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Farm Saved Seed – Virus Workshop

SAC Potatoes Team

Scale of the issue

Fault	2022 (% total area)		2023 (% total area)	
	Downgraded	Failed	Downgraded	Failed
Blackleg	1.10	0.00	2.02	0.13
Total virus	0.26	0.17	1.38	0.71
PVA/PVY/PLRV	6.20	0.34	**15.44**	**1.84**
Variations	0.01	0.01	0.03	0.00
Rogues	0.03	0.04	0.01	0.15
Groundkeepers	0.03	0.03	0.01	0.05

Leaf samples (growing crop)	
PLRV	**55.5%**
PVY^{N}	36.3%
$PVY^{O/C}$	5.4%
PVA	1.4%

Important points:

1) For many grades, a **single infected plant** is enough to exceed tolerance.
2) All these data are **post-roguing**.

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SAC's position

1) **The Scottish Seed Potato crop has excellent health standards**, even with a small rise in virus levels.
2) **The SPCS has strict tolerances**, particularly for the highest grades – a single infected plant is enough for a downgrade.
3) **Downgrades mean that the scheme is working** – although it's tough on individual growers, the fact that a few crops are not holding grade should increase confidence in those that do hold their classification!
4) **Farm Saved Seed should be grown to the same standard as classified seed**. A seed crop is a seed crop.

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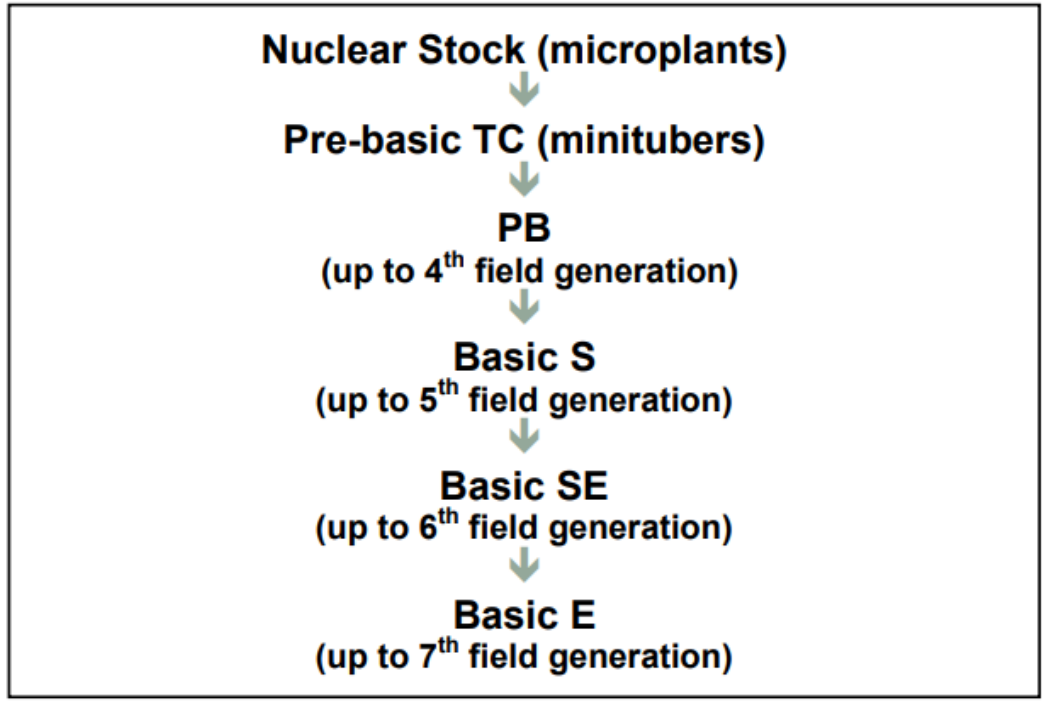
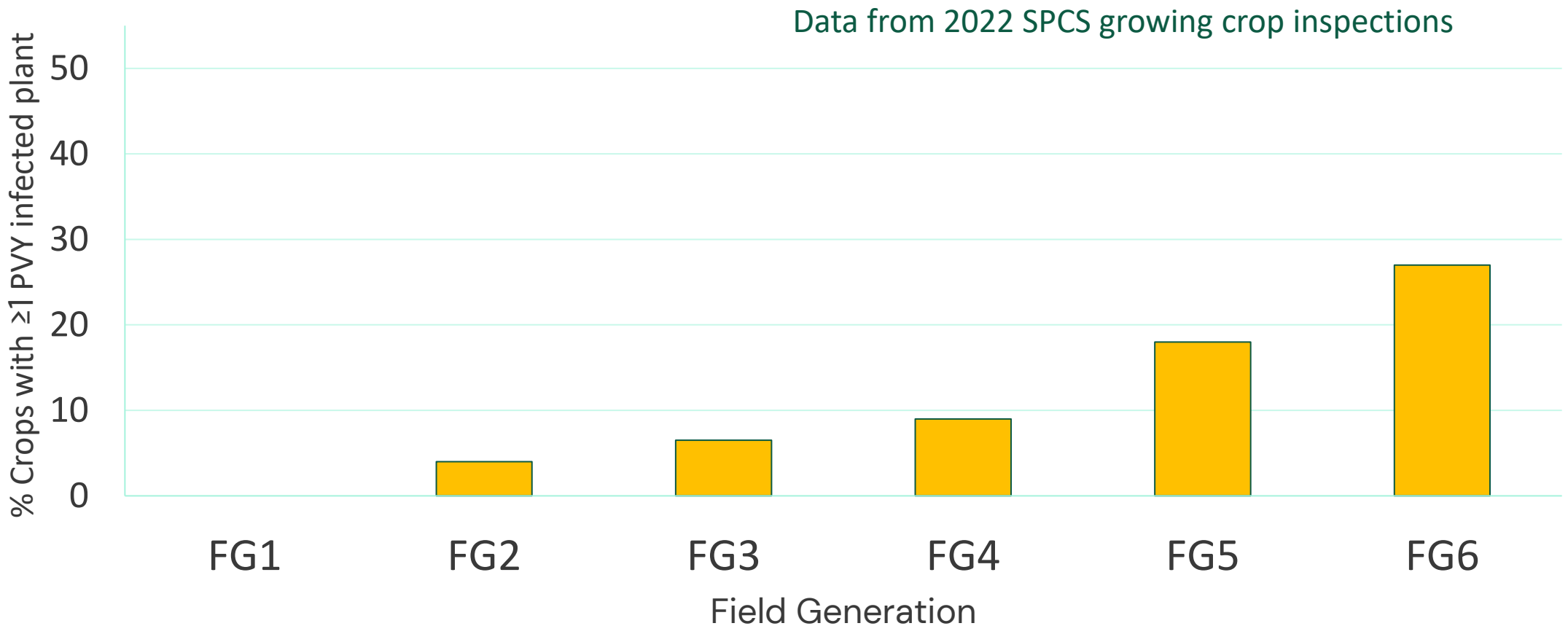
SPCS – Seed Potato Classification Scheme

