PT314

Evaluation of round potato seed in Queensland

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Know-how for Horticulture™

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Industry Summary

The recent availability of round or whole seed from certified seed schemes in Australia has given growers a new option when deciding what seed to purchase. However, little information on the performance of round seed compared to cut seed was available to industry to decide which was the better option. This project initiated by the Heavy Produce Committee of the Queensland Fruit and Vegetable Growers, was designed to compare different whole seed sizes planted at various spacings with a cut seed treatment planted at 25 cm spacing (the normal standard).

Results from our initial trials conducted at Gatton Research Station indicated that for early season plantings (May), the decision to use round or cut seed depended on variety. There was no advantage of using round seed for Exton , Sequoia and Pontiac, but returns from Winlock were favoured by the use of round seed. In a later planting (late June) there was an economic advantage by planting round seed for all three varieties (Sebago, Pontiac and Atlantic) that were evaluated at this planting date. In this planting, there was little difference in economic returns regardless of plant spacing (20, 25, 32.5 and 40 cm). While the larger seed size (80-150 g) gave the highest yields, there appeared to be no advantage in grading the seed into large and small (30-80 g) as the run-grade size of 30-150 g gave a similar yield to the mean yield of the large and small seed sizes.

These trials were followed in the next year by a series of trials on growers' properties; two in the Lockyer Valley , one at Redland Bay and the other on the Atherton Tableland. When the differential costs between cut and round seed were taken into account assuming a farm-gate price of $300/tonne, for the 80-350 g grade of the resulting crop, there was an advantage at the Lockyer and Redland Bay sites of approximately $1 000/ ha (average over the three sites) resulting from the use of round seed. At the North Queensland site where there was no significant advantage of round seed over cut seed, there was a cost disadvantage of approximately $900/ha when the differential seed costs were taken into consideration.

When considering what spacing is best after taking into account the different seed costs required for the various spacings, no consistent pattern emerged. Differences occurred among varieties and among sites. The most economic spacings were generally confined to the 18-32.5 cm range. We believe this variation as well as the variations between the performance of round and cut seed in winter and spring plantings and between N and S-E Queensland plantings are largely due to differences in physiological age of the seed at planting. Future work on the evaluation of round seed will examine the effect this factor has on the performance of round and cut seed.

Technical Summary

This project was instigated by the Heavy Produce Committee of the Queensland Vegetable Growers to establish the benefits if any in using round seed compared to cut seed. Traditionally winter and spring crops in Queensland are planted with cut certified seed . Round seed is normally selected from the spring crop at harvest and planted in an autumn crop in February. Certified round seed is now available to the industry and is promoted on the basis that it reduces seed breakdown resulting in better plant stands and ultimately higher yields.

To establish the performance of round seed compared to cut seed, trials were initially established on Gatton Research Station and subsequently on growers' properties. In the trials on the Research Station plantings were established to correspond with the winter and spring commercial plantings using four varieties (Exton, Pontiac, Sequoia and Winlock) in the winter planting and three (Atlantic, Sebago and Pontiac) in the spring planting. At each planting four spacings were used for the round seed (20, 25, 32.5 and 40 cm) . A spacing of 25 cm was included for each variety at each planting for the cut seed treatment. The round seed for each variety was graded into three sizes which were planted at each of the four spacings. These grades were 30-80, 80-150 and 30-150 g.

In both plantings round seed of the various varieties outyielded the cut seed treatment and yields declined as spacings increased. However, when the cost of seed was taken into account, there was an economic advantage with Winlock only in the winter planting . In the Spring planting, all three varieties produced higher economic returns from the use of round seed compared to the cut seed treatment. While the larger round seed grade gave the highest yields, there was no advantage in grading the seed into large and small seed sizes as the run-grade produced equivalent yields to the mean of the large and small grade seed sizes. In an economic comparison of round and cut seed at the 25 cm spacing, the advantage of round seed was particularly evident in the spring trial in all three varieties. However, in the winter trial the advantage of round seed was only apparent in one of the four varieties evaluated.

In the grower trials round and cut seed of three varieties were evaluated at each site at 20, 25, 32.5 and 40 cm spacings in S-E Queensland sites 18, 23, 28 and 33 cm in North Queensland. Three sites were selected in S-E Queensland and one in North Queensland. Varieties varied at each site depending on the grower's normal choice of varieties. Physiological age of seed also varied among varieties at each site and across sites due to the different harvest times of the certified seed crops in southern Australia. Results indicated that at the S-E Queensland sites there was an approximate advantage of $1000/ha resulting from the use of round seed after the differential costs between using round and cut seed were taken into account. In North Queensland where there was no significant difference between yields from cut and round seed, the use of cut seed gave an economic advantage of $900/ha. There was no clear pattern as to the best spacing other than 40 cm spacing was consistently less attractive than the closer spacings. Optimum spacing differed with variety and site and is believed to be associated with physiological age of the seed at planting. Physiological age of the seed was also believed to play an important role in the variations in the performance of cut and round seed between the winter and spring plantings and between N and S-E Queensland. Future work is planned to examine the effect of physiological age on the performance of cut and round seed.

Introduction

The Queensland potato industry relies substantially on certified seed from southern Australia for establishment of the crop. There are a few exceptions such as the autumn crop in the Lockyer Valley where small, round seed saved from the previous spring crop are planted as one-off certified seed. Some crisping growers may also produce a seed crop from certified seed to enable scheduled planting dates to be met. Because of the wide adoption of certified seed and the relatively high price of this seed delivered to Queensland growing districts, the seed is usually cut into sets to minimise costs.

However, there has been a move in the certified seed industry especially in Victoria to produce a proportion of the certified seed crop to be used as whole or round seed (Strange and Blackmore 1990). This development was partly in response to findings by Strange and Blackmore (1989) that round seed improves crop health, yield and profit. Initial interest in the use of round seed as an alternative to cut seed in Queensland developed primarily in the crisping industry as a potential way to manage size variation in crisping crops where a uniform size (approximately 200 g) maximises returns. Some fresh-market producers have also experimented with round seed by removing the "smalls" (<80 g) from their certified seed order and planting these seed as whole seed.

Theoretically, round seed have a number of advantages over cut seed. A major advantage is the improved emergence and reduced susceptibility to soil borne diseases. Another is the production of more stems and a resultant production of more even-sized tubers and a greater yield of tubers. Studies by Jackson *et al* 1993 determined that failure to achieve satisfactory plant stands in commercial crops in the Lockyer Valley was a major factor limiting yield. Poor plant stands were attributed to seed piece break-down as well as blind seed pieces resulting from machine-cut seed. Finally, the use of round seed reduces chemical usage as no chemical is required for protecting the cut surface that occurs when cut seed are used.

Round seed is now available from seed certification schemes in sizes ranging from 30-150 g. To evaluate the potential of round seed, there is a need to determine how seed size and spacing interacts for various varieties. This study firstly evaluated different round seed sizes at different spaces for a group of varieties at different planting times. A cut seed treatment was included for each variety at a standard spacing at each planting time. Subsequently, cut and round seed were evaluated on district properties using various varieties at various spacings. Results were not unequivocally in favour of the use of round seed although when seed was of optimum physiological age round seed was usually superior to cut seed.

Materials and methods

Winter, Spring and Autumn trials

These trials were conducted at Gatton Research Station in the Lockyer Valley in 1993/1994. Certified round seed were harvested in Victoria in March and received in Queensland in April. On arrival of the certified seed, the varieties to be included in the winter crop (Sequoia, Exton, Winlock and Pontiac) were placed in storage under ambient conditions for two weeks prior to planting while the varieties to be assessed in the spring planting (Sebago, Atlantic and Pontiac) were stored at (4°C) for 1 month prior to preparation for planting. All seed were grown by certified seed growers in Victoria. Sufficient seed of Pontiac were produced to allow inclusion in both plantings. After removal of seed from cold storage for the spring planting, it was stored in a greening room at ambient temperatures for a period of approximately three weeks before planting.

Three round seed sizes (30-80, 80-150 and 30-150 g) were planted at four plant spacings (20, 25, 32.5 and 40 cm) on 18/5/93 (winter crop) and 29/6/93 (spring crop). Round seed ranging from 35-150 g was saved at harvest from each of the three varieties included in the spring crop and cold stored over summer and planted in an autumn crop (17/3/94). Spacings were similar to those used in the winter and spring crops but round seed sizes were slightly different (35-100, 100-150 and 35-150 g). A cut seed treatment was included for each variety at each planting date. The cut seed (approximately 50 g with at least one sprouted eye) was planted at a plant spacing of 25 cm.

All three plantings were allowed to senesce before harvest (28/9/93, 19/10/93 and 12/7/94 respectively for the winter, spring and autumn crops) as this is the common commercial practice in Queensland. At harvest tubers were graded into small (<80 g), No. 1 grade (80-350 g), large (350-450 g) and oversize (>450 g). Emergence counts and the number of stems and tubers per plant were recorded.

District trials

District trials were conducted in 1994/95 in SE Queensland (3 sites) and North Queensland (1 site). In SE Queensland two sites were selected in the Lockyer Valley and one at Redland Bay. Round seed ranging in size from 30-150 g was selected from the grower's certified seed at each site in SE Queensland. At these three sites three varieties were evaluated and round and cut seed were planted 20, 25, 32.5 and 40 cm spacings. In North Queensland three varieties were also assessed at Kairi Research Station using seed purchased from the local Potato Growers Cooperative which was then used to select round seed in the 30-150 g size range. The four spacings used in North Queensland were 18, 23, 28 and 33 cm. The varieties included at each site are listed in Table 1.

Table 1. Varieties evaluated at each of four sites to compare round and cut seed in relation to yield.

Site	Varieties
1 - Lockyer Valley	Sebago, Pontiac and Red la Soda
2 - Lockyer Valley	Sebago, Atlantic and Trent
3 - Redland Bay	Pontiac, Sequoia and Exton
4 - Kairi Research Station	Sebago, Pontiac and Atlantic

Results and Discussion

Winter planting

The results of the factorial experiment of 4 varieties x 3 seed sizes x 4 plant spacings are summarised in Table 2.

Table 2. The significance of the effects of spacings (s) variety (v) and seed size (t) on tuber yield, tuber number per plant, stem number per plant and emergence of potatoes grown from round seed in a winter crop in SE Queensland.

Attribute	Main effects			Interactions		
	s	v	t	sv	st	vt
Yield						
Small grade (<80 g)	xx	xx	xx	xx	ns	xx
No. 1 grade (80-350 g)	xx	xx	xx	x	xx	x
Large grade (350-450 g)	xx	xx	ns	xx	ns	ns
Oversize grade (>450 g)	xx	xx	ns	ns	ns	xx
Total yield	xx	xx	xx	ns	ns	ns
Tuber/plant						
Small	ns	xx	xx	x	ns	xx
No. 1	xx	xx	xx	ns	ns	ns
Large	xx	xx	ns	ns	ns	ns
Oversize	xx	xx	xx	ns	ns	xx
Total	xx	xx	xx	x	ns	xx
Stems/plant						
No. of stems/plant	xx	xx	xx	ns	ns	ns
Emergence						
Emergence %	ns	xx	ns	ns	ns	ns

x - P<0.05; xx - P<0.01; ns - not significant

Yield data

Spacing and variety influenced yield of all grades while seed size did not effect the large and oversize grades. Interactions commonly occurred between spacing and variety and seed size and variety but rarely between spacing and seed size.

Total yield was influenced by spacing, variety and seed size and no interactions were significant. Pontiac and Winlock were significantly higher yielding than Exton and Sequoia with Sequoia being superior to Exton. Yield steadily declined as spacings increased. Significant yield differences occurred between each increment in the spacing treatments. The large seed size produced highest yields followed by the ungraded seed size which was in turn significantly better than the small seed size. The average of the yields obtained from the large and small seed sizes was slightly less than the yield from the ungraded seed.

In the small grade, Winlock produced the highest yields. Yields declined in this grade with increased spacing but the decline was more pronounced in Winlock at wider spacings compared to the other varieties. The larger seed size (80-150 g) generally resulted in a greater number of smalls however this did not occur in Pontiac where the yield of smalls was little influenced by seed size.

All three interactions were significant for the No. 1 grade yield. While yields declined with increased spacing, the yield of Pontiac reduced more rapidly at the wider spacings followed by Exton. Yields of Winlock and Sequoia in this grade had a more gradual decline. This was the only grade in which there was a significant interaction between seed size and spacing. This interaction occurred over the two closer spacings where yield from large seed remained relatively constant compared to that harvested from the ungraded and small seed treatments at these spacings. Yield of Exton and Winlock increased by using ungraded seed compared to small seed but remained similar for these two seed sizes in Pontiac and Sequoia. Yields of all four varieties increased in response to the large seed size (100-150 g). In the large tuber grade yield peaks for the various varieties varied considerably among spacings. For Pontiac it was highest at 25 cm compared to 40 cm for Exton and Winlock and 32 cm for Sequoia. In the oversize grade, Pontiac produced the highest yields particularly from the large seed size at the wider spacings. Oversize yields were substantially lower in the other varieties.

Tuber number

The number of tubers per plant was affected by variety, spacing and seed size. Most common interactions occurred between variety and seed size with no interactions between seed size and spacing being recorded (Table 2).

The total number of tubers per plant increased to a greater extent in Winlock compared to other varieties as spacing increased. Winlock also produced a greater number of tubers per plant from the larger seed size relative to the other varieties.

The number of small tubers per plant varied with variety and spacing and variety and seed size. Highest number of tubers per plant occurred in Winlock at the widest spacing but this occurred at closer spacings for the other varieties. Large seed produced a greater number of small tubers per plant in all varieties except Exton.

In the No. 1 grade main effects of variety, spacing and seed size were the only factors influencing tuber number per plant. Winlock produced significantly higher numbers than the remainder. Tuber number per plant was highest at the widest spacing which was significantly higher than the other three spacings. Spacings of 25 and 32 cm gave similar tuber numbers per plant which were significantly higher than the number per plant at the closest spacing. The large seed size produced the highest tuber number per plant, significantly higher than the ungraded size which was in turn significantly higher than the number of tubers per plant produced from the small seed size.

The number of tubers per plant in the large grade was most pronounced in the widest spacing decreasing as spacing was reduced. Pontiac had a significantly high tuber number per plant in this grade compared to the other varieties.

In the oversize grade, Exton tuber number per plant did not increase with increased spacing to the same extent as occurred in the other varieties. Pontiac produced a larger number of tubers per plant from the large seed size compared to the other varieties.

Emergence and stems per plant

The only factor affecting emergence was variety with Winlock and Pontiac having significantly higher emergence percentage than Exton and Sequoia.

