



Original thinking... applied

Surveillance of Virus Disease in UK Pea Crops

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Crop Health Protection Services

National reference laboratory for plant health in England and Wales

Commercial and statutory testing.

- Plant health and seed inspections
- Covering viral, fungal, bacterial, nematode and insect testing services.

Pesticide residues and Acrylamide analysis

Proficiency schemes (Fapas)

Quality assurance ISO 9001, ISO 10770



Overview

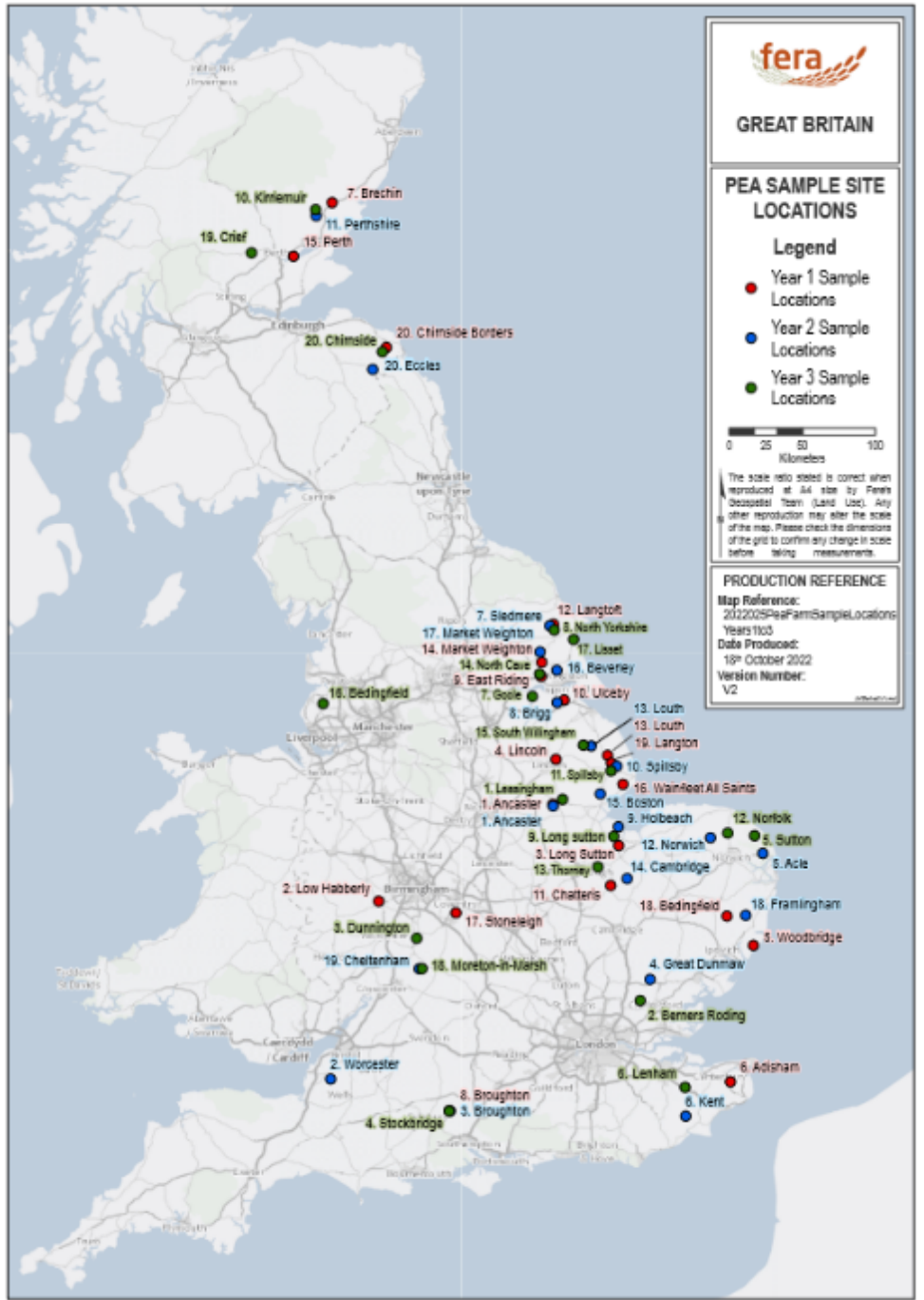
- AHDB funded project to develop a generic method for surveillance
 - FV 459
 - Three year project
 - Working alongside PGRO (the Processors and Growers Research Organisation)
 - Grower funded organisation which looks into crop production, marketing and economics of legumes in the UK.
- To show the feasibility of integrating high throughput sequencing (HTS) into a surveillance workflow.
- Using pea as a model pathosystem
 - To provide an up to date baseline of viruses in UK peas.
 - AHDB-funded literature review 2017



