AHDB potatoes - Crop Protection Treater Group

Group Technical Secretary, Anne Stone
anne.stone@ahdb.org.uk

Minutes of the 31st Meeting (soil diagnostics)

Held by kind invitation at Bayer Cropscience Ltd, Cambridge Science Park CB4 0WB on 8th March 2017 at 11:00.

Attending:

Dennis Walsh - Produce Solutions
Alice Johnston – Bayer Cropscience
Glyn Harper – Sutton Bridge Crop Storage Research
Matthew Back – Harper Adams University
John Sarup – Spud Agronomy
Nick Winmill - Agrii
Danny Hubbard – Team Sprayers
David Turner – David Turner Agriculture
Jeff Beever - McCain
Gerard Croft - BPTA
Alan Horgan - Certis
Eric Anderson – Scottish Agronomy
Paul Goddard - BASF
Paul Overton – Frontier Agriculture
Andy Evans – Scottish Rural University College
Mark Taplin – Harvest Agronomy

Invited guests:

Jennie Brierley
Alison Lees
Neil Boonham
John Elphinstone

Apologies:

Phil Burgess - AHDB
Morley Benson – Certis
Sharon Hall – PPA
Chris Allen – Chafer Horstine
Mark Britten – Syngenta

1. **Welcome and Introduction**. The chairman thanked Bayer for hosting the meeting, and gave a special welcome to the four new members.

2. **Minutes**

These were accepted as a correct record

3. **Matters arising**

The report on the SBCSR project on sprout suppression, by Glyn Harper, will be published in May.

Jeff Beever reported that McCain is using a combined ethylene and CIPC treatment in a commercial store, a major step up from trials at SBCSR. Gerard Croft said he would speak to John Williams from Spearhead, who might be able to arrange for such a trial in a crisping potato store. David Turner reported that Biox-M spearmint oil treatment is applied with a thermal fogger.

Paul Goddard commented that the statement referring to 'treatments causing ethylene release' does not apply to DMN. (The minutes have been amended to clarify).

4. **Topic for discussion**. Soil Diagnostics.

Dr Jennie Brierley and Dr Alison Lees, James Hutton Institute. Diagnostics to inform epidemiology, disease prediction and management decisions. (pdf of presentation available)

JHI develops and validates diagnostic assays. The commercial arm of the Institute is James Hutton Limited. They have a new and evolving Molecular Diagnostic Unit. They currently offer soil testing for FLN. They have not previously offered diagnostic tests for seed and soil borne potato pathogens as listed in the table below, but would be happy to discuss testing possibilities with anyone wishing to submit samples. All enquiries should go to Vanessa Young at Vanessa.Young@huttonltd.com

Diagnostic tests can be of value for seed, for ware going into store, and for soils. The chart of tests developed so far, from the presentation, is shown below.

Real-time PCR diagnostic assays

Pathogen	Disease	Tuber test	Soil Test	Our Publication
Spongospora subterranea	Powdery scab	✓	✓	van de Graaf et al (2003)
Colletotrichum coccodes	Black dot	✓	✓	Cullen et al (2002)
Rhizoctonia solani AG3	Black scurf, stem canker	✓	✓ less reliable	Lees et al (2002)
Streptomyces spp.	Common scab	✓	under validation	Tegg et al (2015)
Helminthosporium solani	Silver scurf	✓	✓ (less applicable)	Cullen et al (2001)
Polyscytalum pustulans	Skinspot	✓	✓ (less applicable)	Lees et al 2008
Fusarium spp.	Dry Rot	✓	✓ (less applicable)	Cullen et al 2005
Phytophthora infestans	Late Blight	✓	not applicable	Lees et al 2012
Phoma foveata	Gangrene	✓	not tested	Cullen et al 2007
Phytophthora erythroseptica	Pink Rot	✓	not tested	Cullen et al 2007
Pythium ultimum	Watery Wound Rot	✓	not tested	Cullen et al 2007
Alternaria solani	Early Blight	✓	not tested	Lees et al (in prep)

DNA extraction from soil: Brierley *et al*. (2009) Applied soil ecology

Some soil tests are fully validated for assessing disease risk, for example, *C. coccodes* (black dot) and *S. subterranea* (powdery scab). Recommendation. The AHDB potatoes leaflet on Black Dot is good, with its explanation of testing in relation to low, medium and high risk. The same is needed for powdery scab and perhaps other diseases. Glyn Harper suggested that even the Black Dot leaflet needs review.

