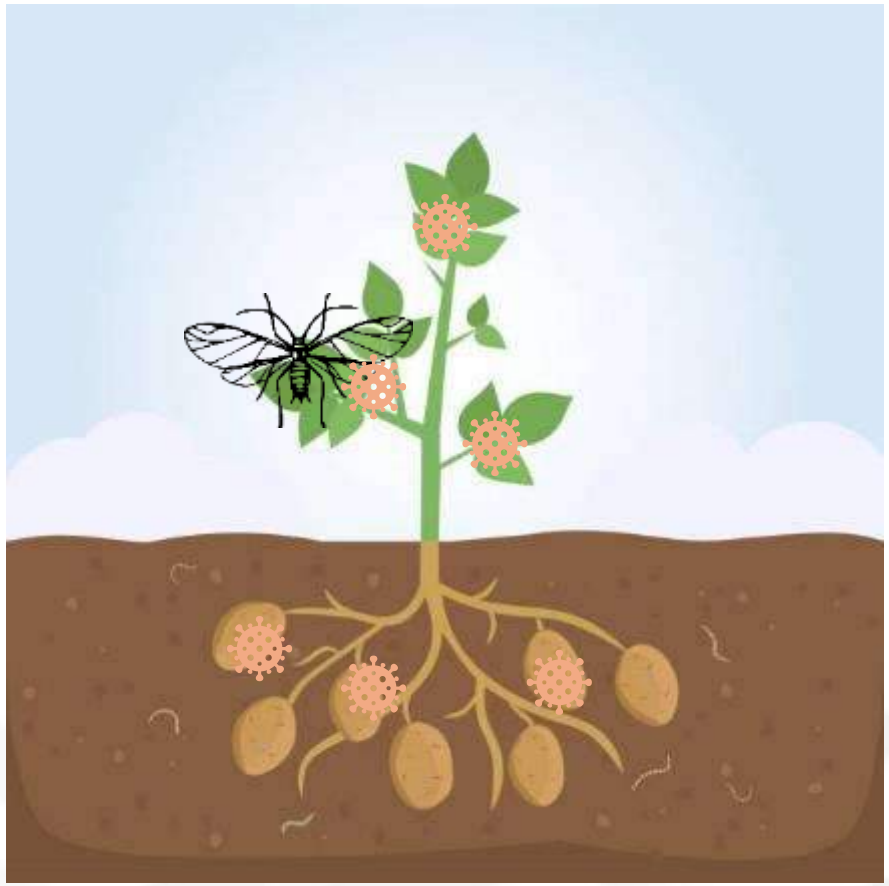
Non-persistent / Stylet borne – PVY, PVA, PVV…

What are persistently transmitted viruses?