- Only pre-basic and basic seed can be planted in Scotland and farm saved seed must only be **multiplied once**.
- Calculations of percentages of faults in the growing crop are based on a population of **60,000 plants per hectare**.
- Article 4 of The Plant Health (Potatoes) (Scotland) Order 2006 – compulsory burning down (**seed or ware**) if plant health risk.



SASA Helping Scotland Grow
gov.scot

Why bother to control virus?



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CLASSIFICATION TOLERANCES

SASA Helping Scotland Grow

gov.scot

Classification Tolerances	Pre-basic Seed Grades		Basic Seed Grades		
	PBTC	PB	S	SE	E
Pre-roguing	0	Only in consultation with Inspector	1.00	1.00	2.00
Deviations from variety and type	0	0.01	0.10	0.10	0.10
PVY/PVA/PLRV	0	0	0.02	0.10	0.40
Total Virus	0	0.10	0.20	0.50	0.80
Blackleg caused by pectobacterium spp.	0	0	0.10	0.50	1.00
Blackleg caused by Dickeya spp.	0	0	0	0	0
PCN	Nil	Nil	Nil	Nil	Nil

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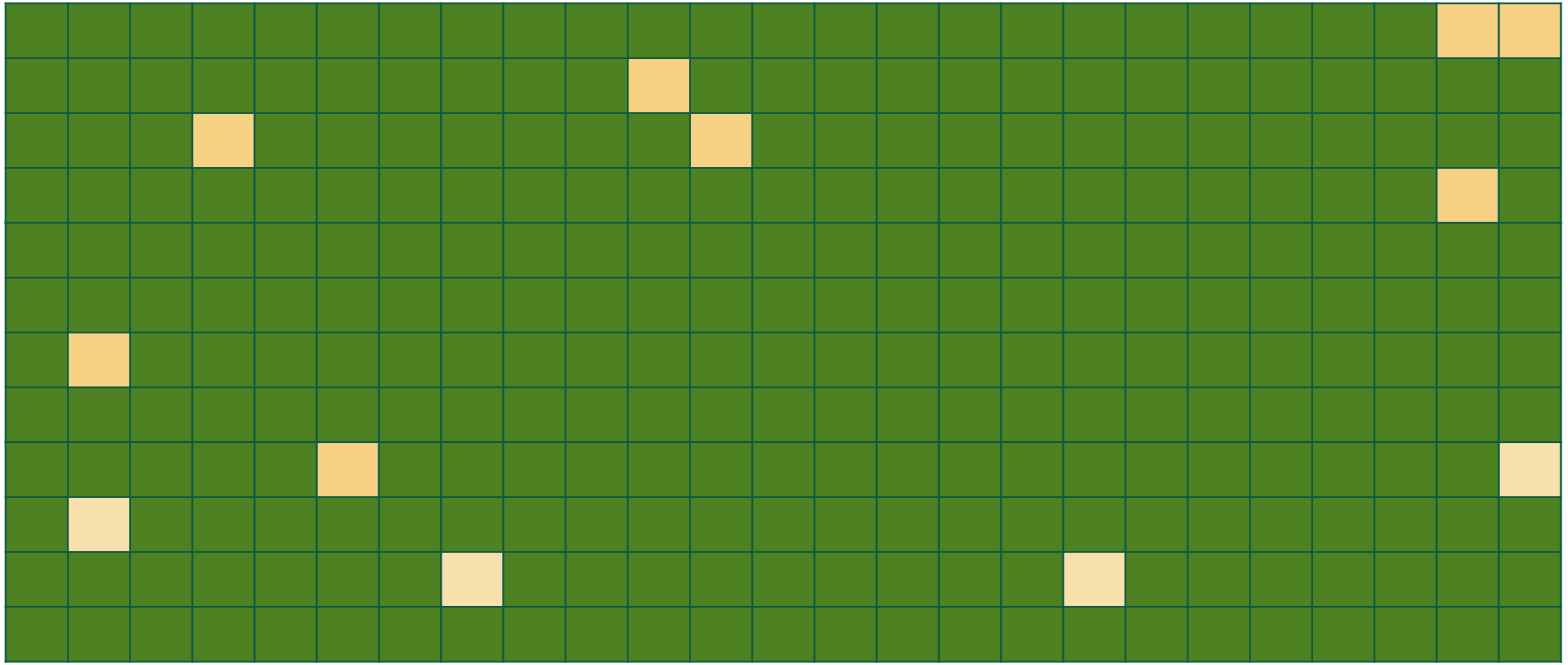
Estimate the % infection



