

The introduction, persistence and impact of seed and soil-borne pathogens on potato crops within a rotation

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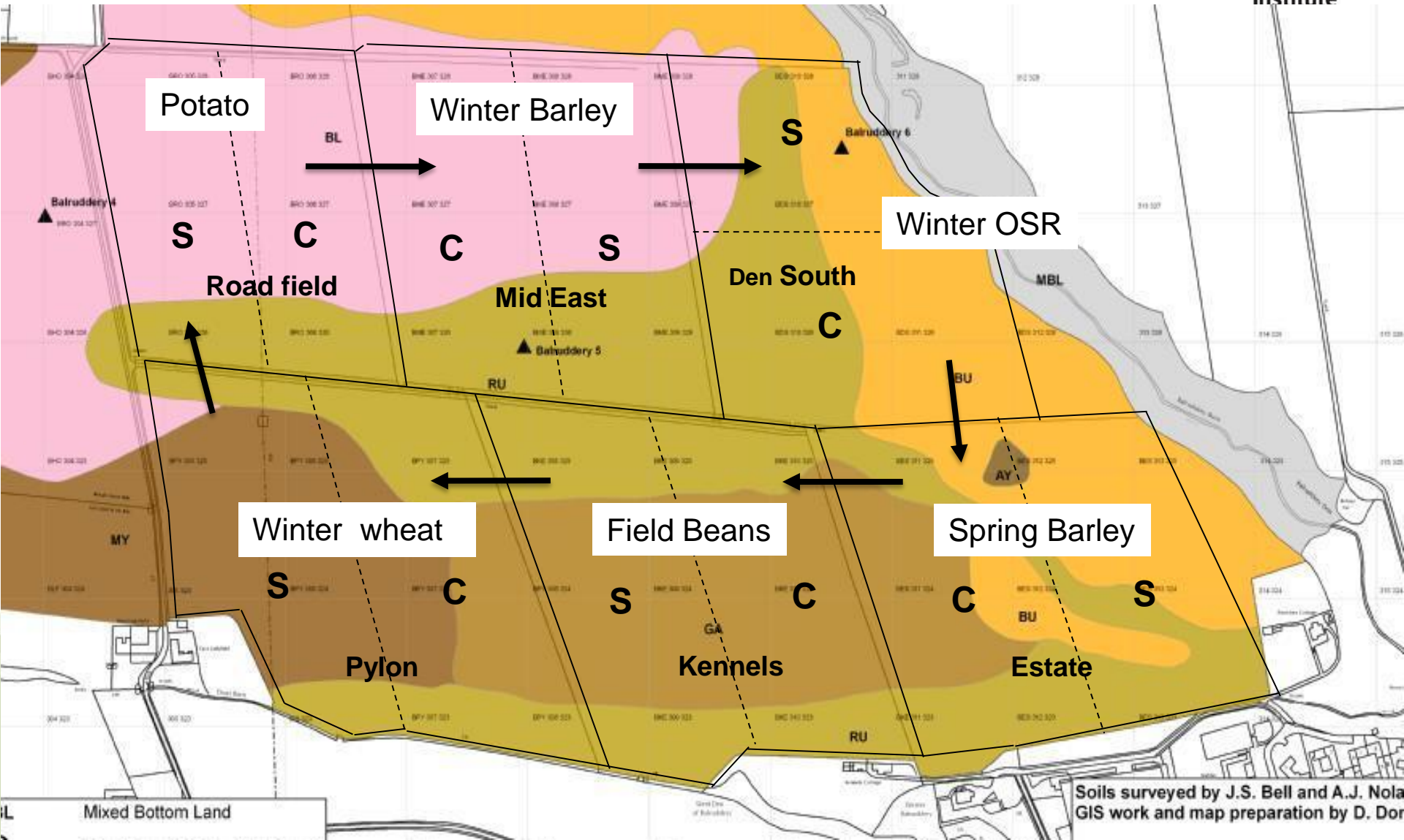


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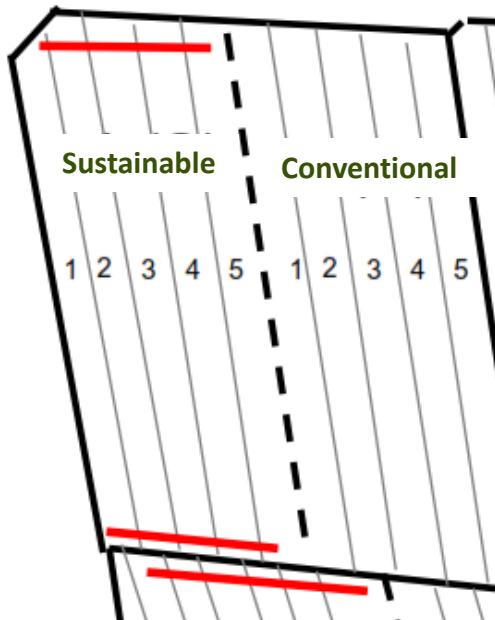
Balruddery rotation & field layout