Persistent / Circulative - PLRV

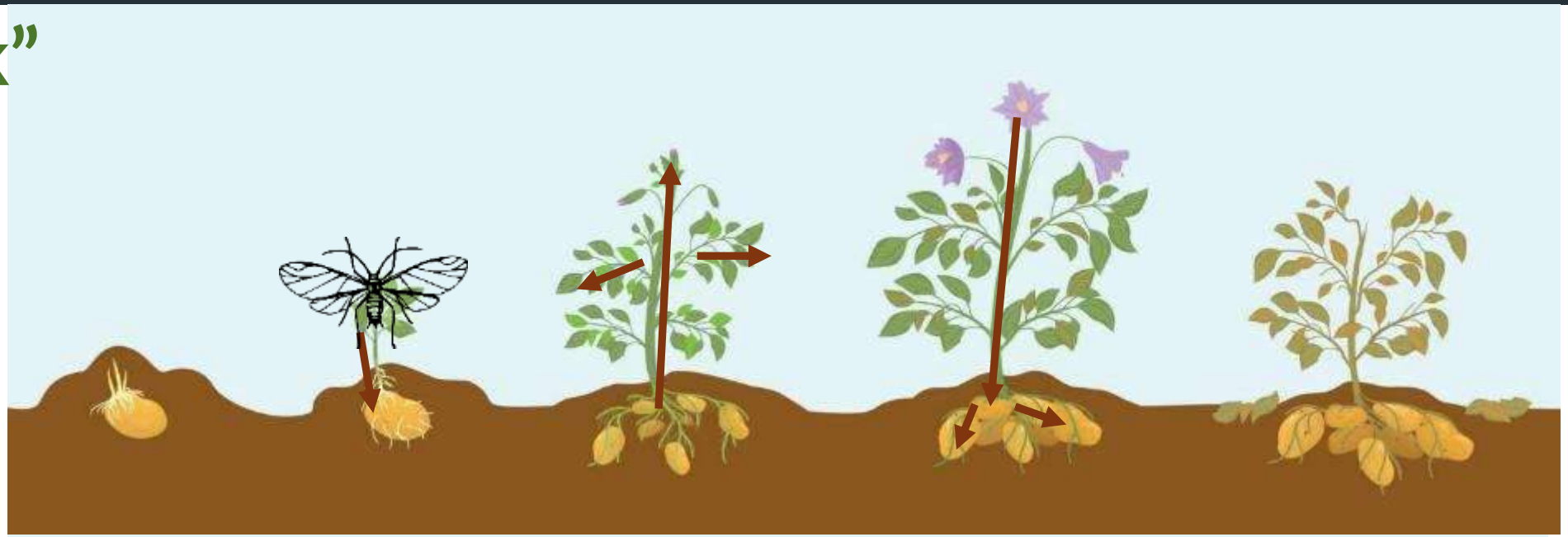
Primary vs Secondary transmission



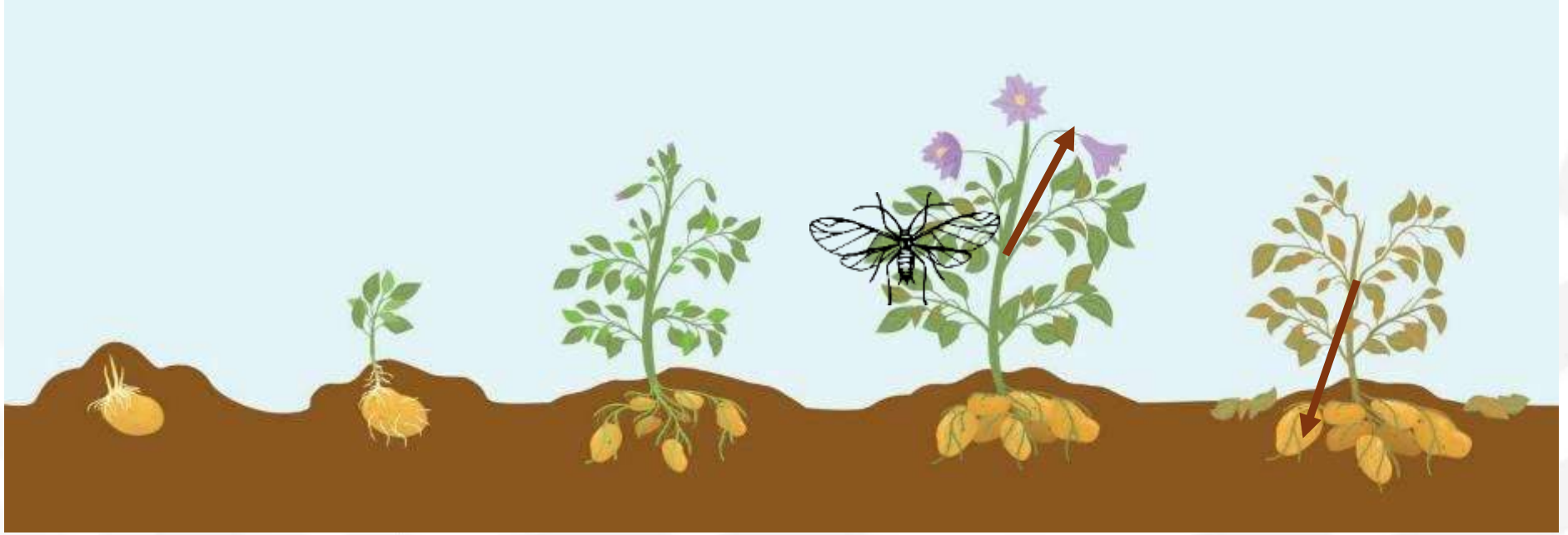
https://www.vecteezy.cm/free-vector/potato-plant
https://www.vecteezy.cm/free-vector/aphid

“Source-Sink”

