



**Date**

25/11/25

**Presenter**

Adrian Fox

# Potato virus issues

# 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 aphid (*Myzus persicae*) inoculation respectively, from the same mosaic-affected potato plant, produced in tobacco symptoms characteristic of the method of infection.<sup>1</sup> 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 aphid-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-

# 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

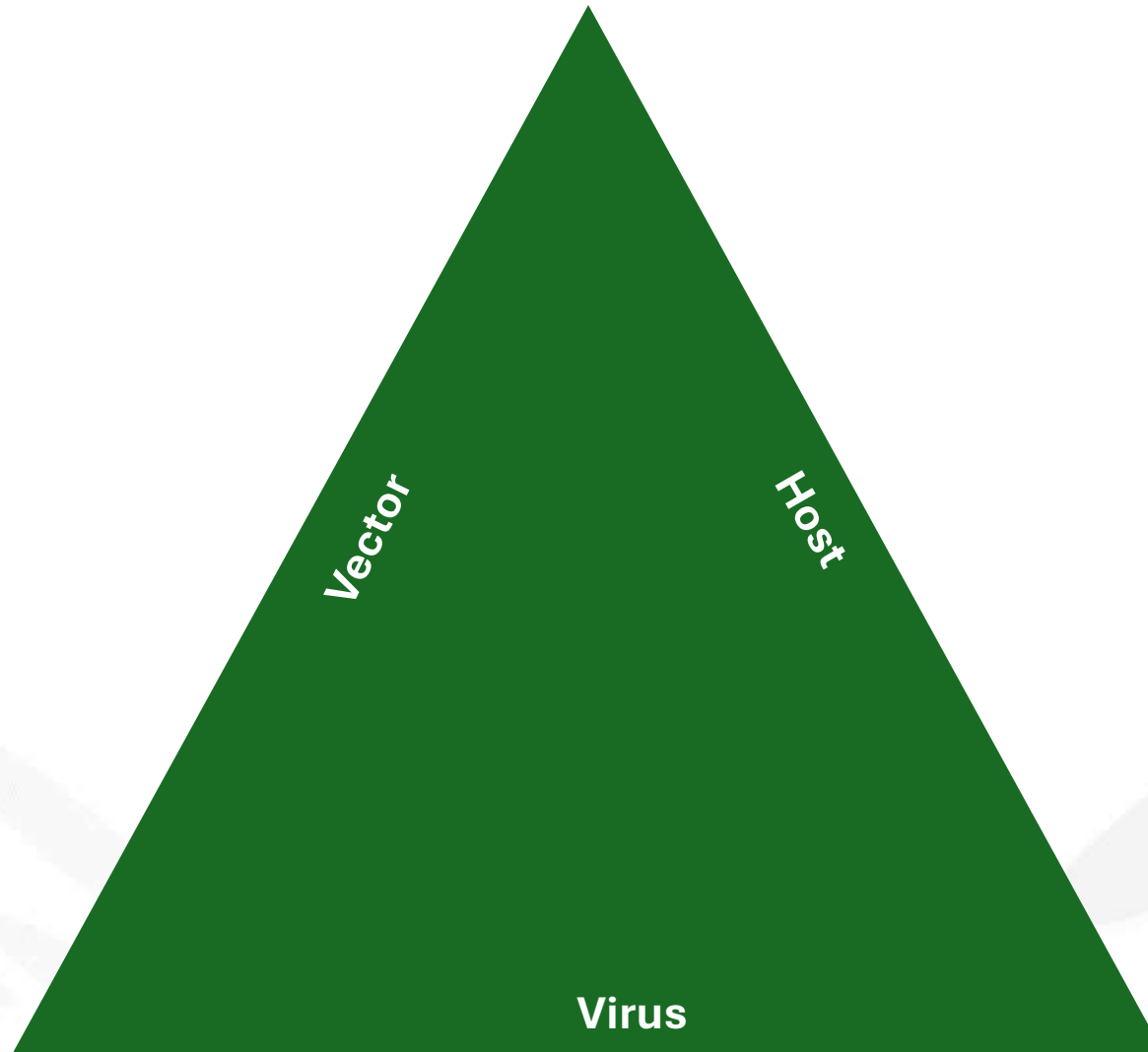