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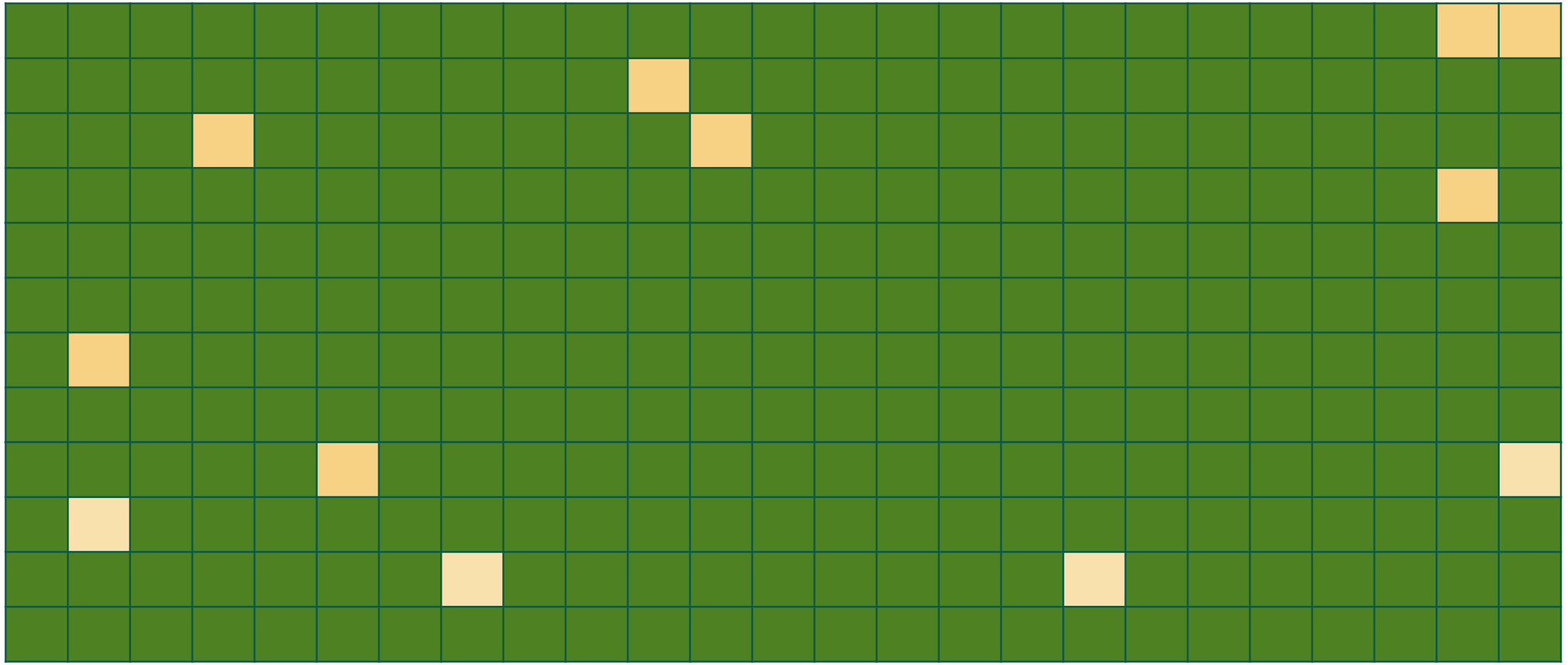
4% – the threshold for compulsory burndown!



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Virus Key Terms

Term	What it means
Persistent virus	Virus that is **persistent in the aphid** once an aphid picks it up it will be **infectious for the rest of its life**.
Non-persistent virus	Virus that are **not persistent in the aphid** virus particles are carried on aphid mouth parts, can be “cleaned”.
Colonizing aphids	Aphids that **colonize** and **breed** on potato plants.
Non-colonizing aphids	Aphids that **do not colonize potato plants but** will probe them as they pass by and **can transmit viruses**.
Primary infection	**Within season infection** plant-to-plant via an aphid.
Secondary infection	**Between season infection** mother plant to daughter plant via seed tuber.

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Potato virus Y (PVY)

- Several strains – PVY^{NTN} most important for Scotland.
- Causes **mosaic symptoms** in haulm, but severity varies with variety.
- **Non-persistent** virus → **non-colonizing aphids** are the important vectors.
- Aphids become infectious and transmit the disease **very rapidly**.
- Implications are variety dependent but include **yield loss**, **cracking**, and **necrotic rings**.

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Potato leaf roll virus (PLRV)

- Very rare in Scottish crop until a few years ago.
- Recent up-tick a concern.
- Classic cigar-like **leaf rolling** (lowest leaves first).
- **Persistent** virus → **colonizing aphids** of most concern.
- We lack a good understand of different strains.
- Yield-loss, net necrosis.


Rooster – mosaic


Rooster – leaf roll

Shepody – leaf roll & mosaic PVY
Note effect of lighting on appearance of symptoms!


Atlantic – mosaic PVY


Lady Rosetta – leaf roll


Brooke – mosaic PVY
Symptoms can be very subtle in some varieties!


