PCN Forum and Workshop

Tuesday 21st March 2023

Hosted by CUPGRA & GB Potatoes

at NIAB,
Park Farm, Villa Road, Impington, Cambridge, CB24 9NZ

FINAL REPORT

Contents :

Collated : 14th April 2023

Section 1. **Presentation Notes:**

Note, meeting Chatham House rules.

Attendees may discuss content of the meeting in the outside world but may not attribute any comments to any particular person or organisation.

NB. Only presenting speakers names have been included all other feedback has been anonymised.

1. **James Price from JHI.**

H1 resistance has helped much, with keeping rostochiensis levels low.

Pallida is more of an issue, as genetically much more variable.

Pallida is getting worse in Scotland, i.e., more of it found and levels in fields, increasing post Innovator now being grown in Scotland.

Only 3% of ware and 8% of seed grown in Scotland is resistant to Pallida.

Scotland still grows 77% of seed for England.

PCN Working group in Scotland, got £2.3 million from Scottish Gov, for 10 work packages.

WP2 – DSS, a tool for Growers. Looks at models and cost benefits for Growers. Very Grower facing, should have an alpha version of this for next year.

WP3 is about Resistance and Market development.

WP 4 is about accelerated crop improvement, and the introduction of Di haploid breeding to introduce pyramid genetic improvements.

Screening for PCN types is difficult and expensive, prominent ones are H1, Gpa5, H3

It is complex work, with contrasting phenotypes and associations etc.

WP 5 is about Tolerance. There is likely to be a link between tolerance and determinacy, so JHI are currently testing genetic markers for this. Tolerance will not reduce PCN population sizes without resistance. However, tolerant crops will sustain a yield under PCN pressure, which could help uptake of PCN resistance varieties.

WP 6 is about ground keepers and break out resistance. Notably developing and tracking plants for spot spraying out, to help reduce PCN multiplication out of potato crops.

WP7 is about IPM and Trap cropping both with sticky thistle and chitin-based compost compounds.

2. **Phil Burgess from SRUC/SACAPP & JHI**

Phil works for the Scottish potato Organization which is a JHI and SRUC collaboration.

These issues still need much KE. PCN is complex.

Protecting the Land base, controlling the epidemic and introducing new varieties

www.pcnhub.ac.uk called PCN Action Scotland

Use Growers to develop messages and lay out stories and strategies.

Developing KE is really important, especially to engage people beyond our current connections e.g., Land Agents, Landowners, Retailers and Processors

3. **Matt Back from Harper Adams University**

Matt's team did the last survey in England, which did show significant increase in Pallida in England, 89% of the infested fields were determined as pure *G. pallida*, 5% contained pure *G. rostochiensis* and the remainder consisted of mixed populations. Survey completed in 2016 and published by AHDB in 2018 (PCN Grower Guide)

The need is to increase the rotation to 1 in 7 or 8 and this is still not happening.

They are working on putting the agronomy into trap crops.

Bio fumigation is still an area of interest, particularly with growing crops (as opposed to chopped up crops) as they continue to exude and leach compounds which suppress PCN.

Novel compounds are of interest. Cover crops, it is great to put more science into the detail of how to make these work, i.e., which species are good, or negative to Nematodes?

Trap crops, there is still much to learn, as indeed with other modes of suppression.

Keen on looking at the application of AI, in recognising PCN. However, this works needs to be able to understand sub species.

Trap crops, 3 main aeras

- Prickly nightshade
- African nightshade or African spinach
- Solanum chenopoidioies

Trying to find the best dead-end host, i.e., to attract the Nematodes to develop, but not reproduce.

With trap crops, found that the best results are often seen 2 years after spuds and need 660 g /DM/ m2 of material grown to work with

Sill work to do in understanding how to fit them into rotations and to see if they can be used between crops, rather than replace a crop. Need efficacy data and need to understand more about precision vs broadcast.

4. **Mark Taylor Chair of GB Potatoes.**

Mark is also the Chairman of the National Potato Virus Forum.

It is important to have defined goals, in timelines and output, rather than just develop a talking shop. Divide out the workload but be clear on what is regulatory and what is practical.

5. **Sebastian Eves-van den Akker, Academic from the University of Cambridge**

Sebastian works on genetics of plant-nematode interactions.

Nematodes generally, and sadly, are towards the bottom of the list that Researchers choose to work on. Likely due to technical intractability (really difficult work on (long life cycle, below ground)).

There needs to be successes to drive momentum – this is moving in the right direction.

To facilitate progress there is the need to building tools, so that the correct questions can be asked (e.g., hardware and software to quantify nematode infection). These tools will allow us to identify which genes in the nematode or in the plant are required for infection, leading to intuitive routes to impact.

There are lots of different ways to think about the plant genes that control the impact of PCN – some of these extend beyond classical understanding of resistance and tolerance (e.g., if nematode lifecycle is slowed down to be longer than the time to harvest, nematode problem goes away the following rotation).