The number of stems per plant was influenced by variety, spacing and seed size. Pontiac produced more than Winlock which in turn produced more than Sequoia and Exton. Wider spacings increased stems per plant with no significant differences between 20 and 25 cm, 25 and 32 cm and 32 and 40 cm. Large seed produced significantly more stems than the other two seed sizes which gave similar numbers of stems per plant.

Spring planting

The results of the factorial experiment of 3 varieties x 3 seed sizes x 4 plant spacings are summarised in Table 3.

Yield data

Spacing and variety influenced the yield in all grades while seed size did not effect the large and oversize grades. This was a similar result to that recorded in the winter planting. Interactions were most commonly recorded between variety and seed size with no significant interactions between spacing and seed size.

Total yield

Pontiac yielded significantly higher than Atlantic and Sebago with Atlantic being superior to Sebago. Yield declined as spacing increased with significant differences between each spacing increment. The large seed size was significantly better than the ungraded size which in turn was superior to the small grade. A significant interaction between variety and seed size occurred where Pontiac yields did no differ in relation to the use of large or ungraded seed in contrast to the other two varieties.

Yield of small tubers decreased with increased plant spacing. Seed size did not influence yield of small tubers in Sebago but large seed produced more small tubers in Atlantic and Pontiac.

In the No. 1 grade yields again declined as spacing increased. Large seed and ungraded seed had no effect on Pontiac yield whereas the large seed improved yields in Sebago and Atlantic.

Table 3. The significance of the effects of spacings (s) variety (v) and seed size (t) on tuber yield, tuber number per plant, stem number per plant and emergence of potatoes grown from round seed in a spring crop in SE Queensland.

Attribute	Main effects			Interactions		
	s	v	t	sv	st	vt
Yield						
Small grade (<80 g)	xx	xx	xx	ns	ns	xx
No. 1 grade (80-350 g)	xx	xx	xx	ns	ns	x
Large grade (350-450 g)	xx	xx	ns	ns	ns	ns
Oversize grade (>450 g)	xx	xx	ns	x	ns	ns
Total yield	xx	xx	xx	ns	ns	xx
Tuber/plant						
Small	ns	xx	xx	ns	ns	xx
No. 1	xx	xx	xx	ns	ns	xx
Large	xx	xx	ns	ns	ns	ns
Oversize	xx	xx	ns	xx	ns	ns
Total	xx	xx	xx	ns	ns	xx
Stems/plant						
No. of stems/plant	ns	xx	xx	ns	ns	ns
Emergence						
Emergence %	ns	x	ns	ns	ns	ns

x - P<0.05; xx - P<0.01; ns - not significant

The large and oversize grades were chiefly influenced by spacing and variety with the greater production of large tubers in the wider spacings. Pontiac produced the highest yield of tubers in these grades.

Tuber number

All three main factors influenced tuber number per plant. Interactions were largely restricted to variety x seed size (Table 3).

Total tuber number per plant increased with increased spacing. Atlantic set more tubers than Pontiac and Sebago which produced similar numbers. The large seed size produced highest tuber set followed by the ungraded seed size.

Spacing had no effect on the tuber set of smalls. Pontiac set the greatest number of small tubers while least small tubers were set by the small seed size, however varieties reacted differently to seed size in that the small seed size had a greater effect on reducing smalls in Atlantic than in the other varieties. In the No. 1 grade tuber set, numbers per plant increased with spacing and Atlantic had the highest set. The effect of seed size was more pronounced on tuber set in Atlantic in this grade than the other varieties with the larger seed size being superior. The tuber set of large and oversize tubers was not influenced by seed size. Pontiac produced the largest number of tubers in these grades and the highest numbers also occurred in the widest spacing.

Emergence and stems/plant

The only factor affecting emergence was variety where Pontiac was better than Sebago but no significant difference occurred between Pontiac and Atlantic. The number of stems per plant was influenced by variety and seed size (Table 3). Pontiac and Sebago produced higher stem counts than Atlantic. The large seed and ungraded seed treatments produced significantly higher stem counts than the small seed.

Winter trial including cut seed

Data is presented for the factorial experiment (48 treatments) and the 4 cut seed treatments (each variety at 25 cm spacing) in Appendix 1 for yield, tuber number per plant, emergence and stem counts. The data has been analysed as 52 individual treatments to determine least significance difference values so that the cut seed treatments can be compared to the relevant whole seed treatments at the 25 cm spacings (shaded sections of tables in Appendix 1). A brief summary of the cut and whole seed treatments for the various varieties is outlined below.

Tuber yield

When cut seed and round seed treatments are compared for the No. 1 grade, the most outstanding differences are that cut seed of Pontiac outyielded the three round seed treatments and that the reverse was the case for Winlock. Differences were not as distinct with the other two varieties. In Sequoia the small and large round seed produced similar yields to the cut seed but the ungraded yield was significantly higher. In Exton the large and ungraded round seed gave superior yields to the cut and small round seed treatments which were similar.

Other interesting results were that cut seed gave significantly less small tubers in Winlock compared to the round seed treatments while the reverse was generally true for Pontiac. At the other end of the scale cut seed produced significantly higher yields of large and oversize tubers in Winlock and again the result was reversed for Pontiac where round seed treatments produced much higher yields of tubers in these grades. When the total tuber yield data is examined, yields were generally significantly higher from the round large, and round ungraded seed treatments.

Tuber numbers

The yield contrasts between Pontiac and Winlock in response to cut and round seed treatments in the small and large/oversize grades appear to be largely related to differences in tuber numbers. In the small grade Winlock produced significantly higher numbers of tubers per plant from the round seed compared to the cut seed and the opposite occurred in Pontiac. Similarly the tuber numbers were higher from the round seed compared to the cut seed in the large and oversize grades in Pontiac and the reverse occurred in Winlock. When the total tubers per plant segment of Appendix 1 is examined, the effects of cut and round seed are particularly different for Winlock and Pontiac and similar for Sequoia and Exton. Round seed increased tuber set in Winlock and reduced it in Pontiac.

Emergence and stems per plant

In restricting comparisons for emergence to the 25 cm spacing, the round large, and round ungraded seed treatments in Winlock and Exton were significantly higher than the corresponding cut seed treatment in these two varieties. However, emergence figures for both round and cut seed treatments were very high, generally above 95% for all treatments.

The only treatments where stem numbers were significantly higher than cut seed treatments at the 25 cm spacing was in the round ungraded seed treatments in Pontiac and Exton.

Spring trial including cut seed

Data is presented for the factorial experiment (36 treatments) and the 3 cut seed treatments (each variety at 25 cm spacing) in Appendix II for yield, tuber number per plant, emergence and stem counts. The data has been analysed as 39 individual treatments to determine least significant difference values to allow comparisons between the cut and round seed treatments at the 25 cm spacings shaded sections of tables in Appendix II. A brief summary of the cut and round seed treatments for the various varieties is outlined below.

Tuber yield

The difference between yields from round seed and cut seed were much more evident in the spring planting compared to the winter planting. Pontiac was the only common variety in the two plantings. An examination of the No. 1 grade and total yield data tables in Appendix II clearly demonstrates the superiority of round seed over cut seed. In the small grade higher yields generally occurred from the use of round seed while in the large and oversize grades yields for Atlantic and Sebago were recorded from the cut seed. There were generally no major differences between the cut and round seed treatments for Pontiac in these grades.

Tuber numbers

While tuber numbers were generally significantly higher in the round seed treatments compared to the corresponding cut seed treatments, it does not appear to be sufficient to account for all the differences in yield indicating that average weight per tuber must have been higher within the various grades for the round seed treatments.

Emergence and stems per plant

Emergence from cut seed of Sebago and Atlantic were significantly lower than the equivalent round seed treatments at the 25 cm spacing. Although the cut seed treatment was lower in Pontiac it was not significantly lower.

Stems per plant were always lower in the cut seed treatments but only in the round ungraded seed treatments were the plant stem numbers significantly higher.

Autumn trial including cut seed

In the autumn comparison of seed saved from the spring crop and replanted in the autumn in the same round seed sizes, a cut seed treatment was again compared to the round seed performance at the 25 cm spacing. No. 1 grade and total yield comparisons for the different seed sizes are presented in Table 4. Round seed treatments gave significantly higher yields in Atlantic and with the ungraded round seed in Pontiac. There were no significant yield differences in the Sebago seed treatments. Similar responses were recorded in the total yield measurements with the exception that the ungraded Sebago round seed produced significantly higher yields than the other Sebago seed sizes.

Table 4. Yield comparison (t/ha) for cut and round seed at 25 cm spacing for one-off certified seed of Atlantic, Pontiac and Sebago planted as an autumn crop (35=30-80 g; 101=30-150 g and 150=80-150 g size round seed).

Attribute	No. 1 grade yield				Total Yield			
Seed Size	Cut	35	101	150	Cut	35	101	150
Atlantic	26.7	32.7	36.7	36.1	31.9	38.8	44.4	41.6
Pontiac	30.3	29.2	35.3	31.5	38.2	39.8	46.9	41.7
Sebago	22.7	25.7	25.2	21.1	28.6	32.3	34.9	29.6
LSD 5%				4.2				5.8

Seed size influenced the yield of small tubers (Table 5) in Atlantic and Sebago but not in Pontiac. Yields of small tubers increased with the use of ungraded and large round seed treatments in Sebago and small and large round seed treatments in Atlantic compared to corresponding cut seed treatments. Similar patterns were reflected in the tuber set per plant (Table 5) with Pontiac being unaffected by the different seed treatments and increased tuber set by the larger seed sizes in Sebago and the ungraded seed treatment in Atlantic.

Table 5. Yield of smalls (t/ha) and tubers per plant of cut and round seed at 25 cm spacing for one-off certified seed of Atlantic, Pontiac and Sebago planted as an autumn crop (35=30-80 g; 101=30-150 g and 150=80-150 g size round seed).

Attribute	Small (<80 g) yield				Tubers per plant			
Seed Size	Cut	35	101	150	Cut	35	101	150
Atlantic	2.4	4.2	2.6	4.4	4.1	4.4	5.7	5.0
Pontiac	5.1	4.1	5.2	3.9	5.7	5.3	6.5	5.3
Sebago	5.7	6.1	9.4	8.1	5.6	6.0	7.6	8.4
LSD 5%				1.7				0.96

Emergence data (Table 6) demonstrates that round seed produced higher emergence counts but these were not significantly higher than those of the equivalent cut seed treatments. Number of stems per plant (Table 6) were increased significantly by the use of ungraded round seed in all varieties compared to the cut seed treatment. Large round seed also had this effect in Sebago. This increased number of stems in the ungraded round seed treatments is reflected in increased yields from this particular seed treatment (Table 4).

Table 6. Emergence (%) and stems per plant of cut and round seed at 25 cm spacing for one-off certified seed of Atlantic, Pontiac and Sebago planted as an autumn crop (35=30-80 g; 101=30-150 g and 150=80-150 g size round seed).

Attribute	Emergence				Stems per plant			
Seed Size	Cut	35	101	150	Cut	35	101	150
Atlantic	93.7	97.6	98.4	99.2	1.9	2.0	3.4	2.5
Pontiac	96.8	99.2	100.0	99.2	2.5	2.6	4.4	3.0
Sebago	93.7	97.6	97.6	94.4	2.3	3.1	3.9	4.6
LSD 5%				5.9				0.98

District trials 1994/95

Site 1 - Redland Bay

Round seed gave a significant yield increase in No. 1 grade and total yields at Redland Bay (Table 7). Significant differences were recorded among the varieties in yields of the large and oversize grades which were reflected in differences for total yields for the varieties. Sequoia produced the highest yields in the grades above No. 1 grade. Close spacings produced higher yields of small grade tubers. The widest spacing reduced No. 1 grade yields compared to the other spacings. The larger grade yields were not affected by spacing. No interactions were recorded.

Table 7. Main effects of variety, spacing and seed type on tuber yield and number, emergence and stems per plant at Site 1 (Redland Bay) in SE Queensland.

ATTRIBUTE	VARIETY				SPACING					SEED TYPE		
	Sequoia	Exton	Pontiac	LSD	20	25	32.5	40	LSD	Whole	Cut	LSD
Yield												
Small (<80g)	3.4	3.6	3.6	ns	4.7	3.5	3.1	2.6	1.5**	3.9	3.1	ns
No. 1 (80-350g)	33.7	30.3	29.3	ns	35.1	30.6	34.9	23.8	8.4*	35.6	26.7	8.1**
Large (350-450g)	6.6	2.6	6.2	2.9**	4.8	4.3	6.0	5.5	ns	5.3	5.0	ns
Oversize (>450g)	5.1	1.2	3.7	2.8*	2.1	3.4	4.0	3.9	ns	3.6	3.1	ns
Total	48.8	37.7	42.8	8.5*	46.7	41.9	48.0	35.8	ns	48.3	37.9	9.4**
Tubers/plant												
Small	1.3	1.5	2.1	0.4**	1.6	1.4	1.5	1.8	ns	1.8	1.4	0.32**
No. 1	4.6	4.6	5.1	ns	3.9	4.4	5.2	5.5	1.1**	5.2	4.3	0.75**
Large	0.4	0.2	0.6	0.22**	0.2	0.3	0.4	0.6	0.25**	0.4	0.4	ns
Oversize	0.2	0.1	0.3	ns	0.1	0.2	0.2	0.3	ns	0.2	0.2	ns
Total	6.5	6.4	8.0	1.0**	5.9	6.4	7.4	8.2	1.2**	7.6	6.3	0.84**
Emergence												
Emergence (%)	89.5	80	65.8	18.8**	78.2	76.8	88.8	75.3	ns	82.8	76.8	ns
Stem Count												
Stems/plant	1.5	1.3	1.8	ns	1.4	1.5	1.4	1.9	ns	1.5	1.6	ns

The number of tubers per plant in the small and No. 1 grades was increased by the use of round seed and this was reflected in total tubers per plant. Very few large and oversize grade tubers per plant and the other two varieties with the main increases occurring in the small and large grades. The number of tubers per plant increased with increased spacing. Interactions at the 5% level of significance occurred between variety and seed type in the small grade size and between variety and spacing for total yields per plant. Pontiac produced a greater number of small grade tubers from round seed relative to the other two varieties. The number of tubers per plant in Exton was not affected to the same extent as in the other two varieties when the spacing was increased from 20-25 cm.

There were no significant differences within seed type, variety or spacing with respect to stems per plant. Although emergence was reduced by the use of cut seed, the difference was not significant. The emergence of Pontiac was significantly lower than the other two varieties.

Site 2 - Grantham, Lockyer Valley

A different group of varieties were assessed at Grantham (Table 8). Here emphasis was on potato varieties that are suitable for processing. Very few large or oversize potatoes were produced at this site. Round seed increased total yield by increasing both the small and No. 1 grade yields. Trent No. 1 grade yields were highest followed by Atlantic and then Sebago with the differences between each of the varieties being significant. Yields at the 20 and 25 cm spacings were similar but were significantly lower at the 40 cm spacing. The decline in yield with increased spacing beyond 25 cm was more pronounced in the round seed treatment.