Testing soil for *Rhizoctonia solani* AG3, is less reliable for example, in a study involving 113 commercial fields, when there was no inoculum detected on soil or seed, still 10% of the crops developed black scurf. Most likely it had been present in pockets of organic matter in the soil, which

were missed during the sampling. When detection in soil had occurred then >30% of crops developed black scurf.

Sampling recommendation is 100 x 10 g samples from a W pattern on 4ha. This 1kg sample is homogenised and a 60g sub sample is analysed. A sample taken for PCN testing is suitable. Either mycelium or sclerotia inoculum can be detected. The inoculum is often in the surface 2cm.

Q. Uniformity of inoculum? **Ans**. Rhizoctonia and free living nematodes are disaggregated. Powdery scab and black dot are more uniformly distributed. Rhizoctonia may be uneven because of exponential growth around each sclerotia, and because of mycelium persisting on organic matter. Preservation on wild hosts can also lead to patchiness.

Q What time of year can sampling be undertaken? **Ans** Pre-planting (Jan-March) is best.

Q. Could cover crops increase carry over of disease, since green manures used to control FLN could have unintentional consequences for other pathogens? **Ans**. No study has been done specifically on cover crops. A study on the effect of compost showed that in Rhizoctonia infected soils, compost addition may increase disease.

Q Why are the resistance scoring (re Rhizoctonia and powdery scab) so vague for new varieties? **Ans** G. Croft replied that scores from trials in Europe can be inaccurate due to lack of disease pressure in Europe.

Q Can the viability of a Rhizoctonia population in a field be tested? **Ans** by A. Lees. No, because field populations are of mixed ages and viabilities.

Q. Can powdery scab increase so fast that initial inoculum is of little relevance? **Ans** Generally disease development is proportional to initial inoculum, there may be circumstances when low levels of inoculum can cause significant amounts of disease.

Q. Could any soil amendment be antagonistic to Rhizoctonia? **Ans** by Matt Back. Trichoderma has been tried (Positive results, especially in combination with fungicide; Wilson et al. Ann Appl Biol 2008)

Q. Can biofumigation treat Rhizoctonia? **Ans** by Matt Back. Isothiocyanates are powerful against sclerotia. John Elphinstone added that common scab returns quickly after soil fumigation.

Dr Alison Lees, JHI. *Phytophthora infestans* late blight detection.

The project is funded by Innovate UK, so the detail is confidential. Unnecessary spraying is taking place because suitable weather conditions (e.g. as assessed by Hutton Criteria) may occur, but disease will not develop unless inoculum is present.

Q What is the time from detection of spores to development of disease symptoms? **Ans** it will depend on the weather. The project is designed to understand the correlation better.

Q Will each farm measure spores, or will it be like aphid trapping, with traps in certain places and general warnings sent out? **Comment** by E Anderson. A better network of weather stations and use of Hutton criteria would improve prediction, even without spore testing.

Q Can met office weather station data be used as well as in-field weather station data **Ans** Yes, depending on the information required both can be useful.

Prof Neil Boonham FERA Use of field diagnostics to help manage disease.

1) Fera is conducting a project on Septoria and other wheat diseases with OptiSense, University of Hertfordshire and Bayer. Spores are collected using a cyclone sampler. It is hoped to produce a quantitative output, though for yellow rust the test is not yet quantitative.
2) A second project, where FERA is working with OptiSense, Agrii and GeneSys Biotech, aims to detect resistant mutations. A hand held machine can discriminate 30 mutations simultaneously. The next task is to provide the results in a useable format.

The mixtures of fungicides which give best control of Septoria today are those which accumulate the most mutations which will bring problems in future.