Long term solution needs different thinking to avoid the current problems.

6. **Nick Winmill- Agri.**

Nick is Technical Lead for Agrii but is ex ADAS and then was in Retail.

He commented about the success of the NSP Stewardship, which was to protect and preserve.

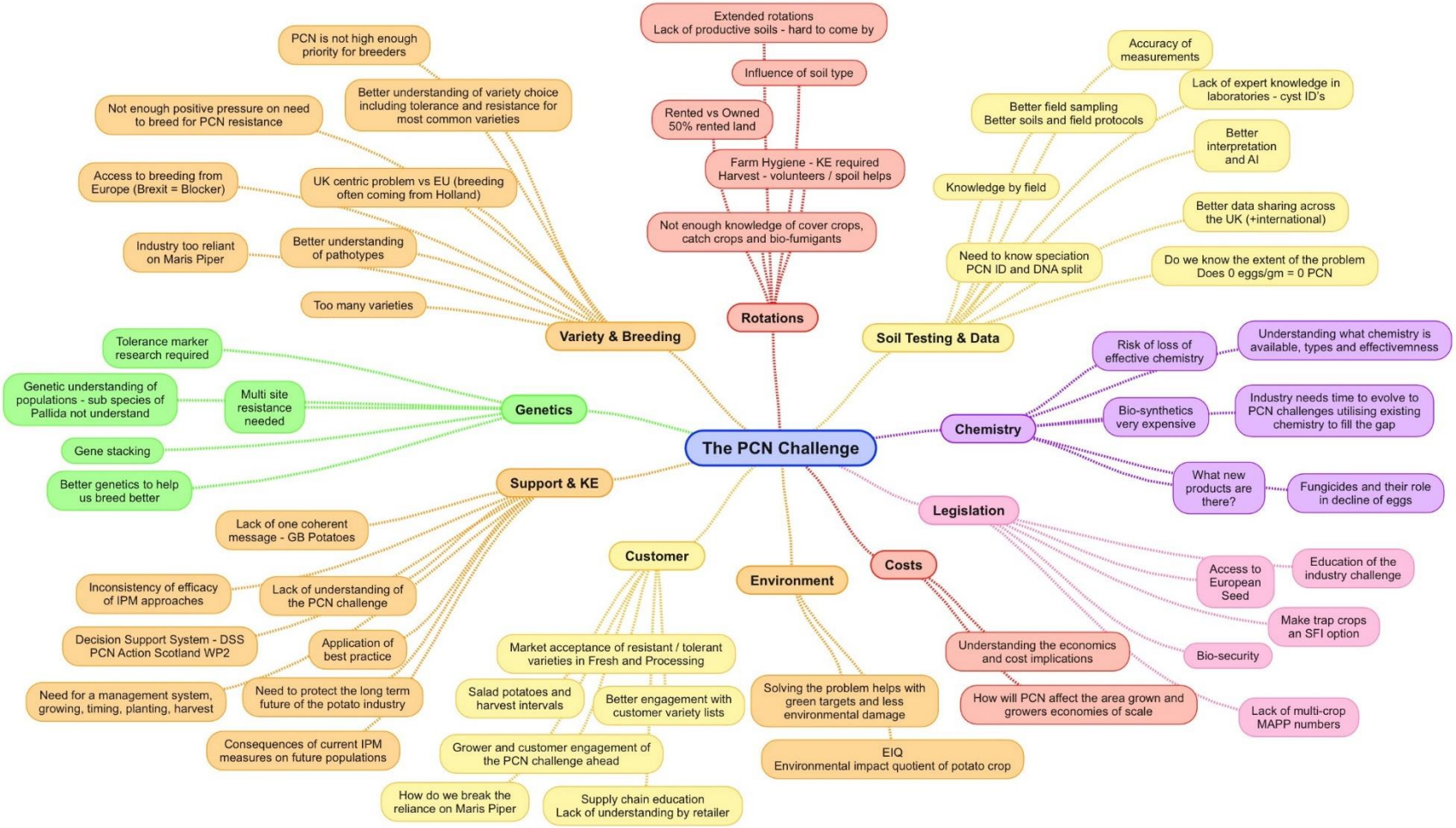
It was about training and supporting best practice, e.g., soil sampling, we now have a good sampling protocol out of this (not before this), to give good monitoring.

He is also big part of the Potato Partnership, ICM approach has to be better accepted and we have to stop planting on sites with high PCN counts. Some of this work is about education and trying to engage the whole supply chain.

