

Monitoring Aphid Virus Vectors in Potato crops

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Plant health & Biodiversity



Summary

- **Aphids-Pest status in seed potatoes**
- **Direct/Indirect damage**
- **Virus vectors**
- **Virus transmission**
- **Monitoring**
- **Local experience**

Agri-Food and Biosciences Institute Northern Ireland



- Initiated 1976
- Contributed to RIS until 1986

Location of suction traps in the UK

Rothamsted Suction Traps in the UK - Google Maps - Windows Internet Explorer

https://maps.google.co.uk/maps/ms?msid=205967296055740986381.000468c450ba1bfc69709&msa=0&ie=UTF8&t=h&ll=-54.749991,-2.373047&spr

Google

Get directions My places Save to My Places

Rothamsted Suction Traps in the UK

Location of Rothamsted Insect Survey Suction Traps.

Public · 10,042 views
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- E II
940 Elgin Two
- D
907 Dundee
- G
942 Gogarbank
- Ay
923 Ayr
- N
906 Newcastle
- P
922 Preston
- K II
943 Kirton Two
- BB
904 Broom's Barn
- We
941 Wellesbourne
- H
917 Hereford
- RT
901 Rothamsted Tower
- Wr
924 Writtle
- SP
908 Silwood Park
- W
Wye 903
- SX
913 Starcross

United Kingdom

100 mi
100 km

Imagery ©2013 TerraMetrics, Map data ©2013 Google, ©2008, Google

Report a problem

Done

Internet | Protected Mode: On

100%

16:52
10/10/2013

Aphids - Significant Pest Status

- **Direct damage - Loss of plant sap, distortion, wilting, galling**



Aphids - Significant Pest Status

- Indirect damage - Worldwide, aphids transmit over 60% of all known plant virus diseases



Plant Virus Transmission by Aphids

Viruses classified by length of time infectivity is retained by the vector.