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Crop cultivars and sustainable treatment



1. Lady Balfour
2. Mayan Gold
3. Vales Sovereign
4. Cabaret
5. Maris Piper

Sustainable treatments:-

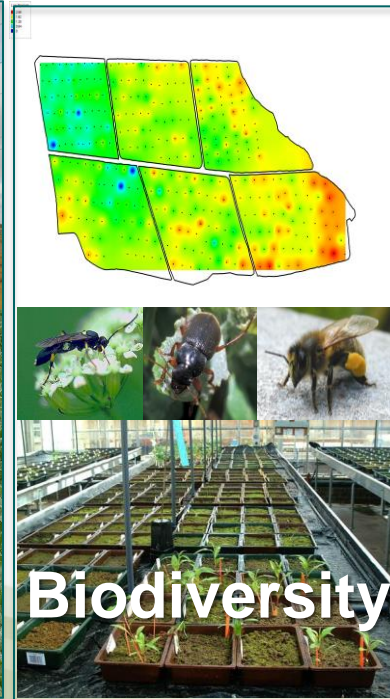
- Addition of compost
- Reduced inorganic fertilizer
- Reduced herbicide application
- Reduced fungicide/pesticide application



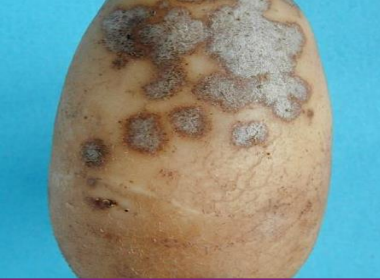
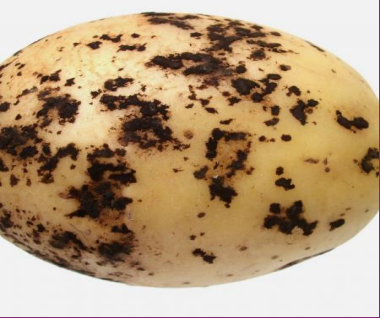
Data collection

On-site meteorological station providing continuous measurements of air temperature, precipitation, wind speed and direction, and solar radiation.

Soil temperature, moisture content, microbial and invertebrate activity, nutrient and water uptake by plants and plant growth are measured alongside nutrient leaching and GHG emissions



Seed- and soil-borne potato pathogens



Seed inoculum

Disease assessed visually, and symptomless infections identified with real-time PCR.

Post harvest disease assessed visually



Disease	Pathogen	Real-time PCR assay
Powdery scab	<i>Spongospora subterranea</i>	van de Graaf et al., 2003
Black scurf	<i>Rhizoctonia solani</i> AG3	Lees et al., 2002
Black dot	<i>Colletotrichum coccodes</i>	Cullen et al., 2002
Silver scurf	<i>Helminthosporium solani</i>	Cullen et al., 2001
Common scab	<i>Pathogenic Streptomyces spp.</i>	M. Tavarria

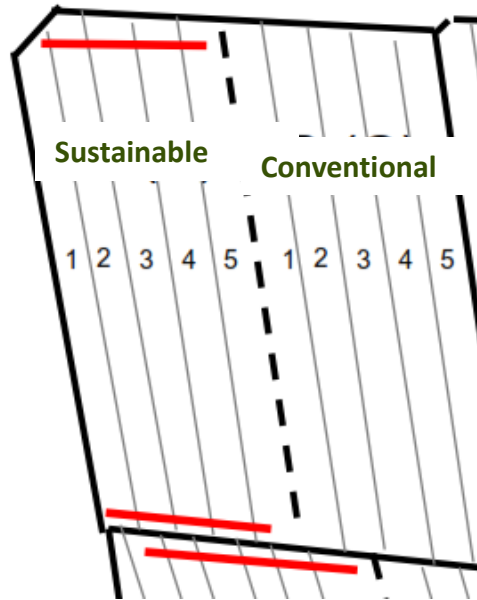


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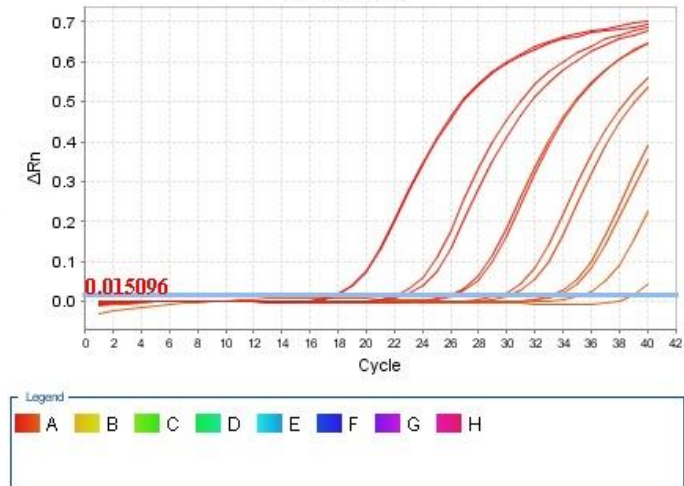
Seed- and soil-borne potato pathogens

Soil inoculum

Inoculum levels in soil are determined pre-planting and post-harvest.