Prior knowledge of UK Peas

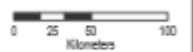
- Pea enation mosaic virus-1 (Pea enation mosaic virus-2)
 - Limited host range, legumes
 - Persistent aphid transmission
 - Long acquisition times by aphids, so possible chemical control
 - Limited aphid range
 - Mechanical transmission, but not known to be seed transmitted
 - Resistant varieties
- Pea seed-borne mosaic virus
 - Limited host range, legumes
 - Seed-borne, use of clean seed for control
 - Non-persistent aphid transmission
 - Short acquisition times by aphids, so chemical control is more challenging





PEA SAMPLE SITE LOCATIONS

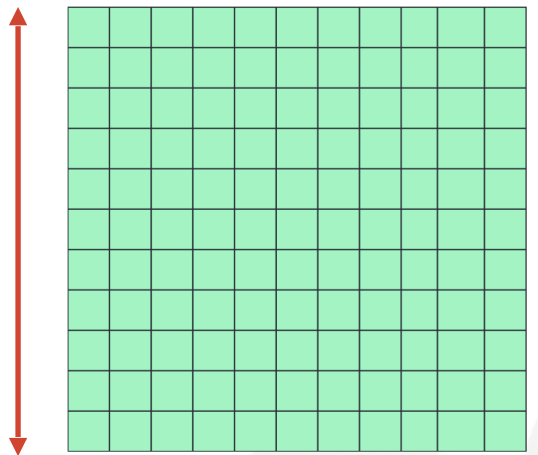
- Legend**
- Year 1 Sample Locations
 - Year 2 Sample Locations
 - Year 3 Sample Locations



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PRODUCTION REFERENCE

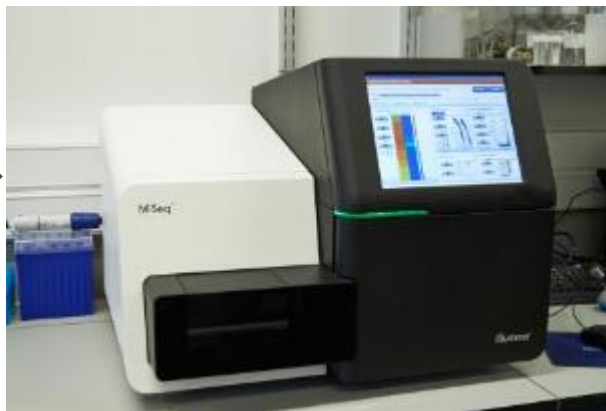
Map Reference: 202205PeaFarmSampleLocations Years 1x3
 Date Produced: 18th October 2022
 Version Number: V2



100m x 100m



Sent to the Fera.

