COMMON SCAB INCIDENCE ON SEED POTATOES, AND SEED-BORNE DISEASE CONTROL

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SUMMARY

This study was conducted to improve awareness and understanding of the significance of common scab caused by *Streptomyces* spp., in commercial tuber seed lines, and to develop control methods. The incidence of common scab disease appeared to be influenced by climatic conditions. Pot and field studies showed that low levels of common scab on infected tuber seeds could be controlled with chemical seed treatments. Mancozeb was shown to be an effective, low cost product for common scab control, reducing the incidence and severity of infections in new tubers. Tuber seeds can be treated before or after storage, and treatments can be dusted or sprayed.

INTRODUCTION

Common scab is a serious disease of potatoes grown for processing, tuber seed and fresh markets in Tasmania and some major production regions in Victoria. Reduced yield and quality of potatoes due to common scab results in lower returns for growers.

There has been uncertainty in the potato industry, of the significance of tuber seed infected with common scab in commercial tuber seed lines, and their potential for transmitting the disease onto new tubers. The aim of this study, therefore, was to determine and clarify the relevance of seedborne infections.

Studies conducted in the early 1990s by Wilson et al. (1999) showed that the fungicide products, fluazinam, flusulfamide and mancozeb have the potential to control common scab. Initial studies conducted in this project showed that mancozeb, which is a low cost product already registered for disease control in potatoes, was effective in controlling seedborne common scab. Its efficacy was consistently found to be similar to fluazinam and flusulfamide. Further studies were conducted to evaluate different types of mancozeb products, with particular emphasis on the development of commercial application methods.

METHODS

Tuber seed infections The incidence of scab diseases, which include common scab and powdery scab, was investigated in the certified Russet Burbank tuber seed lines. A total of 57 tuber seed lines, harvested in 1998 and 1999, were examined. Tuber seed lines from three cold storage facilities were selected at random, and 50 to 100 tubers from each line were washed and assessed for both common scab and powdery scab incidence. Tubers were assessed for common scab lesions and disease severity at harvest.

Disease transmission from infected tuber seeds Infected tuber seeds were evaluated in a pot trial for their ability to transmit common scab onto new tubers in pasteurised soil. Tubers from an infected crop were separated into three categories, according to the presence of common scab lesions and disease severity. The three categories of tuber seeds used were no scab: no visible common scab lesion on the tuber; mild superficial scab: scab lesions that were only skin deep; and deep scab: lesions that were 3 to 5mm deep. Both the superficial and deep scab tuber seeds

had low scab coverage of about 5%. The trial design was a complete randomised block, with 10 replicate pots. Plants were watered on alternate days, and soil moisture ranged from field capacity (after irrigation or rainfall) to close to wilting point.

Chemical seed treatments A second pot trial was conducted to evaluate different mancozeb products, including those currently used by some growers, as well as new products. The mancozeb-based products, Pencozeb®, Dithane®, Tato dust® and Tato bark®, were applied as a dust coating onto severely infected tuber seeds. Shirlan® (flusulfamide) and Maxim® (fludioxinol) were included for comparison. The feasibility of treating infected tuber seed prior to storage was also evaluated in this trial, where whole tuber seeds were treated and then kept in cool store for 4 months before use. In all the other treatments, the infected tuber seeds were cut, treated, and then sown within 24 hours in pasteurised soil. The pot trial was set up and maintained as described above.

Two field trials were conducted to further evaluate different rates and methods of mancozeb seed treatments for the control of common scab transmission from an infected tuber seed line. The tuber seeds used in the trial came from a certified line that had 4 % infected tuber seeds. Note that 4%-infected tuber seed is the threshold level on common scab for seed certification in Tasmania. They were not washed, and were picked at random so that they included tuber seeds with or without common scab lesions. The two trials were conducted at two locations in Tasmania, Sassafras and Thirlstane, within commercial crops where common scab was not considered to be a problem in previous potato crops. The trial design was a complete randomised block with 10 replicate plots. Each plot was sown with 5 tuber seeds, at 32cm spacing, in a single row. The growers managed plants in the trial area in the same manner as in their commercial crops. Tubers were assessed for common scab lesions at harvest.

RESULTS AND DISCUSSION

Tuber seed infections The percentage of tubers infected with common scab was higher in tuber seed lines produced in 1998 than in those harvested in 1999. The opposite applied with powdery scab disease.

Table 1: The level of scab disease in certified tuber seed lines.