EARLY SEASON PRIMARY

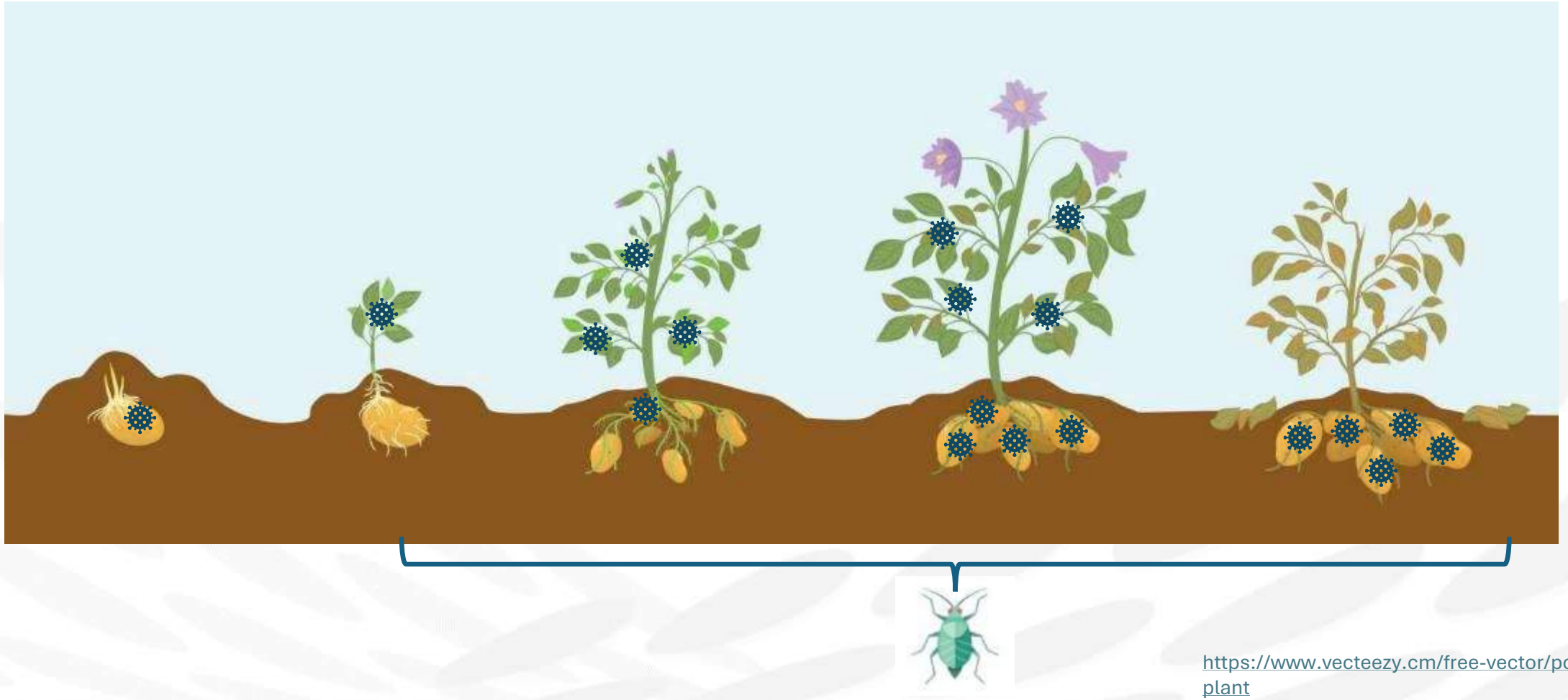


LATE SEASON PRIMARY



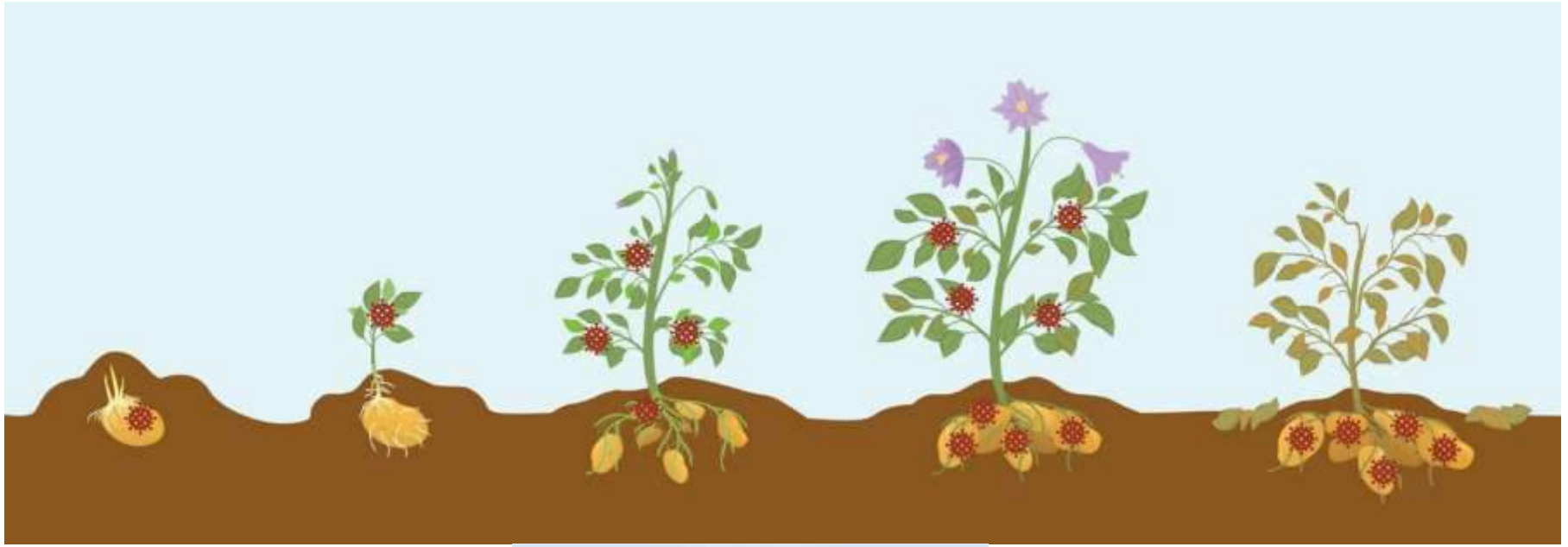
https://www.vecteezy.cm/free-vector/potato-plant