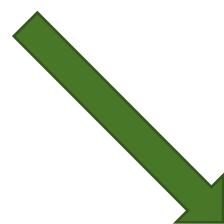


From HTS we get the candidate virus e.g. turnip yellows virus

Mixed size bulks, for incidence



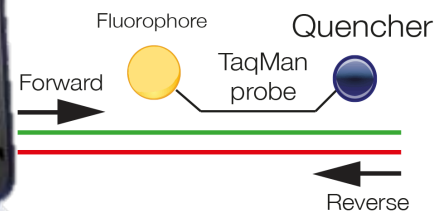
15 bulks of seven leaves



15 samples of single leaves

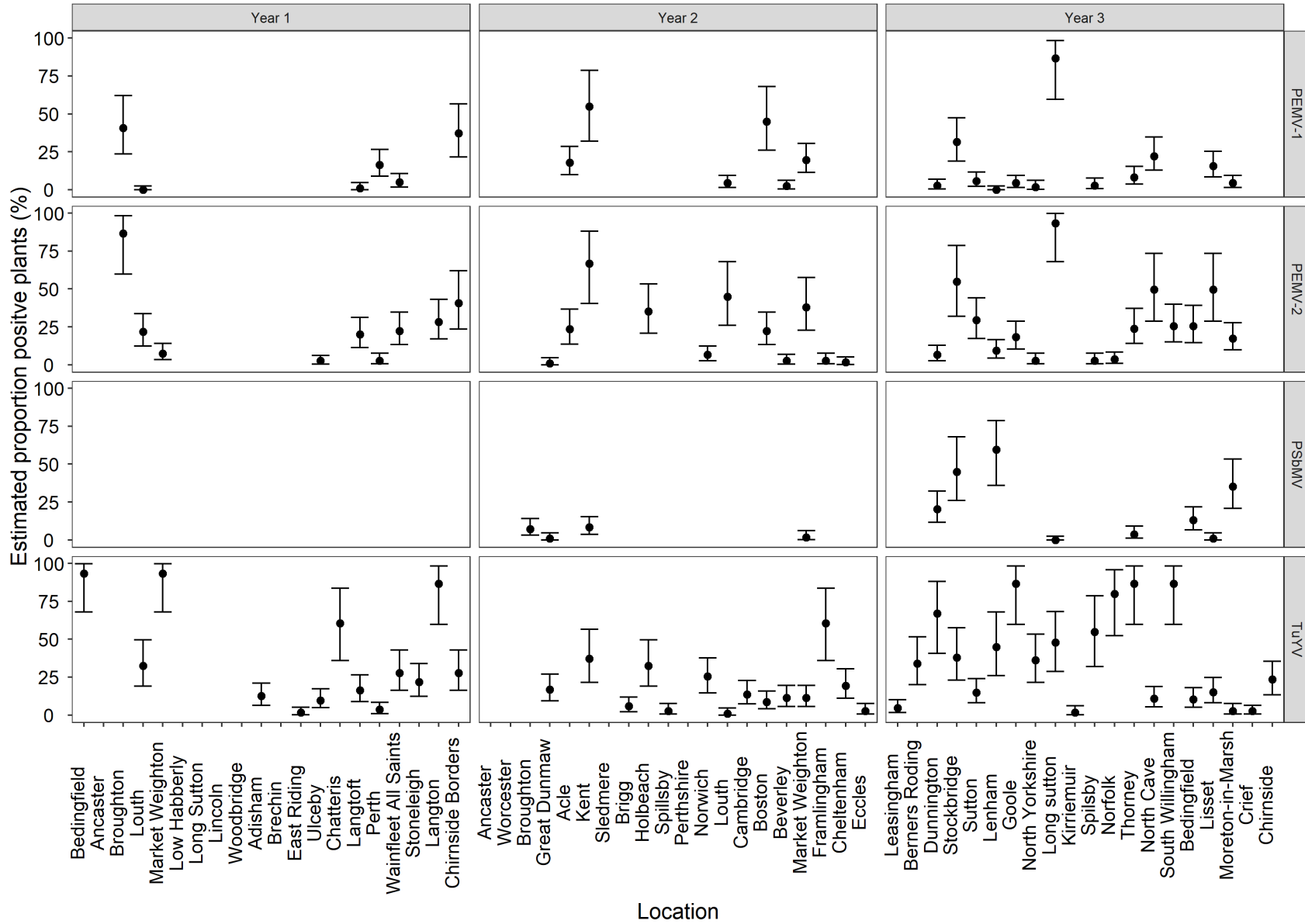


The mixed size bulk samples are then tested by real-time RT-PCR for viruses identified by HTS



This information is then used to determine the incidence of the virus in the field.

