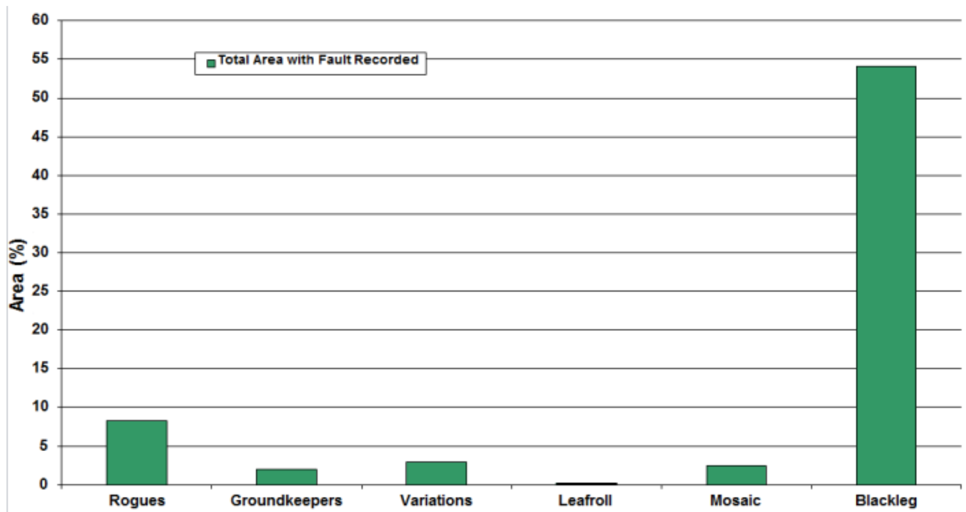
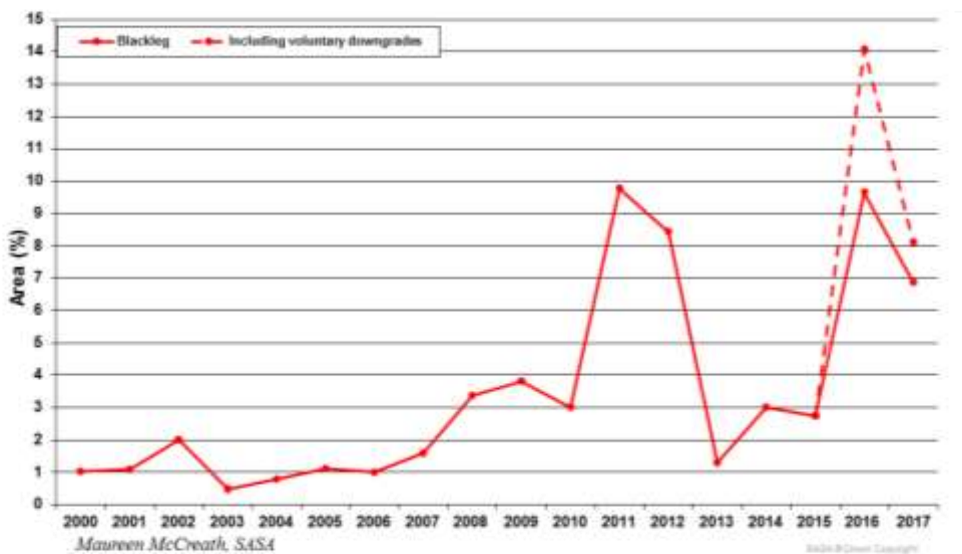
AHDB / Scottish Government-funded projects on blackleg disease