Year harvested	1998	1999
Total no. tuber seed lines examined	37	25
% Tuber seed lines infected by:		
Common scab	49	24
Powdery scab	24	40
Both types of scab	14	4

The differences in the incidence of common and powdery scab diseases appeared to be related to the differences in the rainfall between the two seasons. The average monthly rainfall from October to March (when most potato crops are grown in Tasmania) for 1997/98 and 1998/99 was 26mm and 67mm, respectively. Low soil moisture generally favours common scab development, and vice versa for powdery scab.

A higher percentage of tuber seed lines harvested in 1998 also had both types of scab, compared to those harvested in 1999. It is possible that, in dry seasons, low rainfalls and over-irrigation may create extreme dry and wet periods that favoured both diseases.

Disease transmission from infected tuber seeds A high percentage of new tubers produced from the infected tuber seed line had common scab lesions (Table 2). The increased severity of common scab on tuber seed potatoes increased the incidence and severity of the disease on the new tubers. Laboratory test showed that the deep common scab lesions were found to have higher pathogen levels than the superficial lesions. Tuber seeds from the infected line, with no common scab lesions, could still transmit the disease onto new tubers (Table 2).

Table 2: The effect of scab disease severity of infected tuber seed potatoes on the disease development on new tubers.

Common scab symptom on tuber seed tubers	% Tubers with common scab incidence*	% Tubers with deep scab lesions*
severe deep scab	61 bc	44 bc
mild superficial scab	38 ab	14 a
no scab	27 a	4 a

* Within the same column, means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Chemical seed treatments All mancozeb-based products, Pencozeb®, Dithane®, Tato dust® and Tato bark®, reduced the incidence and severity of common scab infections on new tubers. The level of common scab control achieved with mancozeb was similar to that achieved with Shirlan® and Maxim®.

Table 3: The effects of different products on seedborne common scab in a pot trial.

Product Type	Active ingredient	Application method	Product Rate/tonne	% Tubers with scab incidence**	% Tubers with deep scab**
Pencozeb DF	**80% mancozeb**	**Dusted & stored#**	**2 kg**	9 a	2 a
Pencozeb DF	**80% mancozeb**	**Dusted**	**2 kg**	3 a	1 a
Dithane WP	**80% mancozeb**	**Dusted**	**2 kg**	5 a	4 a
Tato dust WP	**20% mancozeb**	**Dusted**	**4 kg**	8 a	6 a
Tato bark	**8% mancozeb**	**Dusted**	**2 kg**	12 a	10 a
Shirlan SC	**500g/L fluazinam**	**Sprayed**	**40 ml/L***	4 a	3 a
Maxim SC	**100g/L fludioxinol**	**Sprayed**	**13 ml/L***	9 a	2 a
Untreated	**N/A**	**N/A**	**N/A**	61 b	45 b

Whole tubers treated and then kept in cool store for 4 months before use.
* Mixture sprayed onto tuber seeds until run-off, to ensure total coverage.
** Within the same column, means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Effective common scab control was obtained with the early application of mancozeb, at four months before planting, indicating that pre-storage seed treatment for common scab control is an option to growers.

Mancozeb treatments significantly reduced common scab on new tubers, compared to untreated infected tuber seeds, in the two field trials. Results of one of the field trials are shown in Table 4. The result of the second field trial is similar to the trial shown in below. Note, however, that other studies conducted in this project have shown that, in soil where the common scab pathogen level is high and widespread, fungicide seed treatments have little or no effect in reducing common scab infections due to soilborne inoculum.

Table 4: The effects of various mancozeb products and application methods on seedborne common scab in a field trial conducted at Sassafras, in Tasmania.

Treatment	Application method	% Common scab*
80% Mancozeb dust	**Dust**	1 a
20% Mancozeb in talc dust	**Dust**	2 ab
8% Mancozeb in fir bark dust	**Dust**	4 b
8% Mancozeb spray	**Spray**	1 a
Fir bark only	**Dust**	12 c
Untreated	**N/A**	13 c

* Within the same column, means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

OUTCOMES FOR INDUSTRY

The incidence of common scab disease on tuber seed potatoes can vary according to climatic conditions. In low rainfall seasons, common scab can be widespread, even on certified tuber seeds. Low levels of common scab on infected certified tuber seeds, however, could be controlled with chemical seed treatments. Mancozeb based products have been identified as low cost products for common scab control (eg. approximate cost of Dithane® is $8/kg and Tato dust® is $5/kg compared to $205/L for Shirlan®). Tuber seeds can be treated before or after storage, and can be dusted or sprayed. In ground where the common scab pathogen level is high and widespread, fungicide seed treatments have little or no effect on common scab.

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REFERENCES

Wilson, C.R., Ransom, L.M., and Pemberton, B.M. (1999). The relative importance of seed-borne inoculum to common scab disease of potato and the efficacy of seed tuber and soil treatments for disease control. Journal of Phytopathology 147: 13-18.