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Experimental Summary 1989

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88BY26	Rhizoctonia Control in Potatoes
88PE34	Potato Resistance to Powdery Scab
88MD35	Potato Resistance to Powdery Scab

Title: Potato Experiments Winter 1988 Rhizoctonia Control 88BY26

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Abstract:

Control of Rhizoctonia solani infection of potato stems and daughter tubers was demonstrated by preplanting application of tolclofos-methyl (RIZOLEX TM) to either cut or round seed tubers. Yield of tubers from cut seed treated with Rizolex was increased over that of cut seed cured before planting but not when seed was cut and planted the same day. Crops grown from round seed treated with Rizolex yielded higher than from untreated round seed.

Surface sterilization of seed tubers with Sodium hypochlorite was effective in reducing stem damage but not in reducing daughter tuber sclerotes. This indicates that where there is a significant soil population of Rhizoctonia solani, even though stem infection is prevented, late build-up of sclerotes on the tubers may still cause cosmetic problems.

Introduction:

Losses of yield in potato crops may be due to any combination of a large number of factors including those of a physiological and pathological nature. The common pathogen, Thanatephorus cucumeris (anamorph = Rhizoctonia solani), has been implicated in many different aspects of crop reduction including stem loss, stolon pruning and downgrading of tubers by sclerote cover.

In a series of experiments in the south-west of Western Australia, a number of prophylactic chemicals have been examined to determine their effect on stem infection and retention, tuber-set, daughter-tuber sclerote load and yield. During the winter and spring of 1988 an experiment was conducted near Bunbury to examine the effect of tolclofos-methyl [Rizolex (TM)], iprodione [Rovral (TM)],sodium hypochlorite (NaOCl) and mancozeb as fungicides on seed potatoes and their subsequent growth and production. The first two mentioned chemicals had previously been demonstrated to have useful efficacy against R. solani while mancozeb is the standard recommendation for treatment of cut seed and NaOCl is a surface sterilant included to remove seed borne infection.

Materials and Methods:

The property used in this experiment had previously been used in similar Rhizoctonia control experiments and was associated with a commercial crop grown by a licensed grower Mr A. Pelle. The property was at Jindong, south of Busselton and some 100 km south of Bunbury.

Seed was purchased from an Approved crop at Albany and was cut to commercial specifications of blocky setts, approximately 50 g mass and with two eyes while round seed was graded to the same size.

Treatments are tabulated below (Table 1), and include seed dusts and dips applied to seed both before and after cutting or to whole round seed.

Table 1.

Treatment	Chemical (TM)	Rate +	Method
1	Rizolex 250WP	0.2 g/kg	Round seed
2	Rizolex 100D	0.2 g/kg	Round seed
3	Mancozeb 200D	0.1 g/kg	Round seed
4	NaOCl	1% Cl-	Round seed
5	Untreated		Round seed
6	Rizolex 250WP	0.2 g/kg	Dip/cut*
7	Rizolex 100D	0.2 g/kg	Dust/cut*
8	Rizolex 250WP	0.2 g/kg	Cut/dip*
9	Rizolex 100D	0.2 g/kg	Cut/dust*
10	Mancozeb 200D	0.1 g/kg	Cut/dust*
11	NaOCl	1% Cl-	Dip/cut*
12	Untreated		Cut/cure**
13	Untreated		Cut/plant#
14	Rovral WP	0.2 g/kg	Cut/dip*

Note + Material as grammes active ingredient/kg tubers.
* Seed cut, treated and planted on same day.
** Seed cut and cured for 1 day before treatment.
\# Seed cut and planted same day.

Rovral WP contains 500 g/kg iprodione as a wettable powder.
Rizolex 100D contains 100 g/kg tolclofos-methyl as a dust.
Rizolex 250WP contains 250 g/kg tolclofos-methyl as a wettable powder.
Mancozeb 200D contains 200 g/kg mancozeb as a dust.

The last treatment, T14, was included as a grower standard despite the active ingredient being shown to be inferior in previous experiments.

The experiment was planted by hand into prefertilised and opened furrows on July 26 1988, in a randomised replicated block. Spacing was 800 mm X 200 mm. Treatments were single rows seven metres long, replicated four times. The plot was surrounded by commercial potatoes sown on the same day and all potatoes were given general management to commercial standards by the co-operating farmer. The cultivar used was White Rose (syn Delaware) and as noted above, the seed was purchased from Albany.

Soon after emergence one metre of row from the northern end of each plot (five plants) lifted by fork. The stems and sets were then washed, the stems counted and rated for lesions using the method of Hirst and Salt (1959) then weighed. The sets were checked for rot and also weighed.

When the plants had reached 150-200 mm height, one metre (five plants) was lifted by fork from the same end of each treatment plot. The stems were then assessed for lesion development as before. The plants and stems in the remaining five metres of row were then counted. At maturity these five metres of plot were lifted and harvested tubers graded for size then weighed and counted. A twenty tuber sample of the > 80 g fraction was then washed and sclerote development assessed using a similar method of assessment to that used for the stems.