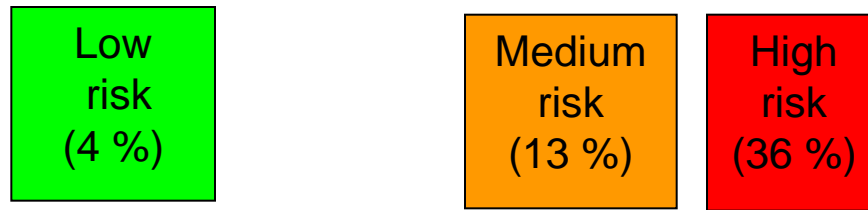


Amplification Plot

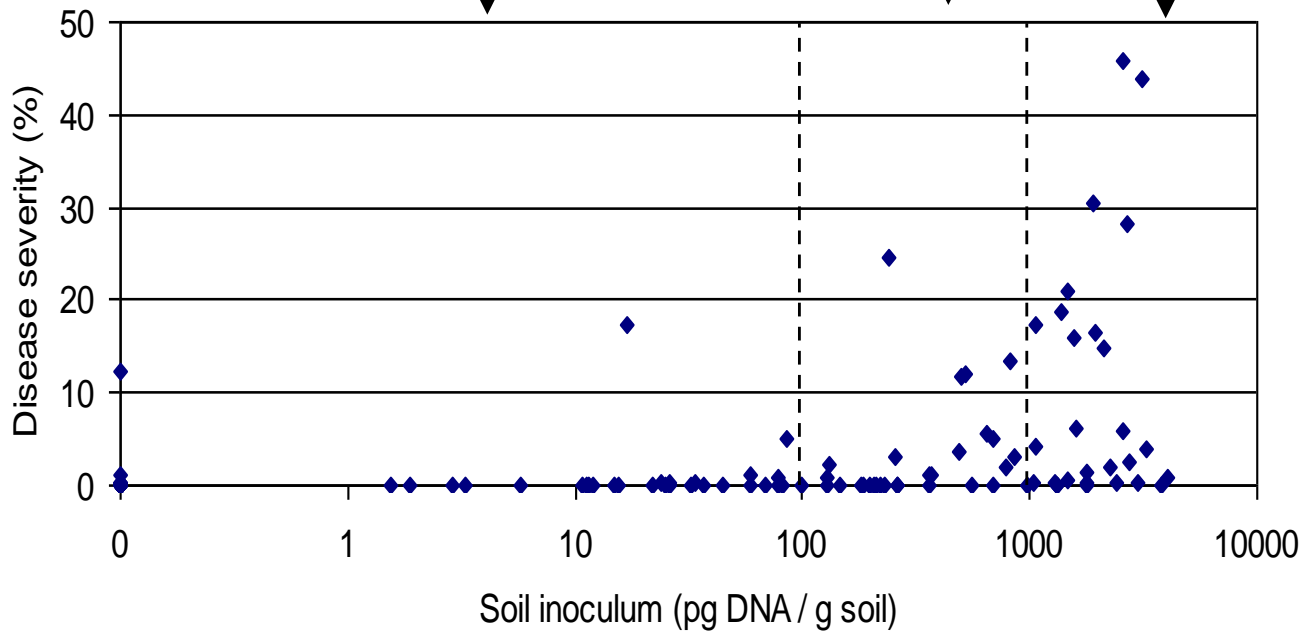


DNA extraction: Brierley *et al.* (2009) Applied soil ecology

Black dot

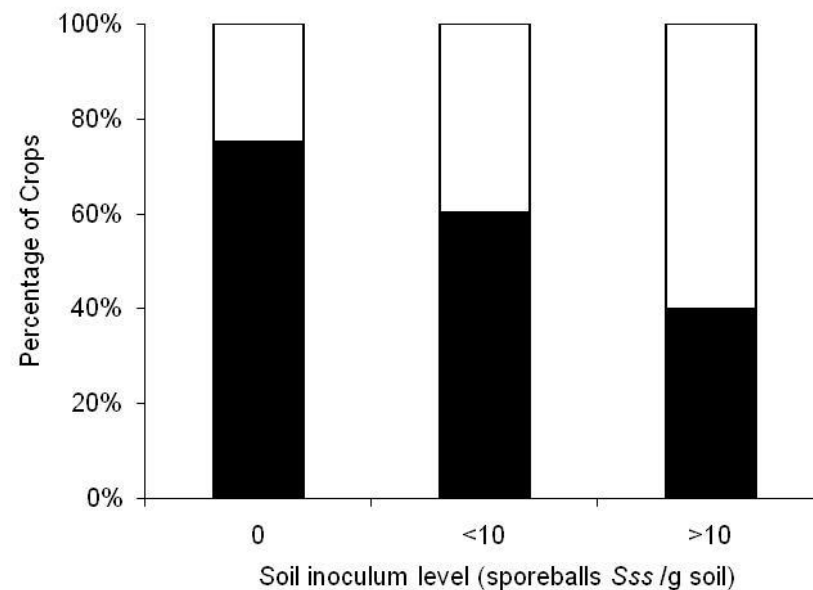
