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Potato Update

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Potatoes NEW ZEALAND
Growing together

Year 3 progress report: Evaluation of seed tuber and in-furrow fungicides on the control of soil-borne diseases in potatoes

Introduction and methods

In New Zealand potato crops, control of the two dominant soilborne pathogens, *Spongospora subterranea* and *Rhizoctonia solani*, has remained difficult, despite the wide range of fungicides and pesticides that are registered for controlling them.

The severity of seed and soil-borne diseases varies by site and season. This update provides further information from one high risk site in South Canterbury.

This trial is the fourth over three seasons. In a trial conducted in the 2015-16 season testing seven fungicides, only one (Nebijin) was reported to have any effect, lowering powdery scab incidence and severity at harvest. This work was continued in the 2016-17 season, and additional treatments were tested in order to identify potential new strategies for disease management.

A replicated trial was set up in a commercial potato crop at Levels, South Canterbury with the cultivar Russet Burbank (planted 1 November 2016). The trial site had been in potatoes six years ago so disease pressure was likely to be high.

The chemical treatments were applied either directly to the seed tubers or as in-furrow sprays at planting, prior to closing the furrows. Eight products were investigated, both with and without formalin, totaling 16 treatments. Standard crop management was undertaken by the grower for the remainder of the season. Disease assessments on the underground stems and tubers were carried out at two crop growth stages (full canopy, 10 weeks after planting and late canopy, 14 weeks after planting) and at harvest (tubers only). A final yield assessment based on marketable tubers (t/ha of tubers >65 mm) was carried out at crop maturity.

Key points

- To date this project has not identified any new control strategies which are more effective than commonly used treatments.
- A replicated trial was set up in a commercial crop in South Canterbury with the potato cultivar Russet Burbank. The trial site had been in potatoes previously, so disease pressure was likely to be high.
- *Rhizoctonia* stem canker and *Spongospora* root galling and tuber powdery scab were the predominant diseases found on the sampled plants. There was no significant difference between any of the treatments for the control of *Rhizoctonia*, apart from formalin, which increased rhizoctonia stem canker severity by 12%.
- *Spongospora* root gall severity and incidence increased as the season progressed, however there were no differences between treatments.
- Plants grown from formalin treated seed developed more severe root galling than those from untreated seed. Formalin reduced yields by 6 t/ ha.
- There was no significant yield difference between the control, Amistar × 2 rate, Pinnacle, Monceren or Monceren × 2 rate treatments (yields range 73-82 t/ha).
- Yields were reduced by the treatments Maxim, Monceren × 2 rate + Amistar × 2 rate and Nebijin (average 66 t/ha).
- No fungicide treatment increased yield in this trial, or in the three trials in the previous two seasons.
- The lack of efficacy of fungicides is a major concern, particularly if they are reducing yields. There is a significant cost associated with applying fungicides and if, at a number of sites in New Zealand, they are providing no control and potentially reducing yield then the reason needs to be understood.

FAR®

Table 1. Treatments, their active ingredients, target disease and application methods (either applied to the potato seed or in-furrow at planting) assessed in South Canterbury in the 2016/17 season.

Fungicide treatment (+ and - Formalin)	Active ingredient	Application method	Rate of product
*Nil (control)	-	-	-
*Monceren®	pencycuron	seed tuber	2 kg/t
*Monceren® × 2 rate	pencycuron	seed tuber	4 kg/t
*Amistar® × 2 rate	azoxystrobin	in furrow	20 mls/100 m row
*Monceren® × 2 rate + Amistar® × 2 rate	pencycuron + azoxystrobin	seed tuber + in furrow	4 kg/t + 20 mls/100 m row
*Nebijin®	flusulfamide	in furrow	4 mls/100 m row
*Maxim®	fludioxonil	seed tuber	250 mls/t of potatoes
*Pinnacle®	fluazinam	pre-planting incorporated	4 L/ha

*Note all treatments were repeated with Formalin (formaldehyde 40%) added taking the above 8 treatment to a total of 16 treatments in the trial.

Results

Different diseases were detected on stems and tubers from the harvested plants, but *Rhizoctonia* stem canker and *Spongospora* root galling and tuber powdery scab predominated.

There was no significant difference between any of the treatments for the control of stem canker, apart from formalin, which increased severity by 12% (P = 0.002). Stem canker severity developed through the season with 25% stem coverage (average of all treatments) at full canopy, increasing to 36% at late canopy. This follows the typical pattern of disease progression in many New Zealand potato crops.