SAC Virus Trial Site 2023
Infector plants
Large trial plots

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2023 SACAPP Virus Transmission Trial

Treatment Programme	PVY Transmission (prob. sections positive within plot. Min: 0 Max: 1)	Rough equivalent percentage infection (PVY)
Oils weekly (7.5 L/ha - full season) + Translaminar insecticides	0.08	0.8%
Half rate oils weekly (3.75 L/ha full season) + Translaminar insecticides	0.08	0.8%
Straw mulch + Translaminar insecticides	0.10	1.0%
Oats intercropping + Translaminar insecticides	0.10	1.0%
Pyrethroids + Translaminar insecticides	0.18	1.8%
No crop protection	0.18	1.8%

Statistically significant result (GLM X^2 test, p= 0.05), but VERY high variability (range on untreated: 0 – 0.4) ***TREAT WITH CAUTION***

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What do we know from growers' **observations**

- Accidental reports of fewer aphid catches in strawed areas.

- Grower demo:
  - Stock split in 2022:
    - Mulched @ 5t/ha vs No cover
  - Stocks replanted 2023:
  - Rogued 2023 Virus plants adjusted for area:
    - 109 infected plants / unit area in area when parent crop **mulched**.
    - 225 infected plants / unit area in area when parent crop **uncovered**.

Practical net demo 2024 – barrier methods may be a viable option to protect early growth.

Several research groups have tried colour dyes in different cropping systems (sugar beet, carrots etc.)
Unfortunately, SAC are not investigating dyes in potatoes this year, but others in the UK are – a topic to watch!
Product solubility is an issue.

British Beet BBRO Research Organisation

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What do trial results tell us?

- Be cautious with trial results – control **depends on when aphids are flying**.
- Infection can be very variable!
- **But we can make key conclusions:**
  - Insecticides alone are not enough.
  - Oils can be effective against PVY.
  - Integrating approaches leads to better control.
  - Camouflage and barrier methods work, but they are not yet practical.
  - Heavy use of oils at high rates can lead to phytotoxicity and yield penalty – but they can be used safely.
- Trials run by other groups such as NIAB, The Potato Partnership, and Scottish Agronomy have produced similar conclusions – this should give the industry confidence in integrated control!

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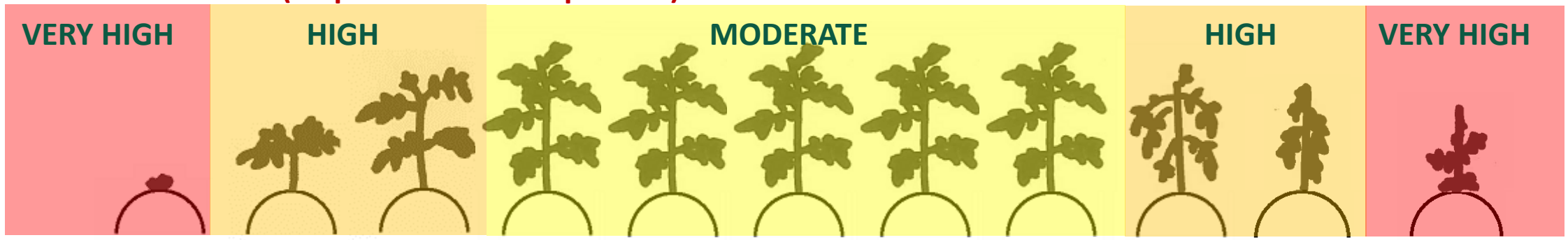
The Six Steps

- Drawn up by the **Scottish Aphid Borne Potato Virus Working Group (SABVWG)**.
- Input from across the industry stakeholders.
- Represents the best available consensus view of **virus management**.
- **All seed growers should be familiar with the six steps.**
- **Redrafted in 2024 to be easier to action.**

Risk of transmission (if aphid vectors are present)



Crop Growth Stage

Emergence	Canopy closure	Stable Canopy	Desiccation	Post-Desiccation Regrowth

Mitigation

Straw mulches and nets

Roguing

Monitor regrowth

Oil & insecticide programme (see page 12)

Potato leaf roll virus | Start from first high-risk aphid flights SYSTEMIC INSECTICIDES such as Teppeki & Insyst

Potato virus Y | Oils applications early (from 30% emergence), followed by SYSTEMIC and PYRETHROID INSECTIDICES

STEP 1: Isolate crops from sources of infection

- Sources of infection include infected seed planted in a field, other potato crops, potato volunteers, and uncontrolled growth in potato dumps.
- The first step to control is to place crops away from these sources.
- Use as healthy seed (high grade, low field generation) as possible.
- Avoid dual purpose crops – they are more exposed to infection and present challenges in formulating a legal and effective insecticide programme.