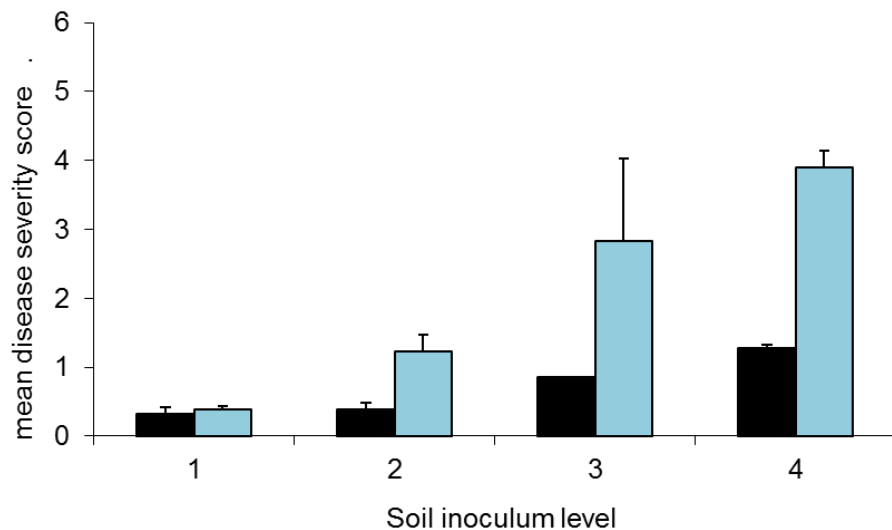


Pre planting -soil test result – disease risk



- Cultivar choice
- Crop duration
- Irrigation
- Chemical control

Powdery scab

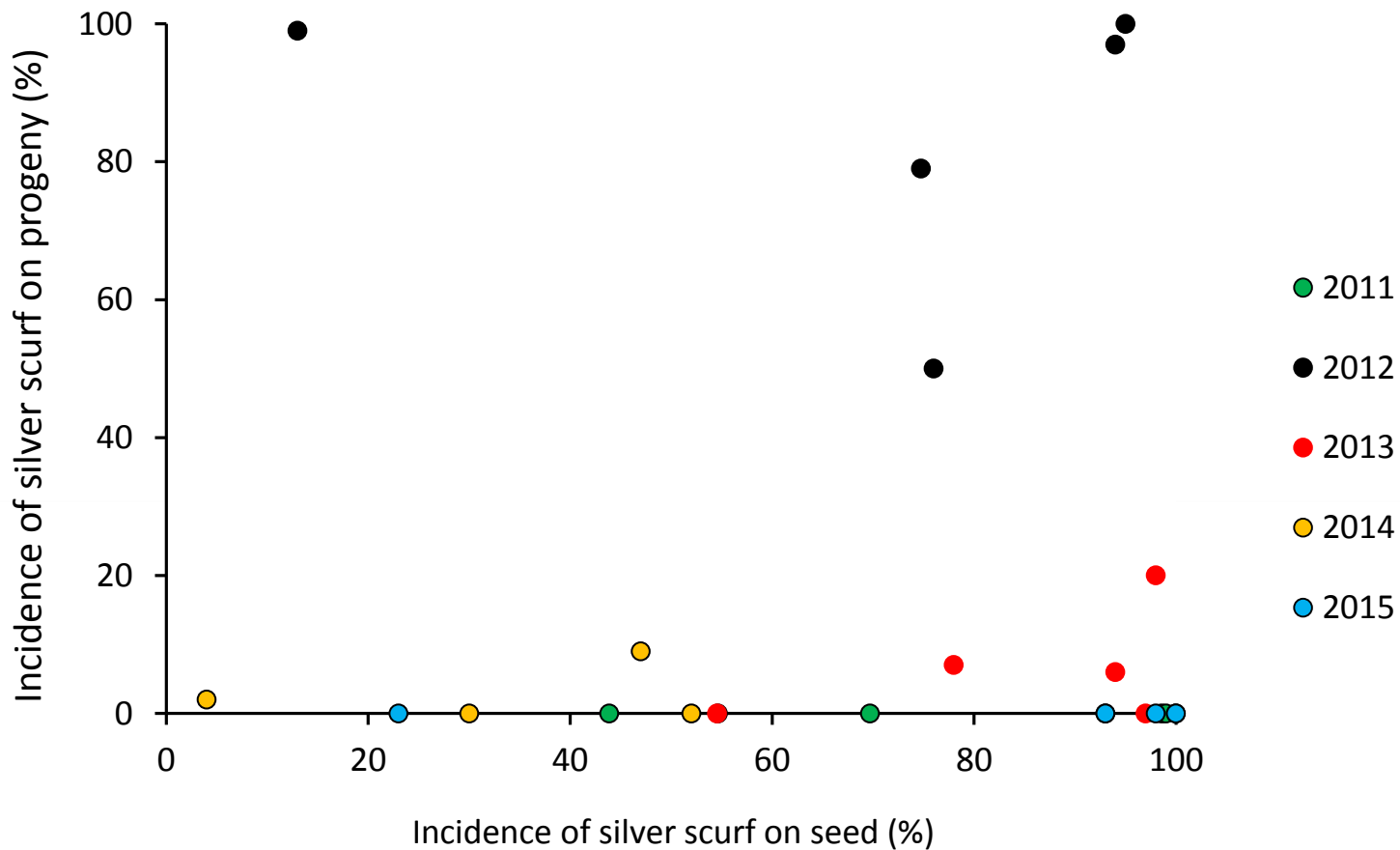
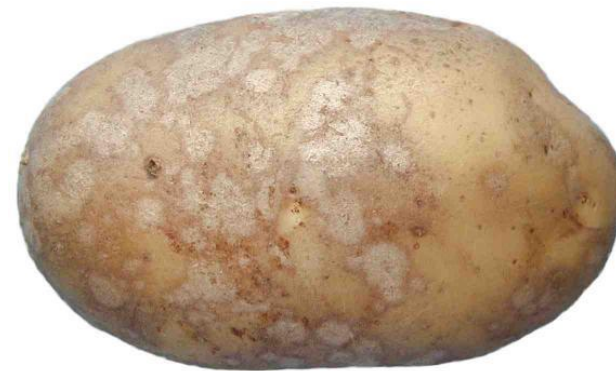