Numbers of tubers per plant increased with the use of round seed and were highest in Trent and lowest in Sebago and decreased as spacing was increased. There were no significant interactions.

Emergence for round seed and cut seed was similar in Trent and Atlantic but round seed was superior in Sebago. The number of stems per plant was affected by seed size and variety. Round seed increased the number of stems and Atlantic produced a significantly higher number of stems then Trent.

Table 8. Main effects of variety, spacing and seed type on tuber yield and number, emergence and stems per plant at Site 2 (Grantham, Lockyer Valley) in SE Queensland.

ATTRIBUTE	VARIETY				SPACING					SEED TYPE		
	Trent	Atlantic	Sebago	LSD	20	25	32.5	40	LSD	Whole	Cut	LSD
Yield												
Small (<80g)	4.7	5.7	3.8	1.0**	6.2	5.4	4.1	3.3	1.2**	5.6	3.9	0.84*
No. 1 (80-350g)	25.3	22.5	18.0	2.3**	23.6	23.9	21.2	19.0	2.7**	25.2	18.6	1.9**
Large (350-450g)	0.2	0.1	0.01	ns	0.0	0.04	0.1	0.2	ns	0.08	0.08	ns
Oversize (>450g)	0.0	0.0	0.04	ns	0.0	0.0	0.0	0.06	ns	0.01	0.02	ns
Total	30.1	28.3	21.9	2.26**	29.8	29.4	25.4	22.4	2.6**	30.9	22.6	1.8**
Tubers/plant												
Small	2.0	2.2	1.6	0.36**	1.8	1.9	2.0	2.0	ns	2.2	1.6	0.3**
No. 1	4.0	3.5	2.9	0.37**	2.8	2.2	3.7	4.0	0.4**	3.9	3.0	0.3**
Large	0.01	0.01	0.00	ns	0.00	0.00	0.01	0.01	ns	0.01	0.01	ns
Oversize	0.00	0.00	0.01	ns	0.00	0.00	0.00	0.01	ns	0.00	0.01	ns
Total	6.0	5.7	4.5	0.45**	4.6	5.2	5.7	6.1	0.52**	6.2	4.6	0.37*
Emergence												
Emergence (%)	96.8	98.9	96.9	ns	96.9	98.8	96.4	98.1	ns	98.6	96.5	2.0*
Stem Count												
Stems/plant	1.8	2.7	2.2	0.57**	2.1	2.1	2.3	2.5	ns	2.6	1.9	0.47*

Site 3 - Gatton, Lockyer Valley

At the Gatton site (Table 9) fresh market varieties were assessed. Yields in the large and oversize grades for the three varieties were minimal. While yields in the No. 1 grade were increased with the use of round seed, the increase was much more pronounced in Pontiac. This same effect was reflected in the total yield figures. Differences occurred in the yields of the varieties within the individual grades but these differences were not apparent in total yields. In No. 1 grade, Pontiac yielded significantly lower than Red la Soda and Sebago. No. 1 grade and total yields were relatively constant over the first three spacings but were generally signficantly lower at the 40 cm spacing.

Tuber number per plant was increased by the use of round seed in the No. 1 grade and total recordings. The number per plant was significantly lower in Pontiac and was highest in the widest two spacings which gave similar tuber set.

While use of round seed resulted in higher emergence counts, this was much more pronounced in Pontiac where the increase was 18% compared to 1-2% in Sebago and Red la Soda. The number of stems per plant was not affected by any of the factors.

Table 9. Main effects of variety, spacing and seed type on tuber yield and number, emergence and stems per plant at Site 3 (Gatton, Lockyer Valley) in SE Queensland.

ATTRIBUTE	VARIETY				SPACING					SEED TYPE		
	Sebago	Red la Soda	Sebago	LSD	20	25	32.5	40	LSD	Whole	Cut	LSD
Yield												
Small (<80g)	3.6	4.5	4.4	0.8**	5.8	4.5	3.5	2.9	0.92**	4.3	4.0	ns
No. 1 (80-350g)	20.3	23.8	24.5	3.3**	25.4	24.1	23.4	18.6	3.8**	26.2	19.5	2.7**
Large (350-450g)	2.6	1.3	0.8	1.2**	1.2	1.4	1.5	2.2	ns	1.8	1.4	ns
Oversize (>450g)	1.9	0.8	0.3	1.3	0.5	1.3	0.8	1.4	ns	1.4	0.6	ns
Total	28.4	30.4	30.0	ns	32.8	31.3	29.2	25.0	4.3*	33.6	25.6	3.1
Tubers/plant												
Small	1.5	1.8	1.7	ns	1.7	1.6	1.6	1.7	ns	1.6	1.7	ns
No. 1	2.7	3.2	3.2	0.46	2.5	2.9	3.4	3.3	0.53**	3.4	2.7	0.37**
Large	0.16	0.08	0.04	0.07**	0.05	0.08	0.01	0.16	0.09**	0.1	0.1	ns
Oversize	0.08	0.04	0.01	0.04**	0.02	0.04	0.04	0.07	0.05*	0.06	0.03	ns
Total	4.4	5.1	5.0	0.5**	4.3	4.6	5.2	5.3	0.58**	5.2	4.5	0.4**
Emergence												
Emergence (%)	89.4	96.8	98.9	4.8**	92.9	95.2	96.7	95.2	ns	98.4	91.6	3.9**
Stem Count												
Stems/plant	1.7	1.6	1.5	ns	1.6	1.5	1.6	1.7	ns	1.7	1.5	ns

Site 4 - Kairi Research Station, North Queensland

Processing and fresh market varieties were evaluated at this site (Table 10). Round seed produced higher total yields but there were no significant differences between the use of round and cut seed for the individual grades. Pontiac produced significantly higher total yields and this was in response to higher yields in No. 1 and large grade sizes. There was no effect of plant spacing on yield in these two grades but the higher yield of smalls at the closest spacing (18 cm) was reflected in highest total yields in this same spacing.

Round seed produced more tubers per plot than cut seed. Sebago produced more small grade tubers than the other varieties but there were no differences among varieties for the number of No. 1 grade tubers. Pontiac produced a significantly higher number of large tubers. Over all grades, Sebago produced a significantly higher number of tubers than Atlantic. As spacing increased the number of small and No. 1 tubers per plot decreased, being significatnly lower in the three wider spacings in the small grade and in the widest spacing for the No. 1 grade. Spacing had no effect on the large grade for this character.

Round seed resulted in more stems per plot. Pontiac produced more stems per plot than the other two varieties; the difference between Pontiac and Sebago being highly significant. Stems per plot was highest at the closest spacing, the differences between the closest spacing and the rest being highly significant as was the difference between the second closest and widest spacings.

Table 10. Main effects of variety, spacing and seed type on tuber yield and number, emergence and stems per plant at Site 4 (Kairi Research Station) in North Queensland.

ATTRIBUTE	VARIETY				SPACING					SEED TYPE		
	Sebago	Pontiac	Atlantic	LSD	18	23	28	33	LSD	Whole	Cut	LSD
Yield												
Small (<80g)	10.0	7.4	8.7	1.5**	11.4	8.9	7.6	6.9	1.8**	9.1	8.3	ns
No. 1 (80-300g)	28.3	34.1	29.9	3.0**	32.0	31.2	30.9	29.0	ns	31.5	30.0	ns
Large (300-450g)	1.5	5.8	1.7	1.6**	2.5	2.9	2.9	3.7	ns	3.3	2.6	ns
Total	39.8	47.2	40.3	3.2**	45.9	43.0	41.4	39.6	3.7**	43.9	40.9	2.6**
Tubers/plot												
Small	52.3	37.8	40.3	6.9**	58.0	45.3	37.3	33.3	8.1**	45.0	41.9	ns
No. 1	74.6	77.0	73.9	ns	80.7	77.2	74.3	68.4	9.4**	78.2	72.1	4.9*
Large	1.9	7.1	2.2	1.9**	3.2	3.7	3.4	4.6	ns	4.1	3.3	ns
Total	128.9	121.9	116.3	9.8**	141.9	126.2	115.1	106.3	11.3**	127.4	117.4	7.9**
Stem Count												
Stems/plot	42.6	50.3	47.7	5.2**	57.2	48.2	43.8	38.3	5.9**	48.5	45.2	3.2*

Commercial Assessment

Results presented above illustrate the comparison between cut and round seed yields but do not reflect the difference when the differential costs of seed types are taken into account. In this section a comparison is made on the financial returns from the use of round and cut seed in the winter and spring trials at Gatton Research Station and in the district trials. In the Gatton Research Station trials, only the comparison between cut and round seed at the 25 cm spacing for each of the varieties is presented as this was the only spacing at which both seed types were planted.

To allow the comparison, seed costs for a hectare were calculated on current seed costs. Round seed costs were based on ungraded round seed (35-150 g) as this was the only commercial round seed available at the time.

Determination of differential seed costs

The number of seed pieces required to plant a hectare at 25 cm spacings in 75 cm wide rows is 52 000. In a 50 kg bag there is an equivalent of 1 000, 50 g seed pieces. The costs of a tonne of certified seed at the time of the experiment (1994/95 was $365). The costs of a tonne of round seed (35-150 g) was $450 (550 seed/bag). Freight per tonne from Victoria to Gatton was $120 per tonne. On a per 50 kg bag basis, the costs for cut seed in the Lockyer was $25.25 which includes $1.00 per bag for cutting. The costs of a bag of round seed delivered was $28.50. To calculate the costs for the Kairi site an additional $50 per tonne freight was included.

In Table 11 the number of bags of round and cut seed and the equivalent costs (including freight and cutting costs) for the various spacings are presented.

Table 11. Relative cost ($) of cut and round seed delivered to Lockyer Valley when planted at a range of spacings.

SEED TYPE	SPACING (cm)							
	20		25		32.5		40	
	Bags	$ Cost	Bags	$ Cost	Bags	$ Cost	Bags	$ Cost
Round	118	3363	95	2708	73	2081	59	1682
Cut	66	1667	52	1313	40	1010	33	833
Difference		1696		1395		1071		849
Equivalent (tonnes) *		5.7		4.7		3.6		2.8

* This refers to the equivalent number of tonnes that have to be produced to get the same return from the crop assuming a price of $300 per tonne for the crop. Similarly a comparison between spacings for a particular seed type can be determined e.g. the extra cost of round seed for the 20 cm spacing over the 40 cm spacing is $1 681 or 5.6 tonnes.

Winter and spring trials at Gatton Research Station

Comparisons between the returns on No. 1 grade yield (80-350 g) for the winter and spring plantings are presented in Figure 1. The equivalent data for the 80-450 g grade is presented in Figure 2. From Figure 1 it can be seen that round seed produced advantageous returns in the variety Winlock but the reverse occurred for Pontiac. For Sequoia and Exton there was a marginal advantage in using round seed. In the spring comparison there was a distinct advantage of round seed over cut seed in Atlantic and Sebago and to a lesser extent in Pontiac.

In Figure 2 when the extra grade (350-450 g) was included for the winter planting the differential between cut and round seed was not as marked because of the relative increase in tubers in this grade from round seed. With the addition of the extra grade in the spring planting the advantage was slightly reduced due to the relative increase in production of tubers in this grade across the three varieties with the use of cut seed.

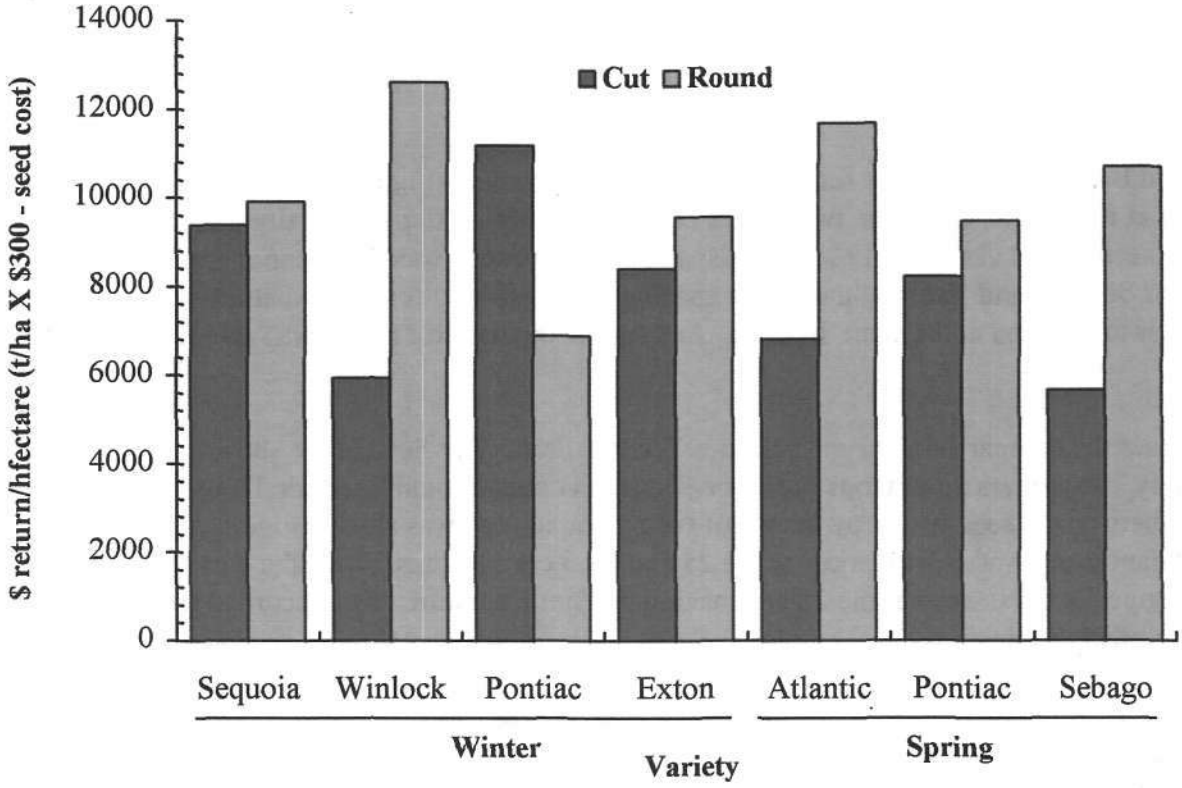

Figure 1 Comparative returns from the use of cut and round seed of various varieties when planted at 25cm spacings in 75cm wide rows. Returns for tubers in the 80-350g grade size are presented.