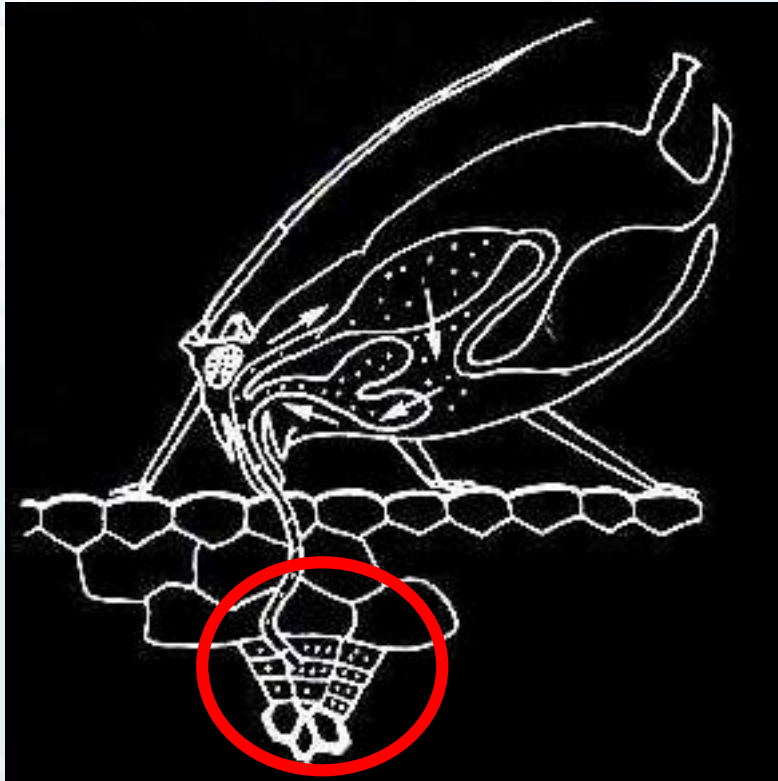
Persistent viruses

Semi-persistent viruses

Non-persistent viruses

Persistent Virus

Long Acquisition

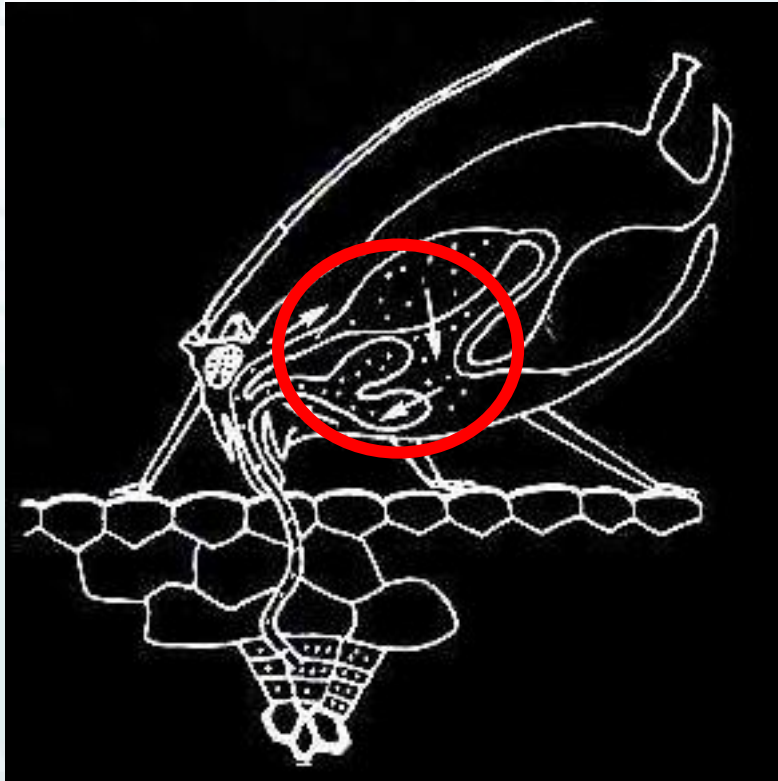


Potato Leaf Roll Virus
PLRV

Persistent Virus

Long Acquisition

Latent Period



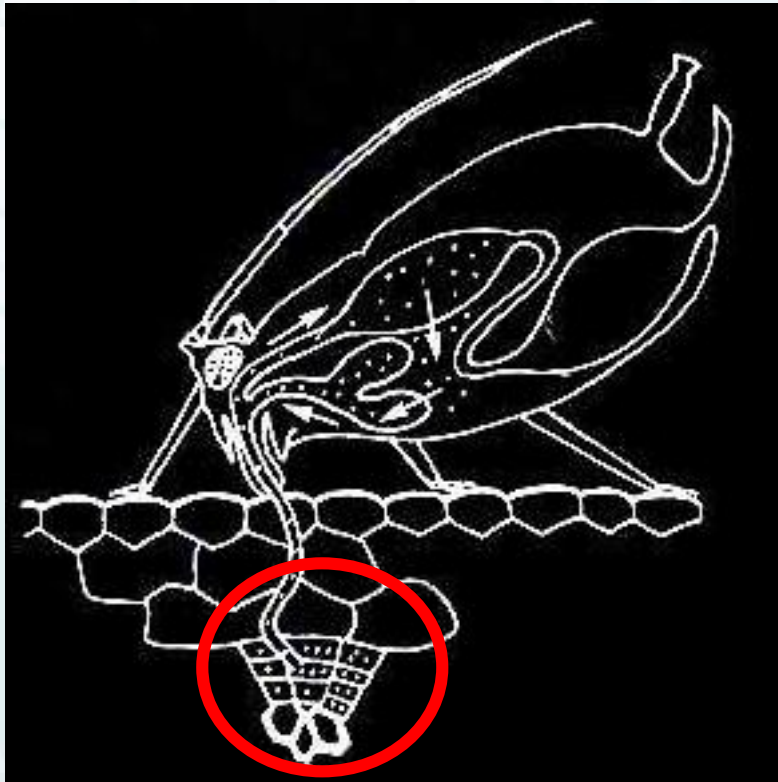
Potato Leaf Roll Virus
PLRV

Persistent Virus