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STEP 2: Remove virus infected plants

- Remove infected material before virus can spread.
- Rogue potato crops
- Control volunteers.

SAC/SRUC’s roguing course

STEP 3: Use resistant varieties, mitigate risks in susceptible varieties

- Use resistant varieties to potato virus Y (PVY) and potato leaf roll virus (PLRV).

- Target varieties with high virus propensity (Maris Piper, Maris Peer, Cara, Atlantic, etc…) with extra control measures.

- Isolate varieties with high virus propensity away from other seed crops.

Virus Propensity

Variety	PVYN 2010-23	Crops with PVYN 2010-23	Leafroll 2010-23	Crops with Leafroll 2010-23	Total Crops
CARA	1.2	181	4.1	297	2392
HERMES	0.2	91	0.7	127	6049
MARIS PIPER	1.9	564	2.1	318	4921
ATLANTIC	4.5	426	0.5	25	1544
DESIREE	1.5	248	0.9	74	2741
LADY ROSETTA	0.1	7	0.5	14	1001
VR 808	3.6	101	0.2	3	449
MARKIES	0.1	5	0.7	31	1491
BROOKE	0.6	26	1.2	26	743
INNOVATOR	0.2	9	0.1	3	917
MARIS PEER	2.3	286	1.3	76	1976
ROYAL	0.1	5	0.3	6	761
KING RUSSET	0.6	5	0.0	0	133
ARSENAL	0.2	6	0.9	13	500
DAISY	1.0	19	3.0	29	318
CARUSO	0.0	0	0.5	2	122
NECTAR	0.6	15	1.0	14	440
KING EDWARD	2.3	133	0.4	10	930
SPUNTA	0.9	23	0.3	3	395

Variety	PVYN 2010-23	Crops with PVYN 2010-23	Leafroll 2010-23	Crops with Leafroll 2010-23	Total Crops
SPUNTA	0.9	23	0.3	3	395
ELLAND	0.3	2	5.7	19	110
MARFONA	1.0	50	0.9	21	784
PREMIERE	0.5	15	0.1	2	492
SAXON	0.1	2	0.0	0	633
ROOSTER	0.5	20	0.2	4	706
BURREN	0.2	9	0.6	15	794
LANORMA	0.6	12	0.1	1	300
PICASSO	0.6	19	0.5	7	479
BANBA	0.1	4	2.4	46	620
LA STRADA	0.6	7	2.6	15	191
CHARLOTTE	1.7	90	0.1	3	842
JAZZY	0.7	10	1.0	7	226
KINGSMAN	0.6	7	3.9	24	205
RUSSET BURBANK	0.5	23	2.2	48	728
PENTLAND DELL	0.6	38	0.2	6	948
SLANEY	1.8	63	1.9	33	577
LADY CLAIRE	0.4	6	1.7	12	227
WILJA	2.3	77	0.3	5	531
SORAYA	0.0	0	0.8	2	85
EDISON	0.0	0	1.3	3	77
GEMSON	0.6	24	0.8	17	697

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STEP 4: Act on aphid monitoring information

- Get yellow water set up and operational early (before emergence). Check suction trap and yellow water trap data regularly.
- Anticipate aphid flights in your area based on this information.
- Act on information – use it to inform insecticide programmes and other control measures.
- Inspect crops regularly.