# The impact of viruses

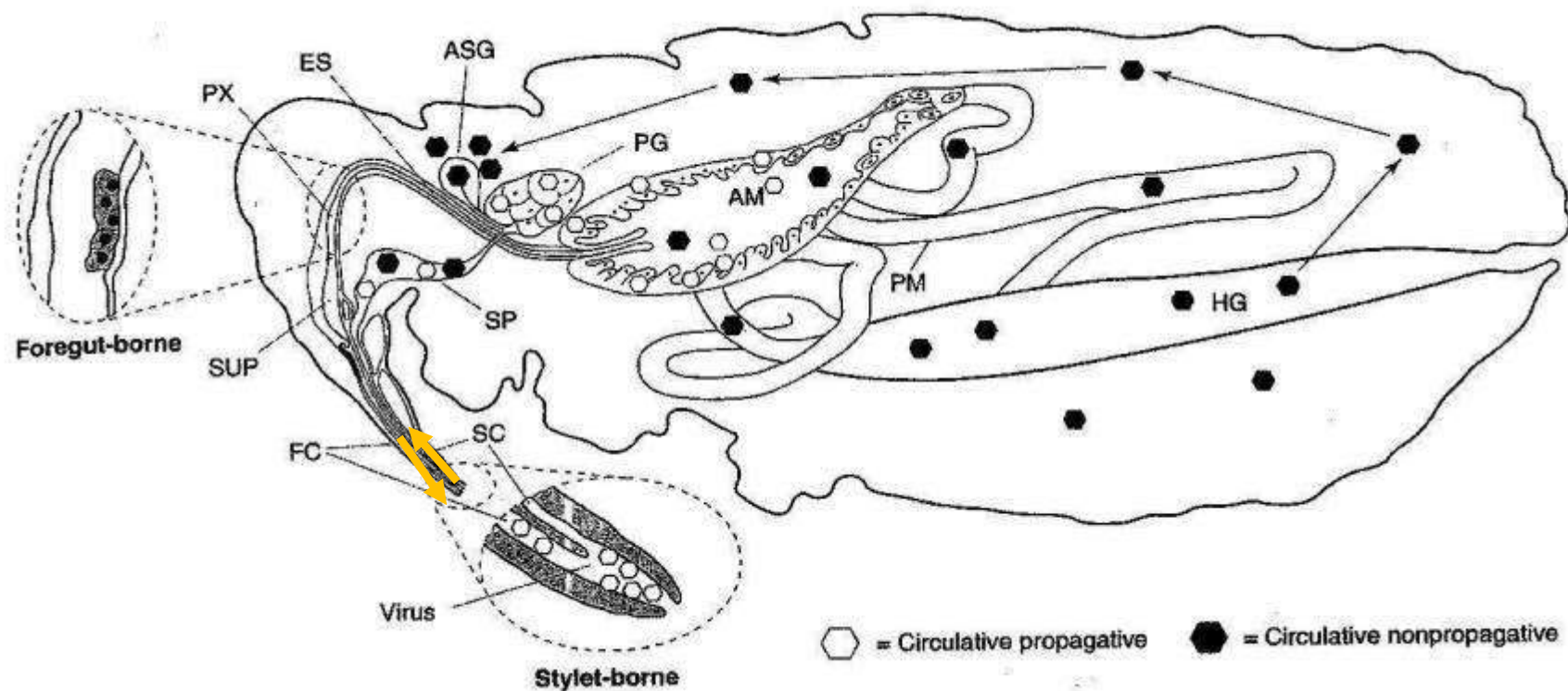
- Potato viruses can lead to both yield and quality loss.
- “Mosaics” (PVY or PVA giving visible symptoms)
  - Cracking
- PVY strains
  - Potato tuber necrotic ring disease (NTN)
  - Yield loss
    - “up to 85% yield loss”
    - Approx. 0.2 t/ha per % virus
- PVA
  - Yield loss
- PLRV
  - Yield
  - Processing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