Long Acquisition

Latent Period

Long Inoculation



Potato Leaf Roll Virus
PLRV

Persistent Virus

Long Acquisition

Latent Period

Long Inoculation

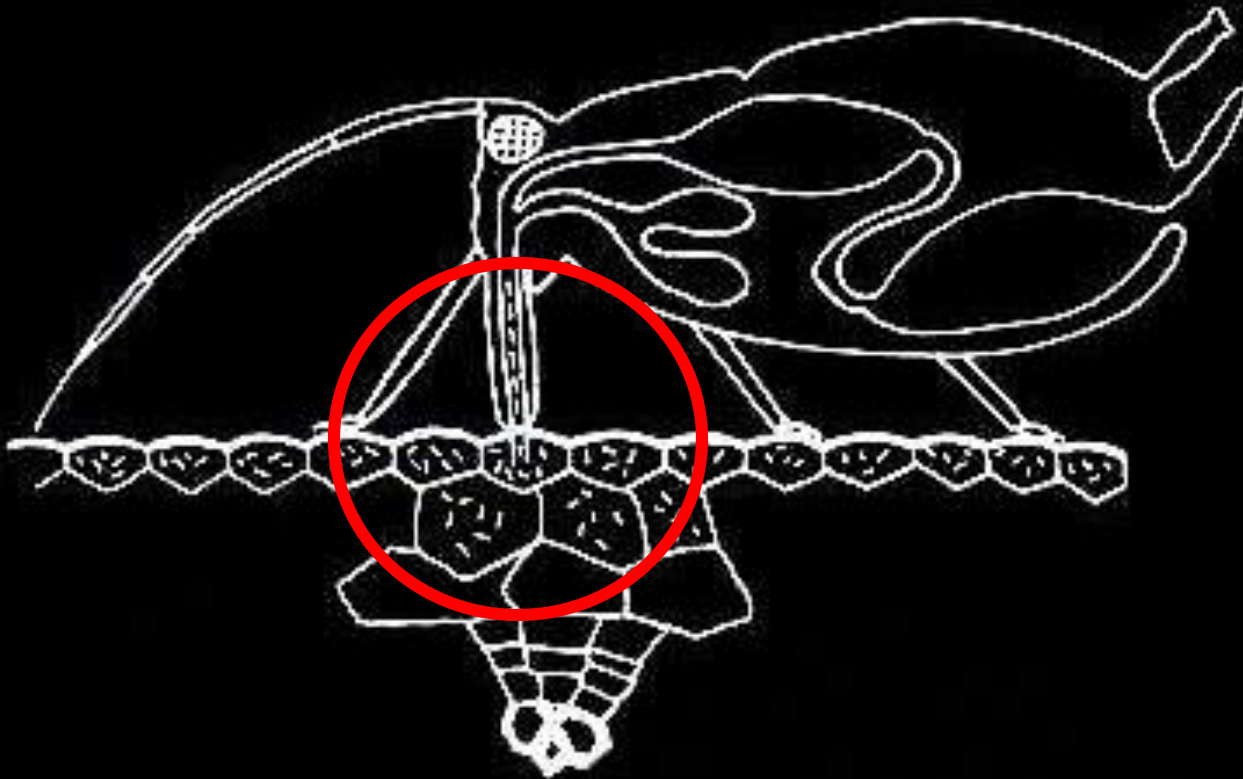
Infectivity
persists in
aphid for life



Potato Leaf Roll Virus
PLRV

Non-persistent Virus

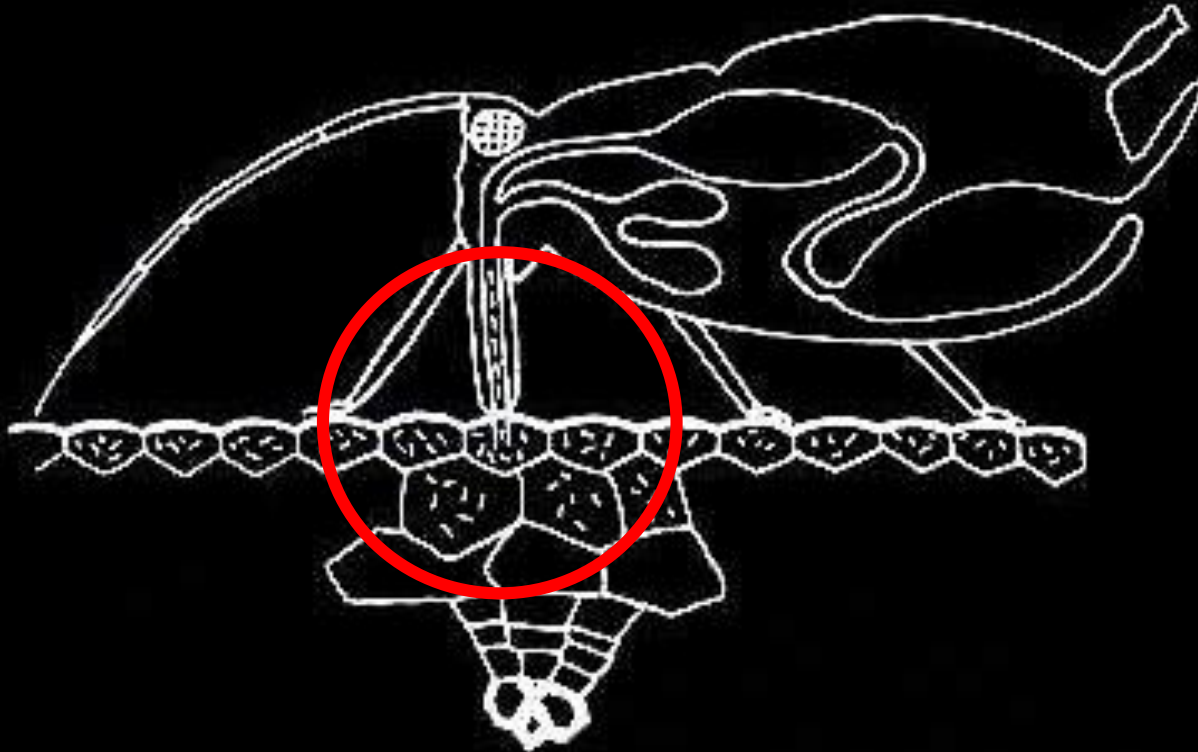
Short Acquisition