Results



Turnip yellows virus (TuYV)

- Huge host range
 - Includes legumes, brassicas, cucurbits etc.
- Persistent transmission by aphids
 - Long acquisition times by aphids, so possible chemical control
- Wide range of aphid vectors
 - Pea aphid
 - Peach-potato aphid
- Not known to be mechanical or seed transmitted
- Reported in peas in Australia (virus surveillance, epidemiology and yield reduction studies), Germany (virus surveillance).

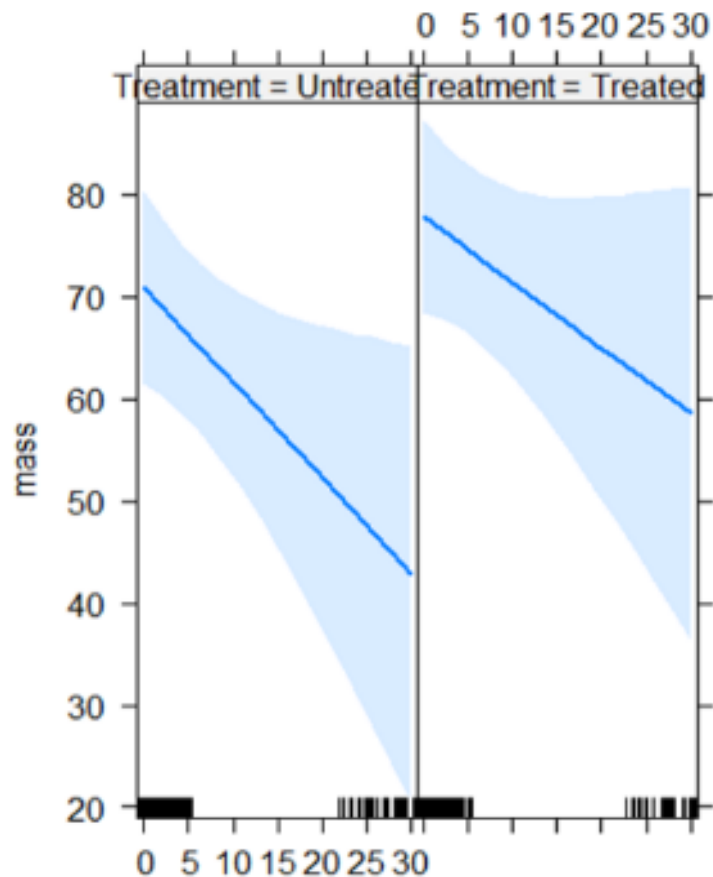


Yield loss, pea enation mosaic virus-1

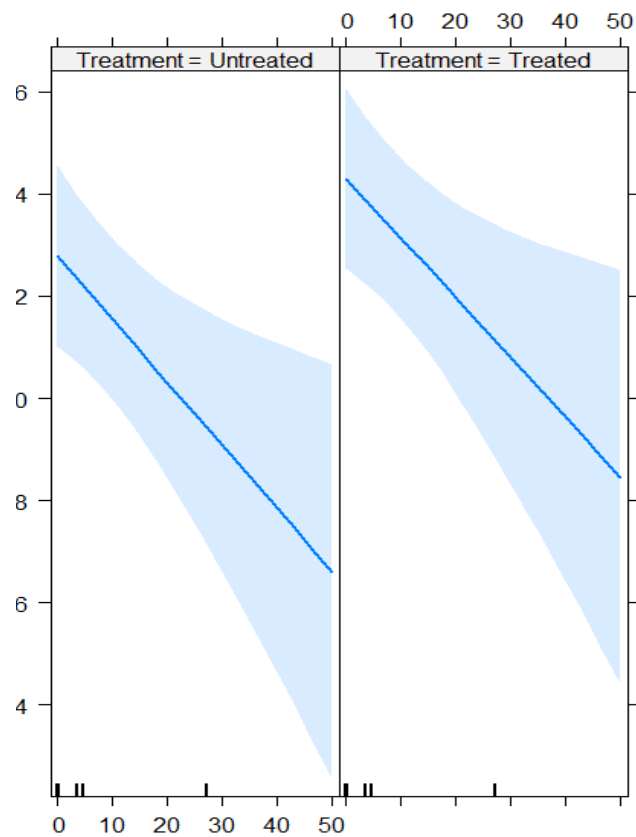
2019

2021

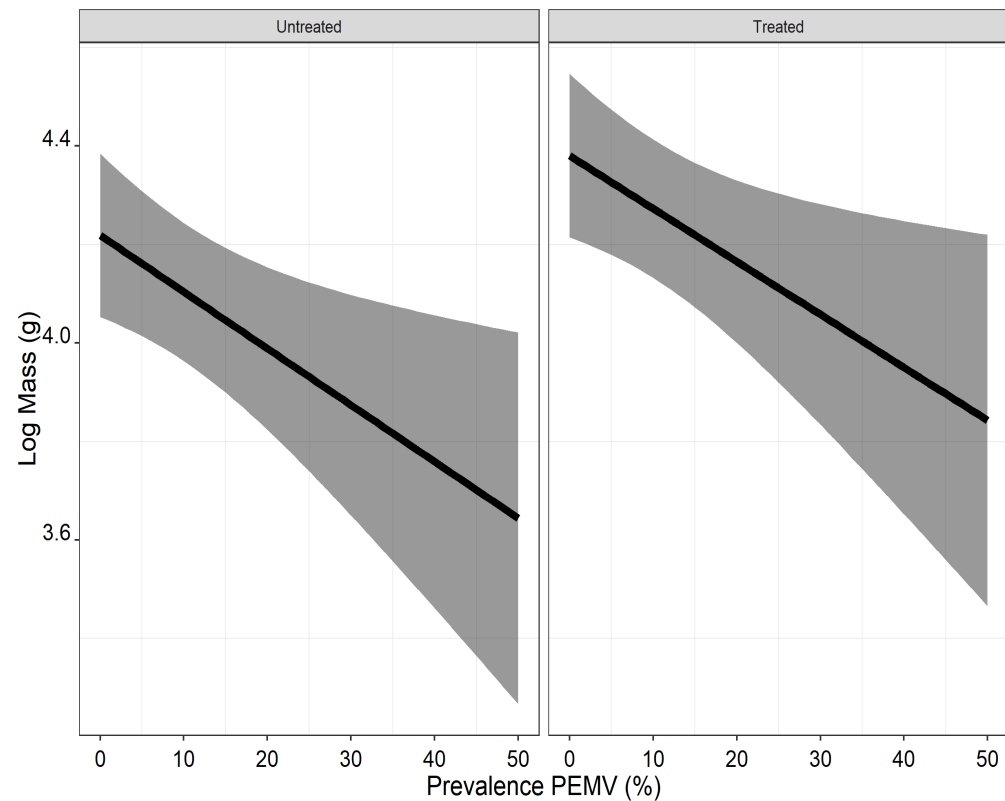
2022



5 sites



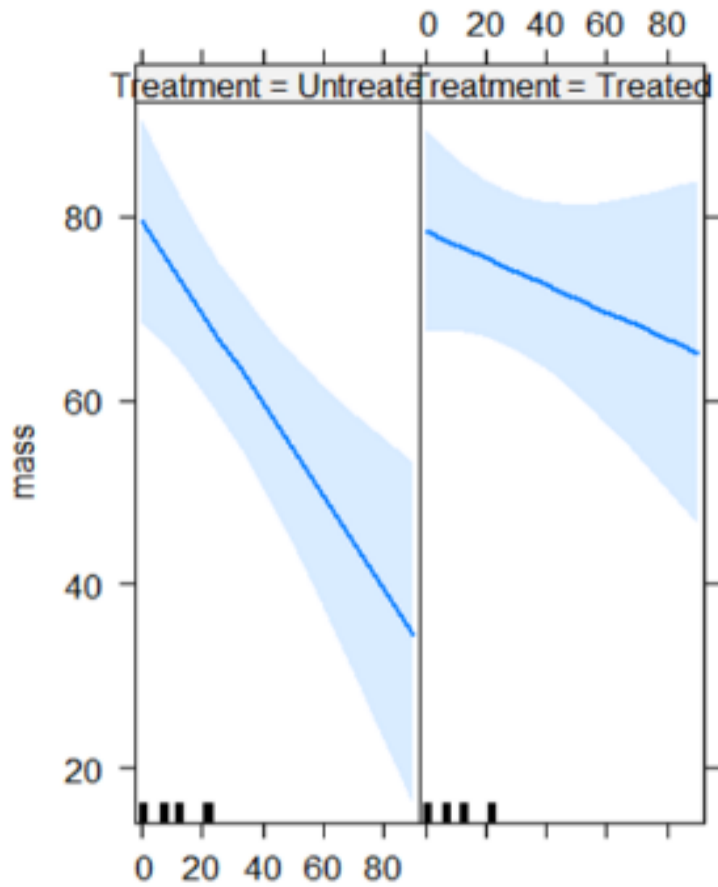
5 sites



4 sites

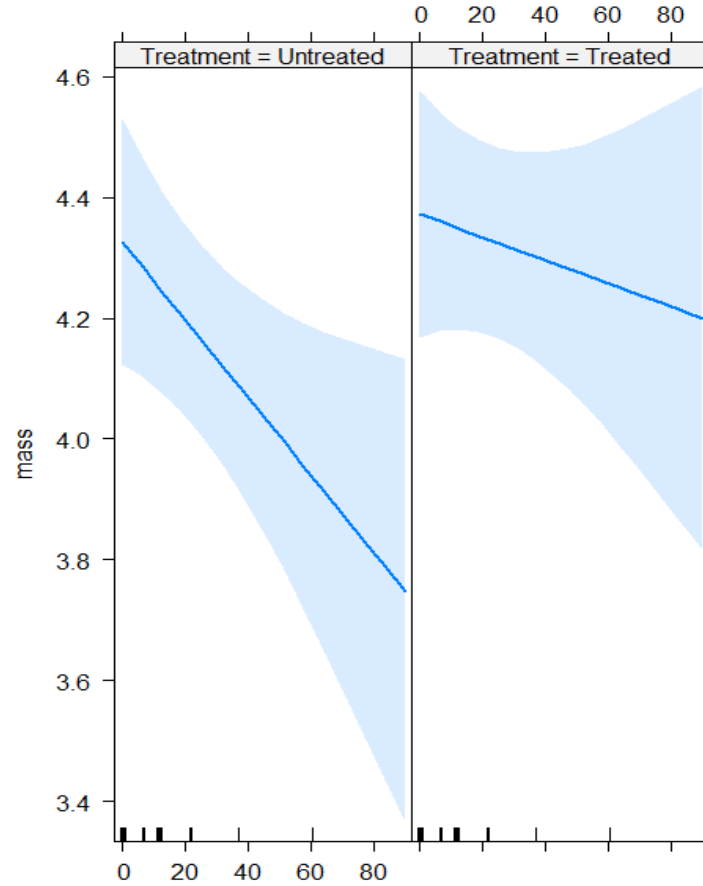
Yield loss, turnip yellows virus

2019



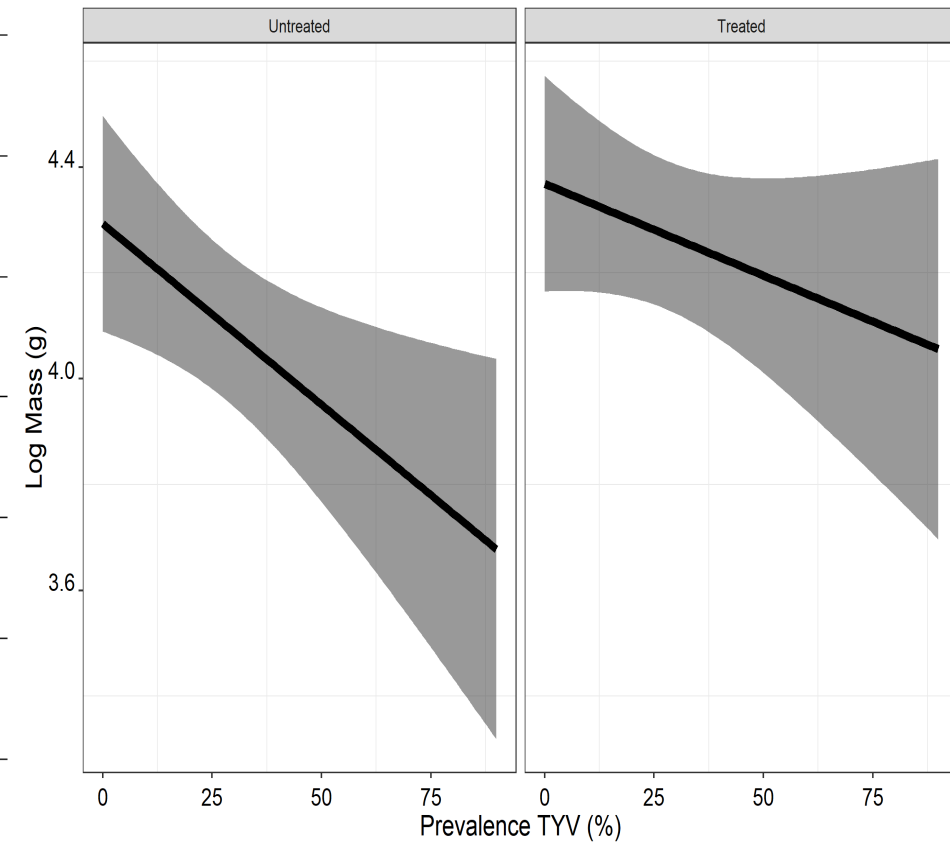
5 sites

2021



5 sites

2022



4 sites

Pea necrotic yellow dwarf virus

- Potential threat to the pea industry
- Limited host range, legume
- Persistent transmission by aphids
- Not known to be seed or mechanically transmitted
- Can cause huge yield losses
- Found across Europe, first finding of this virus in the UK
- Work ongoing in Germany to look at resistant varieties and the effect of PNYDV on nodulation, N₂ fixation and yield (Ziebell, JKI)



Gaafar et al., 2017

Other low incidence findings

- Soybean dwarf virus (SbDV)
 - Limited host range, legumes
 - First finding in UK
 - Persistent transmission
 - Sporadic findings through the study
- Bean yellow mosaic virus (BYMV)
 - Limited host range, legumes
 - Non-persistent transmission
 - Known to occur in UK
 - Sporadic findings
- Bean leafroll virus (BLRV)
 - Limited host range, legumes
 - Persistent transmission
 - Known to occur in UK
 - Only found in year 3
- Cytorhabdoviruses
 - Persistent transmission
 - First finding in the UK