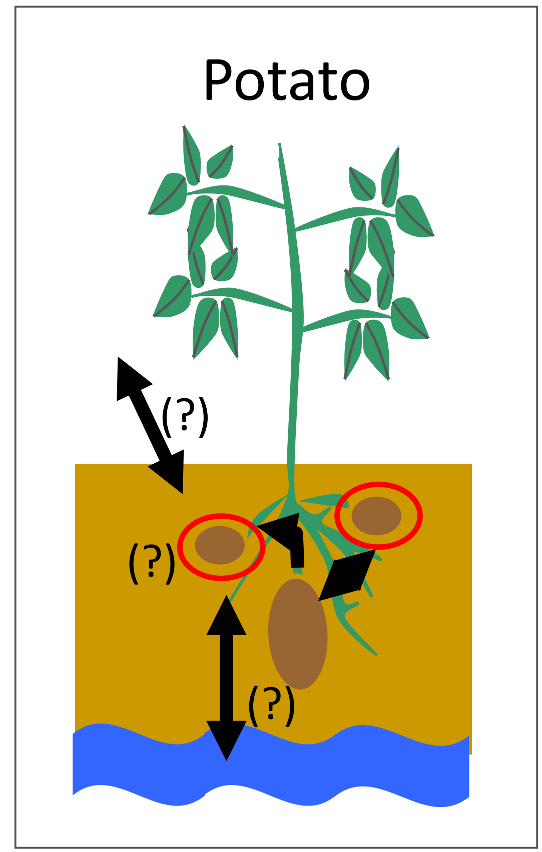
The James Hutton Institute

Sonia Humphris

Blackleg Disease







Blackleg – the research funding landscape

- 2016-21 Scottish Government Science Research Programme (SRP)
- 2013-16 AHDB / Scottish Government
- 2017-19 Scottish Government
- 2017-21 AHDB / Scottish Government

2013-16 AHDB / Scottish Government

Routes of blackleg contamination of high grade potato seed stocks by *Pectobacterium* species and the effects of sulphuric acid treatment on pathogen spread

The James Hutton Institute

The Scottish Government

AHDB POTATOES

SASA Helping Scotland Grow

fera The Food and Environment Research Agency

SRUC

Blackleg findings in seed potato stocks entered for classification in England / Wales