# "The disease triangle"

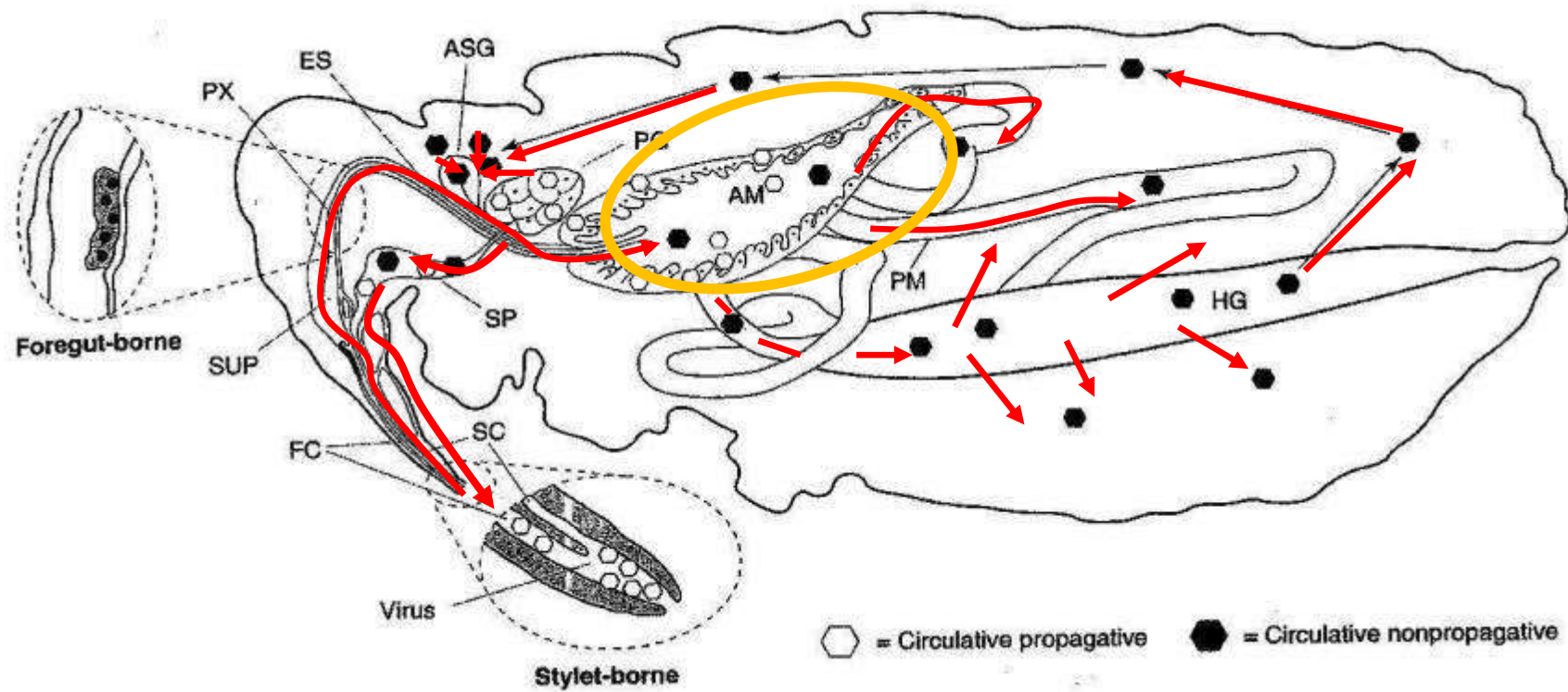


# What are non-persistently transmitted viruses?



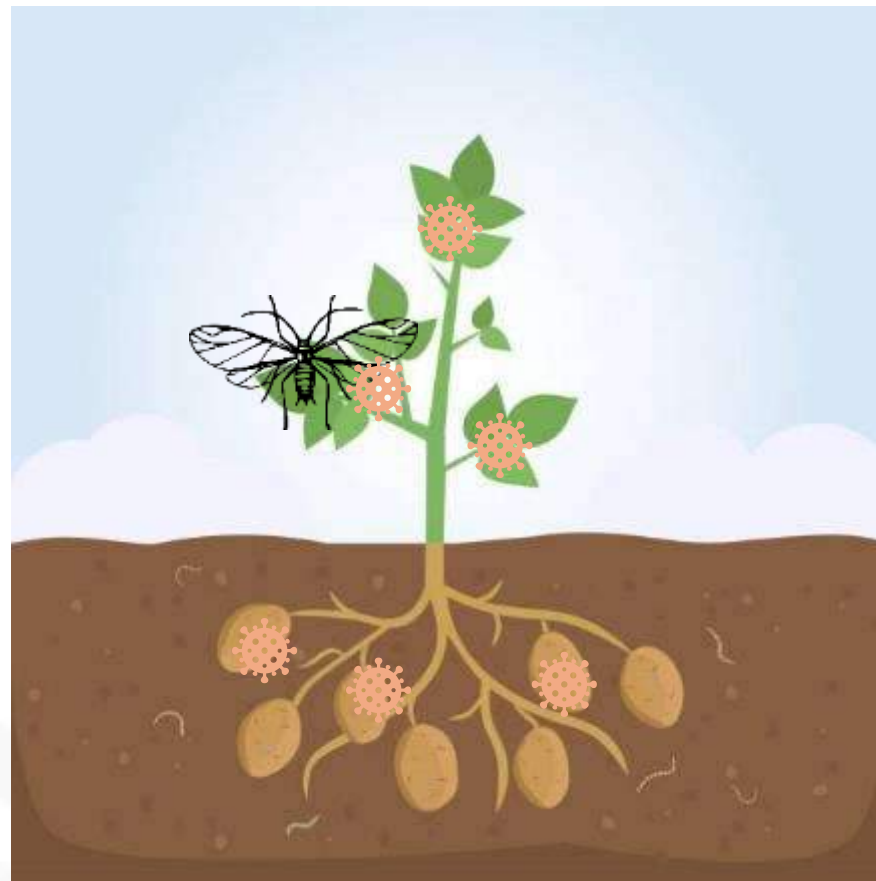
Non-persistent / Stylet borne – PVY, PVA, PVV...