Primary vs Secondary transmission



https://www.vecteezy.cm/free-vector/potato-plant
https://www.vecteezy.cm/free-vector/aphid

Impacts at different life stages



- Primary vs secondary?
- Timing of infection?
  - Pre-tuber initiation?
  - “mature plant resistance”?

https://www.vecteezy.cm/free-vector/potato-plant
https://www.vecteezy.cm/free-vector/aphid

Primary vs Secondary foliar symptoms

- Depending in the timing of infection symptoms of primary infection may not be seen within the growing season…
- **All symptomology is highly dependent on variety as well as isolate of virus**

PLRV:

- Primary: Tops of plants may look pale/yellow or take a bronze/purple tinge; top roll; erect habit (stary plant)
- Secondary: Stunting; upward/inward rolling of lower leaves; leaves become leathery in feel and brittle.

PVY:

- Primary: Late infection will not be seen in season, early infection may develop mosaics
- Secondary: Mild to Severe mosaic

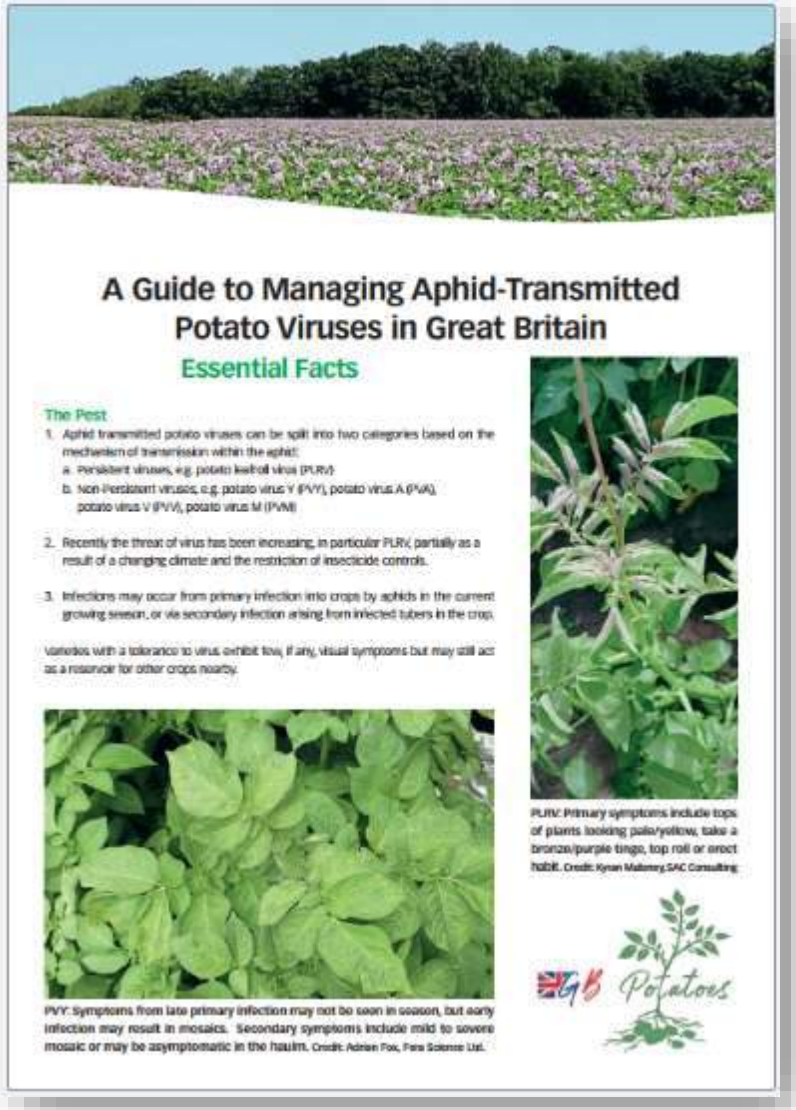
Management advice

Aphid Transmitted Viruses of Potato

Introduction

Key Facts

Symptoms



A Guide to Managing Aphid-Transmitted Potato Viruses in Great Britain

Essential Facts

The Pest

1. Aphid transmitted potato viruses can be split into two categories based on the mechanism of transmission within the aphid:
   a. Persistent viruses, e.g. potato leafroll virus (PLRV)
   b. Non-Persistent viruses, e.g. potato virus Y (PVY), potato virus A (PVA), potato virus V (PVV), potato virus M (PVM)
2. Recently the threat of virus has been increasing, in particular PLRV, partially as a result of a changing climate and the restriction of insecticide controls.
3. Infections may occur from primary infection into crops by aphids in the current growing season, or via secondary infection arising from infected tubers in the crop.

Varieties with a tolerance to virus exhibit few, if any, visual symptoms but may still act as a reservoir for other crops nearby.

PLRV: Primary symptoms include tops of plants looking pale/yellow, take a bronze/purple tinge, top roll or erect habit. Credit: Kynan Mallorey, SAC Consulting

PVY: Symptoms from late primary infection may not be seen in season, but early infection may result in mosaics. Secondary symptoms include mild to severe mosaic or may be asymptomatic in the haulm. Credit: Adrian Fox, Fera Science Ltd.

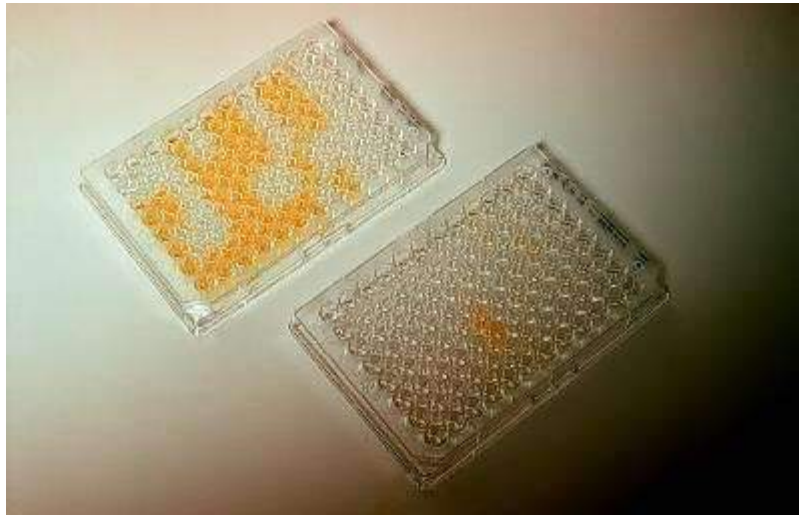
GB Potatoes

https://www.fera.co.uk/media/wysiwyg/crop_health/Aphid_Transmitted_Viruses_of_Potato_Factsheet.pdf