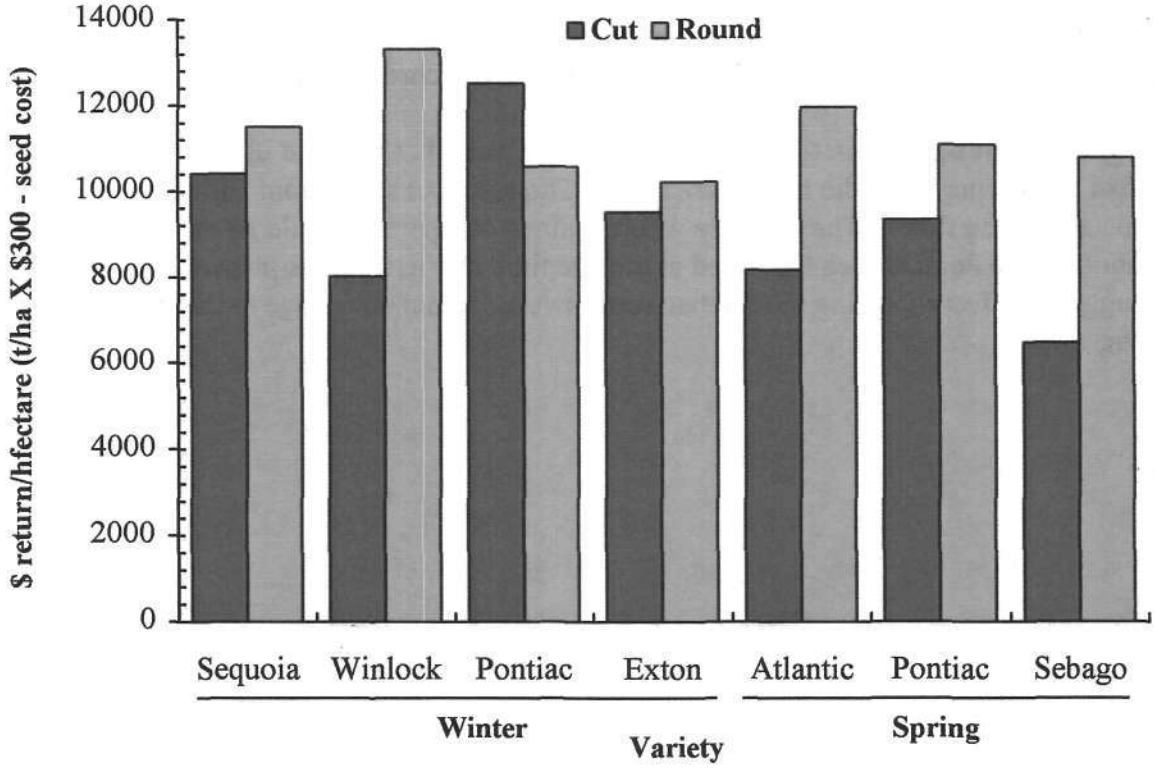

Figure 2 Comparative returns from the use of cut and round seed of various varieties when planted at 25cm spacings in 75cm wide rows. Returns for tubers in the 80-450g grade size are presented.

District Sites

At Redland Bay the comparisons for Sequoia (Figure 3), Pontiac (Figure 4) and Exton (Figure 5) are illustrated at four spacings for the two grades 80-350 g and 80-450 g. Generally there was an advantage to use round seed for all varieties at the 25 cm spacing, but cut seed was the cheaper option at the 20 cm spacing for Sequoia and Exton at the 20 cm spacing. Interestingly round seed at the widest spacing was for superior to cut seed at the same spacing. At this spacing the best return was achieved with Sequoia and Exton.

At Grantham the comparisons for the varieties Trent, Atlantic and Sebago are shown in Figures 6, 7 and 8 respectively. There was no obvious difference between cut and round seed for Trent except at the 40 cm spacing where round seed was superior to cut seed. Round seed was always superior to cut seed in the variety Atlantic and was most marked at the 25 and 32.5 cm spacings. With the variety Sebago, round seed was superior to cut seed at the 25 cm spacing but similar returns were recorded from cut and round seed at the other spacings.

The comparitive returns between cut and round seed at the Gatton site is shown in Figure 9 (Pontiac), Figure 10 (Red la Soda) and Figure 11 (Sebago). In Pontiac, round seed was superior and most pronounced in the 32.5 cm spacing. With Red la Soda, cut seed gave slightly better returns at the closer spacings with this trend being reversed in the wider spacings. The 32.5 cm spacing again gave the superior returns. Little difference occurred between cut and round seed for Sebago at the Gatton site.

Generally the cut seed treatments gave better returns than the round seed at the North Queensland site at Kairi where Sebago (Figure 12), Pontiac (Figure 13) and Atlantic (Figure 14) were evaluated.

At each of the three South Queensland sites the average returns over the four spacings was always greater from round seed regardless of variety. The opposite to this was recorded in North Queensland.

The physiological age of the seed in the various district sites varied as the seed used was the seed the co-operator had at the time when the trials were sown. The seed had come from various sources and had been harvested at varying times. The only site where a direct comparison could be made was at Gatton Research Station where Pontiac seed harvested at the one time in Victoria was planted in a winter and a spring planting. The effect of ageing the Pontiac seed gave a distinct advantage to the round seed in the spring planting.

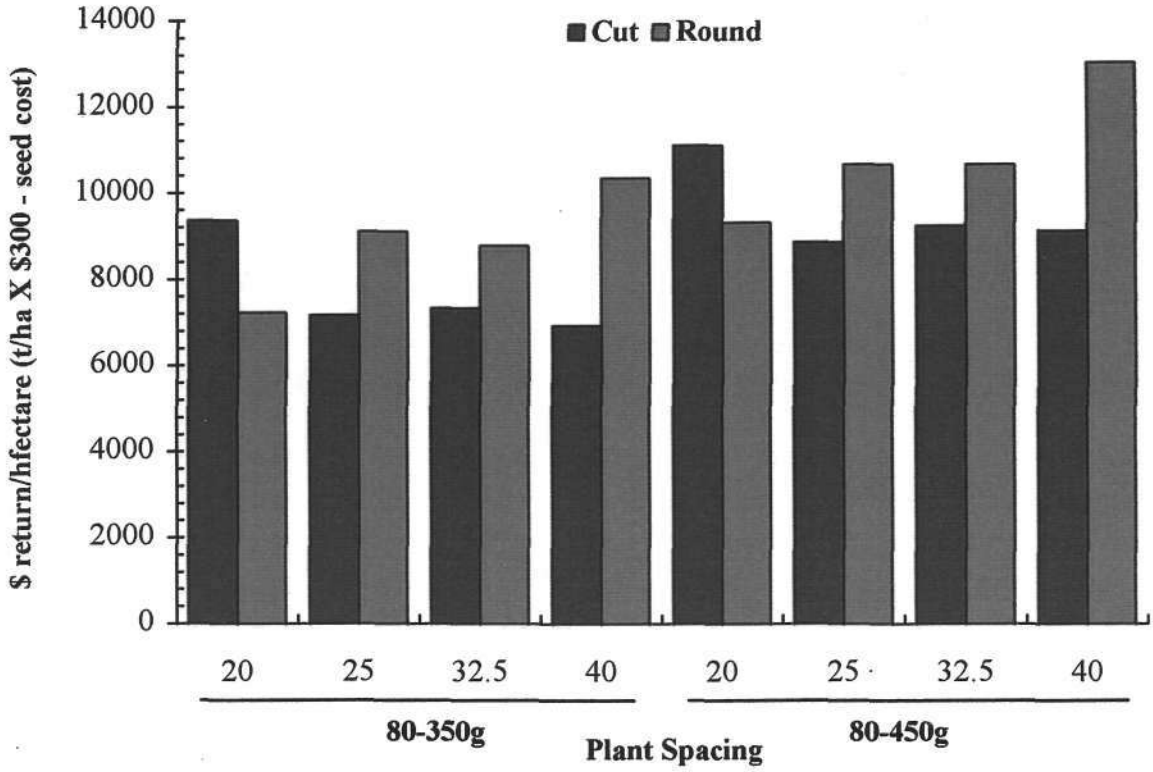

Figure 3 Comparative returns from cut and round seed of Sequoia grown at Redland Bay at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

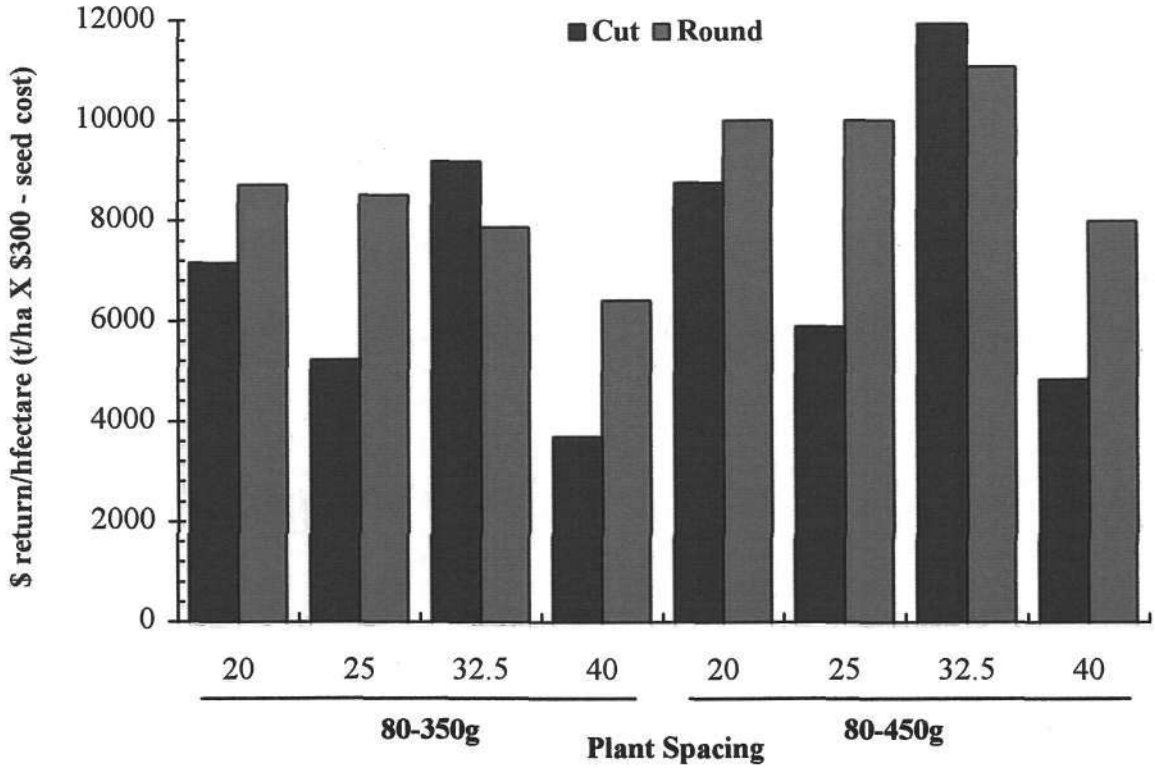

Figure 4 Comparative returns from cut and round seed of Pontiac grown at Redland Bay at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

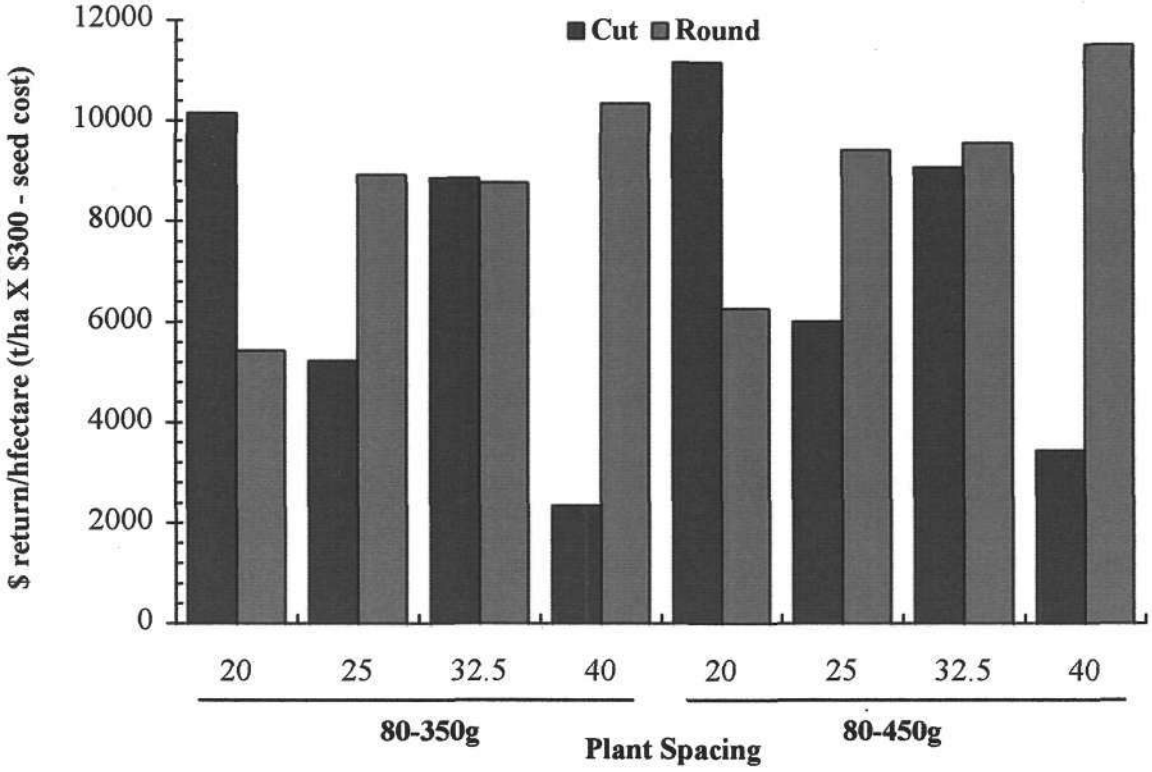

Figure 5 Comparative returns from cut and round seed of Exton grown at Redland Bay at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