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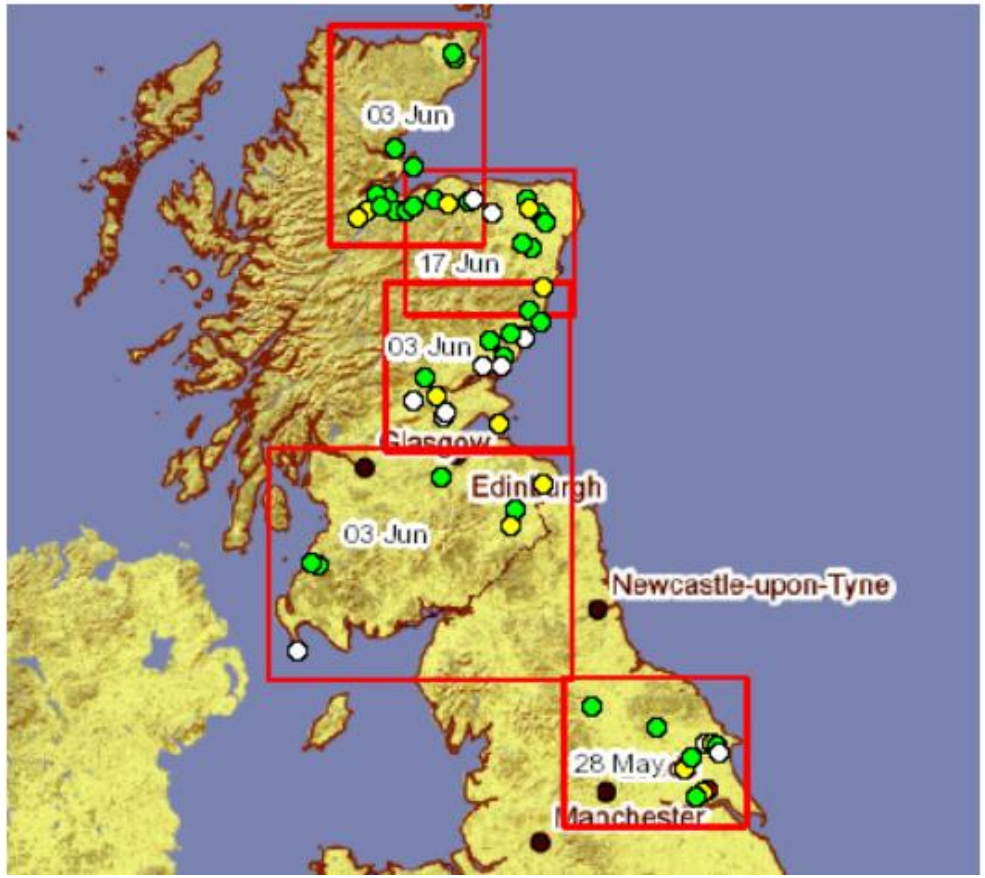
The Yellow Water Trap network is a powerful tool for tracking problem aphids

ALBERT BARTLETT
Est. 1948

Albert Bartlett are sponsoring 45 traps in Scotland for the 2024 season.

Aphid monitoring water trap results for 2024



Aphid Species	Common Name	Aphid PVY Index	23/06	Total PVY Index
Myzus Persicae	Peach-Potato Aphid	1.00	8	8
Acyrthosiphon Pisum	Pea Aphid	0.70	1	0.7
Cavariella Aegopodii	Willow-Carrot Aphid	0.50	56	28
Rhopalosiphum Padi	Bird Cherry-Oat Aphid	0.40	1	0.4
Brachycaudus Helichrysi	Leaf-Curling Plum Aphid	0.21	3	0.63
Macrosiphum Euphorbiae	Potato Aphid	0.20	4	0.8
Hyperomyzus Lactucae	Currant-Sowthistle Aphid	0.16	1	0.16
Aphis Fabae	Black-Bean Aphid	0.10	94	9.4
Brevicoryne Brassicae	Cabbage Aphid	0.0	7	0.07
Capitophorus Horni		0.0	1	0
Unidentifiable		0.0	3	0
Week			48.16	
Cumulative Index			48.16	48.16

Colonising aphids are a big risk for leaf roll transmission
Translaminar insecticides (Teppeki, InSyst) should be effective

Note that PVY vectors are in **bold** and potato colonisers are highlighted

Pay attention to PVY index – even with a low individual index, lots of aphids can be an issue!
Use oils and pyrethroids (resistance notwithstanding)

STEP 5: Target your Spray Programmes

- Monitor aphid fights and target your applications.
- As soon as key aphids are flying, spray.
- Mineral oils can reduce virus acquisition and transmission when sprayed early and frequency.
- Continued over-reliance on pyrethroids is likely to result in further resistance shifts.
- Observe guidelines to ensure an effective, reliable, and legal programme is followed.
- Select sprays that will protect crops from both PVY and PLRV. Systemic insecticides can be very effective against PLRV, but they are not effective for PVY control.

STEP 6: Continue control measures until haulm is dead

- Bring crops down as early as you can – a shorter growing season means less exposure to virus transmission.
- Continue programmes until all green plant material has died.
- Prevent and control regrowth.