Data recorded tended to be excessively variable and all stem data and tuber infection indices were analysed as natural logarithms. Transformed means presented below for these variates are noted on the individual tables.

Results:

1. Stem and plant numbers

Both Stem and Plant numbers were significantly ($P < 0.01$) affected by treatment with T12 (cut/cured no other treatment) having the poorest emergence and fewest stems (Table 2).

2. Stem lesions

There was a significant ($P < 0.01$) treatment effect only at the first lifting date with the untreated and Mancozeb dusted cut sets producing stems with the highest infection indices (Table 2).

3. Stem mass at first lifting

There was a significant ($P < 0.001$) treatment effect in this variate with the highest value recorded from the Rovral treated plots (T14). The lowest value was recorded from T12 (Table 2).

4. Set mass at first liting

Retrieved set mass differed significantly between treatments, (Table 2) but without obvious rotting.

5. Yields

A highly significant ($P < 0.001$) treatment effect was obtained on Tuber yield with the Round seed treatments having generally high values and T3 (Mancozeb) the highest yield of 19.3 kg/plot, equivalent to almost 50 t/ha, (Table 3).

6. Tuber sclerotes

Tuber sclerote Index was also highly significantly affected ($P < 0.001$) by treatment with the Rizolex treatments having the cleanest tubers. Their index ranged from 1.7 to 8.4 while all other treatment had values of 12 and above of which the lowest was from NaOCl treated cut seed and the highest from the untreated round seed (Table 3).

Discussion:

The effect of Rizolex in these experiments confirms the results of previous years, with useful reductions in stem and daughter tuber infections by Rhizoctonia solani. This treatment has previously shown some phytotoxicity when applied to freshly cut seed but in this experiment any damage was insufficient to reduce stem numbers. At the recommended rate of application (0.2 g ai/kg), no damage was detected and yield was increased over the poorer untreated control (T12), but not over T13 which was cut and planted on the same day.

Rovral treatment was effective in controlling infection with R. solani but was less effective than Rizolex in reducing tuber sclerote index.

At the first lifting for stem lesion assessment, the condition of the sets was noted and in all treatments complete whole sets were present. Differences in set mass were obtained but without a preplant weighing of the actual sets the significance of the differences is not clear as there was no evidence of significant rotting.

The reduction in overall stem lesion rating from the first to the second sampling and the lack of treatment difference at that second rating suggest that stems weakened by early infection and seen at the first inspection, had sloughed in the intervening time, leaving the most healthy stems.

Good initial results were obtained from the use of a Sodium hypochlorite seed soak, with stem lesion index being similar to that of other fungicide treatments. Tuber indices were however higher than for the Rizolex treatments indicating that that chemical had controlled both seed and soil infection while the NaOCl soak had controlled only the initial, seed borne infection.

The poorest stand, fewest stems and lowest yield were recorded in the treatment where seed was cut and allowed to cure before planting. This treatment has previously shown poor results and should be avoided.

Conclusion:

The use of Rizolex at the recommended rate of 0.2 g/kg seed whether applied before cutting, to freshly cut seed, or to round seed usefully improved stem lesion indices and reduced the incidence of sclerotes on daughter tubers. Mancozeb, Rovral and NoOCl were ineffective in controlling daughter tuber infection in this experiment indicating that there was a considerable component of soil borne infection in the site used.

The poorest treatment was seed, cut and allowed to cure before planting. This is in line with previous work and is not a recommended treatment.

Table 2. Emergence data

Treatment no.	Stem no. no./5 m#	Plant no. no./5 m#	(I) 1 % a#	(I) 2 % b#	Stem mass g/5 plant#	Set mass g/5 plant
1	37.6	24.5	3.8	1.2	42.3	284
2	43.4	26.0	1.5	0.8	43.5	275
3	41.5	24.5	0.7	2.8	40.9	266
4	33.4	22.8	0.0	2.5	43.9	273
5	34.9	23.5	7.8	8.2	37.7	259
6	32.5	25.3	5.0	2.5	61.0	183
7	33.9	24.5	0.0	1.5	73.1	185
8	37.5	24.5	2.4	2.4	54.5	194
9	34.4	23.8	0.6	0.5	46.5	192
10	33.6	24.0	13.4	3.4	42.3	215
11	32.2	24.8	2.5	0.0	70.3	223
12	26.2	21.3	18.0	3.2	31.9	193
13	32.4	23.8	14.8	12.8	52.8	228
14	39.8	24.3	0.9	2.8	82.1	198
Sig	***	**	**	NS	***	***
5% LSD	1.94	1.97	4.59		2.45	27.0
SED	0.958	0.975	2.27	2.56	1.21	13.4

Note # Retransformed log means.
a First lifting date.
b Second lifting date.
I Infection Index.