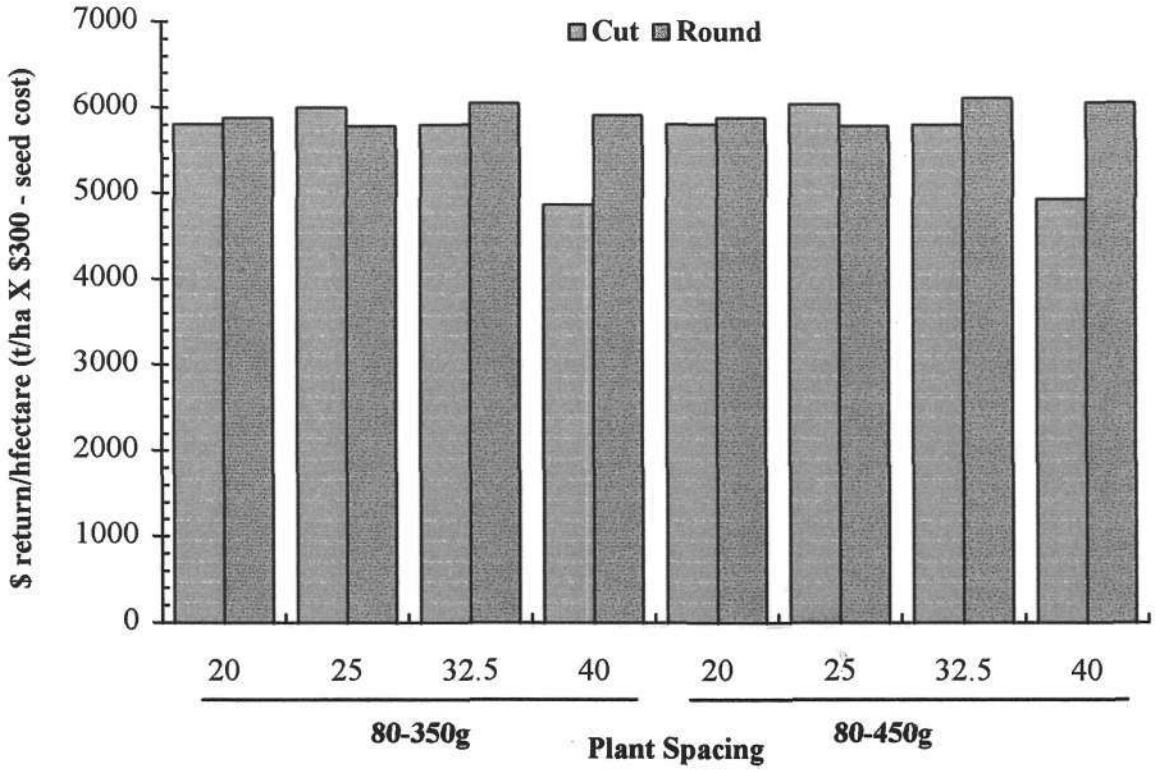

Figure 6 Comparative returns from cut and round seed of Trent grown at Grantham at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

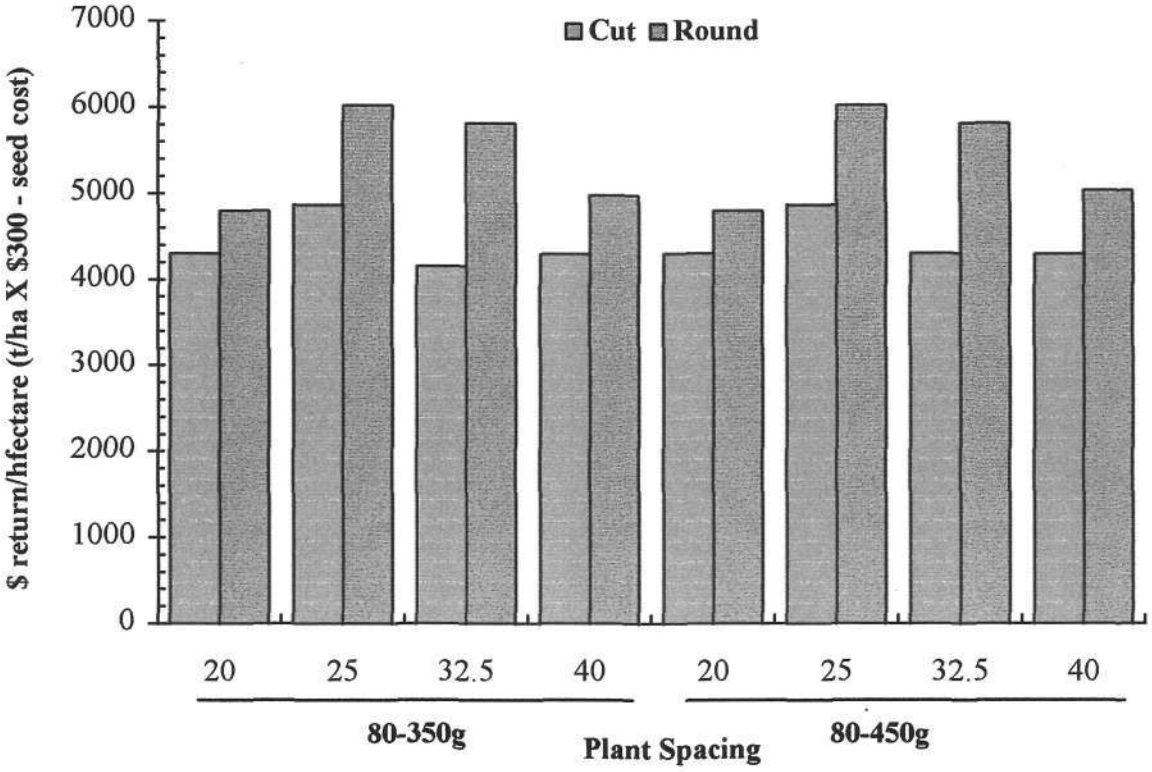

Figure 7 Comparative returns from cut and round seed of Atlantic grown at Grantham at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

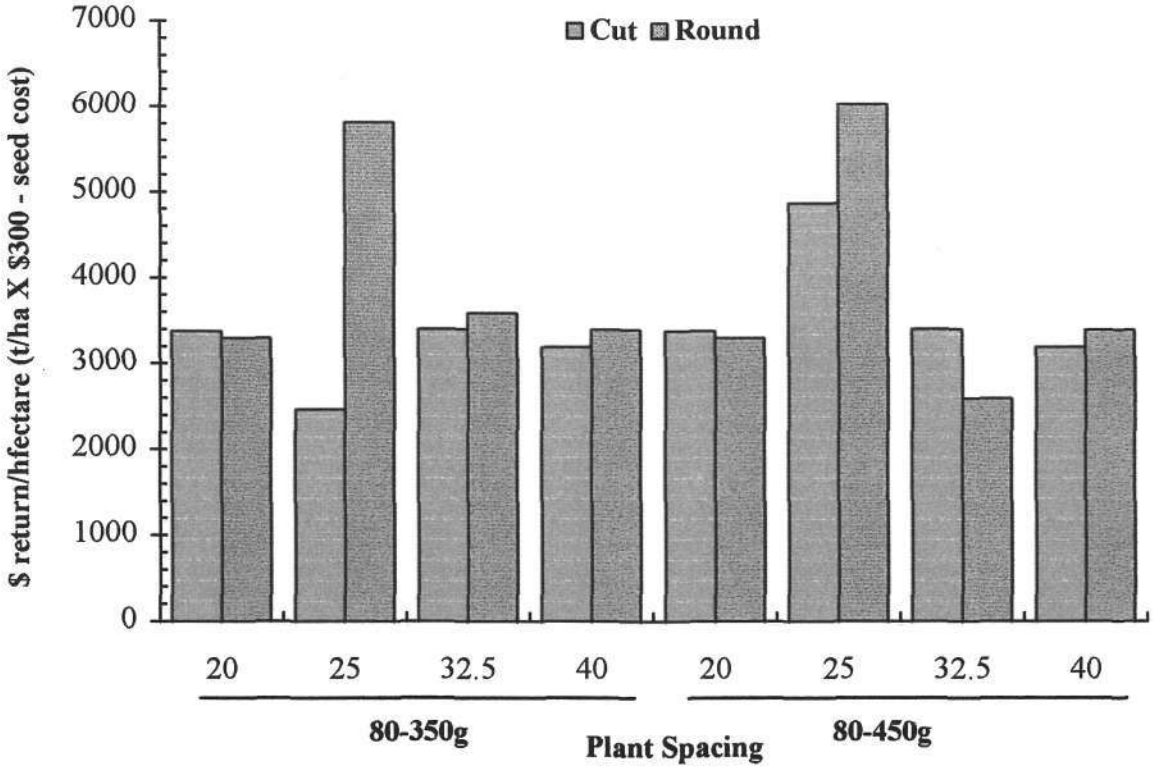

Figure 8 Comparative returns from cut and round seed of Sebago grown at Grantham at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

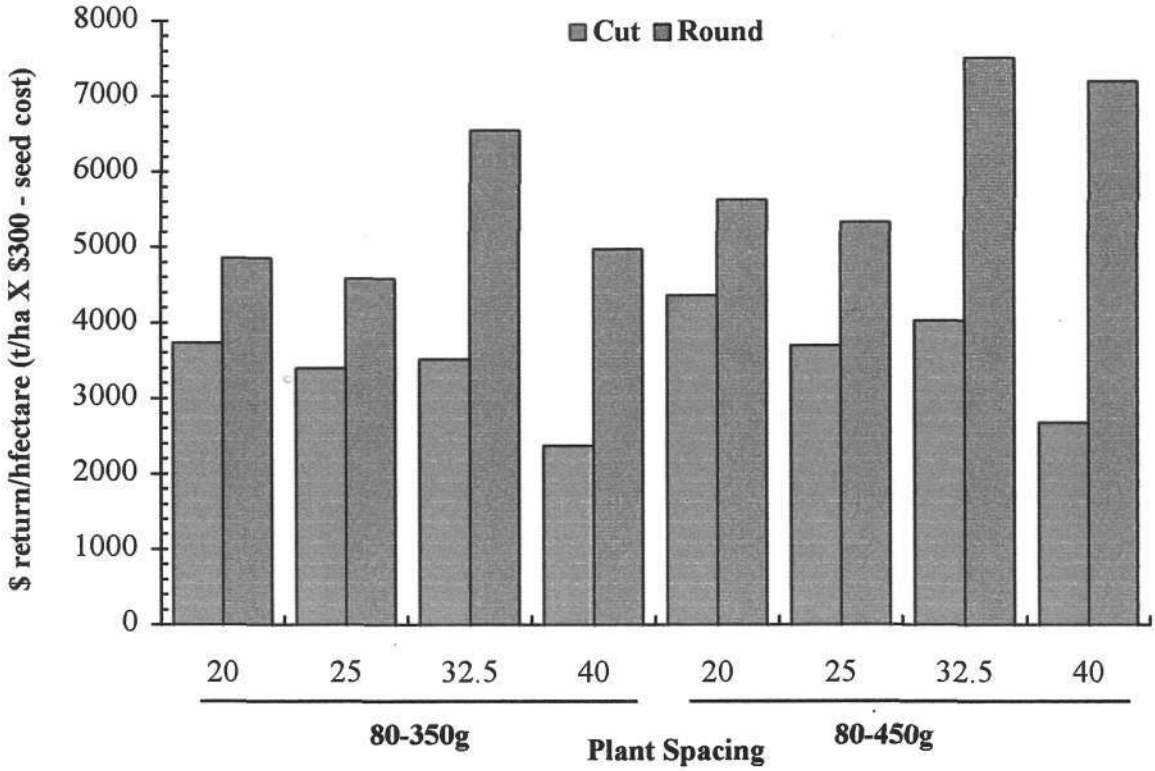

Figure 9 Comparative returns from cut and round seed of Pontiac grown at Gatton at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

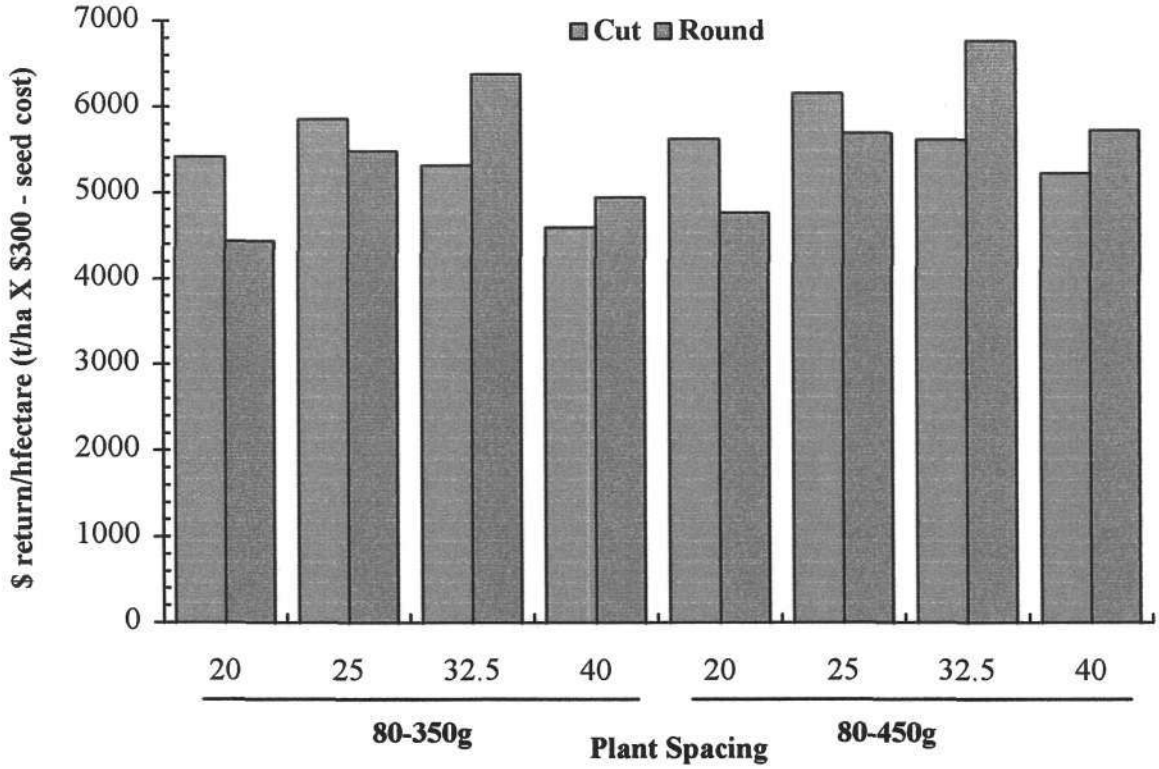

Figure 10 Comparative returns from cut and round seed of Red la Soda grown at Gatton at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