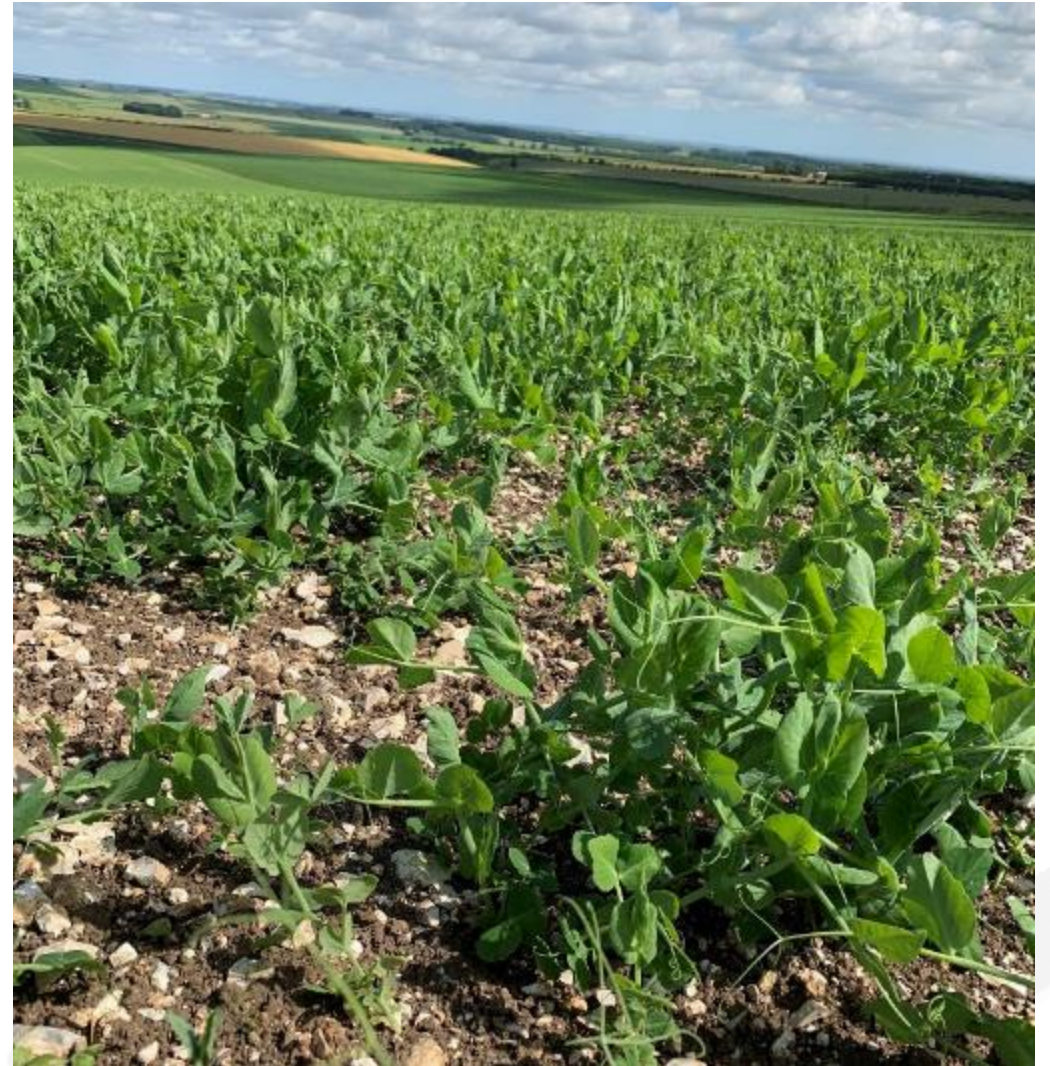


Conclusion

This work is helping to provide a better understanding of which viruses are present in UK peas and their incidence.

- First findings of three viruses in UK peas—turnip yellows virus, soybean dwarf virus and pea necrotic yellow dwarf virus.
- This can go towards management of viruses in UK peas.
- Further work could include, looking at varieties resistant to TuYV, is it the same TuYV in OSR, weeds and peas? The effect of virus on pea marketability and nutritional content.

We've shown that high throughput sequencing can be successfully integrated into a surveillance workflow.



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Department
for Environment
Food & Rural Affairs



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