Table 3. Harvest data

Treatment no.	Yield kg/plot	Tuber index %
1	18.0	8.4
2	17.8	1.7
3	19.3	21.2
4	16.5	31.1
5	15.2	61.5
6	15.0	4.0
7	16.4	3.1
8	15.8	3.5
9	16.0	4.3
10	15.0	36.9
11	15.7	12.0
12	13.5	46.3
13	15.5	46.7
14	15.1	28.8
Sig	***	***
5% LSD	1.94	3.01
SED	0.958	1.49

The experiments were laid out as randomized replicated blocks of the six chosen cultivars as single rows 5 m long and separated by 0.5 m of a coloured cultivar. Row spacing was 750 mm and sets were hand placed at 150 mm apart and 100 mm deep. Treatments were replicated ten times.

All three experiments were planted over a three day period June 18-20.

Seed was not dipped in any fungicidal material before cutting and planting, and fertilising and culture was to grower standard except at VRS where Departmental recommendations were followed. Crops were allowed to mature as late as possible before digging to encourage development of any infection. After digging, the > 80 g tubers were sorted into four infection classes, nil, light, medium and heavy, and weighed separately. An Infection index (I) was calculated using the formula I = (light + medium*2 + heavy*3)*100/(Total*3).

Results were analyzed by first converting to natural logarithms to reduce internal variability. Figures quoted below are means after retransformation.

Results:

Two of the three sites produced tubers heavily infected with powdery scab and there the two cultivars Exton and Katahdin produced the highest yields of clean (unscabbed) tubers (Tables 1 and 3). Bremer and Atlantic appeared to be intermediate in susceptibility on both properties with White Rose being, as expected, most severely affected and with the lowest yield of clean tubers. Kennebec was most severely affected on Site #3 while Geographe was also severely affected there, the only property on which it was grown.

The third property had a low incidence of powdery scab infection (Table 2) and apart from Kennebec, all cultivar yields were similar.

Discussion:

The slow emergence of cv Kennebec, which is known to be susceptible to Powdery scab affected both yield and scab incidence, the late tuber production being apparently after the main period of infection, an effect particularly noted on Site #1.

On property #3 the poor total yield of cv White Rose was unexpected as this is usually a high yielding cultivar as demonstrated on the other two properties. No particular cause for the low yield was noted during growth.

The low scab index shown by cvs Exton and Katahdin confirmed the reported resistance to powdery scab of these two cultivars and their high total yield of around 40 t/ha in these experiments makes them worth industry evaluation.

Conclusion:

Both Exton and Katahdin have useful resistance to Powdery scab and under severe disease pressure have saleable yields superior to White Rose (Delaware). In the field free of the disease, yields were comparable.

References:

(1) Nachmias A. and Krikun J. (1988). Etiology and control of powdery scab of potato in a semi-arid region of Israel. Phytoparasitica 16(1): 33-38.

(2) Kirkham R.P. (1986). Screening for resistance to powdery scab disease of potatoes. Australian Journal of Experimemtal Agriculture 26: 245-7.

APPENDIX 1. PADDOCK DETAILS

Site #1 Stevens Farms

North of Perth, 35 km, alkaline sand, previously cropped to Potatoes and Cauliflowers. Previous summer sown to irrigated fodder grass and subsequently ploughed under.

Site #2 Hammond Bros

South of Perth, 20 km, acid poorly drained sand, previously cropped to potatoes. Previous summer, after digging last potato crop, was fumigated with Metham Sodium, 200 litres/ha.

Site #3 vrs Medina

South of Perth, 35 km, alkaline sand, previously cropped to potatoes including a previous powdery scab experiment.

APPENDIX 2. CULTIVARS USED ON DIFFERENT PROPERTIES

Cultivar	Site #1	Site #2	Site #3
Atlantic	*	*	NO
Bremer	*	*	*
Exton	*	*	*
Katahdin	*	*	*
Kennebec	*	*	*
White Rose	*	*	*
Geographe	NO	NO	*

Table 1. Harvest results Site #1 (tubers > 80 g)

Cultivar	Yield clean kg/plot	Yield total kg/plot	Scab index %
Atlantic	6.8	10.3	11.8
Bremer	7.7	13.2	14.0
Exton	8.3	12.7	10.3
Katahdin	9.2	14.0	9.8
Kennebec	6.6	8.6	5.4
White Rose	5.7	15.0	26.3
Sig.	NS	NS	5%

Table 2. Harvest results Site #2 (tubers > 80 g)

Cultivar	Yield clean kg/plot	Yield total kg/plot	Scab index %
Atlantic	14.1	15.3	3.1
Bremer	14.5	15.5	1.9
Exton	14.3	14.5	0.5
Katahdin	14.0	14.6	0.9
Kennebec	8.5	9.2	2.0
White Rose	14.3	14.7	1.1
Sig	0.1%	0.1%	5%.

Table 3. Harvest results Site #3 (tubers > 80 g)

Cultivar	Yield clean kg/plot	Yield total kg/plot	Scab index %
Bremer	9.7	15.3	14.6
Exton	11.0	16.3	7.4
Katahdin	12.3	16.2	7.2
Kennebec	4.8	11.2	23.9
Geographe	3.8	16.0	40.8
White Rose	1.4	12.6	32.6
Sig	0.1%	0.1%	0.1%