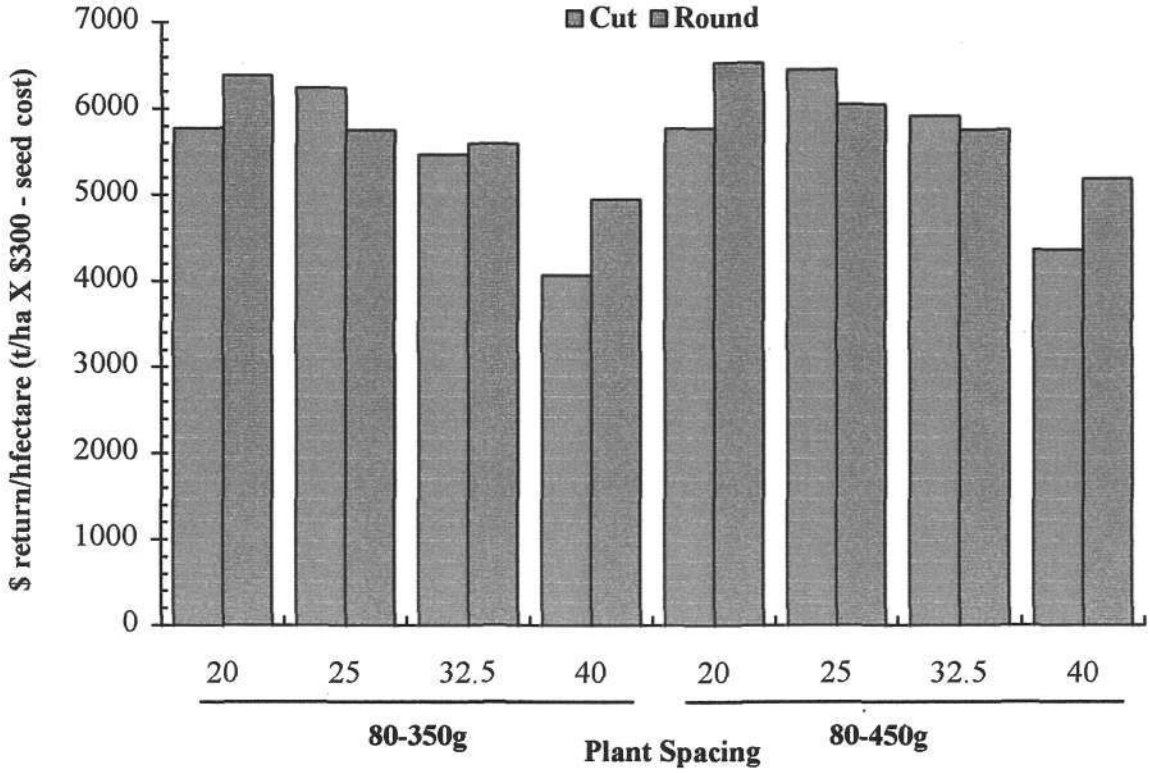

Figure 11 Comparative returns from cut and round seed of Sebago grown at Gatton at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

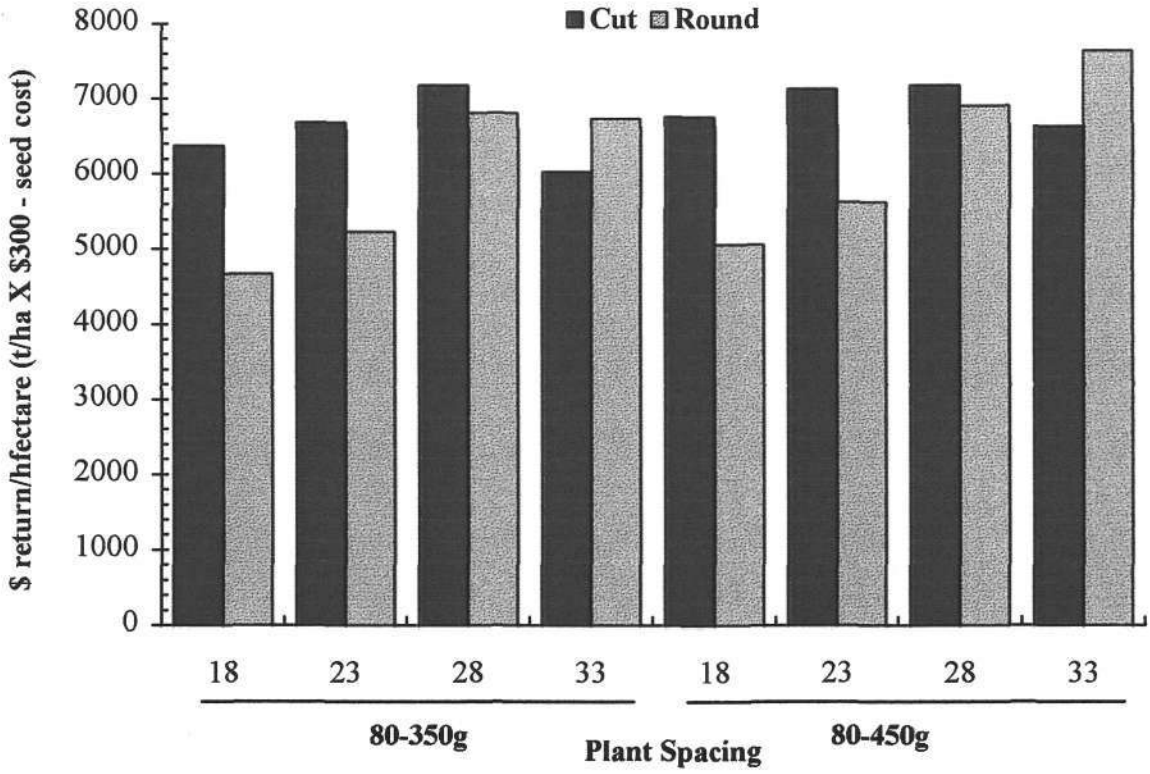

Figure 12 Comparative returns from cut and round seed of Sebago grown at Kairi (NQ) at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

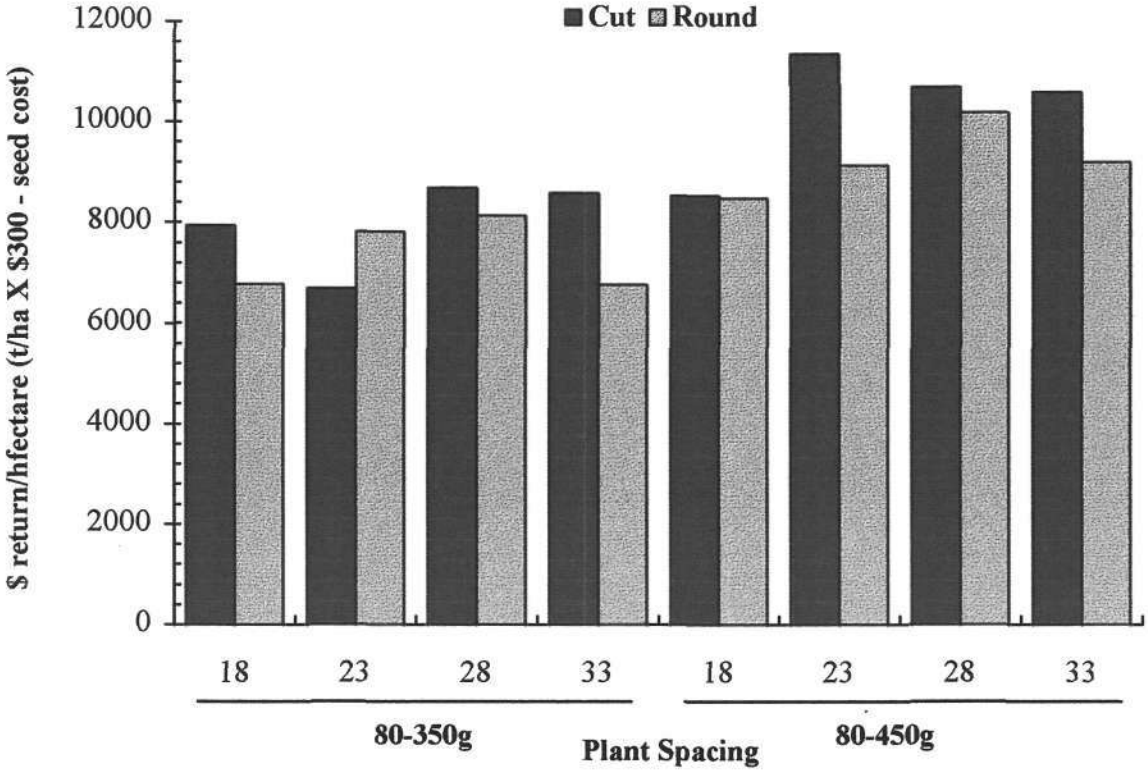

Figure 13 Comparative returns from cut and round seed of Pontiac grown at Kairi (NQ) at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

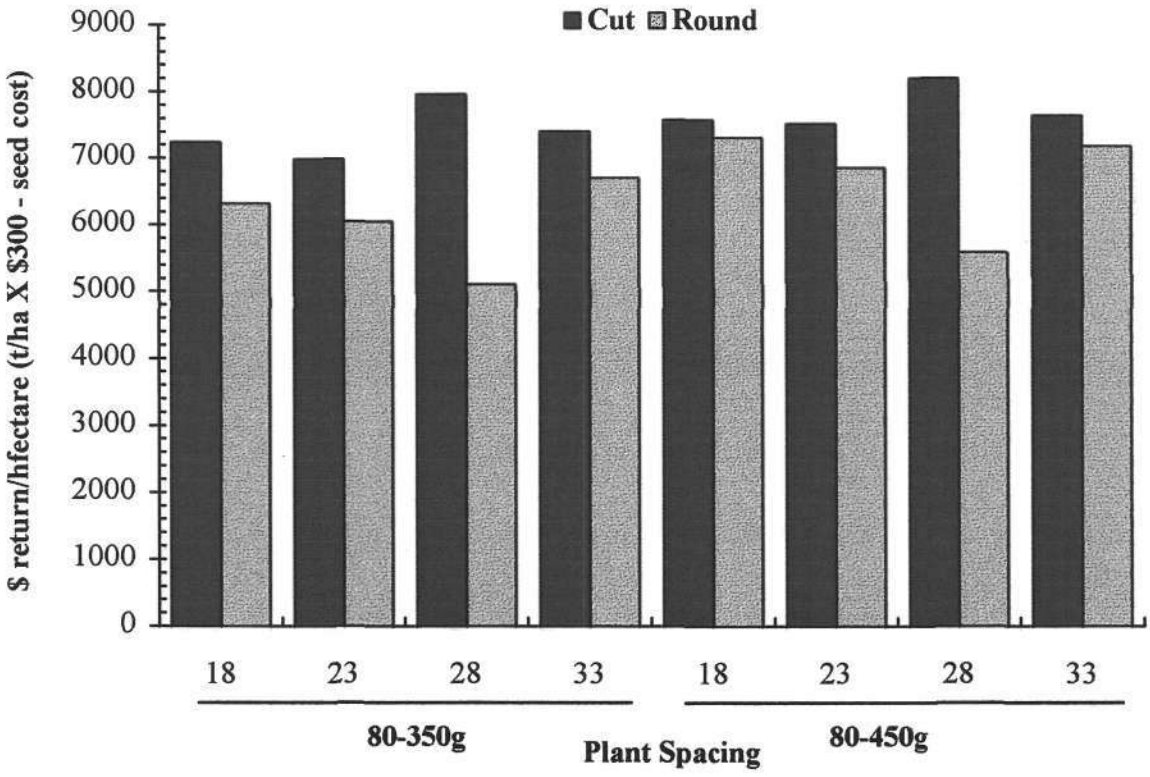

Figure 14 Comparative returns from cut and round seed of Atlantic grown at Kairi (NQ) at various spacings in 75cm wide rows. Returns for tubers in the 80-350g and 80-450g size ranges are presented.

General Conclusions

While large round seed (80-150 g) produced highest yields, there appears to be no advantage in grading round seed into two groups of small and large and planting separately as the ungraded seed treatment produced a similar yield to the mean of the yields obtained from the large and small grade seed treatments.

The advantage of round seed over cut seed appeared to increase with later plantings indicating the importance of ageing the seed to get the best performance from round seed.

Improved emergence was generally associated with round seed but the number of stems per seed piece was not always increased with the use of round seed. This again indicates the need for ageing the round seed to maximise performance.

Varieties react differently depending on spacing and seed size but interactions on differences in yield patterns resulting from different combinations of spacing and seed size were uncommon. Generally the 20-25 cm spacing with ungraded round seed (30-150 g) gave consistent high yields.

Although the performance of round seed over cut seed may be very apparent in terms of plant growth and vigour as well as increased yields, the economic advantage may be minimal once the extra costs of the use of round seed is taken into account. For example at a plant spacing of 25 cm an extra 4.7 t/ha would need to be produced in S.E. Queensland assuming present differential seed costs between cut and round seed and an on-farm return of $300.00 per tonne for No. 1 grade tubers.

The fact that cut seed generally outperformed round seed in the winter planting compared to the spring planting at Gatton Research Station and in N Queensland indicates that ageing of the seed is important in deriving the full benefits of round seed. The seed for the winter planting and the N Queensland planting would have been physiologically younger seed because of the need to plant early.

General Discussion

Extension/adoption by industry

Results of the project have been presented to grower meetings and in extension publications. While round seed gave increased returns in many instances in the trial work, there was no conclusive evidence that the use of round seed for all varieties will always out-perform cut seed. Round seed is almost used exclusively by processing growers because of the advantages of round seed with the variety Atlantic. The use of round seed with this variety in the trial work was shown to be advantageous. Cut seed of Atlantic appear to be more susceptible to breakdown than many other varieties plus the use of round seed provides more control over tuber size which is particularly important for the processing industry.

A number of fresh market growers are experimenting with a small amount of round seed. Many see the benefits of yield improvement but they may not be aware that they need an extra 4-5 t/ha at a 25 cm plant spacing from round seed to cover the additional cost of using this seed in preference to cut seed.

Producers are aware of the ongoing studies on the effect of physiological age on the performance of round seed and some growers are recognising the need to arrange to have round seed produced earlier to optimise the physiological age of their seed for their particular planting times.

Direction for future research

The assessment of round seed indicated the need for a study to be undertaken which will examine the effect of physiological age on the performance of cut and round seed. It appears that unless the round seed is aged sufficiently to allow multiple sprouting, the performance of the seed may not be superior to cut seed. A study which is evaluating varying physiological ages of seed of various varieties is now underway at Gatton Research Station. This study will be extended to other sites in Queensland in the latter stages of the project provided funding is forthcoming.

Financial/commercial benefits

The economic analyses indicated that increased returns as high as $3 600/ha could be achieved (average advantage of 3 varieties for 80-350 g grade planted as a spring crop at Gatton Research Station, Figure 2) by using round seed in place of cut seed. The problem persists that there is no consistent advantage associated with the use of round seed. The study on the effect of physiological age on the performance of round seed should clarify the role of round seed. If it can be shown that consistent improved returns can be made, it is likely that the seed industry could improve production technology to reduce the cost of production of this type of seed.

Acknowledgements

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Jackson, K.J., Duff, A.A., and Kerr, J. (1994). An evaluation of round seed for Pontiac production in S.E. Queensland. *Potato Australia.* **5**:29-31.