The James Hutton Institute

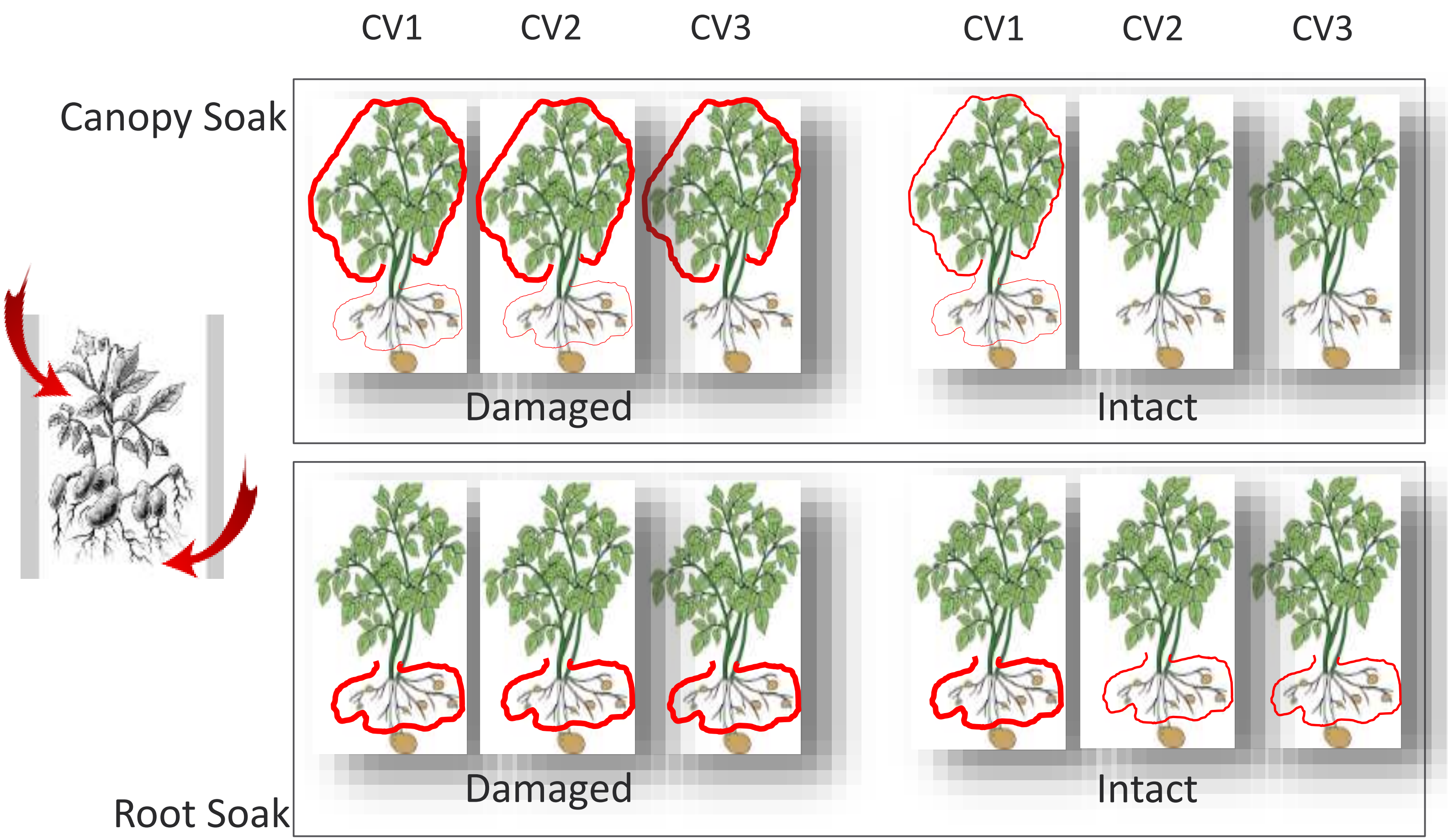
	2010	2011	2012	2013	2014	2015
% seed stocks with blackleg	32.1	21.5	33.8	29.5	28.6	23.7
% blackleg caused by *D. solani*	7.0	2.3	1.8	1.7	0.4	0.4
% blackleg caused by *D. dianthicola*	0.4	0.6	1.8	0.0	0.4	0.4
% blackleg caused by *P. atrosepticum*	75.2	74.4	84.1	86.5	81.2	89.4
% blackleg caused by other *Pectobacterium* spp.	17.4	22.7	12.3	11.8	18.0	9.8

Determining populations

	2010	2011	2012	2013	2014	2015
% seed stocks with blackleg	31.5	49.2	52.7	32.3	42.3	29.3
% blackleg caused by *D. solani*	0	0	0	0	0	0
% blackleg caused by *D. dianthicola*	0	0	0	0	0	0
% blackleg caused by *P. atrosepticum*	93.8	96.3	95.5	96.4	96.8	95.2
% blackleg caused by other *Pectobacterium* spp.*	6.2	3.7	4.5	3.6	3.2	4.8