# What are persistently transmitted viruses?



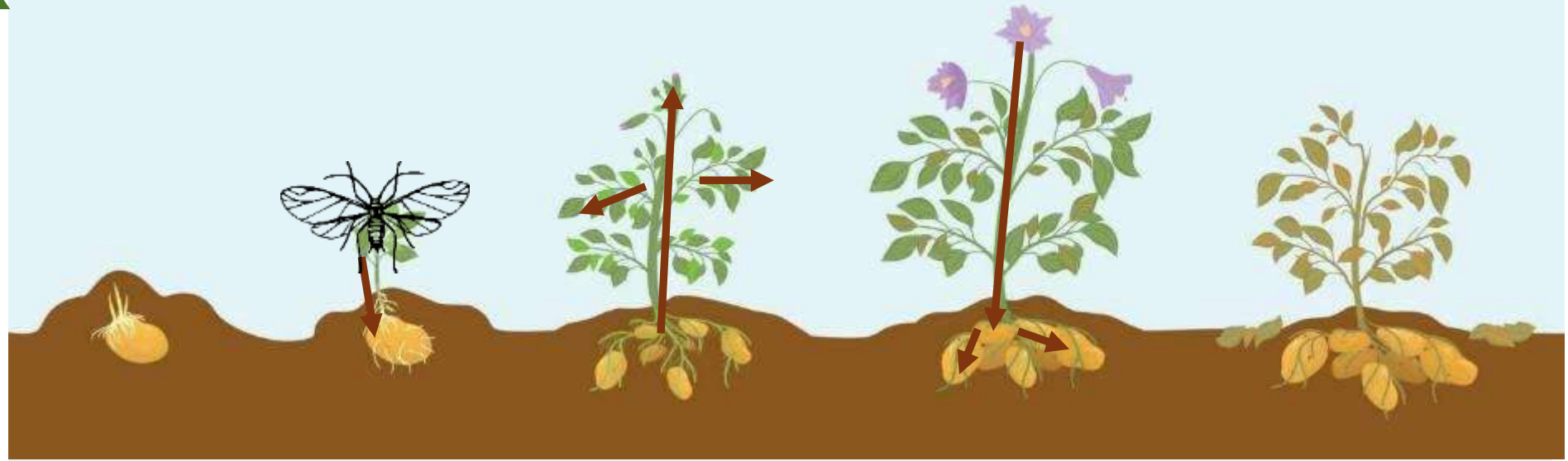
Persistent / Circulative - PLRV

# Primary vs Secondary transmission

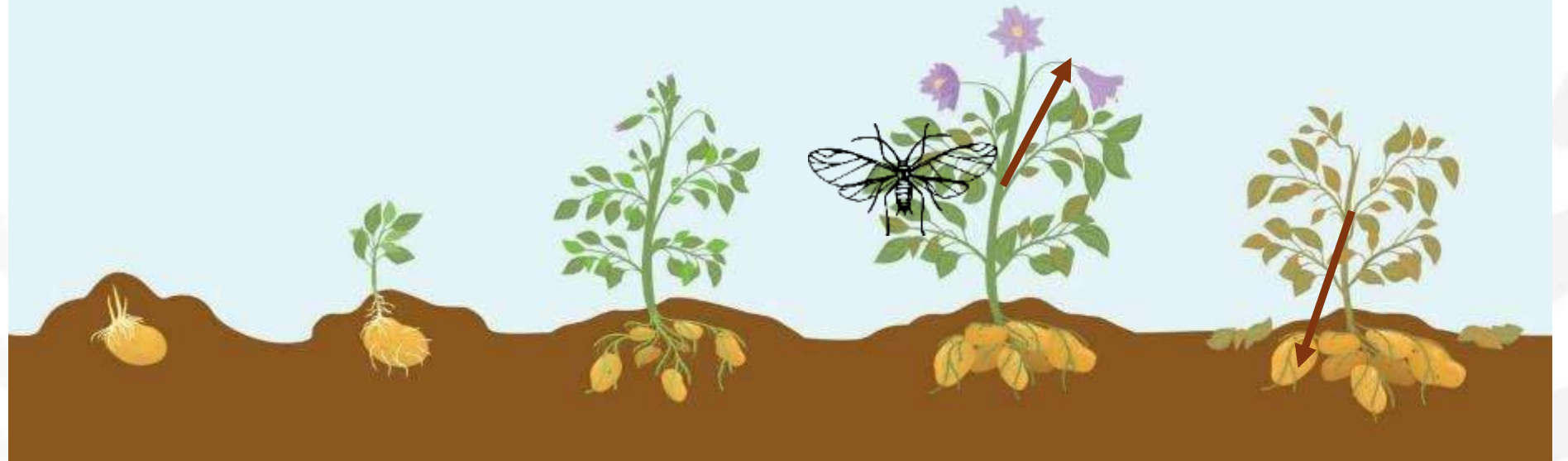


# “Source-Sink”

**EARLY  
SEASON  
PRIMARY**



**LATE SEASON  
PRIMARY**



# Primary vs Secondary transmission



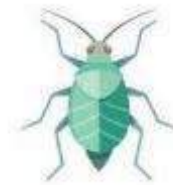
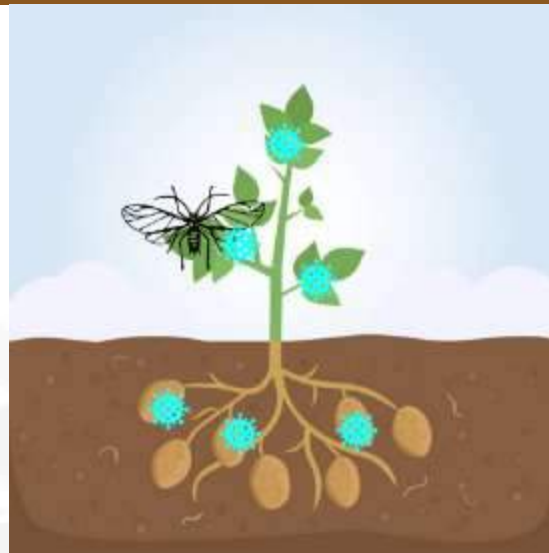
<https://www.vecteezy.com/free-vector/potato-plant>

<https://www.vecteezy.com/free-vector/aphid>

# Impacts at different life stages



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



<https://www.vecteezy.com/free-vector/potato-plant>

<https://www.vecteezy.com/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

Viruses are among the most economically important diseases of potato. Those transmitted by aphid vectors are the most prevalent and damaging to crops, accounting for almost 75% of potato virus disease infections. There are two groups of aphid transmitted viruses which affect potato which can be divided on the basis of their mode of transmission; these are Persistent and Non-Persistent. The only persistent virus affecting potato crops in the UK is Potato leaf roll virus (PLRV), commonly characterised as the name suggests by rolling leaves. Non-persistent viruses are also called the mosaic viruses as they cause a range of generalised mottles or mosaic symptoms in affected plants.

There are several non-persistent viruses, the most common and of greatest economic importance are the potyviruses (PVY strains, PVX, PVV) and less common are the carteriviruses (CRV and CRN). In each case the appearance and severity of symptoms can vary depending upon virus, variety, and number of viruses affecting the plant. It is not uncommon to find more than one virus in a crop or even multiple viruses in the same plant.

### Key Facts

- Aphid transmitted viruses are the major reason for crops having seed certification
- Cause a range of health and tuber symptoms
- The potential yield loss may be up to 20% dependent upon potato variety and growing conditions
- Are grouped by mode of transmission, into Persistent and Non-Persistent