Non-persistent Virus

Short Acquisition

Short Inoculation



Non-persistent Virus

Short Acquisition

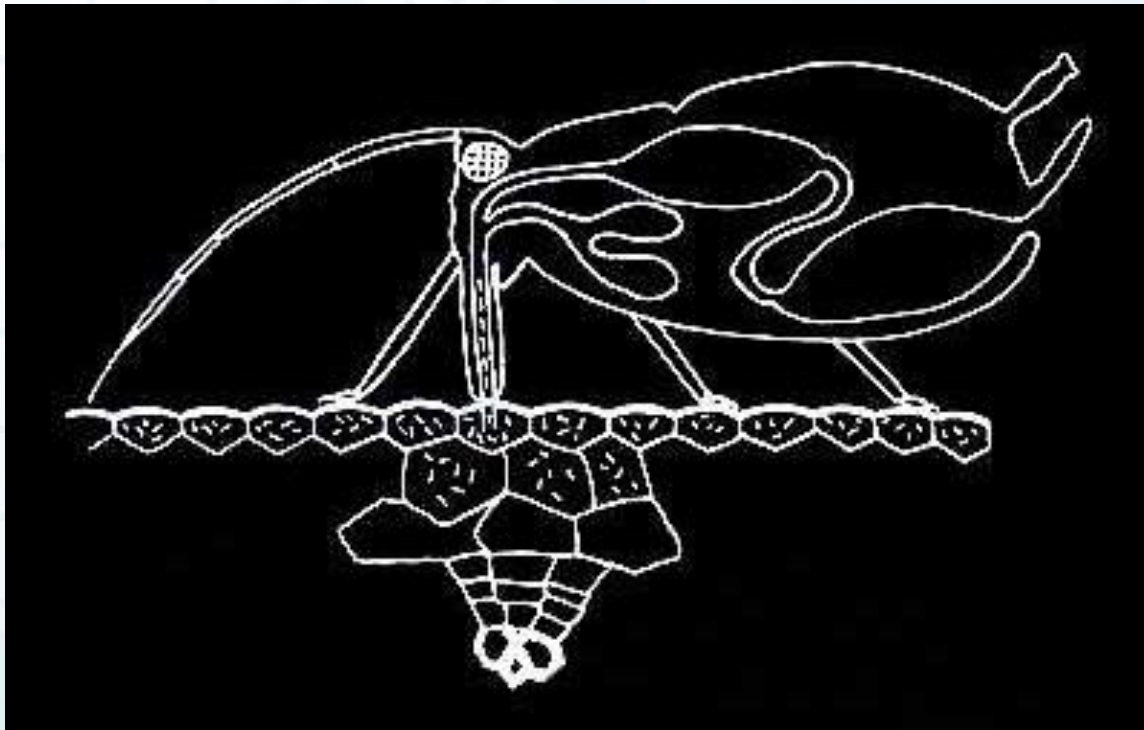
Short Inoculation

Infectivity does
not persist in
aphid for long



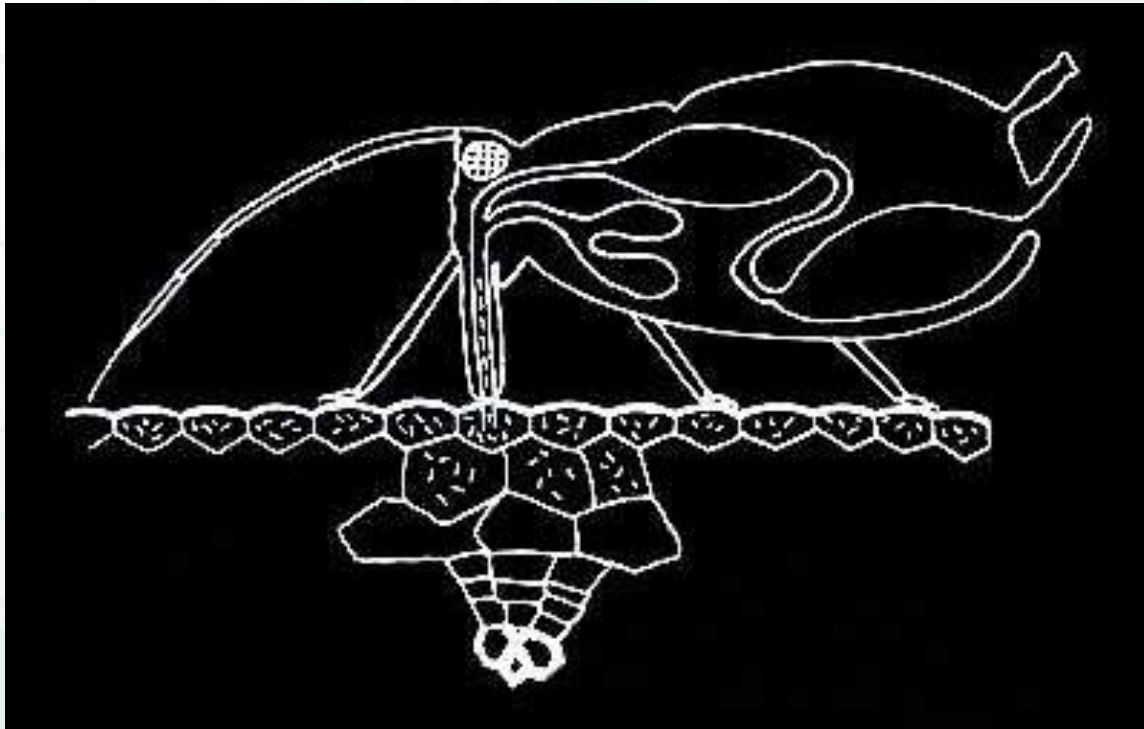
Non-persistent Virus

Vector efficiency decreases with longer acquisition feeds (e.g. colonising species)