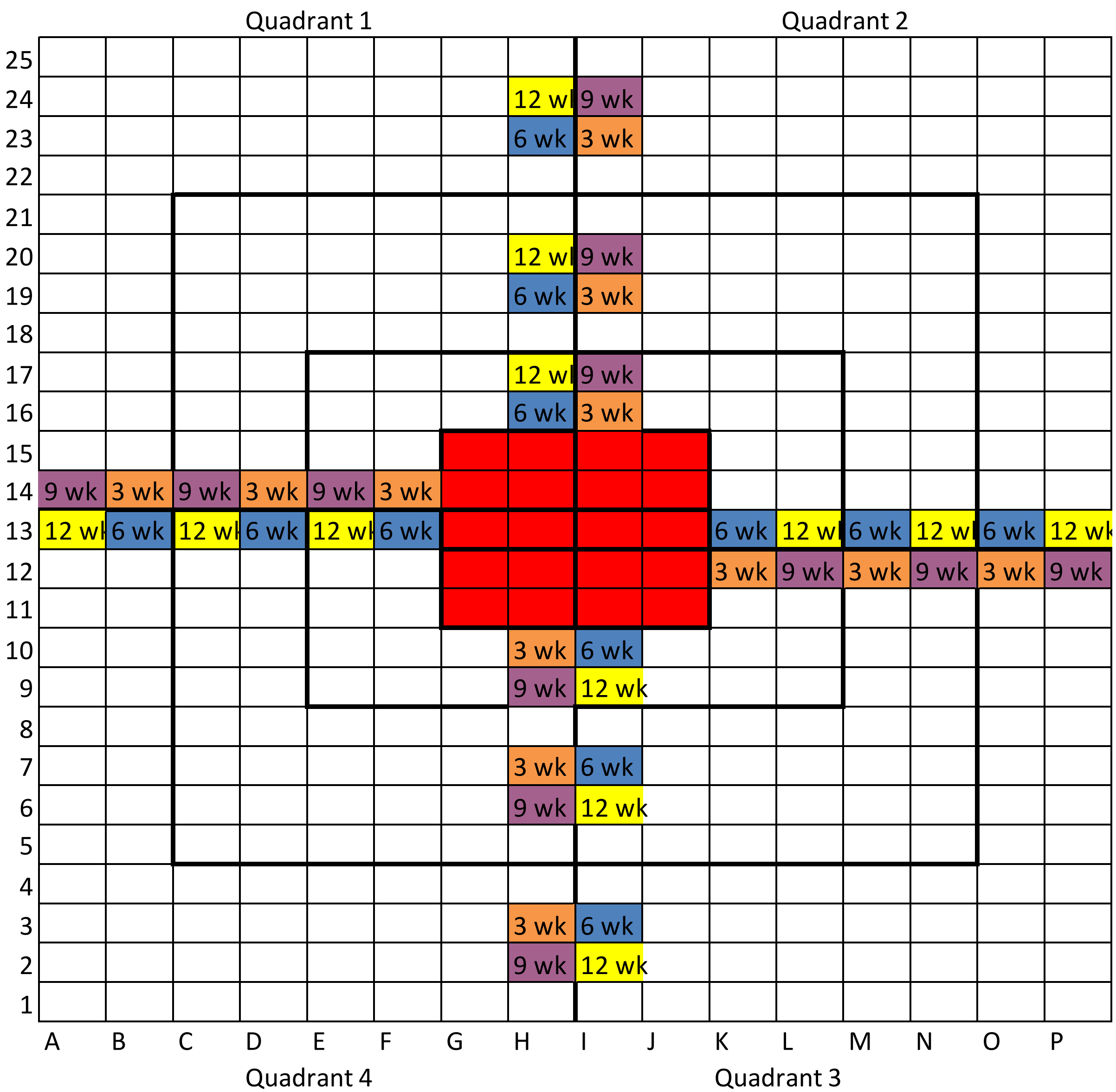
- Have populations of *P. atrosepticum* changed over time?
- Two hundred Pba strains, which included recent isolates and historic strains were sequenced.
- No evidence of change to Pba populations over time.

Movement of *P. atrosepticum* into and around the plant (excluding via seed tubers)



- Bacteria on the roots or canopy can enter the plant
- Some cultivars are more susceptible to this than others
- Damage increases internalisation

Movement of *Pba* within fields



- Using experimental plots, track the movement of *Pba* from infected to healthy plants by monitoring the canopy and below ground during the growing season
- Samples were taken from leaves, stem and roots at 3, 6, 9 and 12 weeks post emergence.

Movement of *Pba* within fields

- Contamination of plant parts and blackleg appeared later in the season and increased with irrigation.
- No obvious pattern of spread from the marked central zone.
- Progeny tuber contamination and blackleg was caused by environmental *Pectobacterium* spp. as well as the marked strain.
- Although contamination was found on plants both above and below ground, majority of contamination was found on the roots and base of stem of the plants.