Brierley *et al.* (2012) Plant Pathology

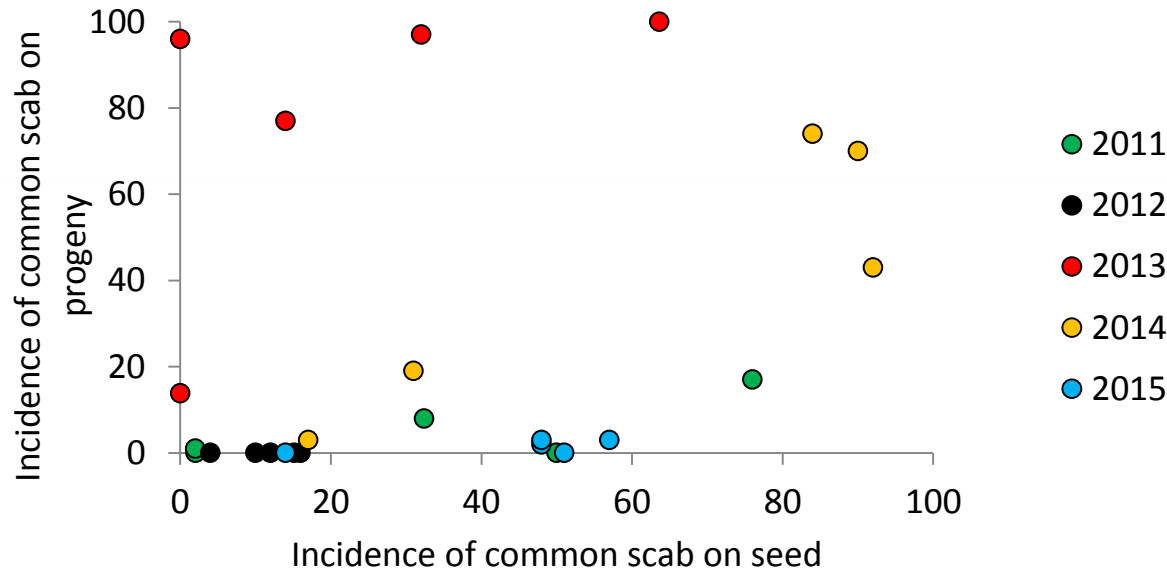
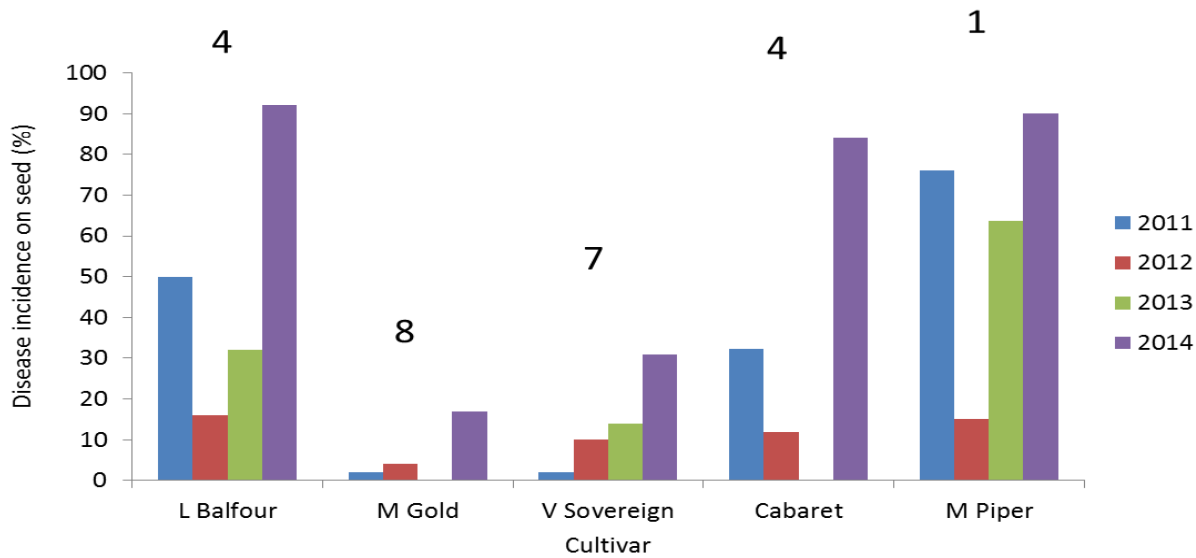
Powdery scab
 No powdery scab