- Persistent viruses include PLRV
- Non-persistent viruses include the mosaic viruses PVY and PVX
- Viruses may be present alone or in combination resulting in varied symptoms
- Planting certified seed will help reduce the risk of virus infection in the growing crop
- Planting home saved seed always has the risk of virus infection to ensure that risk of virus infection is kept to a minimum

### Symptoms

**Persistent Viruses - Potato leaf roll virus**

Primary symptoms of PLRV arising from current season infection include the rolling of upper leaves and chlorosis (yellowing) or reddening. Secondary infection, i.e. that arising from an infected mother tuber, include stunting, chlorosis or pale colouration. Plants tend to have an upright stiff growth habit and the characteristic:

In the tuber, some varieties will exhibit net necrosis. This presents as brown flecking throughout the vascular tissue of the tuber. Net necrosis develops as a result of primary (in-season) spread of the virus. It is not seen in progeny of mother plants grown from infected tubers (secondary infection). The appearance of net necrosis is dependant upon timing of infection and variety susceptibility. Not all varieties will exhibit this symptom when infected. However, some varieties, such as Russet Burbank, are susceptible and symptoms can be problematic where tubers are destined for chipping or processing.



PVY symptoms - Note characteristic rolling of lower leaves



Mosaic symptoms of PVY in potato

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

### Essential Facts


#### The Pest

- Aphid transmitted potato viruses can be split into two categories based on the mechanism of transmission within the aphid:
  - Persistent viruses, e.g. potato leafroll virus (PLRV)
  - Non-Persistent viruses, e.g. potato virus Y (PVY), potato virus A (PVA), potato virus V (PVV), potato virus M (PVM)
- 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.
- 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 low, 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 bronzy/purple tinge, top roll or erect habit. Credit: Kylan Maloney, 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.