Fera

Start clean, stay clean…

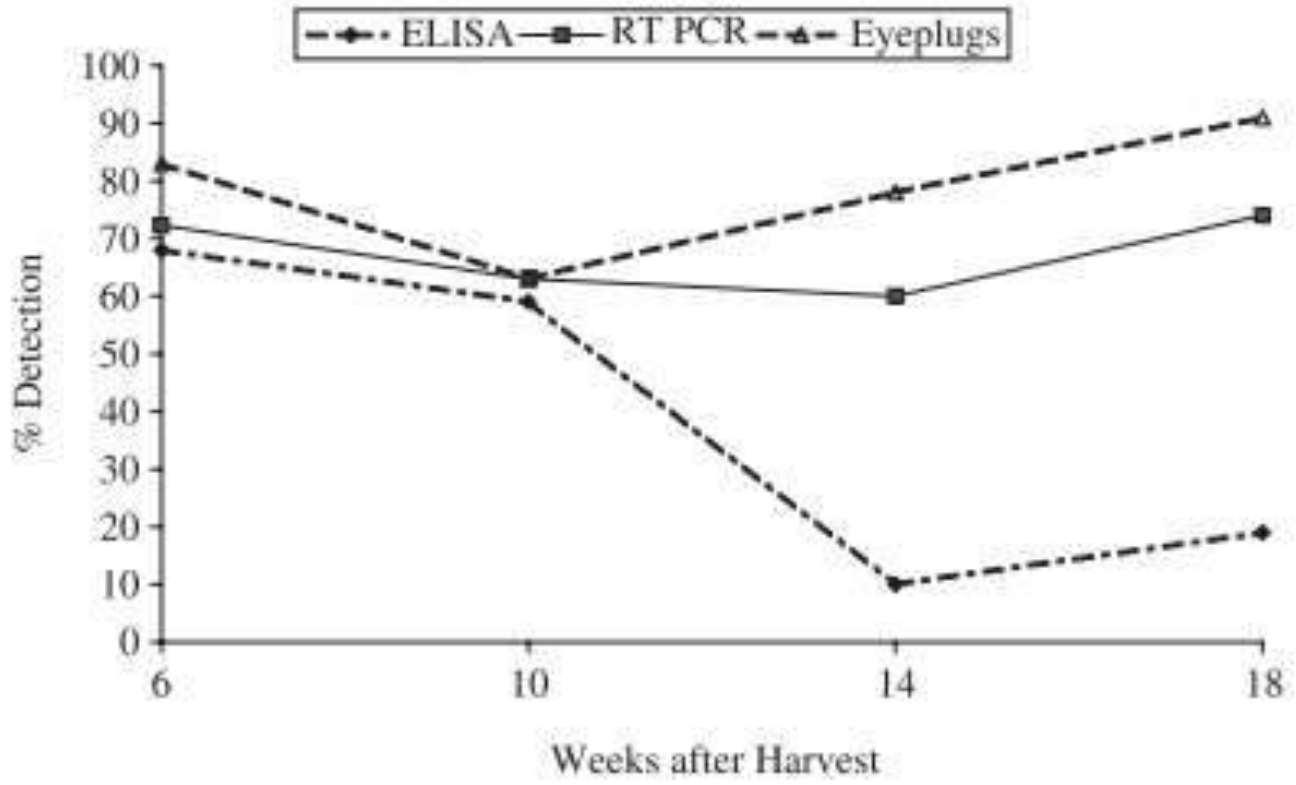
The grow out test



Fera

The Direct test

The Direct Test vs the Grow Out



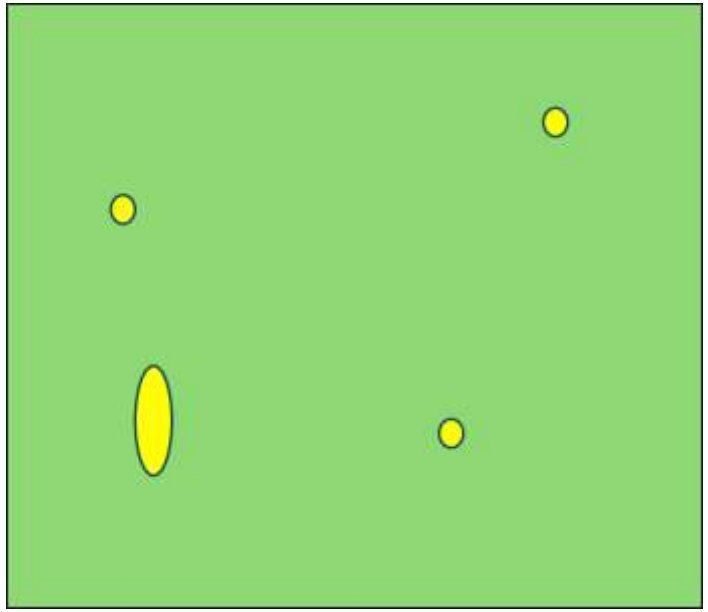
Fox et al (2005) EPPO Bulletin

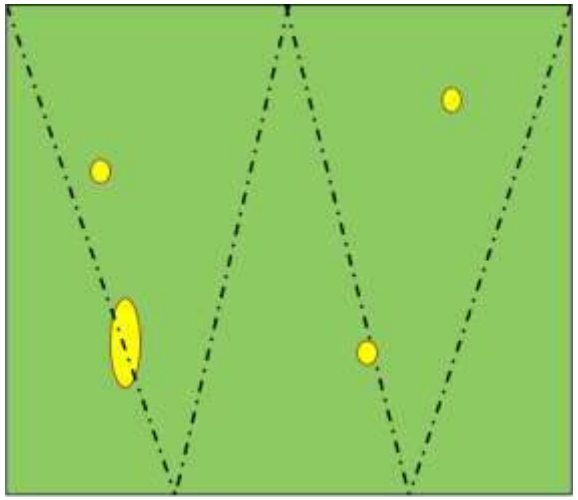
Fera

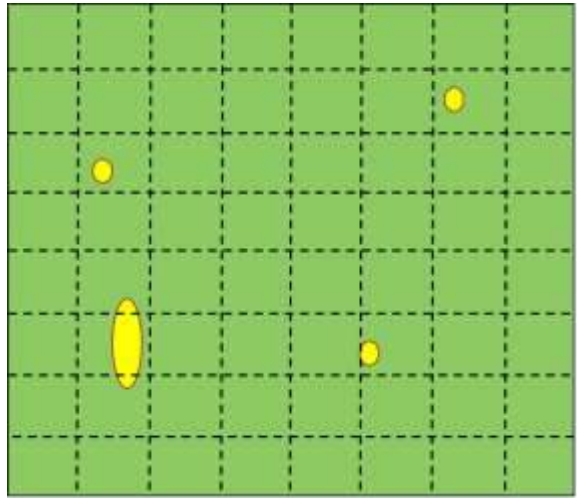
Sampling is key

- The test relies on a **'representative'** sample
  - More likely to have higher incidence around field margins
  - Ideally:
    - after burn-down, before harvest
    - Sample across the field, not from one corner…
    - One tuber per plant with good spread across sampling area
    - Each tuber should be representative of the plant sampled

- If sampling from boxes/bags take a sample as widely as possible from the stock
  - **NOT IDEAL!**







Fera