Non-persistent Virus

Vector efficiency decreases with longer acquisition feeds (e.g. colonising species)



Non-colonising species can be effective vectors of non-persistent viruses

Aphid Vectors in Potato Crops

Colonising Species:

**Peach potato aphid
(*Myzus persicae*)**



**Potato aphid
(*Macrosiphum euphorbiae*)**

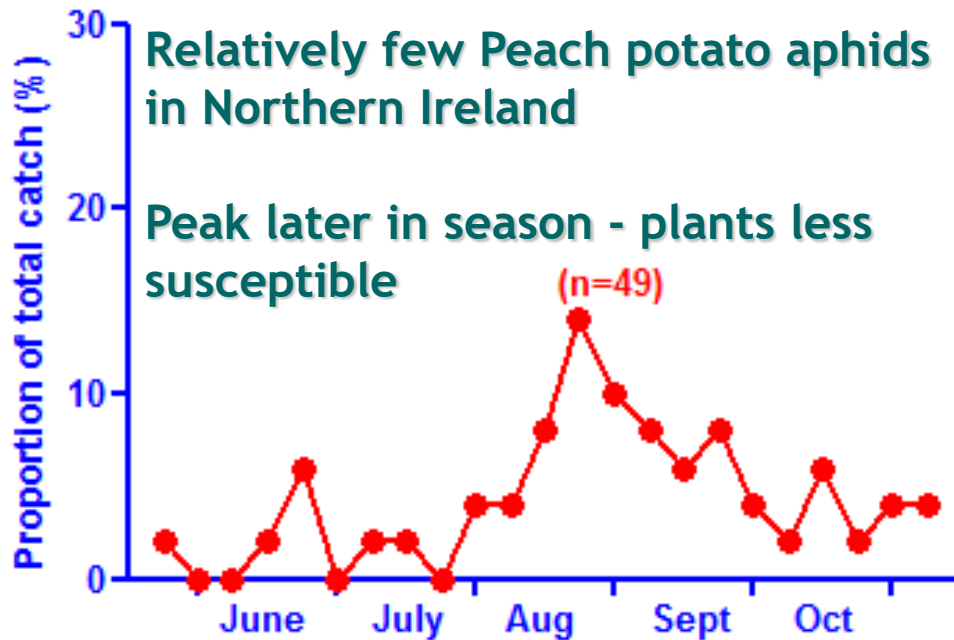


**Bulb and potato aphid
(*Rhopalosiphoninus latysiphon*)**



Aphid monitoring using 12.2m suction trap

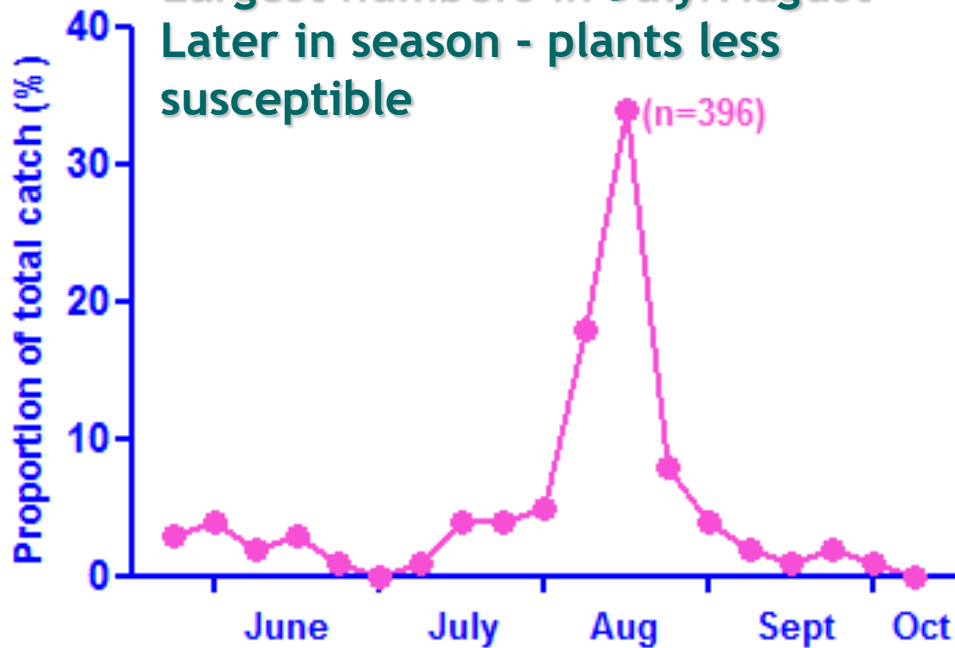
Peach potato aphid (*Myzus persicae*)



Aphid monitoring using 12.2m suction trap

Potato aphid (*Macrosiphum euphorbiae*)

Largest numbers in July/August
Later in season - plants less
susceptible



Aphid Vectors in Potato Crops

Non-Colonising Species

Only non-persistent viruses may be transmitted!