Q. Can the populations be characterised, indicating which chemicals would be most effective? **Ans** potentially.

Comment, by Alison Lees. There is much less resistance to the chemistry available for late blight than there is for Septoria. **Q**. Is this method more suited to Alternaria? **Ans** from A. Lees, Yes, since more is known about resistance mechanisms.

John Elphinstone FERA, SBSH Partnership Management for soil biology and soil health (presentation available)

SBSH has 10 interlinking projects, with a consortium of FERA, SASA, ADAS and Newcastle University.

Relative sensitivity of assays

qPCR is more sensitive than LAMP, detecting one part in 10^{-2} versus 10^{-3}. LAMP has the advantage of being less affected by inhibitors than qPCR. LAMP assays can detect both DNA and RNA. RNA is not a good predictor of viability, though it might be expected to be.

Cost

Currently a single test for a single disease costs up to £200, so they are little used. If 16 samples were submitted at the same time for one target, the cost would be £65 each. Turn round time could be as little as one day, but FERA accumulates samples for the same target, to reduce cost. The aim of the SBSH projects is to be able to test a soil sample for five pathogens causing common diseases, (*Rhizoctonia, Colletotrichum, Spongospora, Verticillium, Streptomyces)* much reducing the cost per disease.

Key steps in soil testing

Sampling, DNA extraction, amplification, interpretation.

Sampling can be on a grid or W zigzag.

The correct sample size to extract from is not known, but it is thought to be much greater than currently in use. Literature suggests that the quantity of soil from which DNA should be extracted depends on the distribution of the organism and the number of sub samples. A major part of the research is to determine the sample size that will give reliable results. Concurrently, methods are being developed to extract DNA from as much as 1kg soil.

Soil health

Sometimes the aim is to quantify soil bacteriological health, and identifying key targets will enable this.

Q. How many soil samples are currently being tested commercially? **Ans** Almost none at FERA. Andy Evans reported that about 100 a year for powdery scab *S. subterranea*, and less for black dot *C.*

coccodes are being conducted at SASA. The cost is about £150 per assay, with the DNA extraction being the most expensive element. The small number of samples is a problem for SASA as for FERA.

Q Are these assays being used at field level. **Ans** from J. Elphinstone No, because knowledge of presence/absence doesn't help, since environmental conditions determine if disease develops.

Q What is the 'risk v return'? **Ans.** The difficulty is that the risk is so great if environmental conditions favour development of disease.

Q When a field is being sampled anyway, for PCN prior to a seed crop, all the other diseases could be tested for from the same sample. How much would this drive costs down? **Ans** Certainly that approach would reduce costs. Similarly JHI is trying to marry the FLN and soil pathogen testing, which is not straightforward because they are processed in different ways.

Q How does the new AHDB policy of working through agronomists link to the FERA led project? **Ans.** Agronomists should attend the open day and also input to the project in its early years.

Comment by M.Back. A set of numbers on a table doesn't provide enough interpretation for growers. **Ans** from agronomists, use an agronomist to interpret.

Comment. From the list of pathogens for which assays are available, individual face to face questioning of stakeholders will be necessary to identify priorities for inclusion.

5. Getting the message across.

The group agreed that AHDB (Potatoes) should sample fields on SPot Farms and use the results to raise awareness of what diagnostics are available now, what will be available, and their value.

The Black Dot and Powdery Scab leaflets should be reviewed by AHDB Potatoes, in the light of the current state of diagnostics available. The Powdery Scab document states that the tests, while commercially available, are not yet validated; this may now have changed.

The group requested that the presentations be circulated.

6. Topics for future meetings

From a request from the chairman and suggestions of PCN, FLN, irrigation, slugs and wireworm, and Limex; the topic of free living nematodes was agreed. All members present indicated a willingness to travel to Dundee, to allow the group to see the FLN labs of JHI.

7. Date of next meeting.

Preferably November 1st, though this will depend on Roy Neilson.

8. Any other business

The group wants to see the PCN Guide published. It supported the inclusion of survey results from Scotland, including a statement about differences in methodology so that they are not comparable with those from England and Wales.