

## Paper 7

# PATHOGEN TESTED POTATOES IN NEW ZEALAND. II. FIELD EVALUATION

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Lincoln, Pukekohe, Gore and Palmerston North

## INTRODUCTION

The techniques for the production of pathogen tested potato seed have been described by several researchers and the adaption of their techniques in New Zealand reported by Martin (1985). Trials to establish the merits of pathogen tested seed in New Zealand were initiated in the 1980/81 season and reported (Ovenden and Martin, 1981). The trialling system was maintained for the 1981/82 and 1982/83 seasons and results for all three seasons are reported here.

## MATERIALS AND METHODS

The trials were conducted over three seasons at sites within the major table potato producing areas of South Auckland (Pukekohe), Manawatu (Palmerston North), Canterbury (Lincoln) and Southland (Gore). Cultivars trialled were Rua, Ilam Hardy, Sebago, Red King Edward and Iwa, using stage 4 pathogen tested seed.

Each trial was a 5 replicate randomised block design of two row plots with 10 tubers/row; the cultivars trialled were in separate blocks. The tubers sown were selected for uniformity in size and an even total weight/plot within cultivars. Normal commercial table potato production methods were employed in the sowing, management and harvesting of each trial.

Yield and tuber production was recorded and representative samples were retained for cooking and processing quality evaluation.

### Rua and Ilam Hardy

At Lincoln, pathogen tested lines of Rua and Ilam Hardy were each compared with 4 certified group I lines and 1 group III line in the 1980/81 season. The group III line was removed in subsequent seasons and replaced with a further group I line. The other sites contained 1 group I and 1 group III initially, and 2 group I lines in subsequent seasons. The group I lines grown at each site were the same, while extra group I's at Lincoln were included to test the variability within group I and to ensure the group I lines tested at the other sites were within the top producing lines.

### Sebago, Red King Edward and Iwa

Sebago, Red King Edward and Iwa are minority cultivars with small numbers of registered growers. Pathogen tested Sebago seed was tested against group I seed at Lincoln, Palmerston North, Pukekohe and Gore. Red King Edward and Iwa were tested against group II seed, Red King Edward at Lincoln and Gore, and Iwa at Lincoln and Pukekohe.

## RESULTS AND DISCUSSION

### Ilam Hardy (Table 1)

Ilam Hardy responded to the removal of pathogens to a limited extent. Responses were consistent for the 1980/81 and 1981/82 seasons, but were negligible in the 1982/83 season when unseasonal climatic conditions were experienced at all sites. The trial at Lincoln was defoliated by a hailstorm in January; rainfall at Gore was exceptionally high; winds of high strength and long duration were experienced at Pukekohe and at Palmerston North.

The total yield differences were reflected by table yield increases of around 10% (Table 6) from the pathogen tested seed. Extra tubers were set and, overall, a slightly higher proportion were bulked to table sized. The tubers were produced in a less variable size range hence the table grade tended to be more even in size. Although the Lincoln trial in the 1982/83 season was defoliated early, the potential of the pathogen tested plants to out yield the group I lines was evident as the set size was larger and there was a lower level of variation between plots in total yield and total tuber production.

### Rua (Table 2)

Field germination varied over the seasons and had an influence on the results, particularly in the North Island in 1981/82 and 1982/83.

Rua responded to pathogen testing to a greater extent than Ilam Hardy in the South Island, with yield increases of around 20%, but in the North Island yield increases were about 12% — similar to Ilam Hardy (Table 6). Pathogen tested Rua and group I Rua produced sets of about the

**Table 1. Yield and tuber production (sites x season) of Ilam Hardy**

	1980/81			1981/82				1982/83			
	Puke	P.N.	Lcn	Gore	Puke	P.N.	Lcn	Gore	Puke	P.N.	Lcn
<b>Table yield (t/ha)</b>											
pathogen tested	54.7	52.6	64.0	48.5	34.7	65.1	60.3	44.5	32.4	32.9	16.9
group I	44.5	47.3	57.8	42.4	30.8	58.3	46.5	40.0	37.2	31.8	19.6
C.V.%	15	10	14	6	15	9	10	9	11	8	21
Significance	*	NS	NS	**	NS	NS	**	NS	NS	NS	NS
<b>Table tubers (/plot)</b>											
pathogen tested	157	156	131	130	79	—	123	154	79	—	56
group I	115	133	128	104	65	—	100	125	86	—	57
C.V.%	20	10	13	8	13	—	8	23	13	—	18
Significance	*	*	NS	**	*	—	**	**	NS	—	NS
<b>Total yield (t/ha)</b>											
pathogen tested	71.8	62.2	74.0	50.2	56.3	73.2	73.1	47.2	54.7	39.1	43.1
group I	59.5	58.0	71.6	45.3	49.0	67.3	62.1	43.4	58.0	40.7	39.6
C.V.%	11	7	10	5	12	9	8	8	8	6	9
Significance	*	NS	**	NS	NS	**	NS	NS	NS	NS	
<b>Total tubers (/plot)</b>											
pathogen tested	252	248	199	150	216	—	207	189	225	—	245
group I	214	232	232	134	191	—	203	169	228	—	208
C.V.%	15	7	10	8	11	—	8	8	8	—	9
Significance	NS	NS	*	*	NS	—	NS	*	NS	—	**