Silver scurf

No soil inoculum has been detected

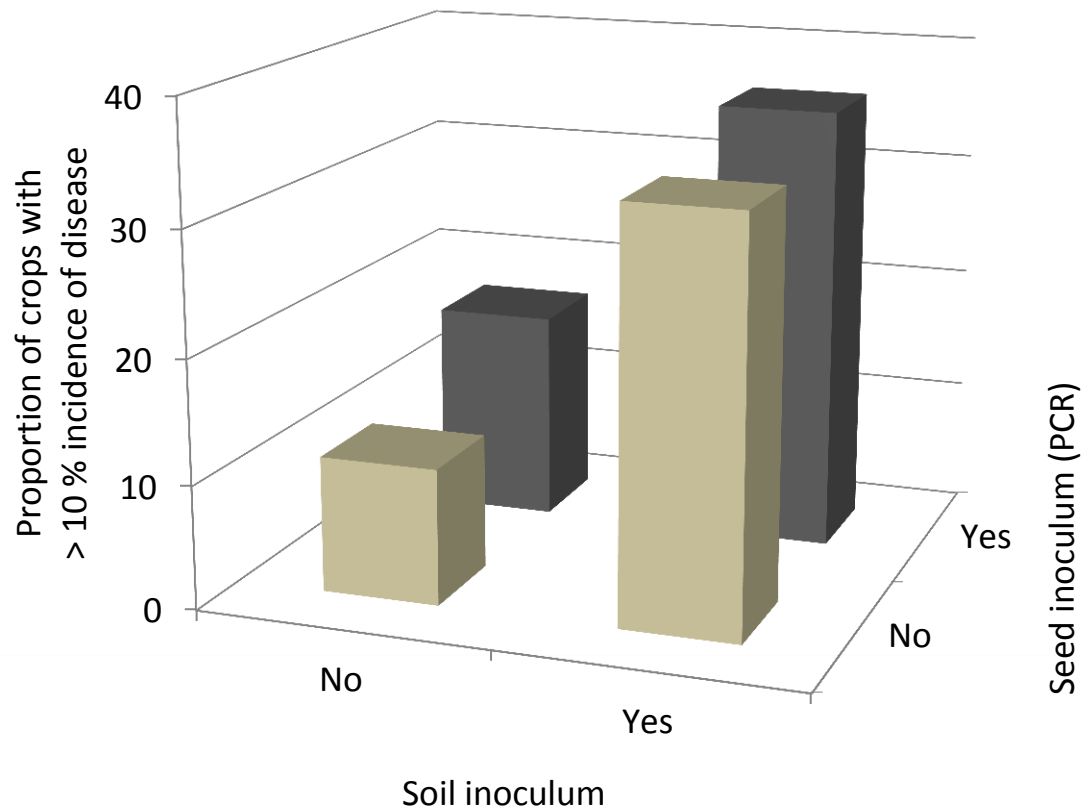


Common scab



Currently validating an assay for pathogenic streptomyces spp.
(Michael Tavaría (Applied Biosystems, Melbourne))

Rhizoctonia : black scurf



Black scurf on tubers

Incidence of black scurf (%) on seed stocks and progeny tubers grown in both conventional and sustainable treatments