Follow

## The Six Steps

to ensure

Effective virus management in potato crops

see overleaf for details

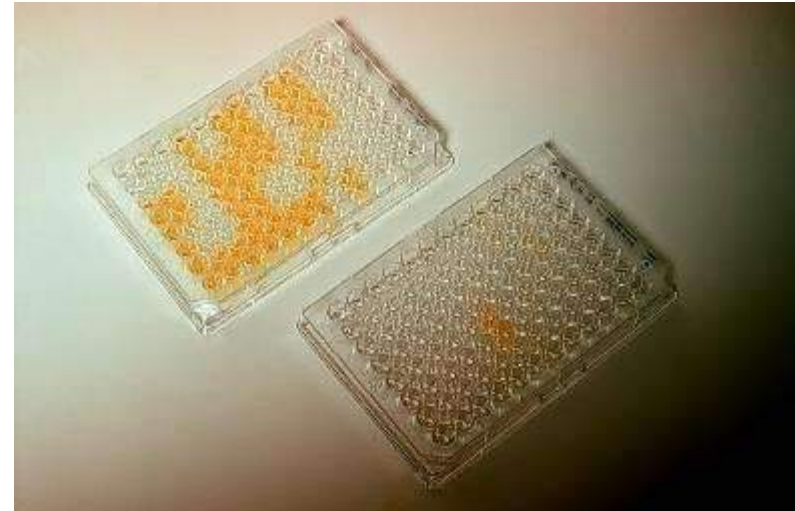


[https://www.fera.co.uk/media/wysiwyg/crop\\_health/Aphid\\_Transmitted\\_Viruses\\_of\\_Potato\\_Factsheet.pdf](https://www.fera.co.uk/media/wysiwyg/crop_health/Aphid_Transmitted_Viruses_of_Potato_Factsheet.pdf)