(Puke - Pukekohe, PN - Palmerston North, Lcn - Lincoln)

**Table 2. Yield and tuber production (sites x season) of Rua**

	Lcn	Even Emergence			Group I Seed Failure				
		1980/81	1981/82	1982/83	1981/82	1982/83	1981/82	1982/83	
		Puke	P.N.	Lcn	Lcn	Puke	P.N.	Puke	P.N.
<b>Table yield (t/ha)</b>									
pathogen tested	78.7	46.9	56.2	84.7	57.1	43.2	78.1	48.8	41.1
group I	68.5	41.2	49.7	67.0	44.5	30.7	42.3	31.6	21.3
C.V.%	9	22	6	7	14	21	16	9	8
Significance	**	NS	**	**	**	*	**	**	**
<b>Table tubers (/plot)</b>									
pathogen tested	136	89	140	132	106	91	—	94	—
group I	108	94	118	102	91	52	—	61	—
C.V.%	9	25	10	8	10	25	—	15	—
Significance	**	NS	*	**	**	**	—	**	—
<b>Total yield (t/ha)</b>									
pathogen tested	84.7	51.3	62.9	90.0	61.0	63.9	83.1	56.7	49.1
group I	74.5	47.0	59.1	75.7	50.3	42.4	47.5	38.6	25.3
C.V.%	8	18	7	6	13	14	15	10	7
Significance	**	NS	NS	**	**	**	**	**	**
<b>Total tubers (/plot)</b>									
pathogen tested	177	140	186	173	134	229	—	169	—
group I	149	155	184	173	134	131	—	116	—
C.V.%	12	16	12	9	11	17	—	16	—
Significance	*	NS	NS	NS	NS	**	—	**	—
<b>Field Emergence (20 = 100%)</b>									
(x/plot)									
pathogen tested	20	20	17	20	20	20	20	19	20
group I	20	19	16	20	20	15	13	15	15

(Puke - Pukekohe, P.N. - Palmerston North, Lcn - Lincoln)

**Table 3. Yield and tuber production (sites x season) of Sebago**

	1980/81				1981/82				1982/83			
	Puke	P.N.	Lcn	Gore	Puke	P.N.	Lcn	Gore	Puke	P.N.	Lcn	
<b>Table yield (t/ha)</b>												
pathogen tested	54.0	62.7	59.1	52.2	46.0	73.2	71.0	31.4	34.6	41.1	38.0	
group I average	46.6	3.1	54.5	37.0	26.7	57.2	51.0	26.5	41.4	38.8	39.0	
C.V.%	13	19	8	11	16	14	9	18	15	18	15	
Significance	NS	**	NS	**	**	**	**	NS	NS	NS	NS	
<b>Table tubers (/plot)</b>												
pathogen tested	148	111	145	141	98	—	143	120	101	—	113	
group I average	111	81	113	93	61	—	113	105	94	—	89	
C.V.%	19	15	8	12	20	—	10	11	16	—	13	
Significance	*	**	**	**	**	—	**	NS	NS	—	**	
<b>Total yield (t/ha)</b>												
pathogen tested	72.0	70.0	69.3	54.5	64.4	77.0	80.9	34.0	56.0	52.29	63.8	
group I average	59.7	46.2	63.4	39.7	47.0	62.7	64.6	30.8	54.0	45.5	50.9	
C.V.%	10	16	4	10	9	13	6	13	10	19	7	
Significance	**	**	**	**	*	**	NS	NS	NS	**		
<b>Total tubers (/plot)</b>												
pathogen tested	260	179	219	167	226	—	210	159	252	—	276	
group I average	197	141	171	121	205	—	217	165	193	—	173	
C.V.%	11	19	12	10	14	—	8	5	12	—	18	
Significance	**	*	**	**	NS	—	NS	NS	**	—	**	

(Puke - Pukekohe, PN - Palmerston North, Lcn - Lincoln)

same size, but a greater proportion of the pathogen tested sets were bulked to table size. The table produce of pathogen tested Rua tended to be more even in size and smaller than the produce of group I. Germination has been a problem peculiar to Rua seed sent to the North Island from the South Island. Seed failure of the pathogen tested seed was negligible in comparison with the failure of the group I seed, hence an improvement in confidence in the germination of Rua is possible if pathogen tested seed is used.

#### Sebago (Table 3)

Sebago responded positively to pathogen testing, with yield increases greater than Ilam Hardy and Rua (20% and 30% increase on group I seed) (Table 6), but more variable — yield responses varied from those similar to Ilam Hardy to well above Ilam Hardy and Rua. Set sizes were larger than group I seed, but the proportion of tubers bulked to table size was variable. However, table tuber size was even in comparison with group I.