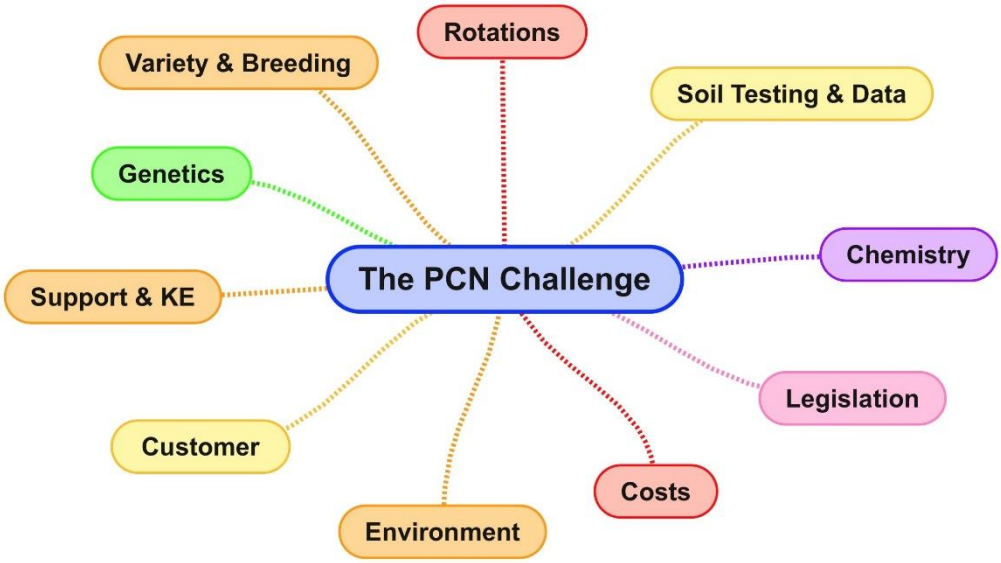
7. **Andy Cunningham from Syngenta**

Syngenta are committed to supporting Nemathorin for re-registration.

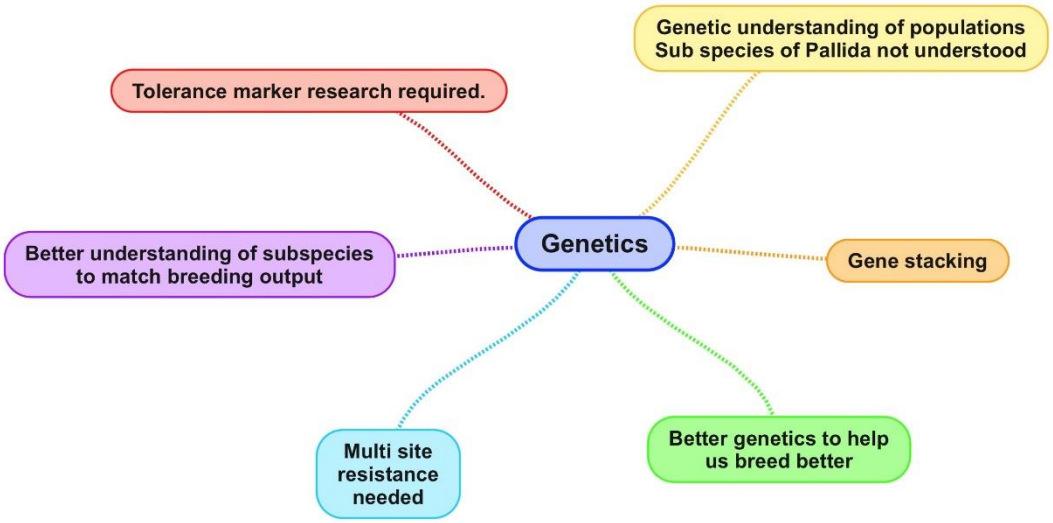
Section 2. **The PCN Challenge: Full version as collated from Workshop Session1**