The nature of *Rhizoctonia* symptoms observed on the potato plants may have reflected the contribution of both the seed- and soilborne forms of this pathogen. The appearance of symptoms consistent with soilborne infection was evident (Figure 1, Figure 2), indicating that the previous cropping sequence favoured the survival of *Rhizoctonia* in the field. Seedborne disease incidence was less than soilborne disease incidence, and not related to the treatments, suggesting that the seed (whole) may have been only lightly infected with the disease.

Spongospora root gall severity and incidence increased as the season progressed, and plants from formalin treated seed developed more severe root gall symptoms than those that were not formalin treated. At the final assessment there was a small difference in powdery scab severity between the formalin treatments, where the use of formalin reduced the severity score from 0.45 to 0.38, where a score of 1 = 5% coverage.

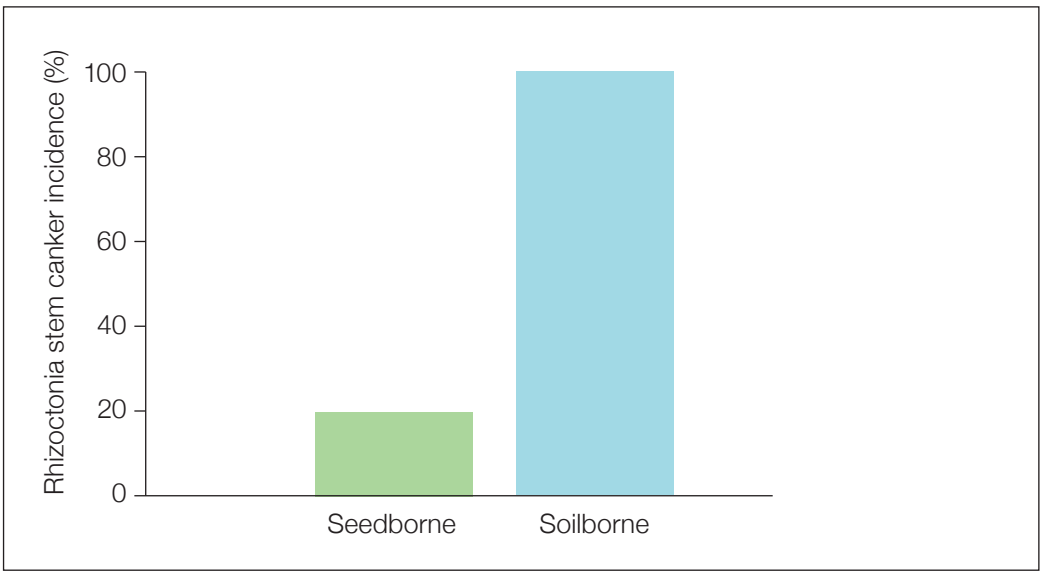

Figure 1. Incidence of seed-and soil-borne *Rhizoctonia* stem canker symptoms at full canopy, average of all treatments.

Figure 2. Soil-borne *Rhizoctonia* stem canker symptoms (left), seed-borne symptoms (right).

Table 2. Treatment effect on potato tuber mean marketable yield (t/ha) at Levels, South Canterbury in the 2016/17 season.

	Marketable yield (t/ha)		
	Mean over formalin treatment	+ Formalin	- Formalin
Nil (control)	82	76	89
Monceren® × 2 rate	76	73	79
Amistar® × 2 rate	75	70	80
Monceren®	75	70	80
Pinnacle®	73	77	69
Nebijin®	68	65	71
Monceren® × 2 rate + Amistar® × 2 rate	68	70	66
Maxim®	61	55	68
Mean	**72**	**70**	**75**
LSD (P < 0.05)	**10**	**14**	

For marketable yield, there was no evidence of a treatment interaction between formalin seed tuber treatment and fungicide treatment. There was no significant difference in yield between the control, Amistar® × 2 rate, Pinnacle®, Monceren®, Monceren® × 2 rate (yield range 73-82 t/ha) treatments. Yield was significantly less with the Maxim®, Monceren® × 2 rate + Amistar® × 2 rate and Nebijin® (yield range 61-68 t/ha). In this trial, the use of formalin decreased the marketable yields by 6 t/ha.

All treatments that exceeded label rate had tubers tested for residues. None of these exceeded New Zealand residue levels.

Discussion

Although *Rhizoctonia* and *Spongospora* diseases were widespread (and in some cases severe) in the trial area, none were controlled by any of the chemical treatments. In some cases, yield was reduced by these treatments.

These results are comparable to findings from similar trials conducted in the previous two seasons. Formalin treatment of seed tubers is becoming more popular with potato growers, but results from the present trial show that this treatment may also cause yield reductions.

To date this project has not identified any new control strategies which are more effective than commonly used treatments. Responses to fungicides may need evaluation at a wider range of sites and under different disease pressures.

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