Jackson, K.J., Duff, A.A., and Kerr, J. (1994). Seed age - A major factor determining spacing of round seed to maximise No. 1 grade yield. *National Potato Industry Conference, Adelaide*, pp. 54-55.

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Farmers meetings were held in the Lockyer Valley and Redland Bay to communicate results of the Research Station trials. Results were also communicated to North Queensland for use by extension staff.

APPENDIX I

WINTER WHOLE SEED TRIAL 1993

Yield of Tubers <80g - t/ha. (LSD 5% = 1.3)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	4.3	5.1	3.9	2.7	3.0	3.4	3.9	2.9	3.2	2.9	2.1	2.2	2.3
Winlock	8.2	9.7	10.2	2.3	6.6	8.7	7.1	5.2	6.1	5.2	3.6	6.3	5.2
Pontiac	2.6	3.6	3.0	4.3	2.0	3.1	2.3	2.4	2.9	2.4	1.7	1.8	2.2
Exton	4.2	4.1	4.1	2.9	3.7	2.8	3.6	2.5	2.4	3.2	2.0	2.2	2.1

Yield of Tubers 80-350g - t/ha (LSD 5% = 5.1)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	43.7	45.5	46.8	35.7	36.6	42.1	34.7	31.2	36.7	32.2	26.1	31.3	25.7
Winlock	45.6	49.8	55.9	24.7	38.7	51.1	43.9	39.1	43.3	39.5	31.0	39.9	40.4
Pontiac	31.9	31.2	30.7	41.7	29.1	32.0	29.2	23.4	23.9	21.6	16.1	23.1	20.0
Exton	33.7	38.7	38.7	32.4	29.2	40.9	39.0	28.8	29.3	29.1	27.6	28.2	24.5

Yield of Tubers 350-450g - t/ha (LSD 5% = 3.7)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	2.2	4.1	3.4	3.3	5.8	5.3	5.8	5.7	6.5	7.2	6.4	4.1	6.7
Winlock	3.1	2.3	0.6	6.9	4.9	2.3	3.1	4.5	3.2	6.5	8.6	4.0	4.2
Pontiac	9.3	10.0	9.7	4.4	8.2	12.3	10.6	8.2	9.8	10.9	7.2	6.3	9.0
Exton	2.5	2.2	2.8	3.7	2.5	2.2	1.3	3.0	4.6	3.7	3.2	5.2	6.9

Yield of Tubers >450g - t/ha (LSD 5% = 5.2)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	1.4	1.6	1.5	0.7	2.2	3.0	3.2	5.8	4.8	4.4	6.7	7.0	7.9
Winlock	1.1	1.0	0.7	16.1	1.8	0.4	2.0	3.3	2.5	4.7	5.4	2.2	3.5
Pontiac	10.4	20.9	19.6	1.8	17.7	16.3	17.1	16.9	24.2	19.4	22.1	24.4	19.9
Exton	0.0	0.6	0.2	0.9	0.7	0.9	0.2	0.7	3.5	3.9	1.7	2.0	2.8

Total Yield - t/ha (LSD 5% = 5.6)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	51.6	56.4	55.6	42.5	47.6	53.8	47.6	45.6	51.2	46.7	41.4	44.7	42.5
Winlock	58.0	62.8	67.5	49.7	51.9	62.6	56.1	52.1	55.0	55.9	48.6	52.4	53.3
Pontiac	54.2	65.7	63.0	52.2	57.0	63.7	59.3	50.9	60.9	54.3	47.1	55.7	51.1
Exton	40.5	45.7	45.7	40.0	36.1	46.8	44.1	35.1	39.8	39.9	34.0	37.6	36.3

Number of Tubers <80g per Plant (LSD 5% = 0.5)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	1.2	1.5	1.1	1.0	1.1	1.2	1.4	1.2	1.5	1.4	1.2	1.3	1.3
Winlock	2.6	3.0	3.1	1.0	2.4	3.2	2.7	2.6	2.9	2.3	2.3	3.9	3.1
Pontiac	0.8	1.0	0.9	1.6	0.8	1.0	0.8	1.1	1.5	1.1	1.0	1.1	1.3
Exton	1.2	1.2	1.2	1.1	1.6	1.1	1.4	1.2	1.2	1.6	1.1	1.4	1.2

Number of Tubers 80-350g per Plant (LSD 5% = 0.8)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	3.9	3.9	4.3	3.7	3.9	4.5	3.8	4.0	4.9	4.7	4.1	4.9	4.5
Winlock	4.3	4.9	5.0	2.3	3.6	5.8	5.4	5.3	6.2	5.4	5.1	6.9	6.9
Pontiac	2.5	2.4	2.3	4.4	2.6	3.1	2.6	2.7	2.7	2.7	2.4	3.3	3.1
Exton	3.2	3.5	3.6	3.7	3.5	4.3	4.3	4.1	4.2	4.0	4.6	4.7	4.4

Number of Tubers 350-450g per Plant (LSD 5% = 0.2)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	0.1	0.2	0.1	0.2	0.3	00.3	0.3	0.3	0.4	0.4	0.5	0.3	0.5
Winlock	0.1	0.9	0.1	0.3	0.2	0.1	0.1	0.3	0.2	0.4	0.7	0.3	0.3
Pontiac	0.4	0.4	0.4	0.2	0.4	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.7
Exton	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.3	0.2	0.4	0.4	0.5

Number of Tubers >450g per Plant (LSD 5% = 0.2)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.4	0.3	0.4
Winlock	0.0	0.0	0.0	0.5	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.2
Pontiac	0.3	0.5	0.5	0.1	0.6	0.5	0.5	0.7	1.0	0.8	1.1	1.2	0.9
Exton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.2

Number of Tubers per Plant (LSD 5% = 0.8)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	5.2	5.6	5.6	4.9	5.4	6.0	5.6	5.8	7.0	6.8	6.2	6.8	6.8
Winlock	7.0	8.0	8.1	4.1	7.3	9.1	8.4	8.4	9.4	8.4	8.3	11.3	10.3
Pontiac	3.9	4.3	4.0	6.2	4.3	5.2	4.5	5.0	5.8	5.2	5.0	6.1	5.9
Exton	4.6	4.8	4.9	5.0	5.3	5.6	5.8	5.5	5.8	6.0	6.2	6.6	6.3

Percent Emergence (LSD 5% = 3.6)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	98.7	99.4	97.4	99.2	96.0	97.6	98.4	97.9	99.0	97.9	98.7	98.7	96.2
Winlock	98.1	100	99.4	96.0	97.6	100	100	100	100	100	98.7	100	100
Pontiac	98.7	99.4	98.7	98.4	100	100	99.2	100	100	100	100	100	100
Exton	97.4	96.2	100	95.2	98.4	100	99.2	92.7	96.9	96.9	98.7	98.7	96.2

Number of Stems per Plant (LSD 5% = 0.4)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Sequoia	1.4	1.4	1.3	1.1	1.2	1.2	1.2	1.2	1.5	1.6	1.6	1.6	1.5
Winlock	1.4	1.6	1.3	1.4	1.4	1.7	1.8	1.6	1.8	1.5	1.6	1.9	1.8
Pontiac	1.6	1.6	1.7	1.3	1.6	2.0	1.7	1.7	2.2	1.6	1.9	2.0	1.7
1.6o1.2	1.2	1.4	1.3	1.6	1.2	1.3	1.2	1.3	1.5	1.6	1.5	1.6	1.5

APPENDIX II

SPRING WHOLE SEED TRIAL 1993

Yield of Tubers <80g - t/ha. (LSD 5% = 1.5)

Seed Spacing	20cm				25cm			32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	5.9	10.2	7.0	2.7	5.1	7.5	6.5	3.1	5.9	4.1	3.4	4.3	3.3
Pontiac	6.9	8.1	8.1	4.2	5.4	7.2	6.6	4.1	4.8	5.4	3.1	3.6	3.4
Sebago	6.5	6.9	6.3	2.6	5.4	5.9	5.1	3.4	3.8	4.4	2.7	3.5	2.8

Yield of Tubers 80-350g - t/ha (LSD 5% = 5.2)

Seed Spacing	20cm				25cm			32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	45.9	47.4	48.3	27.1	40.1	48.0	45.7	37.2	48.0	41.7	35.5	47.1	42.5
Pontiac	43.0	49.8	46.0	31.2	38.5	40.6	40.7	35.3	38.8	40.6	37.7	36.6	37.9
Sebago	45.9	51.2	48.6	33.3	43.3	44.7	43.2	38.6	46.5	38.7	37.7	38.7	35.9

Yield of Tubers 350-450g - t/ha (LSD 5% = 2.2)

Seed Spacing	20cm				25cm			32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	0.2	0.2	0.3	4.5	0.7	0.9	0.3	1.0	1.1	1.1	3.1	1.5	1.7
Pontiac	2.8	2.1	5.0	3.7	4.4	5.4	6.0	5.5	6.1	3.6	5.0	6.5	6.0
Sebago	0.8	0.3	0.3	2.8	1.5	0.3	1.0	2.3	1.6	2.0	2.5	3.8	2.1

Yield of Tubers >450g - t/ha (LSD 5% = 1.7)

Seed Spacing	20cm				25cm			32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	0.0	0.0	0.0	1.1	0.9	0.0	0.7	0.0	0.0	0.2	0.0	0.4	0.2
Pontiac	1.3	1.3	1.5	3.0	2.5	3.5	4.0	3.2	3.9	3.8	2.1	4.5	2.4
Sebago	0.0	0.7	0.0	0.8	0.0	0.0	0.4	0.6	0.0	1.0	0.4	0.4	0.4

Total Yield - t/ha (LSD 5% = 4.5)

Seed Spacing	20cm				25cm			32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	52.0	57.7	55.6	35.4	46.7	56.5	53.2	41.2	55.0	47.2	42.0	53.4	47.7
Pontiac	54.0	61.4	60.7	42.6	50.8	56.7	57.3	48.0	53.7	53.4	47.9	51.2	49.7
Sebago	53.2	59.1	55.2	29.5	50.2	50.9	49.8	44.9	51.9	46.1	43.3	46.4	41.2

Number of Tubers <80g per Plant (LSD 5% = 0.7)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	1.8	2.6	2.1	1.5	1.8	2.7	2.5	1.4	2.8	1.9	1.9	2.6	2.1
Pontiac	2.0	2.5	2.6	1.6	2.3	2.7	2.7	2.3	2.5	3.0	1.9	2.2	2.4
Sebago	1.9	2.0	1.7	1.4	1.9	2.1	1.9	1.7	1.8	2.1	1.6	1.9	1.6

Number of Tubers 80-350g per Plant (LSD 5% = 0.8)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	4.6	5.0	5.0	4.5	4.8	5.9	5.7	5.4	7.0	6.2	6.2	8.6	6.9
Pontiac	4.1	4.6	4.4	3.6	4.0	4.7	4.5	4.9	5.3	5.7	5.8	6.0	6.3
Sebago	4.5	5.1	4.7	3.7	5.0	5.4	5.0	5.7	6.7	5.8	6.2	6.7	6.6

Number of Tubers 350-450g per Plant (LSD 5% = 0.1)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.1	0.1
Pontiac	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.2	0.3	0.5	0.4
Sebago	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.1	0.2	0.3	0.2

Number of Tubers >450g per Plant (LSD 5% = 0.1)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pontiac	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.2	0.1
Sebago	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

Number of Tubers per Plant (LSD 5% = 1.1)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	6.3	7.6	7.1	6.5	6.6	8.7	8.3	6.8	9.8	8.2	8.4	11.3	9.1
Pontiac	6.2	7.2	7.2	5.4	6.6	7.8	7.7	7.7	8.3	9.0	8.1	8.9	9.3
Sebago	6.4	7.1	7.2	5.3	7.0	7.5	6.9	7.6	8.7	8.0	8.0	8.9	8.4

Percent Emergence (LSD 5% = 4.4)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	100	100	100	66.7	99.2	100	99.2	100	100	99.0	97.4	100	98.7
Pontiac	100	100	100	96.0	99.2	100	100	100	100	100	100	100	100
Sebago	98.1	99.4	100	75.4	99.2	99.2	99.2	97.9	100	97.9	100	100	98.7

Number of Stems per Plant (LSD 5% = 0.8)

Seed Spacing	20cm			25cm				32.5cm			40cm		
Seed Size	35	101	150	Cut	35	101	150	35	101	150	35	101	150
Atlantic	1.7	2.3	2.4	1.9	2.0	2.9	2.3	1.8	3.1	2.3	1.8	2.3	3.0
Pontiac	2.2	3.1	2.6	1.8	2.5	2.8	2.6	2.7	3.1	2.4	2.6	3.1	3.3
Sebago	2.6	3.6	3.0	2.0	2.4	3.2	2.6	2.4	2.6	2.7	2.5	3.1	3.0

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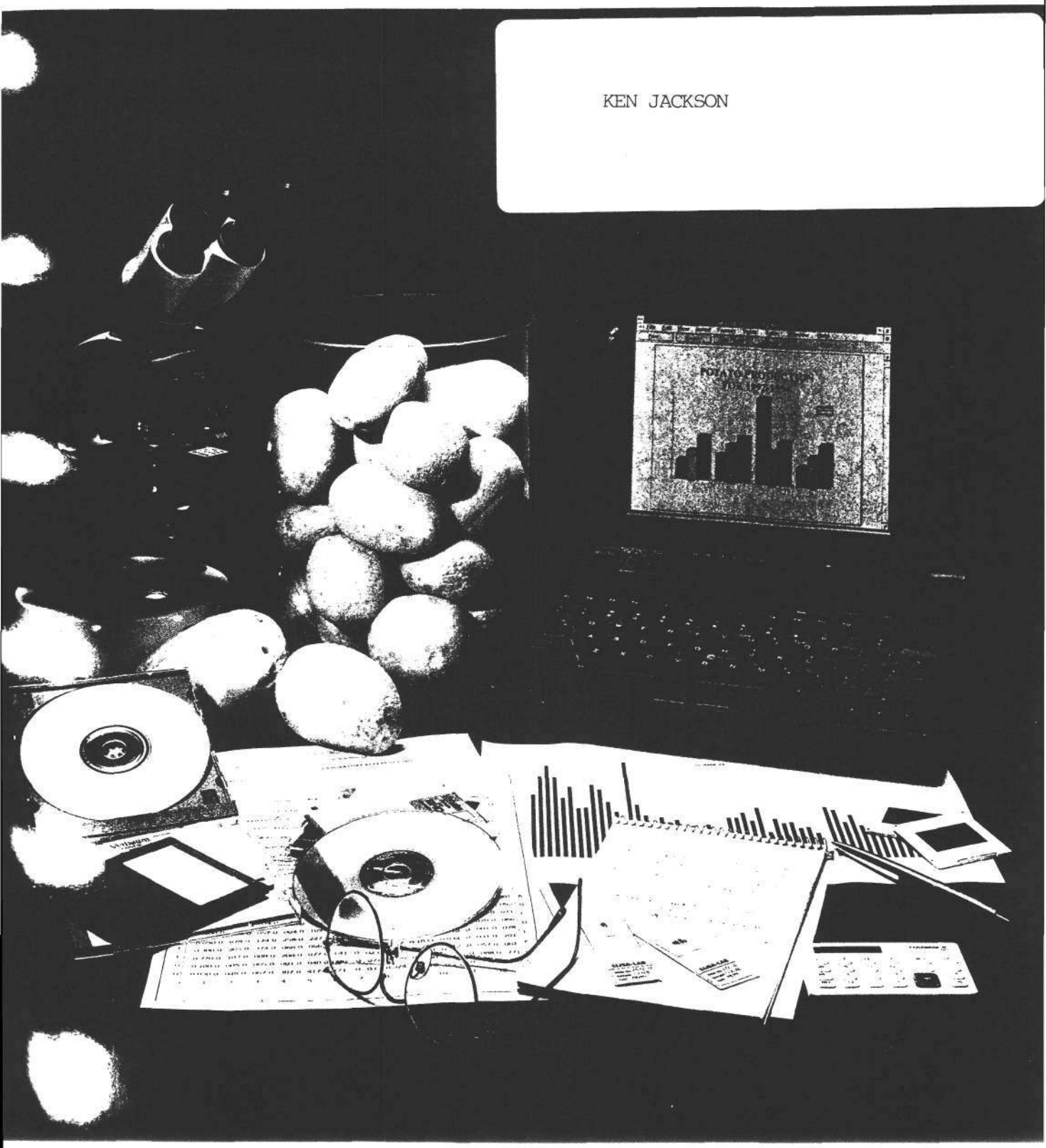

An Evaluation of Round Seed for Pontiac Production in S.E. Queensland

Joe Luck covering hand planted round seed spacing trial at Gatton Research Station

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Pontiac is a high quality, fresh market potato provided its size can be controlled and bright skin colour retained.