Leaf curling plum aphid
(*Brachycaudus helichrysi*)

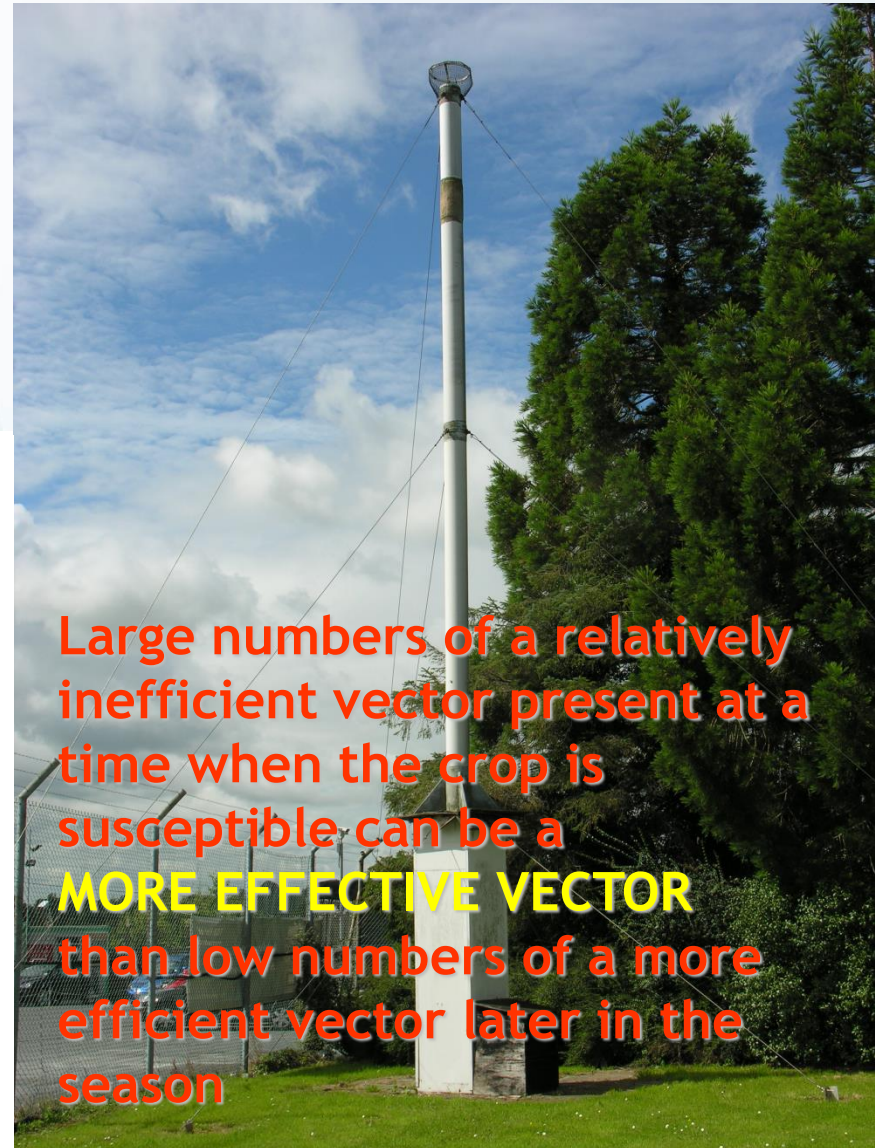
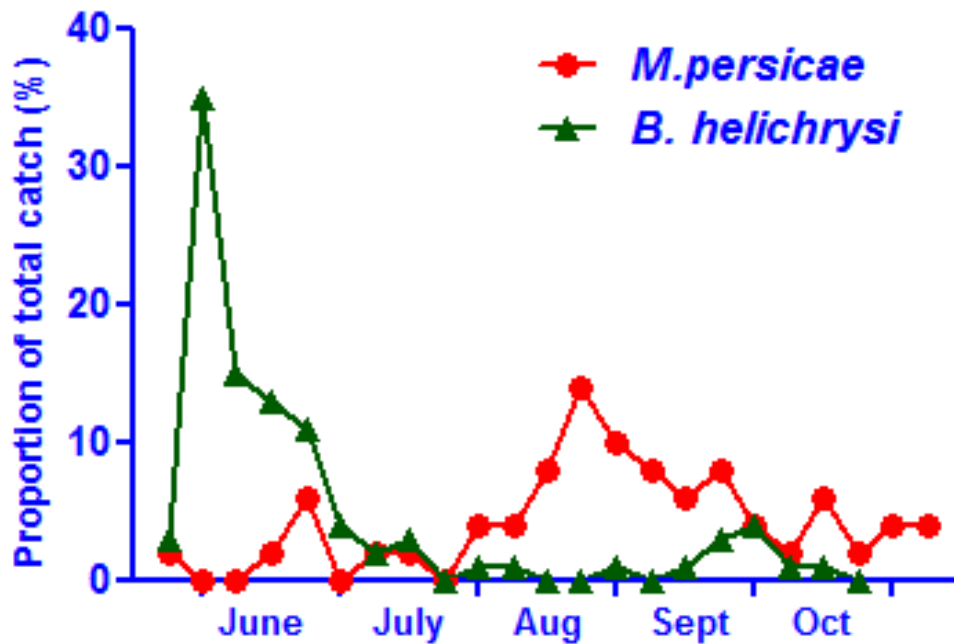