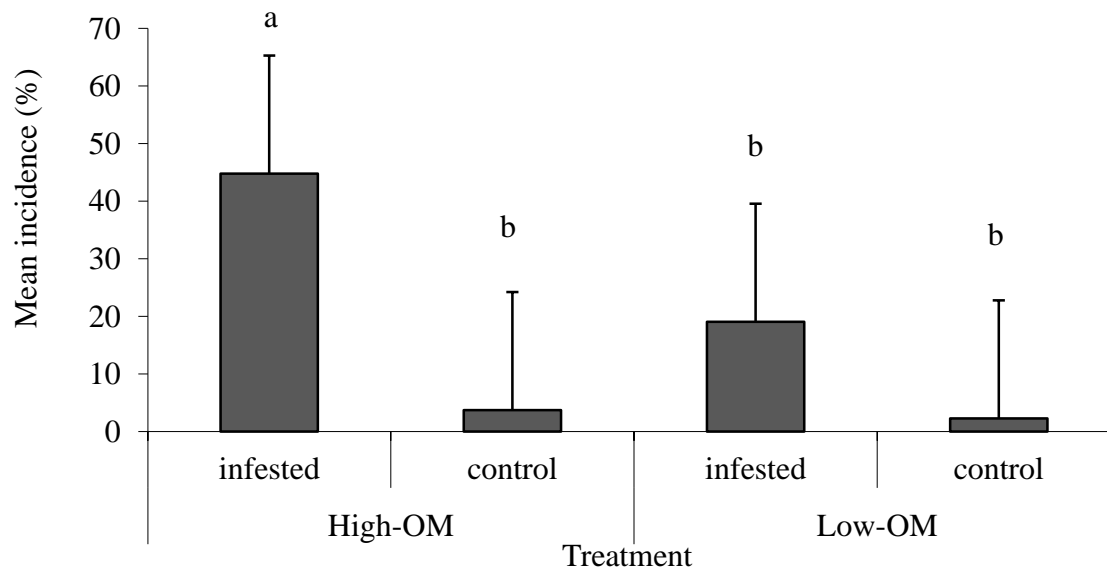
Cultivar	Agronomy	2011	
		seed	progeny
Cabaret	Conv.	28	46
	Sust.		13
Lady Balfour	Conv.	1	7
	Sust.		
Maris Piper	Conv.	0	12
	Sust.		0
Mayan Gold	Conv.	0	0
	Sust.		0
Vales sovereign	Conv.	7	2
	Sust.		5

Soil infestation

Could increased soil organic matter increase disease caused by *Rhizoctonia solani* AG3 on potato?

In field plots infested with *R. solani* AG3 to which additional OM (barley straw and manure) had been incorporated:

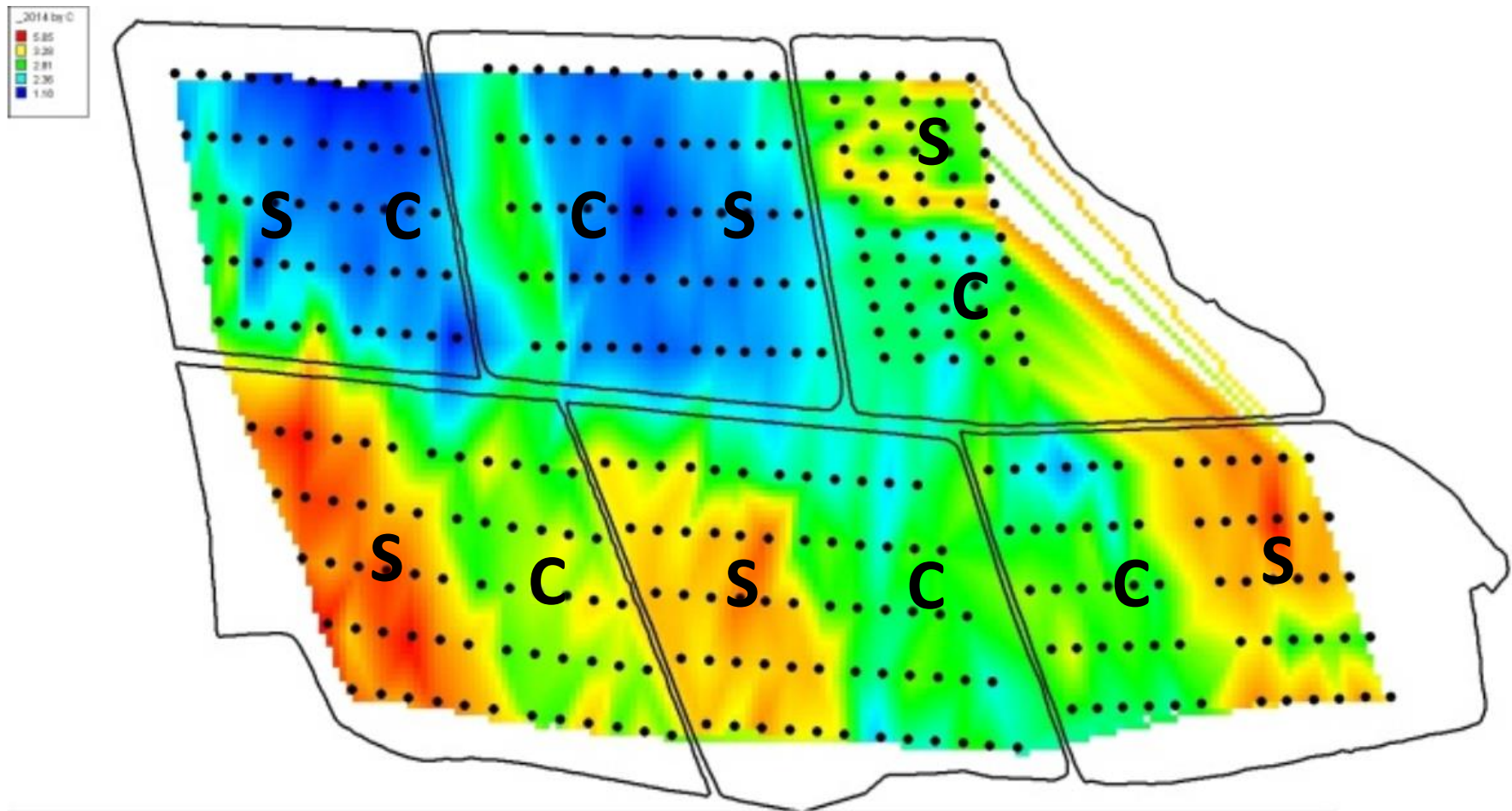
- plant emergence was delayed
- stolon pruning increased
- yield decreased
- black scurf on progeny tubers increased (see figure below)





