

A NEW, RAPID TOOL TO SCREEN FOR POWDERY SCAB RESISTANCE

Half-way through a three-year project to improve understanding of *Spongospora* (powdery scab), the Tasmanian Institute of Agriculture has successfully developed a method that rapidly identifies varietal differences in susceptibility to this disease. *PotatoLink* spoke to Professor Calum Wilson about the novel root attachment screening component of the project.

Powdery scab can be a devastating disease. Not only does it reduce quality and marketability, it also disrupts root function, and can greatly reduce yield.

However, there are clear differences in disease susceptibility between varieties. Traditionally, varietal screening requires either glasshouse or field trials. Potatoes are grown in pathogen-infested soil in large, replicated experiments.

Such trials take many months to complete as the potato plant needs to grow to full maturity. This makes them expensive in both resources and skilled labor. The results, especially in field trials, can also be variable as soil-borne sources of pathogen may be patchy across the trial site.

The research team, headed by Professor Callum Wilson at the Tasmanian Institute of Agriculture (TIA) at the University of Tasmania, has developed a rapid and robust laboratory test to screen potato varieties for resistance to the root infection phase of powdery scab disease. Professor Wilson says, "The new test we have developed allows varieties to be tested within a period of days without even having to leave the laboratory. This greatly reduces the time required for screening, as well as costs associated with resource inputs."

Root infection is the first and most important phase of this disease. Successful root infection allows the pathogen to multiply exponentially within the root zone, leading to

extensive root damage and eventually to tuber disease. Varieties that have increased resistance to root infection will be impacted less by the pathogen in terms of both tuber yields and quality.

"Targeting early stages of root infection was the key to this screening technique. This is when the powdery scab pathogen releases motile spores. The spores swim through the water in the soil and bind to potato roots, leading to infection and disease. The efficiency of potato root attachment by the pathogen spore has been demonstrated to impact subsequent root and tuber disease development" explains Professor Wilson.

PhD student Xian Yu has been working on developing this assay and has used it successfully to screen a large number of potato varieties for resistance to root infection.

The varietal resistance rankings determined by the new laboratory assay for a selection of lines are shown in Table 1.

Highly susceptible		Moderately susceptible		Moderately resistant		Good resistance	
Nicola	12.19	Gold Rush	6.8	Dutch Cream	4.93	Toolangi Delight	2.5
Liseta	10.32	Yukon Gold	6.72	Pink Eye	4.76	Tolaas	2.02
Kranz	9.65	Tasman	6.52	Banana	4.66	Granola	1.57
Shepody	9.4	Pink Fir Apple	6.51	Red Pontiac	4.66	Russet Nugget	1.24
Shine	9.29	Spunta	6.44	Spey	4.54		
Patrones	8.82	Frontier Russet	6.4	Nampa	4.26		
Delaware	8.76	Lustre	6.4	Cranberry Red	4.16		
Nooksack	8.67	Wilwash	6.34	Purple Congo	3.75		
Coliban	8.24	Leven	6.13	Fontenot	3.65		
Red Ruby	8.12	Bintje	6.12	Ruby Lou	3.61		
Southern Cross	8.12	Pentland Dell	5.98	Brake light	3.36		
Kennebec	8.06	Mainstay	5.94	Sebago	3.3		
Diament	7.91	Cariboo	5.85	Russet Burbank	3.29		
King Edward	7.67	Atlantic	5.71	Dawmore	3.24		
Sapphire	7.59	Pontiac	5.55	Desiree	3.15		
Sunrise	7.48	Chieftain	5.52				
Crystal	7.35	Sequoia	5.47				
Bison	7.27	Bismark	5.36				
Kipfler	7.25	Yellow King	5.27				
Up-to-Date	7.08	Maris Piper	5.17				

Table 1. Selected variety resistance rankings based on the novel root attachment assay.



Figure 1. Powdery scab pathogen spores (arrowed) attached to potato root hairs (left)

Figure 2. Professor Calum Wilson and PhD student Xian Yu inspecting tissue culture potatoes (right)

The team at TIA found that higher numbers of zoospores attached to the roots of varieties known to be susceptible to powdery scab root infection by traditional assays. Similarly, those varieties with known resistance to root infection had low numbers of zoospores attached to the root. These results validate the effectiveness of this robust, quick assay.

This may now enable the screening of hundreds of potato cultivars for resistance to powdery scab within weeks, instead of the traditional

glasshouse or field methods that take many months and are more expensive.

"The importance of this early phase of root infection cannot be underestimated. Interventions at this stage can provide major benefits in disease outcomes later in the season. The project is also looking closely at how the spores bind to roots and how resistant varieties reduce root infection. These may lead to novel controls focused on preventing root infection and tools to assist breeding for disease resistance," Professor Wilson says.

Hort Innovation
Strategic levy investment

■ For more information from this project, please contact Dr Calum Wilson at calum.wilson@utas.edu.au

This project, *Mechanisms and manipulation of resistance to powdery scab in potato roots (PT17003)* is being funded by Hort Innovation, using the processing and fresh potato research and development levy, in-kind contributions from the Tasmanian Institute of Agriculture and contributions from the Australian Government.