#### Red King Edward (Table 4)

Red King Edward was trialled at Lincoln and Gore in 1980/81 but in subsequent seasons was only trialled at Gore, as Canterbury was climatically unsuitable.

Red King Edward was variable in yield over the seasons. In the 1980/81 season, the pathogen tested plants were significantly superior in yield and tended to produce larger sets, but a lower proportion bulked to table size. In the 1981/82 season only a superior set size was recorded, and in the 1982/83 season the pathogen tested seed performed worse than the group I seed, probably due to

reintroduction of diseases, to which Red King Edward is highly susceptible, particularly verticillium wilt. As a base level of disease was not present, the disease would be more active.

**Table 4. Yield and tuber production (sites x season) of Red King Edward**

	1980/81		1981/82	1982/83
	Lincoln	Gore	Gore	Gore
<b>Table yield (t/ha)</b>				
pathogen tested	25.2	39.6	14.9	50.8
group II average	16.2	26.7	14.3	61.7
C.V.%	36	10	38	21
Significance	**	**	NS	NS
<b>Table tubers (/plot)</b>				
pathogen tested	68	150	84	151
group II average	48	102	74	211
C.V.%	36	8	33	25
Significance	NS	**	NS	NS
<b>Total yield (t/ha)</b>				
pathogen tested	64.7	51.6	30.4	69.4
group II average	50.9	38.1	25.0	75.1
C.V.%	13	9	26	18
Significance	**	**	NS	NS
<b>Total tubers (/plot)</b>				
pathogen tested	368	286	283	305
group II average	318	249	250	337
C.V.%	15	9	26	18
Significance	NS	*	*	NS

## Iwa (Table 5)

In keeping with the responses of the other cultivars trialled, the response of Iwa to pathogen testing, at Pukekohe was negligible but at Lincoln a 20% improvement in yield was shown (Table 6). There was, however, considerable variation in the size of sets and the proportion of the sets bulked to table size. Variation in the size of the table tubers was also evident with no obvious difference between the pathogen tested and the group II material.

**Table 5. Yield and tuber production (sites x seasons) of Iwa**

	1981/82		1982/83	
	Lincoln	Pukekohe	Lincoln	
<b>Table yield (t/ha)</b>				
pathogen tested	93.2	46.7	60.4	
group II average	85.5	46.9	44.9	
C.V.%	6	13	8	
Significance	*	NS	**	
<b>Table tubers (/plot)</b>				
pathogen tested	169	116	154	
group II average	141	110	110	
C.V.%	8	18	10	
Significance	**	NS	**	
<b>Total yield (t/ha)</b>				
pathogen tested	103.5	61.2	72.7	
group II average	97.9	63.4	65.6	
C.V.%	4	6	5	
Significance	*	NS	**	
<b>Total tubers (/plot)</b>				
pathogen tested	238	226	232	
group II average	216	233	254	
C.V.%	5	9	10	
Significance	**	NS	NS	

**Table 6. Average percentage increase in yield (PT over group I) over 3 years**

	Pukekohe		Palmerston North		Lincoln		Gore	
	Total yield	Table yield	Total yield	Table yield	Total yield	Table yield	Total yield	Table yield
Ilam Hardy	10.0	7.6	4.03	8.8	10.0	8.9	9.9	12.8
Rua	9.1 <sup>B</sup>	13.8 <sup>B</sup>	6.4 <sup>B</sup>	12.2 <sup>B</sup>	18.0	23.2	—	—
Sebago	20.4	23.9	29.7	31.4	20.0	15.0	23.8 <sup>A</sup>	29.8 <sup>A</sup>
RKE	—	—	—	—	27.1 <sup>B</sup>	55.6 <sup>B</sup>	16.5	11.6
Iwa	-3.5 <sup>C</sup>	-0.4 <sup>C</sup>	—	—	8.3 <sup>D</sup>	21.8	—	—

(A - 1980/81 and 1981/82 only, B - 1980/81 only, C - 1982/83 only, D - 1981/82 and 1982/83 only).

## Quality evaluation

The cooking and processing quality evaluation did not show any advantage in pathogen testing any of the cultivars. However, in all cultivars, the pathogen tested seed was soil free due to a smoother shape and absence of external pathogens. The certified seed tended to be infected by rhizoctonia to which soil adheres. The multiplication of pathogen tested seed in rhizoctonia-free soil precludes the build up of this pathogen.

## CONCLUSION

All the cultivars trialled (Ilam Hardy, Rua, Sebago, Red King Edward and Iwa) responded to the removal of pathogens. Increased table yields are attributed to enhanced plant vigour resulting in larger tuber sets, and/or a larger proportion of the tuber production bulking to table size. The tubers graded as table are generally even in size and smaller than the certified seed lines. They are also cleaner on digging, as they lack external pathogens when sown and the buildup of such pathogens is very slow, so there is little skin surface roughness for soil to adhere to. Emergence is even and reliable, lending confidence to the growing of Rua in the North Island in particular.

These results demonstrate a moderate improvement in both yield and saleable quality by using pathogen tested potato seed.

## REFERENCES

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