

EVALUATION OF PATHOGEN TESTED POTATO SEED IN NEW ZEALAND

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ABSTRACT

Pathogen tested potato seed stocks of Ilam Hardy, Rua, Sebago and Red King Edward produced by meristem tip culture were evaluated during 1980 in four regional field trials. Each trial contained two or more cultivars and was a comparison between the pathogen tested seed and commercially available certified Group I and Group III seed.

In all cultivars, pathogen tested seed out-yielded Group I and Group III by from 14% for Ilam Hardy to 23% for Sebago in total yield. Yield and numbers of table potatoes of all cultivars varied in proportion when compared with the Group I standard, hence the plant vigour was enhanced without increasing the individual tuber size. The increase in total yield was not as high as table yield because of the higher seed and pig potato yield of Group I and Group III.

INTRODUCTION

The New Zealand Seed Potato Certification Scheme aims to provide growers with seed from crops which are free from virus diseases and true to type. Crops submitted for certification are classified in three groups (I, II, III), Group I being the highest grade. The crops are scored for diseases, rogues, and bolters, and the degree of isolation and classification of the seed source are considered before each seed line is classified into a specified group.

There has been speculation for many years on the likely benefit of developing Pathogen Tested (PT) seed potato stocks in New Zealand, particularly after a successful scheme was established in Australia in 1968 (Harrison *et al.*, 1974; Harrison and Mattingley, 1977). The first step towards producing PT seed in New Zealand was the introduction in 1976 of PT Sebago from Australia and 'virus-tested stem cutting' Red King Edward from Scotland. A co-operative programme between Crop Research Division, Alex McDonald & Son Ltd, Merchants and Mr Nelson Pyper (a Southland farmer) was formalised in 1977. The pathogen testing, maintenance and multiplication of Sebago and Red King Edward were followed by heat treatment (Kassanis, 1954; Mellor and Stace-Smith, 1967) and meristem tip culture techniques (used to eradicate potato pathogens, Melor and Stace-Smith, 1967; Quak, 1970) to produce PT stocks of eight further cultivars, including Rua and Ilam Hardy, the two most important cultivars in New Zealand. Field multiplication (Stages 1 to 4) was carried out in low disease risk areas near Methven, Canterbury, and the first certified seed crop of Sebago (Stage 5) will be grown in 1981/82.

In 1980, four trials were conducted within the main potato growing areas to compare PT seed with certified Group I and Group III seed of four cultivars. This paper presents yields from these trials. Processing and quality test results will be presented when available.

MATERIALS AND METHODS

Pathogen tested potato evaluation trials were conducted at four sites. Four cultivars were included in the

Lincoln trial but at the other sites only the most common cultivars were tested (Table 1).

At Lincoln, the PT lines of Rua and Ilam Hardy were each compared with four Group I and one Group III line of these cultivars. Sebago and Red King Edward at Lincoln and all cultivars at Pukekohe, Palmerston North and Gore, were compared with a Group I and a Group III line of each one. At Lincoln, the four Group I lines were grown to test for variability within each group.

Each trial was a five-replicate randomised block design with two row plots. Cultivars were in separate blocks in each site. The rows were 3m long, with 76cm between rows and a tuber spacing of 33cm within rows.

Twenty field-grown tubers of uniform size and a total weight of approximately 1800g were selected for each plot. Tubers were stored from May in a commercial seed store and removed to break dormancy three weeks before planting. Normal commercial table potato production methods were employed in the management of each trial.

Yield and tuber numbers were recorded and representative samples were retained for a table tuber five-month storage experiment and for tuber cooking quality assessment.

Table 1: Trial Sites and Cultivars Tested

Site	Cultivars
Pukekohe	Ilam Hardy, Sebago Rua
Palmerston North	Ilam Hardy Rua
Lincoln	Ilam Hardy, Sebago, Rua, Red King Edward
Gore	Ilam Hardy, Sebago, Red King Edward

RESULTS

As the statistical analysis showed similar cultivar differences for all sites, the data are presented (Tables 2 and 3) as a composite of site means and expressed as relative yields (Group I = 100). The coefficients of variation were within acceptable limits for potato trials.

In all cultivars, PT seed gave a highly significant ($P < 0.01$) increase in table tuber yield over Group I seed (range: from 14% for Ilam Hardy to 29% for Red King Edward). Group III Red King Edward yielded significantly less (29%) than Group I, with no significant differences between the other cultivars. Numbers of table tubers per plant showed differences similar to those for yield.

PT seed gave significantly ($P < 0.01$) higher total yields than Group I in all cultivars (range: from 9% for Ilam Hardy to 23% for Sebago) but the advantage to PT was larger for table yield (except for Sebago) because a larger proportion of the PT tubers set had bulked up to table size. Group III Red King Edward seed yielded significantly (19%) less than Group I, with no significant differences in the other cultivars.