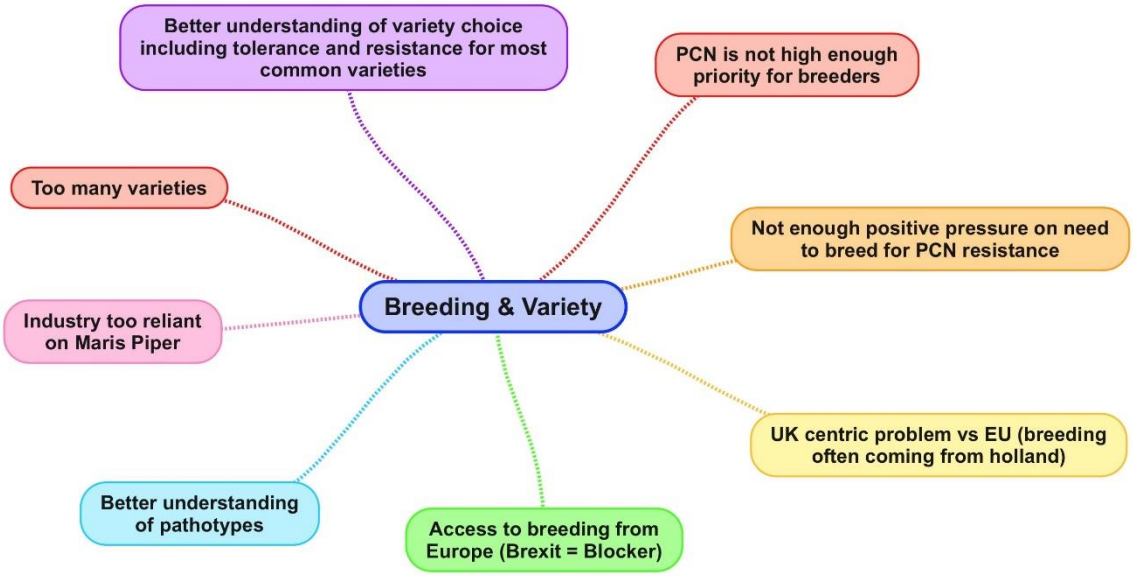


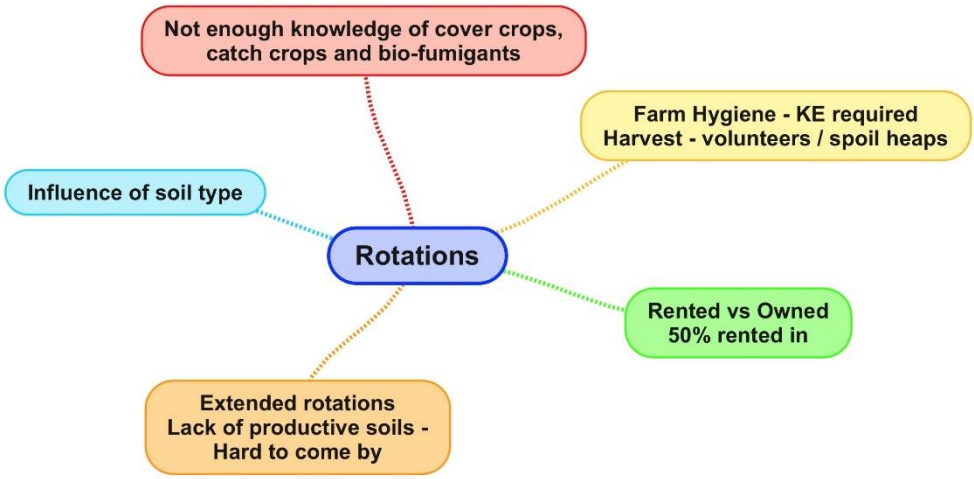
Main Categories: The PCN Challenge

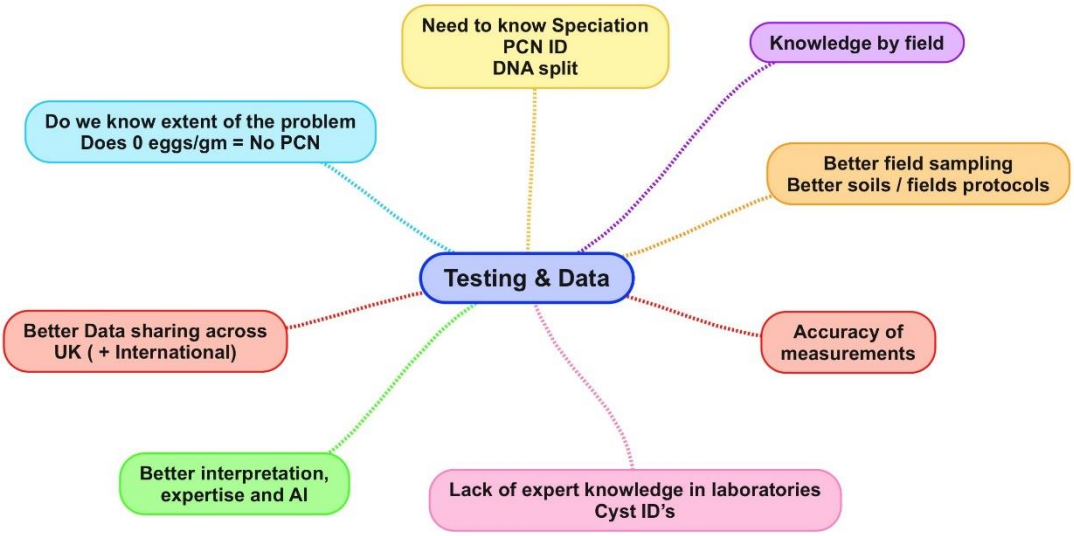


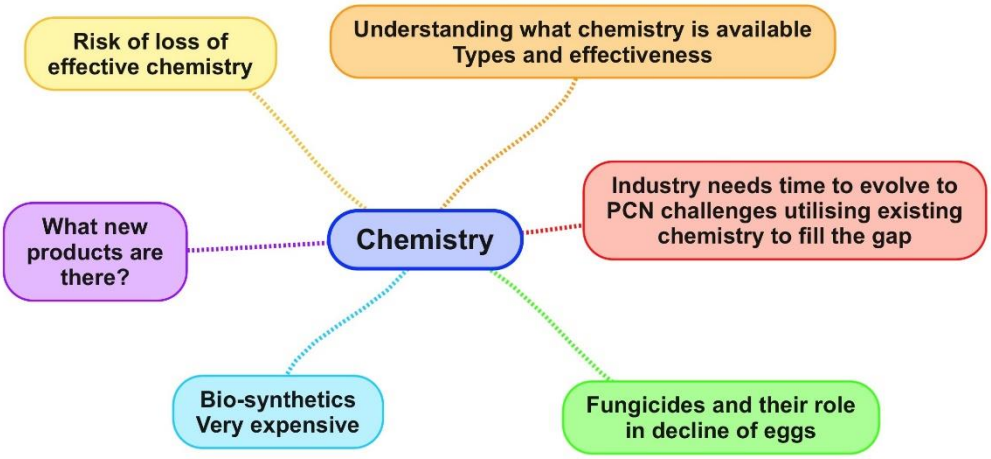
Main Categories broken down into their sub-categories.

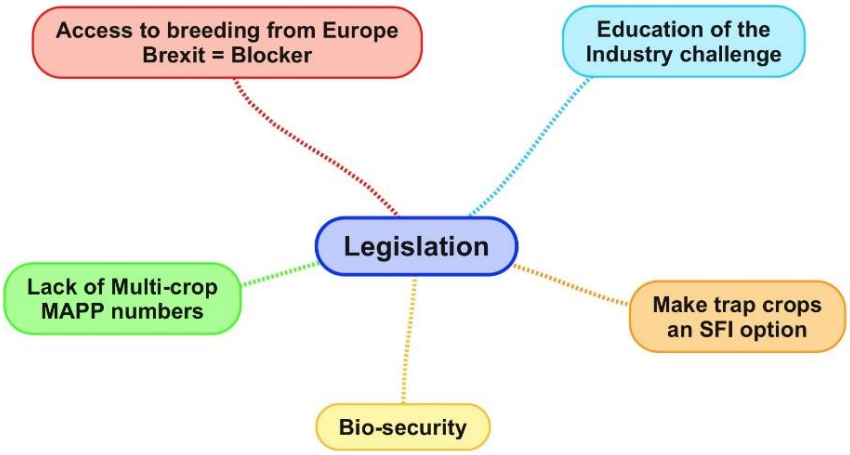


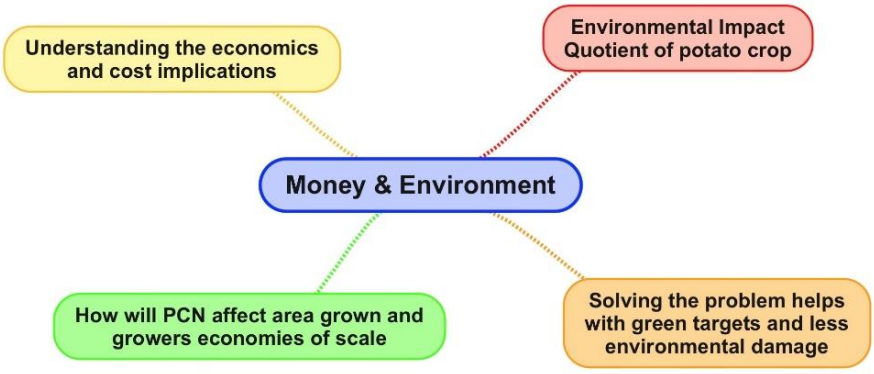

Better understanding of variety choice including tolerance and resistance for most common varieties
PCN is not high enough priority for breeders
Too many varieties
Not enough positive pressure on need to breed for PCN resistance
Breeding & Variety
Industry too reliant on Maris Piper
UK centric problem vs EU (breeding often coming from holland)
Better understanding of pathotypes
Access to breeding from Europe (Brexit = Blocker)