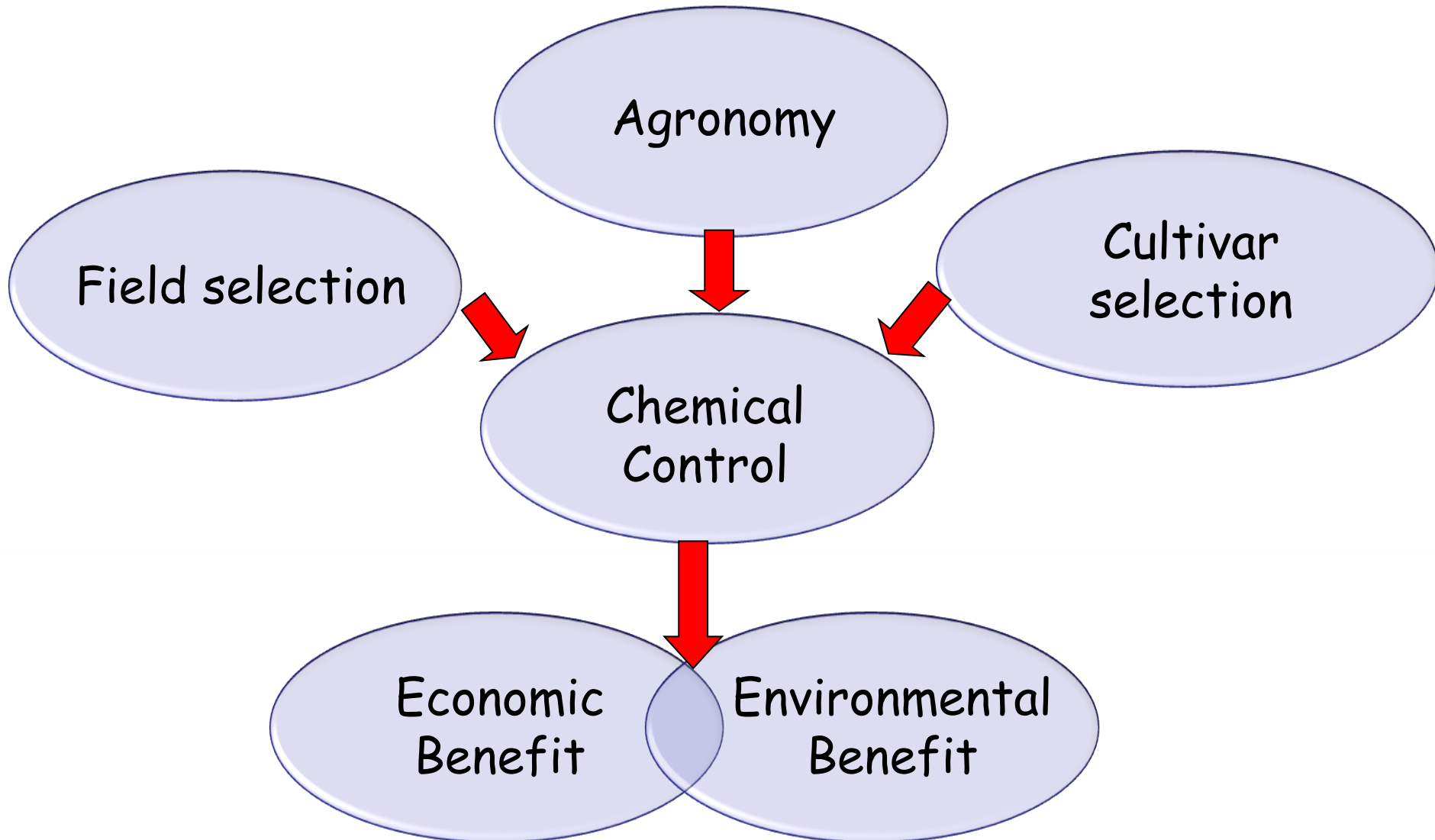
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Soil organic matter (2014)



Assessing disease risk

Quantifying seed- and soil-borne inoculum





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