Tracing infection to source

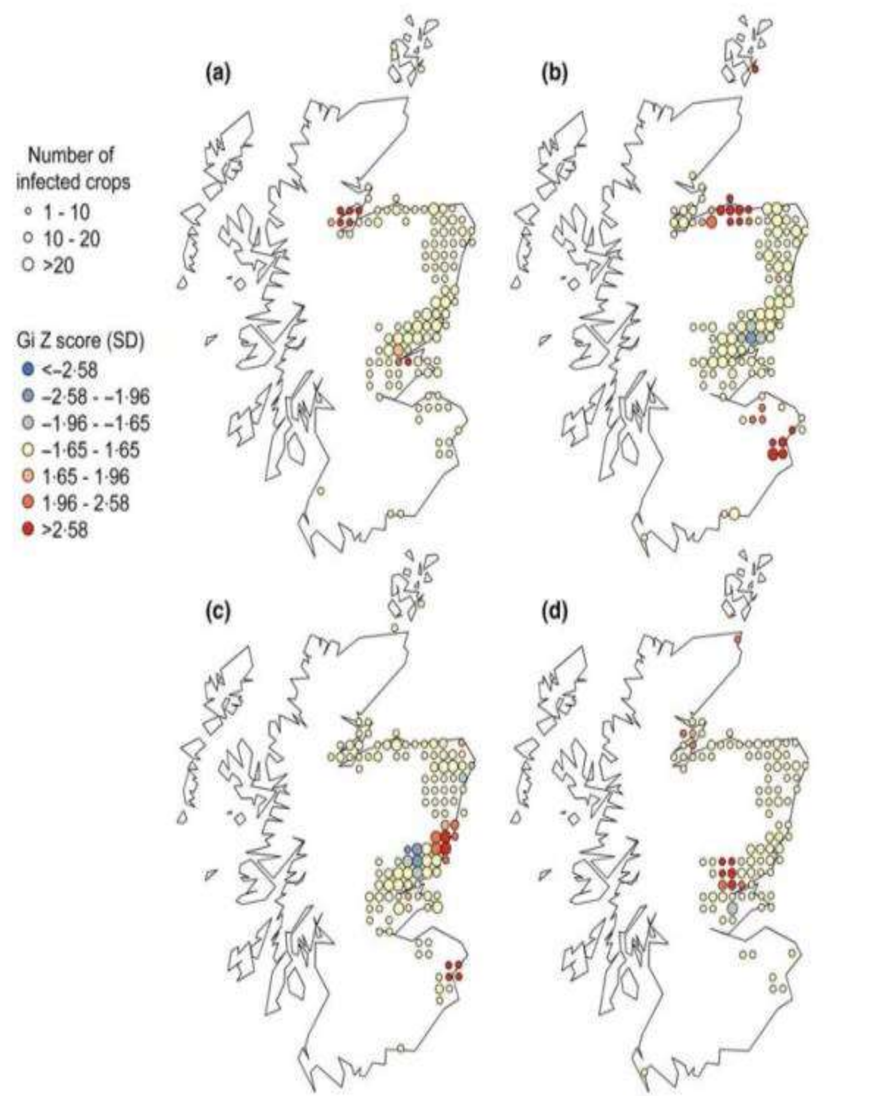
- Field to field spread

- Typing of Pba isolates taken from a single field of cv Sagitta indicated that different strain types were present.
- These strain types were similar to those found on crops in adjacent fields.
- Some evidence that strains are moving between fields

Tracing infection to source

- Contamination of progeny tubers often occurs during the first field generation grown from mini-tubers with *Pba* isolates originating from the local environment.
- *Pba* strains isolated from the harvested tubers varied with the location at which the mini-tubers were grown.
- For field generations 2 and above sources of contamination include the latently infected seed stock and contaminated machinery.

Modelling blackleg incidence using SPUDS



- Investigate the spatial distribution of blackleg-affected seed potato crops in Scotland over 4 years
- Strong evidence of clustering of blackleg-affected seed potato crops. (critical distance 15-25km)
- The location of blackleg clusters varies from year to year suggesting that disease is unlikely to be linked to production practices at specific geographical locations
- What is the cause of these clusters?

Effect of sulphuric acid on pathogen spread

- Sulphuric acid resulted in faster early leaf and stem death.
- Reductions in tuber contamination in two seasons (not significant).
- Commercial work taking place to fine tune haulm destruction.