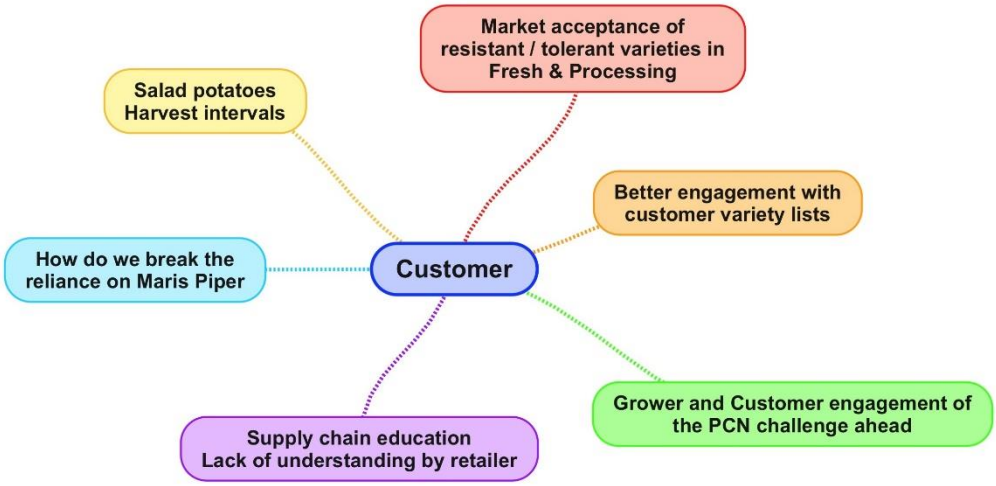

Not enough knowledge of cover crops, catch crops and bio-fumigants
Farm Hygiene - KE required
Harvest - volunteers / spoil heaps
Influence of soil type
Rotations
Rented vs Owned
50% rented in
Extended rotations
Lack of productive soils - Hard to come by

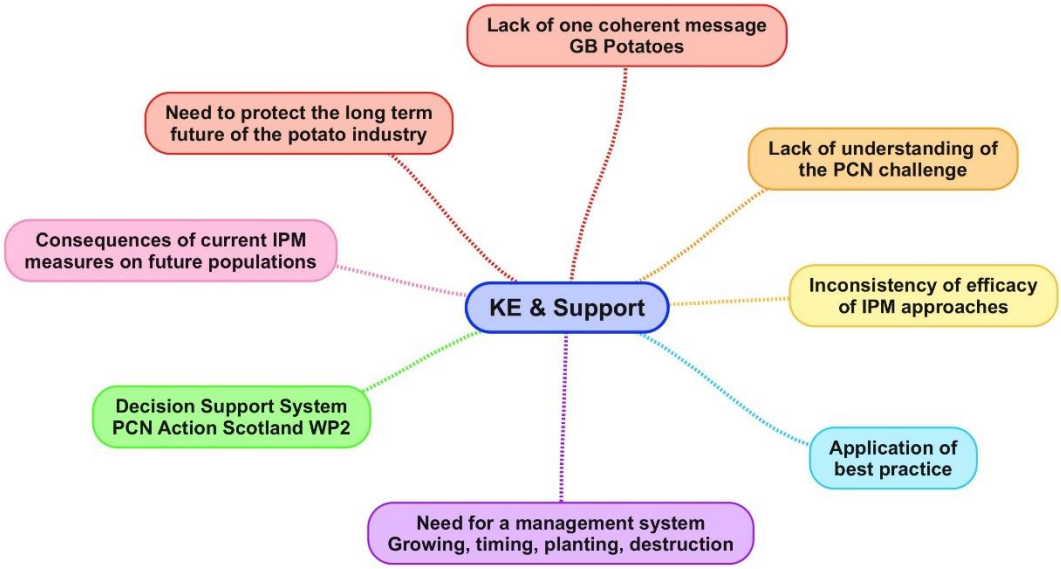

Need to know Speciation
PCN ID
DNA split
Knowledge by field
Do we know extent of the problem
Does 0 eggs/gm = No PCN
Better field sampling
Better soils / fields protocols
Testing & Data
Better Data sharing across
UK (+ International)
Accuracy of
measurements
Better interpretation,
expertise and AI
Lack of expert knowledge in laboratories
Cyst ID's


Risk of loss of
effective chemistry
Understanding what chemistry is available
Types and effectiveness
Industry needs time to evolve to
PCN challenges utilising existing
chemistry to fill the gap
What new
products are
there?
Chemistry
Bio-synthetics
Very expensive
Fungicides and their role
in decline of eggs


Access to breeding from Europe
Brexit = Blocker
Education of the
Industry challenge
Legislation
Lack of Multi-crop
MAPP numbers
Make trap crops
an SFI option
Bio-security


Understanding the economics
and cost implications
Environmental Impact
Quotient of potato crop
Money & Environment
How will PCN affect area grown and
growers economies of scale
Solving the problem helps
with green targets and less
environmental damage


Market acceptance of resistant / tolerant varieties in Fresh & Processing
Salad potatoes Harvest intervals
Better engagement with customer variety lists
How do we break the reliance on Maris Piper
Customer
Grower and Customer engagement of the PCN challenge ahead
Supply chain education Lack of understanding by retailer


Lack of one coherent message GB Potatoes
Need to protect the long term future of the potato industry
Lack of understanding of the PCN challenge
Consequences of current IPM measures on future populations
KE & Support
Inconsistency of efficacy of IPM approaches
Decision Support System PCN Action Scotland WP2
Application of best practice
Need for a management system Growing, timing, planting, destruction

Section 3. Key Actions / Priorities

Please note, these are an exact copy of each groups' thoughts, in their entirety.