Relative vector efficiencies
Virus PVY^N

Peach potato aphid	14/25
Leaf curling plum aphid	4/25

Aphid monitoring using 12.2m suction trap

Non-persistent Viruses



Large numbers of a relatively inefficient vector present at a time when the crop is susceptible can be a **MORE EFFECTIVE VECTOR** than low numbers of a more efficient vector later in the season

Aphid monitoring and Control



Suction trap – general aphid activity and migration



Water trap – within crop aphid abundances and activity
Northing *et al.*, 2004

Pilot Aphid Monitoring Scheme. How it works?



Water traps and sampling materials issued to farms sites.

Water traps set in potato crop at canopy height at farms sites.

Water trap contents collected weekly from farms sites.

Samples returned to AFBI laboratories by post or courier.

©Scheme similar to that developed by FERA, York

Transmission Indices for PVY

Species	Common Name	PVY Index
<i>Myzus persicae</i>	Peach-Potato Aphid	1.00
<i>Acyrtosiphon pisum</i>	Pea Aphid	0.70
<i>Aphis nasturtii</i>	Buckthorn-Potato Aphid	0.40
<i>Rhopalosiphum padi</i>	Bird Cherry-Oat Aphid	0.40
<i>Metopolophium dirhodum</i>	Rose-Grain Aphid	0.30
<i>Brachycaudus helichrysi</i>	Leaf-Curling Plum Aphid	0.21
<i>Macrosiphum euphorbiae</i>	Potato Aphid	0.20
<i>Aulacorthum solani</i>	Glasshouse and Potato Aphid	0.20
<i>Myzus ascalonicus</i>	Shallot Aphid	0.20
<i>Myzus ornatus</i>	Violet Aphid	0.20
<i>Rhopalosiphoninus latysiphon</i>	Bulb and Potato Aphid	0.20
<i>Hyperomyzus lactucae</i>	Currant-Sowthistle Aphid	0.16
<i>Aphis fabae</i>	Black-Bean Aphid	0.10
<i>Brevicoryne brassicae</i>	Cabbage Aphid	0.01
<i>Sitobion avenae</i>	Grain Aphid	0.01

Crop colonisers are highlighted.

Calculate Vector Pressure Index (VPI)

1. For each species multiply the number in the trap by the relative transmission efficiency* value
2. Add the results together for all species caught in the trap
3. Add this value to the previous week's cumulative vector pressure index

*Relative to *Myzus persicae* = 1.0



Results and Communications Regional Vector Pressure Indices notified to growers via AFBI website

Weekly VP Index Value

- 0.0 – 2.0
- 2.1 – 10.0
- >10.0
- No sample

Results published weekly on AFBI website including activity report and current status of each site.

WEEK ENDING								
18th June 2016								
Site	Activity report	Current status:						
Ballymena	Low levels of aphid activity. 4 <i>Macrosiphum eurphorbiae</i> (potato aphid) and 2 <i>Myzus persicae</i> (peach-potato aphid) recorded. Significant numbers of cereal aphid <i>Rhopalosiphum padi</i> recorded during this period.							
Ballymoney	5 <i>Macrosiphum eurphorbiae</i> (potato aphid). Low numbers of <i>Rhopalosiphum</i> spp. recorded during this period.							
Cranfield	High numbers of <i>Myzus persicae</i> (peach-potato aphid) recorded. Moderate number of <i>Macrosiphum eurphorbiae</i> (potato aphid) also recorded during this period.							
Kilkeel	High numbers of <i>Macrosiphum eurphorbiae</i> (potato aphid) recorded during this period. Small numbers of <i>Rhopalosiphum padi</i> also recorded.							
Limavady	1 <i>Myzus persicae</i> (peach-potato aphid) recorded. No other aphids of significance recorded during this period.							
Loughgall	Moderate levels of <i>Macrosiphum eurphorbiae</i> (potato aphid) and 1 <i>Myzus persicae</i> (peach-potato aphid) recorded during this period.							
Strabane	No aphids of significance recorded at this site during this period.							
Key		<table border="1"> <tr> <td>LOW RISK</td> <td>Low virus vector activity, no action required</td> </tr> <tr> <td>MODERATE RISK</td> <td>Increased vigilance and monitoring of aphid populations required</td> </tr> <tr> <td>HIGH RISK</td> <td>Severe risk of PVY transmission by aphids</td> </tr> </table>	LOW RISK	Low virus vector activity, no action required	MODERATE RISK	Increased vigilance and monitoring of aphid populations required	HIGH RISK	Severe risk of PVY transmission by aphids
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HIGH RISK	Severe risk of PVY transmission by aphids							

Benefits

Financial

Informs the decision-making processes when considering the need for insecticide treatments. Some commercial growers have reported savings of £22 per hectare over two years by being able to **reduce the number of aphicide treatments**.