# Start clean, stay clean...



# The grow out test

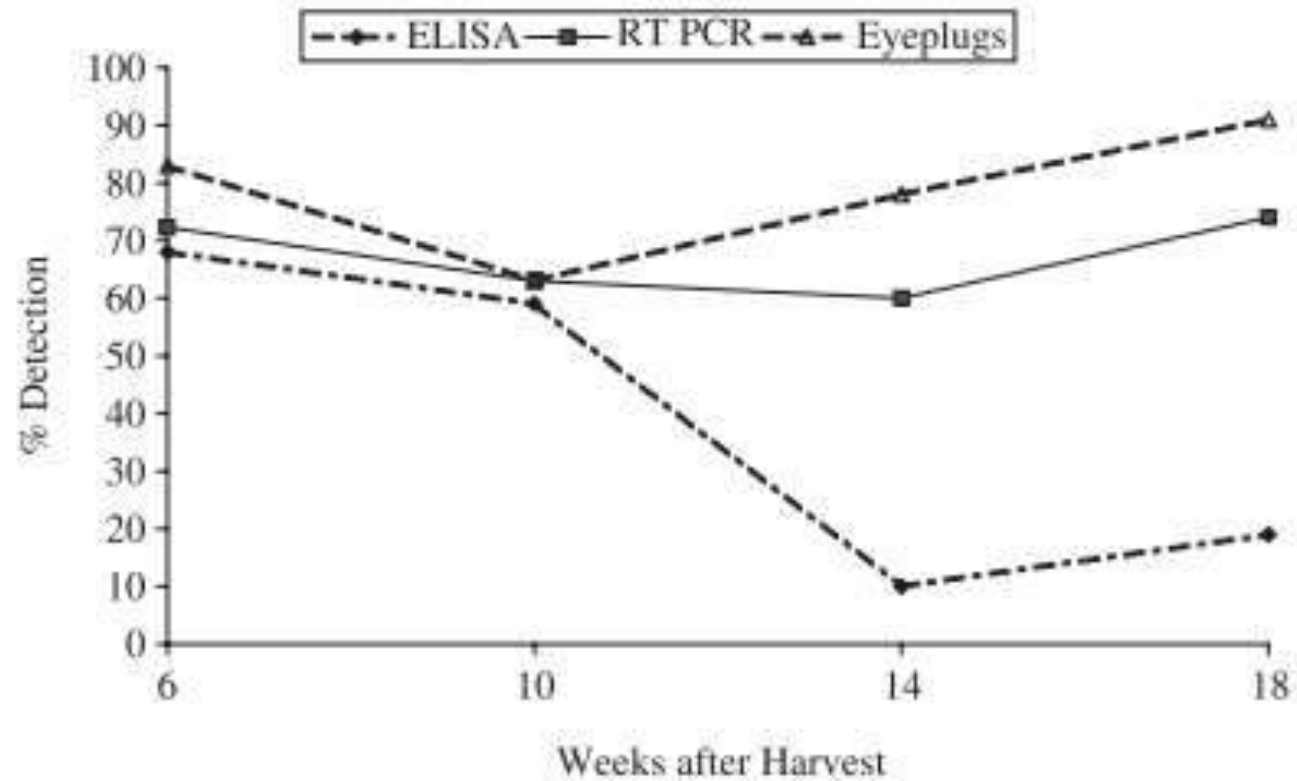


# The Direct test



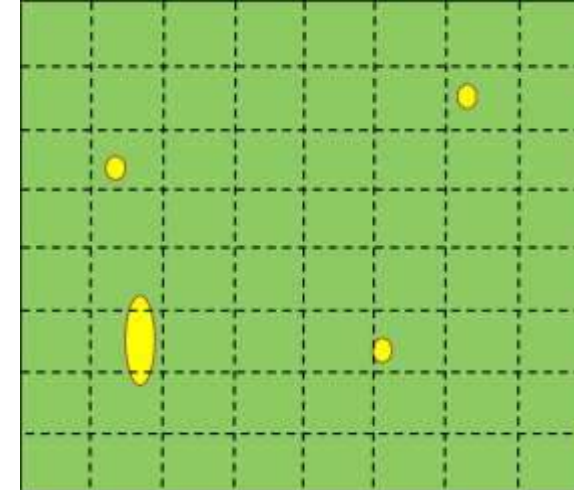
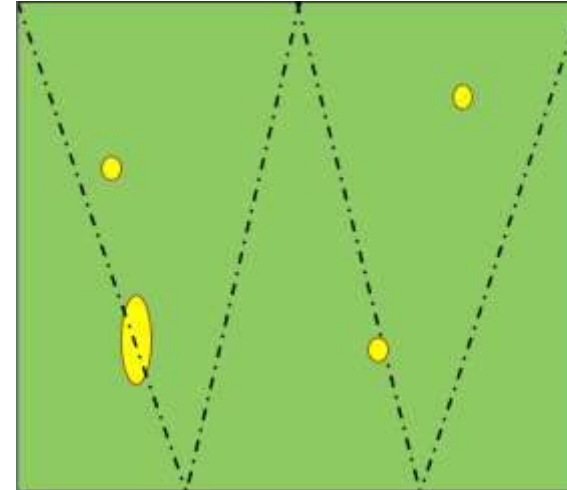
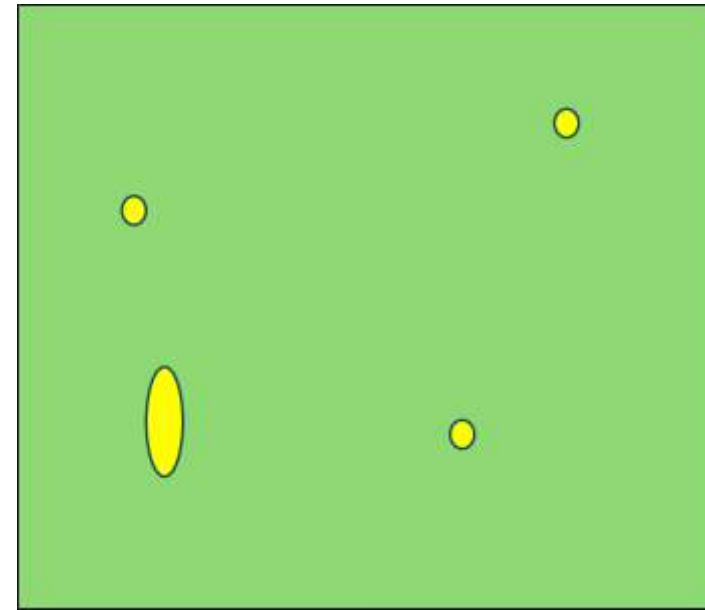
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# The Direct Test vs the Grow Out



# 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!**



# Spraying Diseases

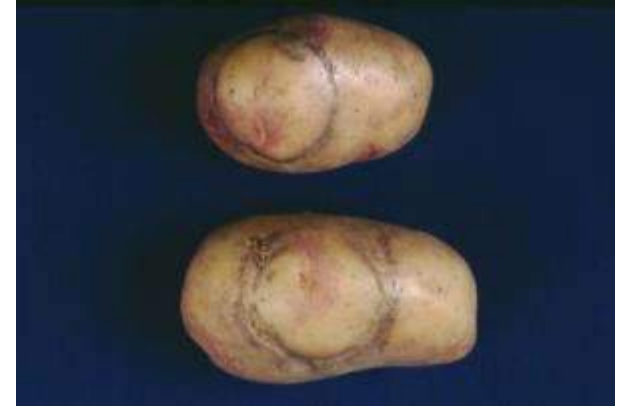
Spraying is the term for brown necrotic arcs, rings or flecks in tuber flesh (US = Corky Ringspot / CRS)

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



# What it is not...

Surface lines and depressions may be:

PVY<sup>NTN</sup>

- Tuber necrosis

Tobacco necrosis virus

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

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

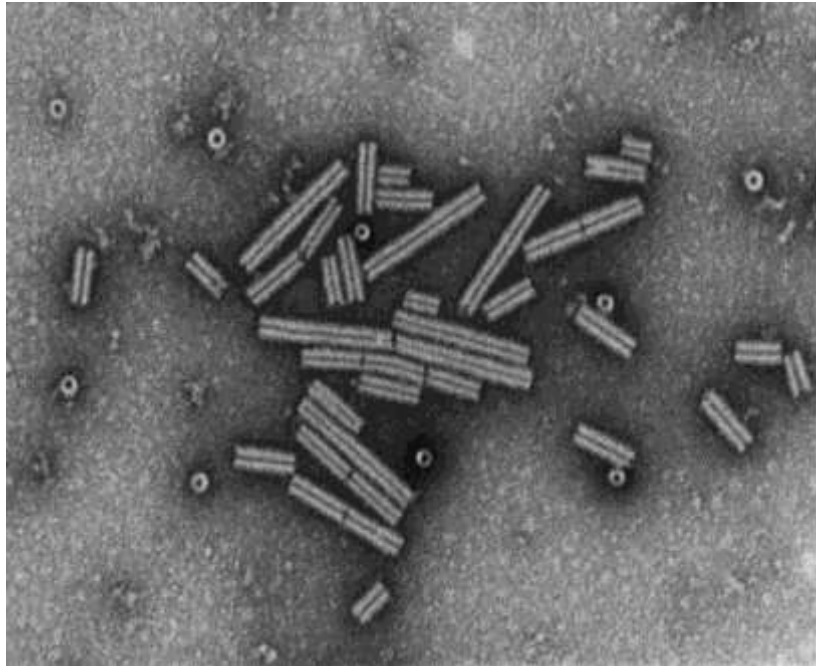


# TRV has a broad host range..

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

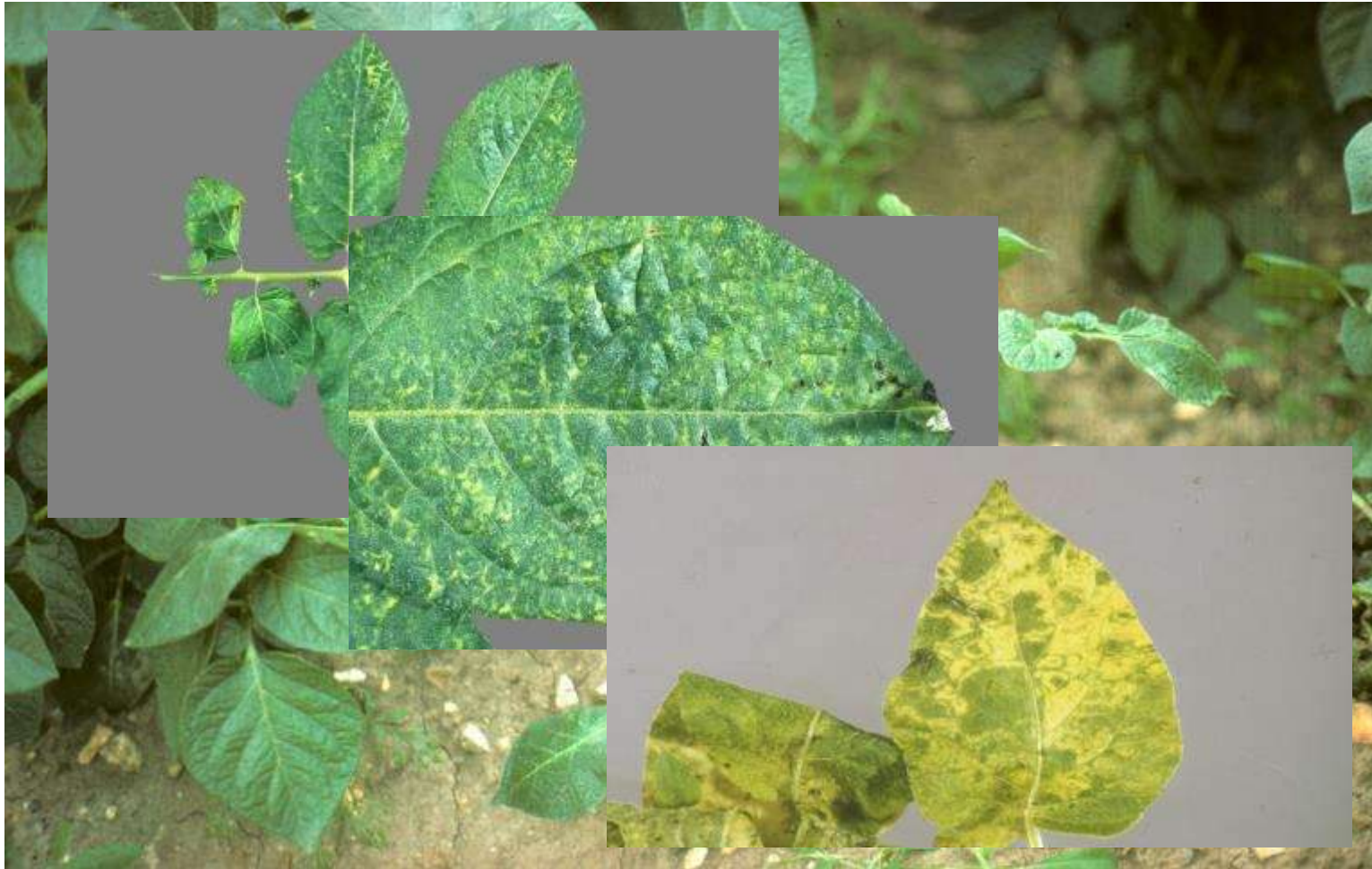


# TRV – M & NM-types



- 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 

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