Insecticide use in seed potatoes 2022 (treated ha) – SASA pesticide usage survey

The “Average” insecticide programme

- SASA Survey treated area / certified seed area – not a real programme, but indicates general practice.
- Data is survey data, some pesticide use has been underreported in the past (e.g. Vydate [fosthiazate]).

3	**Hallmark equivalents**	**(pyrethroid)**
2	**Sven equivalents**	**(pyrethroid)**
1	**InSyst**	
0.5	**Teppeki**	

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PVY Virus – Olie H

- Emergency Authorisation of Olie H (Paraffin Oil) approved for Seed potatoes.
- BPTA will be collecting data on Olie H use to support repeat application
- Must use in conjunction with other IPM measures
- Approved for use between 23 May and 31 August
- Potential for phytotoxicity

SPO SEED POTATO ORGANISATION

Horticulture Crop Protection

Max individual dose	6.25 l/Ha
Max number of treatments (per year)	6 (from BBCH 40 – tuber initiation)
Latest time of application	BBCH 99 Harvested product with a 1-day PHI
Aquatic buffer zone distance	18 metres
Minimum application interval	7 days
Application restrictions	Must be applied by sprayer with at least 3-star low drift nozzles. Cannot be applied by handheld equipment

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Tank mixing oils and blight sprays

- **Field trial evidence safe**:
  - Revus
  - Percos
  - Infinito

- **Evidence or manufacturer recommendation not safe**:
  - Ranman Top
  - Zorvec
  - Fluazinam products
  - Zoxamide products

PPO – SPECIAL REPORT NO 17 – 2015, 69-76

Impact of oils tank mixed with late blight fungicides on leaf blight control in three growing seasons

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[2] Scottish Agronomy Ltd, Arlary Farm, Milnathort, KY13 9SJ, Scotland, UK

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What does a good spray programme look like?

- Starts early.
- Covers full season.
- Effective against both PVY and PLRV.
- Careful use of pyrethroids (depending on aphid species).
- Must integrated with other methods.

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A "typical" seed potato spray programme

		PVY control	PLRV control (monitor aphid species)
1	50 % emergence	Cropspray 11E	
2	+ 7 days	Cropspray 11E	Teppeki
3	+ 7 days	Cropspray 11E	
4	+ 7 days (Tuber Initiation)	Pyrethroid	InSyst (after TI)
5	+ 7 days	Pyrethroid	
6	+ 7 days	Pyrethroid	Teppeki
7	+ 7 days	Pyrethroid	
8	+ 7 days	Pyrethroid	InSyst (before 31 July)
9	+ 7 day	Pyrethroid	
10	+ 7 days	Pyrethroid	Movento (if required, after flowering)

However, use of Pyrethroids **is too high for long term sustainability** – substitute some with Olie H, use Pyrethroids strategically. Resistance issues are present in several important aphid species.
The program above assumes high aphid pressure and flights of colonising aphids around the 2nd spray.
MAKE SURE YOU COMPLY WITH PRODUCT LABELS – there are further restrictions not listed in this table.
Seed potatoes only – not a ware programme

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Dual purpose crops

- **Discouraged** for following reasons:
  - Only one InSyst.
  - Teppeki unsupported. Grower's risk.
  - Olie H Emergence Authorisation seed only.
  - Longer season – more exposure.

- Many dual-purpose crops have high virus health and there are strong incentives for a "ware fraction"
  - Industry debate is needed on this topic!
  - If dual purpose crops are grown **extra attention will be required**.

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Tuber indexing

- Heavily dependent on **sampling protocol**
  - Flags presence or likely absence of virus – easy to miss infections at low incidence!
- Retesting and resampling can lead to different results!
- In our view not a substitute for growing crop inspections – but does gives one more piece of information. Can flag problem stocks.
- Labs are working on standardising methods. Sampling methods are under scrutiny.

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Thanks for listening!

- This workshop is only an introduction to virus control, may topics where not have covered.
- Feel free to contact a member of the SAC Potatoes Team (or speak to your agronomist/advisor) if you should like more info on:
  - Other IPM measures (purge strips, natural enemies).
  - Volunteer control.
  - Insecticide resistance management.
  - Aphid & virus modelling/forecasting.
  - Strains of PVY & PLRV.
  - Other potyviruses.