Spraing Diseases

Spraing is the term for brown necrotic arcs, rings or flecks in tuber flesh (US = Corky Ringspot / CRS)

In severe cases external rings will be visible

The symptoms are caused by infection by Potato mop top virus and/or Tobacco rattle virus in susceptible varieties

The symptoms are sporadic, and influenced by variety and environment

- TRV spread via nematodes
- PMTV spread via powdery scab fungus

Pictures courtesy of SASA

What it is not…

Surface lines and depressions may be:

PVY^{NTN}

- Tuber necrosis

Tobacco necrosis virus

- Spread via *Olipidium*. Dry depressions. Superficial.

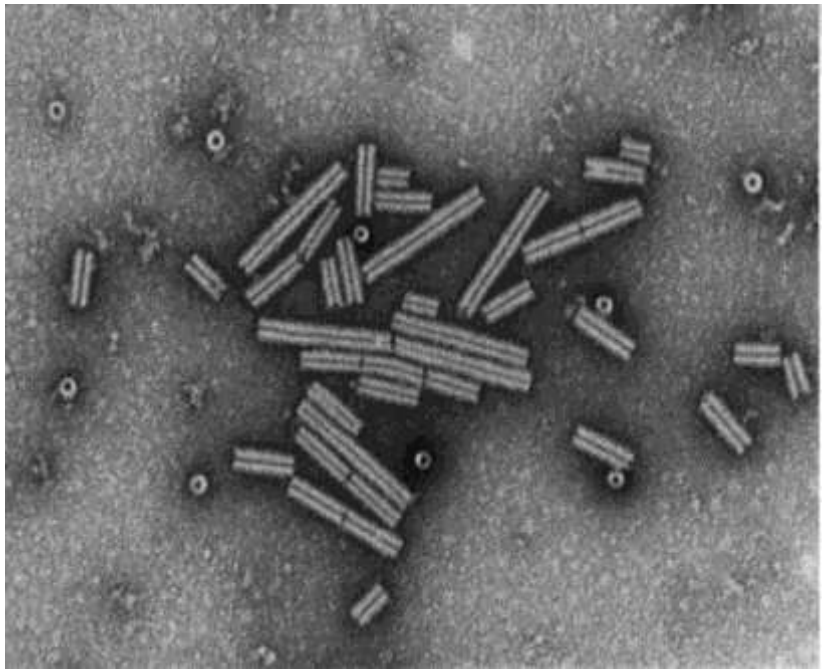
Internal brown marks may be Internal Rust Spot, heat necrosis, Alfalfa mosaic virus (calico)…

Fera

TRV has a broad host range..