Key Questions

- Environmental isolates have significantly more impact on the development of blackleg than had been previously been thought.
- Where in the environment is this initial source of infection coming from?
- What is the balance between seed-borne and environmental sources in older generations?

New blackleg projects

- 2017-19 Scottish Government
- 2017-21 AHDB / Scottish Government

The James Hutton Institute

fera
The Food and Environment Research Agency

SRUC

AHDB POTATOES

SASA
Helping Scotland Grow

AHDB POTATOES
Sutton Bridge
Crop Storage Research

The Scottish Government
Riaghaltas na h-Alba

Blackleg – the research landscape

The James
Hutton
Institute

McCain

AGRICO

cygnet PB

Techneat
engineering ltd

Greenvale AP
Natural choice for fresh potatoes

Cp Caithness Potatoes Ltd
Breeding • Growing • Delivering

aps Biocontrol

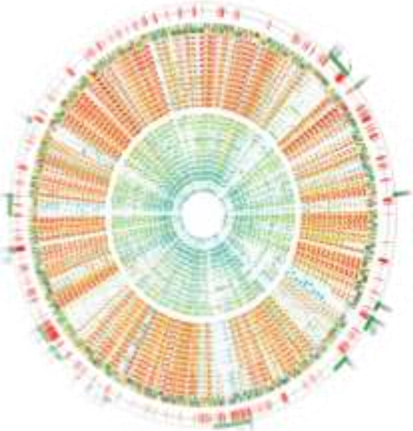
HZPC
Growing with our potatoes

BRANSTON
Potatoes are our business...

New project 1 – Scottish Government

- Modifying the Scottish Seed Potato Classification Scheme to Achieve Greater Control of Blackleg

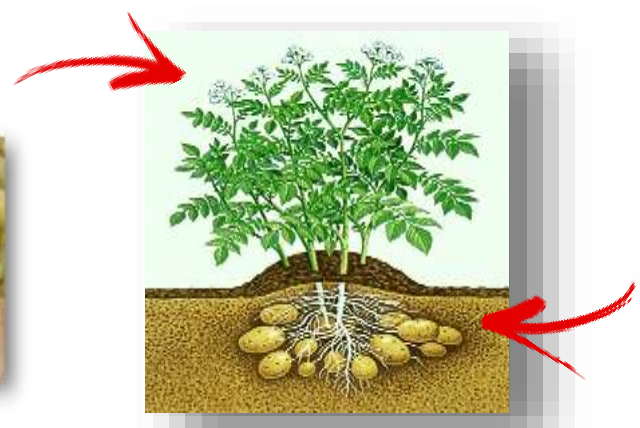
- Improved genomics-based strain fingerprinting method.
- Balance between seed-borne and environmental infection sources.
- Effectiveness of roguing on reducing disease incidence.



New project 2 – AHDB/Scot Gov

- Improved seed management to minimise losses due to *Pectobacterium* spp.

- Identify the major routes of initial contamination of high grade tubers including minitubers, air and soil.
- Monitor the seed production process for points within the system that may lead to an increase or decrease in bacterial contamination.
- Develop and test novel control options, including phages, UV and ozone.



Knowledge Exchange

Euphresco
Dickeya and *Pectobacterium*

THE POTATO INDUSTRY EVENT
BP2017
NOVEMBER 22 & 23
HARROGATE
YORKSHIRE EVENT CENTRE

The James Hutton Institute

Potatoes in Practice

UNIVERSITY OF CAMBRIDGE
CAMBRIDGE UNIVERSITY
POTATO GROWERS RESEARCH ASSOCIATION
28TH ANNUAL CAMBRIDGE POTATO CONFERENCE

Acknowledgements

Leighton Pritchard
Ian Toth
Pete Skelsey
Lauren Watts
Emma Campbell

Glyn Harper

Gerry Saddler
Greig Cahill
Triona Davey

Stuart Wale
Innes Jessiman

John Elphinstone