TABLE 2: Relative yield — composite analysis of all sites.

	Table Yield	Total Yield
Ilam Hardy (4 sites)		
PT	114 a A	109 a A
GP. I	100 b B (22.76 kg)	100 b B (27.81 kg)
GP.III	97 b B	96 b B
CV%	13%	10%
Rua (3 sites)		
PT	122 a A	117 a A
GP.I	100 b B (23.43 kg)	100 b B (26.76 kg)
GP.III	108 b B	108 b AB
CV%	13%	11%
Sebago (3 sites)		
PT	118 a A	123 a A
GP.I	100 b B (20.95 kg)	100 b B (23.96 kg)
GP.III	98 b B	103 b B
CV%	11%	8%
Red King Edward (2 sites)		
PT	129 a A	119 a A
GP.I	100 b B (11.31 kg)	100 b B (22.09 kg)
GP.III	71 c C	81 c C
CV%	21%	12%

The cultivars reacted differently in total number of tubers produced. There were no significant differences between treatments for Rua and Ilam Hardy. PT Sebago seed produced significantly ($P < 0.01$) more tubers than Group III which produced significantly ($P < 0.01$) more than Group I. Red King Edward PT seed produced significantly more than Group III, but not significantly more than Group I.

Comparisons between four Group I lines of Ilam Hardy and of Rua were made at Lincoln. There were no significant differences in table ware production between PT Ilam Hardy and the four Group I lines. Within the Group I lines, there was an 8% difference between the highest and lowest yielding line. The production of table potatoes by PT Rua seed was significantly higher than from two of the Group I lines but not significantly different from the other two lines. The PT Rua seed yielded 6% higher than the top Group I line while there was a 22% yield range within the Group I lines.

Over all cultivars, PT seed produced significantly higher yields of total and table potatoes and higher numbers of table tubers. However, cultivar differences in total tuber numbers were not consistent.

TABLE 3: Relative Number of Tubers — composite analysis of all Sites.

	Number of Table Tubers	Total Number of Tubers
Ilam Hardy (3 sites)		
PT	115 a A	100 a
G.P.I	100 b B (125)	100 a (213)
G.P.III	90 b B	88 a
CV%	13%	11%
Rua (3 sites)		
PT	120 a A	108 a
G.P.I	100 b B (101)	100 a (154)
G.P.III	109 b B	111 a
CV%	13%	13%
Sebago (3 sites)		
PT	144 a A	147 a A
G.P.I	100 b B (101)	100 c C (146)
GP.III	98 b B	103 b B
CV%	14%	11%
Red King Edward (2 sites)		
PT	128 a A	112 a
G.P.I	100 b B (85)	100 a b (292)
G.P.III	75 c C	93 b
CV%	18%	13%

DISCUSSION

These trials were designed to compare the table ware production of PT seed against Group I and III seed lines. The significant increases in yield of PT over the certified lines under the conditions of these trials demonstrate the benefits of using pathogen tested seed. Trials of Red King Edward and Sebago PT seed at Yaldhurst, 1978, gave similar results to these trials, with larger total yield increases of 44% and 32% respectively. (J.P. Malcolm pers. comm.)

Table yield and table tuber numbers of PT and Group III varied in proportion when compared with the Group I standard. Thus, by removal of pathogens, the vigour was enhanced without increasing the individual size of the larger tubers. The average tuber weight in each cultivar was similar for the three types of seed used. The size of the tubers is an important consideration as oversize potatoes are not acceptable on the fresh market.

The four top lines of Group I Ilam Hardy and Rua were included to check for variation between them and to compare them with the PT lines. The Ilam Hardy Group I lines were less variable (8%) than the Rua lines (22%).

Total yield increases were not as high as table yield, demonstrating the higher seed and pig components of Groups I and III. Pig potato yields are generally variable in table ware trials.

In Rua and Ilam Hardy treatments there were no significant differences in total tuber numbers. The 23% increase in total tuber numbers of Group III Sebago compared to Group I was not reflected in a significant increase in weight of total or table potatoes. However, the 47% increase in total number of potatoes from PT stock produced a significant increase in both total and table grade yield.

Red King Edward tends to set a large number of tubers (approximately twice as many as Rua or Sebago). The PT line did not produce significantly more tubers than the

Group I line, but did yield significantly more total and table grade potatoes. It appears that potatoes grown from PT stock are capable of better bulking, so producing more table grade and less small potatoes.

CONCLUSION

These trials have demonstrated the improved performance of pathogen tested potatoes over available commercial seed. PT seed produced more tubers of an even marketable size and a smaller proportion of seed and pig potatoes, while Group I and Group III tended to produce a wider tuber size range with proportionally higher seed and pig yields.

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