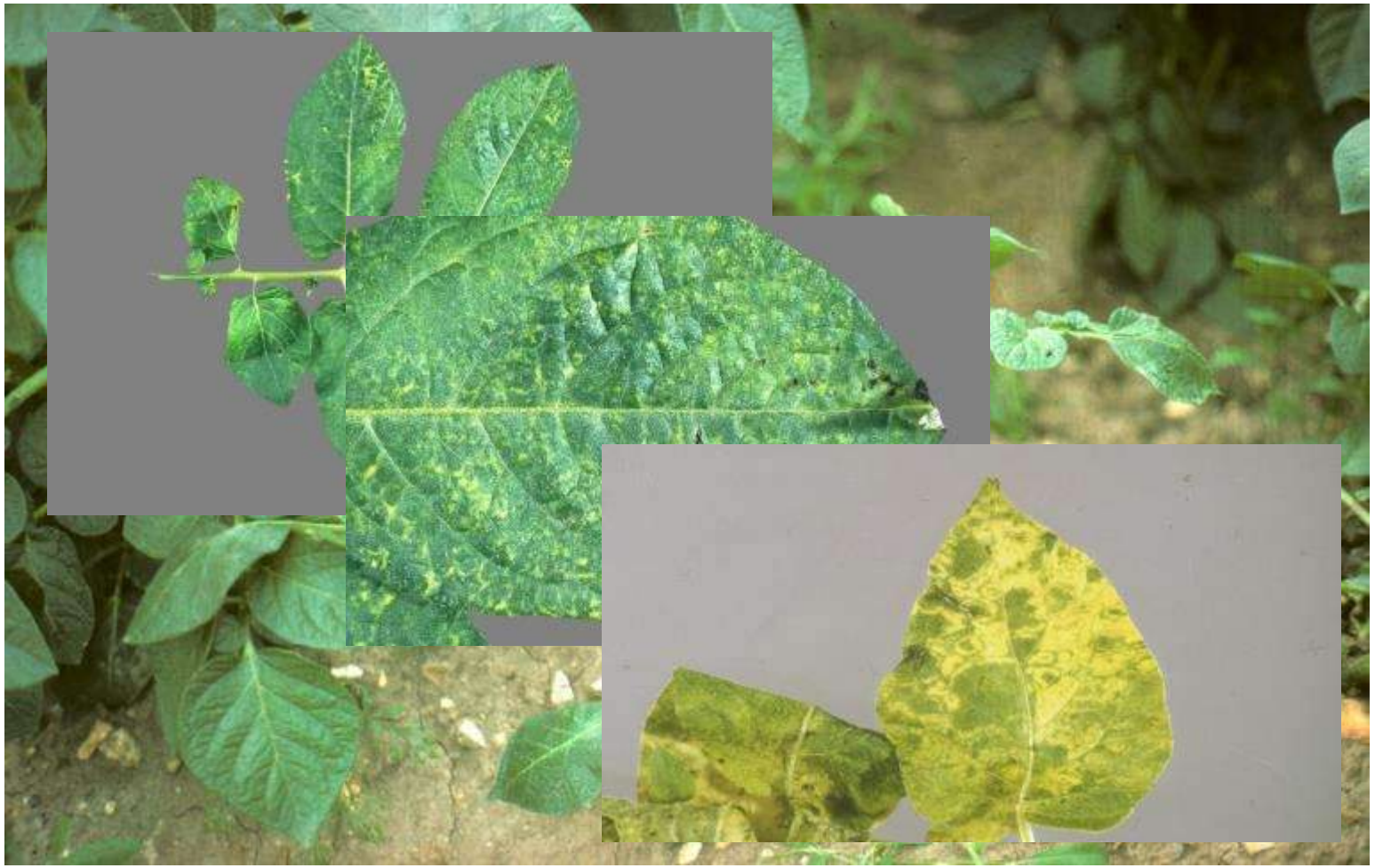
Over 400 plant species are known to be susceptible to TRV including many common field weeds:

TRV – M & NM-types



- TRV virion consists of two part single stranded RNA helix (RNA-1 & RNA-2)
- NM (Non Multiplying) isolates lack the smaller part of the part of the genome and cannot code for coat protein
- NM isolates are associated with spraing
  - symptoms are worst in primary infection
- M-type (Multiplying) are “intact virus” and transmissible via nematodes

TRV – Foliar Symptoms: NM-type?



TRV – Tuber Symptoms – NM type

TRV – Foliar Symptoms: M-type

King Edward

Saxon

TRV – Tuber Symptoms : M-type

Nadine

Romano

Rocket

Saxon

Diagnostic development need:

Current diagnostics:

- “reactive” testing affected tubers for the presence of the causal agents
  - Too late?
- “proactive” bait test of field soil by growing out susceptible plants in the glasshouse and testing after ~4 weeks
  - Not ideal?

ENIGMA

A fera led collaborative R&D model fera

Call
+44 (0)300 100 0321

Email
Adrian.fox@fera.co.uk

Website
www.fera.co.uk

LinkedIn
@FeraScience

YouTube
@FeraScienceLTD

Copyright © 2025 Fera Science Limited (“Fera”). All rights reserved.
Registered Office: York Biotech Campus, Sand Hutton, York, YO41 1LZ.
Registered in England & Wales, No 9462391. VAT Registration ID: GB 435647035

Fera