Key Actions / Priorities – Table A

1. Test to species level all fields for PCN levels and map this. Get a base line and de-stigmatise data sharing – Make a statutory requirement.
2. Get a marker for tolerance and use it in breeding plus a proxy for easy testing.
3. Make variety choice a genuine choice – education in supply chains, understanding benefits to be gained and risks of certain varieties.
4. Better understanding of cover crops, trap crops, chitin and other IPM controls that can be deployed within rotations, (then educate growers, supply chains etc). How other crops in the rotation (i.e., wheat), could affect PCN between potato crops. Sharing data between growers on successes in rotational control.
5. Route to implementation for solved research questions – ensuring that KE reaches all and that all engage.

Key Actions / Priorities – Table B

1. Quantify the challenge, keep it simple and clear.
2. Steering group needs to be created, (10 max people), research, supply chain, agronomy, government.
3. Need to raise awareness with regulators and government. Ensure there is effective communication.
4. Identify best practice, what are realistic deliverables.

Key Actions / Priorities – Table C

1. Learn from Scottish working group priorities.
2. Knowledge exchange and engagement.
3. Use new Agritech technologies (detection / mapping).
4. Protecting land base. Post harvest testing / detection of low populations.
5. Harvesting setup to reduce volunteers / costs / management.

Key Actions / Priorities – Table D

1. Setup GB PCN Forum.
2. Ensure all potato land is tested and speciate if PCN are found.
3. Protected seed regions in Scotland regards PCN, to stop ware creep.
4. Updated PCN model.
5. Independent variety testing.
6. Retaining of KE for understanding research within the industry.

Key Actions / Priorities – Table E

1. Continued variety trials, KE, and breeding.
2. Gene markers, resistance, and tolerance.
3. Must sample fields pre cropping, and speciate if present.
4. Reinforce farm hygiene, landlord especially owners.
5. Trap cropping into environmental schemes.

Key Actions / Priorities – Table F

1. Engage with geneticists to understand PCN populations / and objectives of work.
2. Need to understand the species present in infested land, ideally pathotype / mitotype.
3. Greater uptake of GE in the industry.
4. Change the mindset of using susceptible varieties.
5. Investigate past research, where it was showing potential, e.g., Pochonia Chlamydosporia.
6. Applying new methods on a farm level.

Section 4. **Agreed Top Actions / PCN Priorities**

In no particular order, and as appeared via our workshop discussion:

Now amended with feedback received in italics.

- Gene Markers for Resistance & Tolerance.

  'The Scottish PCN working group will cover this and repeating this work would be a misallocation of funds that could be used elsewhere.'

- Understanding the genetic variations in Pallida + Variety.

  'The Scottish PCN working group currently have a RESAS package investigating this and are testing markers to ID different pallida populations.'

- Protecting the land base & better detection / intensive / targeted sampling.
- Supply chain education to understand implications of variety choice.
- Need for national steering / coordination group.
- Stewardship protocol for volunteers.
- Next generation training experts of tomorrow.

  'Training someone to ID nematodes down a microscope is time consuming and costly. Training a molecular biologist to extract DNA and PCR is more accurate and transferrable.'

- Encouraging growers to sample more including speciation.

  These samples have to be processed by labs that can be trusted. A central system like SASA have, would really help England & Wales.

- Revisit existing knowledge / research.
- Explore opportunity to share/ collate grower data better, mapping.
- Development of accurate decision support systems.
- Bio fumigation understanding.
- Independent verification of variety lists.

Section 5. **Feed Back from Attendees**

- A project to quantify the problem for England, contacting CHAP to identify what Government sponsorship help can be accessed.

- Consider creating a national forum, to join up our conversation.
  We discussed the opportunity for a National PCN Forum at our GBP Board meeting following the PCN workshop with unanimous support.
  We believe GBP are best placed to lead and steer the next steps on behalf of the industry and would like to propose we do this. We do see a "joined-up" cohesive plan for Industry as the way forward and it will need careful planning. Next steps can include.
  - Consider and convene a Steering Group
  - Agree the remit and mandate of the group.
  - Set Agenda and agree work streams and industry "owners"

- Co ordinating with the work being undertaken in Scotland (www.pcnhub.ac.uk).
  The group should be aware of
  https://www.pcnhub.ac.uk/publications/pcn-working-group-final-report and
  https://www.pcnhub.ac.uk/publications/plant-health-centre-future-threat-pcn-report.
  Consider mapping out what 'English' growers and supply chains need to do, to (a) compliment and benefit from what is being undertaken currently and then (b) identify the gaps which need to be addressed from your perspective. Common interests in Scottish work packages.
  Consideration given to what is meant by 'National' in this context. We currently have a national approach – I.e., Scotland. England or GB? As noted, Scotland are making progress in this area and we would not want to lessen our impact in Scotland by confusing the issues, and something we need to be aware of.