Environmental

Risk assessment for spread of PVY in relation to time of haulm desiccation crop, thus maximising your yield without risking the virus health of the seed.

Provides growers with a full record of **Integrated Pest Management** methods and the potential risk of virus transmission.

Provides information on the potential quality of home saved seed, thus providing the opportunity to save the expense involved in buying-in classified seed potatoes.

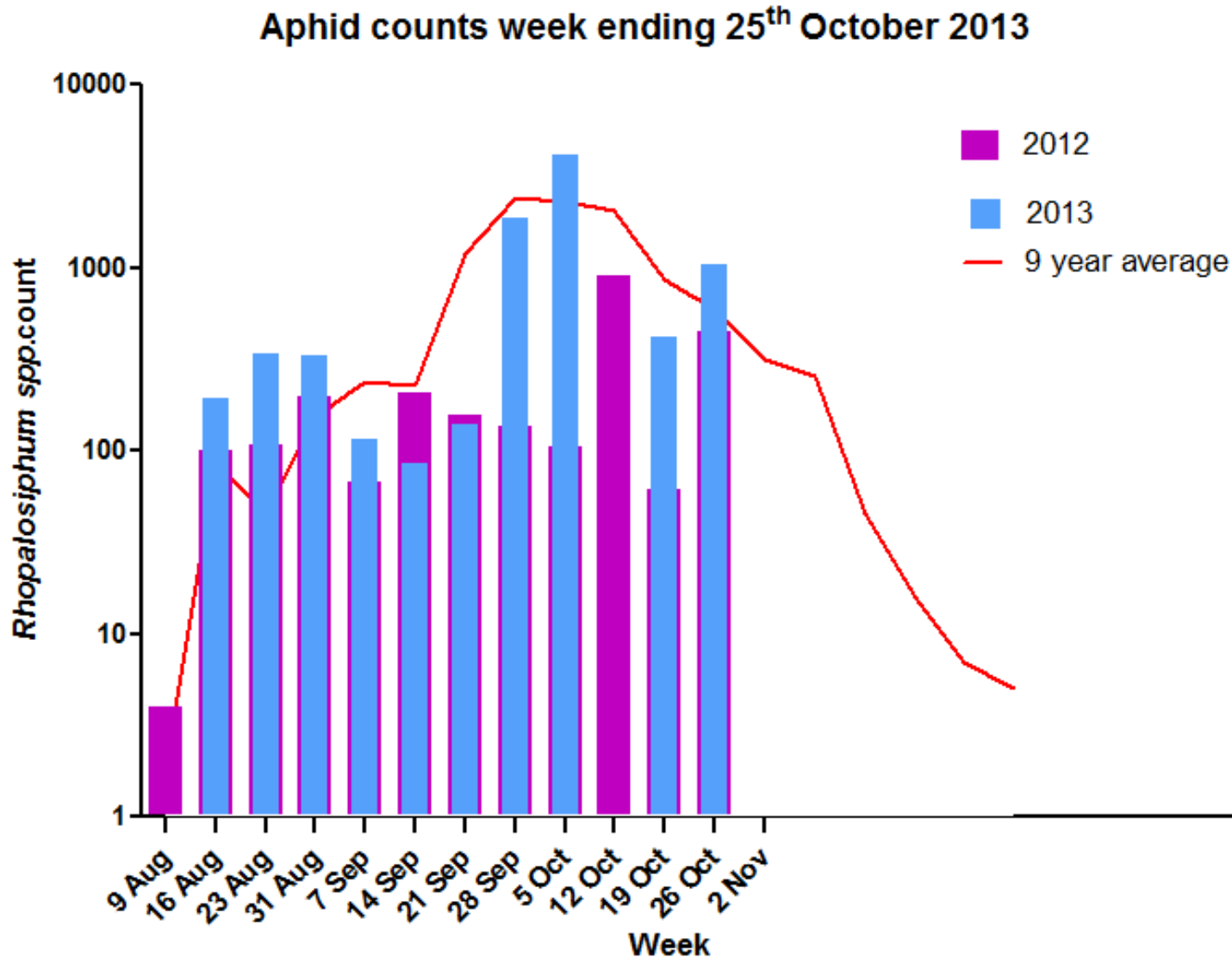
Benefits

Financial Environmental

A more rational use of insecticides may lead to:

- Increased levels of **natural predators** and
- Reduced risk of aphid populations developing **insecticide resistance**.

Suction trap data in NI also used to predict aphid virus vectors in winter cereal crops



Sustainable Pest & Disease Control is Highly Dependent upon



MONITORING