- Consider formation of a “National PCN Forum” – inviting representatives from across the sectors to take part, including representation from the PCN Forum in Scotland. The National Virus Forum works very well, and I believe would be a good model to follow in the first instance.

  Task One – assess whether GB Potatoes would wish to have a leading/coordinating role from the outset.

  Task Two - review the work undertaken by the PCN Forum in Scotland and identify if their output can be used as KE in England

  Task Three – identify any gaps in research (not covered by the PCN Forum)

  Task Four – agree workstreams and responsibilities.

- The key point for me is we do not repeat the work going on in Scotland but build upon it.

- I have put a table of the PCN working group work packages below and how each of your categories is related. The rest of the UK need to have their own version of the working group. I would be very worried about wasted cost on overlapping research though. I am happy to volunteer to remain a contact (probably in combination with Phil Burgess) to help link the Scottish and rest of UK efforts. It is likely that costs needed from England & Wales will be higher than what the PCN working group won. Therefore, cutting out additional research on tolerance & resistance could help move funds to other areas that will need a lot of work, primarily testing.

Scottish PCN working group	Categories from workshop
WP1 – Economics	Costs, Money & environment
WP2 – DSS	Customer, Money & environment
WP3 – Markers and resistance	Genetics
WP4 – Breeding/Di haploid induction	Breeding & variety, Genetics
WP5 – Tolerance	Genetics, Breeding & variety
WP6 – Groundkeepers	Rotations
WP7 – IPM & alternative controls	Chemistry, Rotations

WP8 – KE	Support & KE
WP9 – Policy	Legislation
WP10 - Testing	Testing & Data

- I like the suggestions for continuation/development.

- Tolerance and determinacy were mentioned by James Price in WP5. NIAB CUF's work on assessing variety determinacy is important here, providing best measure, and understanding this would be crucial in any PCN tolerance assessments, given the difficulty in carrying these out and accounting for seasonal and crop physiological condition. Mention made of a putative tolerance marker from JHI, consider thinking about how to link this to determinacy assessment. Possible merits via genetic approach but needs to be grounded in reality. Consider mapping outputs from this forum with those from the Scottish report (Phil Burgess) and priorities established based on the knowledge of what work is ongoing in the new Scottish work packages.
  Progress has been made from where the industry was 20-30 years ago, tools are available but need better commercially acceptable pallida resistant varieties. Key message is about sampling (numbers and species) and crucially extending rotations. How cover crops / biofumigants/ antagonists fit in with that is complementary, not crucial to PCN management.

- As a key Scottish partner we would value the opportunity to have further involvement in a partnership on a UK wide R&D and KE programme. As participants and trials operator in the PCN action Scotland collaboration we believe that we can bring something of value to the process and outputs.

- A useful focus for a first meeting might be the quantification of the problem/ economics piece: why is PCN an issue, how much of an issue etc with a particular focus on using farmer data to help put the story together. A conversation about anonymised data-sharing with Lab testing facilities, and how that might work. We have the data from the last survey in 2016 and Scottish statutory seed potato fields data. A target might be to have a system in place for farmers to be able to opt to share their data by the time that the pre sampling for next year's crop is happening.

- H1 resistance has helped much, with keeping rostochiensis levels low. Pallida is more of an issue, as genetically much more variable. In response to comments regarding increased levels of pallida in Scotland, it is unlikely that Pallida levels will have increased post an Innovator crop as it has a very good resistance level.
  I noticed that there was no representation from the processing sector .I know members from this sector that would be interested in joining the group.

- For all the focus, effort, and expense so far on breeding in resistance to PCN, this does not look like it will deliver an industry wide solution in the immediate future (5-10 years). Nematicides have worked mostly in a suppressive manner with increasing evidence that PCN, especially *G pallida* is escaping (due to the long egg hatch period) and in numerous situations leaving significant residual populations even after applications of the existing synthetic nematicides. This is being exacerbated by the increasing fluctuations in weather compromising efficacy (to wet – to dry). This is not helping to improve the overall land bank for potato production. Availability of nematicides to 'hold the fort' before resistance cultivars are both broadly available and acceptable will be vital, but they will only be acceptable with both adequate efficacy and low environmental impact.

- It appears that Scotland has already done the same thinking but got the money to do something about it. We may not need to duplicate efforts here (probably most of their findings will be similarly applicable in the south).

- Due to time constraints, we had hoped to cover a workshop slot on, 'Who is missing from the room.' This could be added to any Agenda going forwards to ensure full engagement and best outcomes.

Section 6. **Next Steps**

CUPGRA will work with GB Potatoes and JHI, to identify a date, venue and set an agenda for the first meeting of a PCN National Forum, to be announced shortly. It is envisaged that the new forum will decide a workplan going forwards.