Pontiac is the main red skinned variety grown in Queensland and in the recent consumer survey on potatoes, it was one of the few potatoes known by name. Presently, it accounts for 15% of Queensland's fresh market production. The variety is widely adapted and high yielding. However, high yields are often achieved by a large proportion of oversize tubers (greater than 350g). Tubers in this size range are much less attractive because of their deep eyes which result in excess peeling losses.

Pontiac was one of the varieties included in a round seed assessment trial conducted by the Queensland Department of Primary Industries at Gatton Research Station in the Lockyer Valley. Although other varieties were assessed, this article solely refers to the findings related to the use of whole seed in Pontiac. Yields within various grades were measured and the costs of using whole seed are examined.

EXPERIMENTAL DETAILS

Certified whole seed harvested in Victoria in March 1993 were received in Queensland in April. Three, round seed sizes (30-80, 80-150 and 30-150g) were planted at four plant spacings (20, 25, 32.5 and 40cm) at two planting times 18/5/93 (winter crop) and 29/6/93 (spring crop).

On arrival of the certified seed, the portion required for the winter crop was graded and held at ambient temperature for two weeks prior to planting. The portion for the spring crop was cool stored (4°C) for 1 month prior to preparation for planting. Seed for the autumn crop (planted 17/3/94) was selected from the harvest of the spring crop in October 1993 and cool stored for four months before planting in the same seed sizes and spacings as the previous two trials.

In each of the plantings a cut seed treatment was included at the 25cm spacing. All three plantings were allowed to senesce before harvest as this is the common commercial practice in Queensland. At harvest tubers were graded into small (less than 80g), No. 1 grade (80-350g) and oversize (greater than 350g).

EFFECT OF SEED SIZE

Analysis of the effect of seed size indicated that there was little difference between 30-150g and 80-150g, but these two seed sizes were consistently better than 30-80g in terms of total and No. 1 grade yields regardless of plant spacing. As there was little difference between the larger two seed sizes, results from the 30-150g seed size at the various spacings are discussed below as this seed size is commercially available. A gross margin (gross return minus variable costs) can be calculated for the various plant spacings at all the planting dates using commercial seed costs.

EFFECT OF ROUND SEED SPACING ON YIELD COMPOSITION

Yield in Figure 1 is divided into No. 1 grade (80-350g), oversize (greater than 350g) and smalls (less than 80g).

Alan Duff (left) and Ken Jackson (right) insuring precise placement of tubers in a round seed spacing trial at Gatton Research Station.

It is evident that whole seed resulted in almost half the total yield in the winter planting being oversize regardless of plant spacing. In contrast, the oversize portion of the cut seed treatment was substantially less resulting in a greater yield of No. 1 grade despite a lower total yield.

In the spring planting where the same seed was kept another six weeks, oversize was not a problem in any of the treatments. No. 1 grade and total yields for all the round seed spacings were superior to the cut seed treatment indicating the benefit of ageing and cool storing the original seed.

In the autumn planting there was little difference between the cut seed treatment and the corresponding whole seed treatment, and little difference among the treatments for oversize production.

However, autumn plantings are often made earlier than in this trial and cut seed is normally not contemplated at this time because of the risk of high temperatures and increased rainfall at plantings in late January and February.

In fact the cut seed treatment had optimum conditions in all three plantings as little or no rain fell between planting and emergence. Losses up to 50% can occur in plant stands from seed piece break down of cut seed if excessive rainfall occurs on the heavier soils of the Lockyer between planting and emergence.

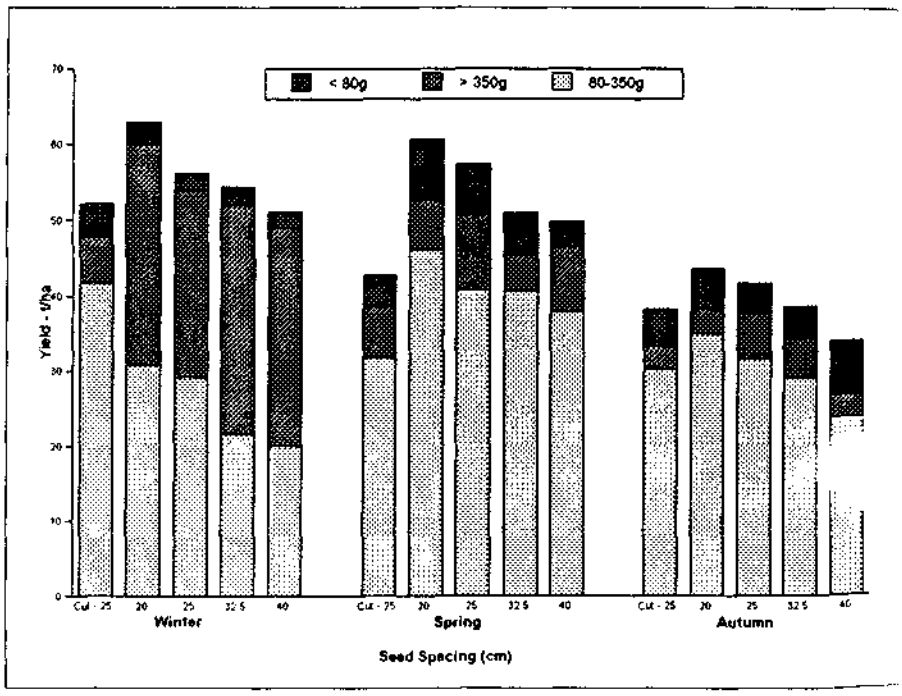

Figure 1: Composition of total yield of Pontiac potatoes grown from round seed (30-150g) at 20, 25, 32.5 and 40 cm spacings and cut seed (50g) at 25cm spacing in winter, sr and autumn growing seasons at Gatton Research Station.

EFFECT OF ROUND SEED SPACING ON NO. 1 YIELD

Figure 1 illustrates that as seed spacing was increased from 20cm to 40cm, No. 1 grade yield generally declined steadily. However, to determine if gross margins for this grade followed a similar trend, a gross margin analysis was conducted. The analysis takes into account all the variable production costs for each of the treatments. It allows for the extra cost of round seed over cut seed and the increased amount of seed required to plant at 20cm compared to the wider spacings.

GROSS MARGIN ANALYSIS

Figure 2 illustrates the gross margins for the various treatments at the three planting times. In winter, the cut seed treatment was superior while in the spring the round seed spacing at 20cm was slightly better than the round seed in the wider spacings. In the autumn round seed at 20cm was again better than round seed at wider spacings. Although the cut seed treatment performed well at this time, it is a high risk treatment for reasons mentioned above.

CONCLUSIONS

Generally, clear statements about the management of round seed in relation to maximising the yield of No. 1 grade tubers in Pontiac are difficult to make without further evaluation. As a result further trials are being undertaken. However, there is substantial evidence from the trials to date to suggest that:-

- unless planters are incapable of handling a mixture of round seed from 30-150g there appears to be no reason to separate smalls (30-80g) from larger seed (80-150g) and to have these two seed lots planted at different spacings
- round seed (30-150g) appear to give the best monetary returns from a 20cm spacing compared to wider spacings
- round seed needs to be aged to promote multiple sprouting to reduce oversizing or alternatively juvenile round seed may need to be harvested before vine maturity to minimise oversizing
- to maximise No. 1 grade yields from winter plantings certified round seed will need to be produced 4-6 weeks earlier than it is produced presently
- further comparisons of cut and round seed are needed particularly at the 20cm spacings

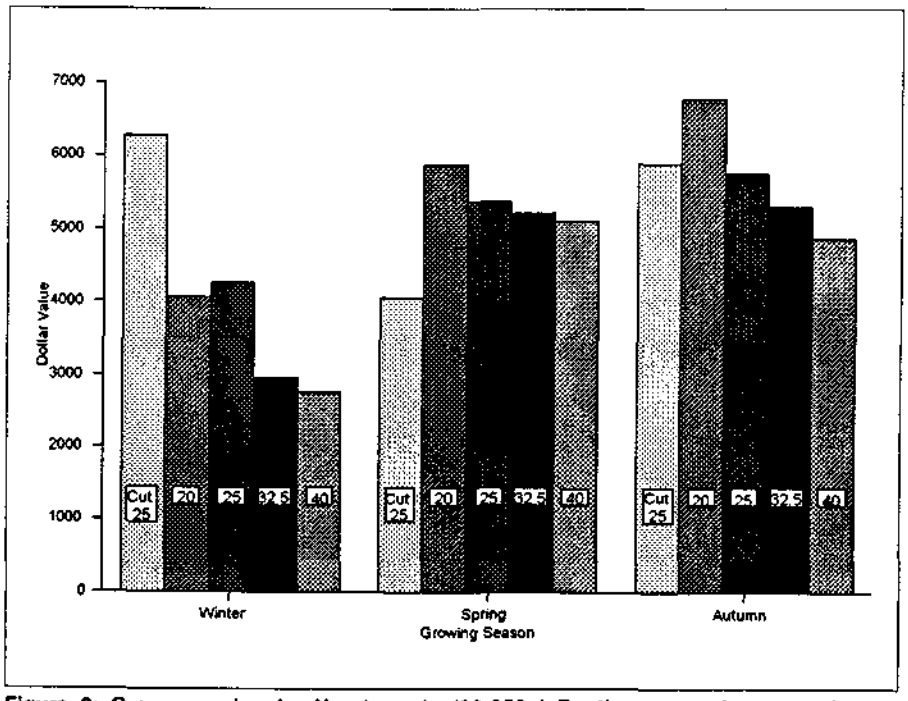

Figure 2: Gross margins for No. 1 grade (80-350g) Pontiac grown from round seed (30-150g) at 20, 25, 32.5 and 40cm spacings and cut seed (50g) at 25cm spacings in winter, spring and autumn growing season at Gatton Research Station.

George Pan (left) and Ken Jackson (right) check plan for round seed spacing trials at Gatton Research Station.

Queensland Fruit &
Vegetable Growers

1995 Research Report

Use of round seed in potato production

Introduction

Traditionally winter and spring potato crops in Queensland have been planted using cut certified seed. Round (whole) seed is now available from certified seed schemes, but the performance of such seed in Queensland has not been established.

Issues

Expected advantages of round seed over cut seed include less seed piece breakdown, less opportunity of disease entry through the seed piece, more stems per seed piece and more even plant stands. The overall advantage of round seed should translate into higher yields and a more even grade of potatoes. The use of round seed also eliminates the need for a seed dressing at planting resulting in less chemical usage.

Background

A number of varieties were evaluated in winter and spring plantings. In addition to comparing round and cut seed, trials investigated the best size and spacing for the round seed. Spacings of round seed evaluated were 20, 25, 32.5 and 40 cm and seed were divided into the following sizes: 30-80 grams (small), 80-150 grams (large) and 30-150 grams (ungraded). In the winter evaluation, Pontiac, Sequoia, Winlock and Exton were included while Sebago, Pontiac and Atlantic were tested in the spring planting. Factors considered also included the age of the seed and the number of eyes at planting.

Results

Cut vs whole seed at 25 cm spacing. All results have taken into account the price differential between cut seed and whole seed. In the winter planting (planted May 18, 1993) the advantage of whole seed varied with variety. No advantage was obtained with planting whole seed of Exton, Sequoia and Pontiac but there was an advantage by using whole seed for Winlock. In the spring planting (planted June 29, 1993) there was an economic advantage for planting whole seed compared to cut for all three varieties - Sebago, Pontiac and Atlantic. (See graph).

Size of round seed. The large seed (80-150 grams) gave the highest yields but not sufficiently higher than the ungraded (30-150 grams) size to warrant grading out the large seed and planting it separately to the small seed. The small seed (30-80 grams) gave the lowest yield. The average of the large seed size and small seed size yields was equivalent to the ungraded seed size yields. These results hold true regardless of the four spacings used.

Spacing. Highest yields were obtained at 20cm and decreased as spacings increased. However, when the costs for the differing amounts of seed required for the various spacings were taken into account there was little difference between the returns for the 20 and 25cm spacings which were both superior to the returns from the wider spacings in the winter planting.

Conclusions

The decision to use round or cut seed appears to depend largely on the age of the seed at planting. If the seed is in the juvenile stage where only the first eye has sprouted, there appears to be no advantage in using round seed. Best results from round seed appear to be when all apical dominance has regressed and all eyes are sprouting. This means that growers will need to obtain seed earlier in the season to allow the ageing to advance to this stage. Future research is planned to try to obtain certified seed earlier in the season to further evaluate the potential of round seed in early season plantings. Currently a series of round versus cut seed trials are being undertaken on growers properties to obtain further comparisons between cut and round seed.

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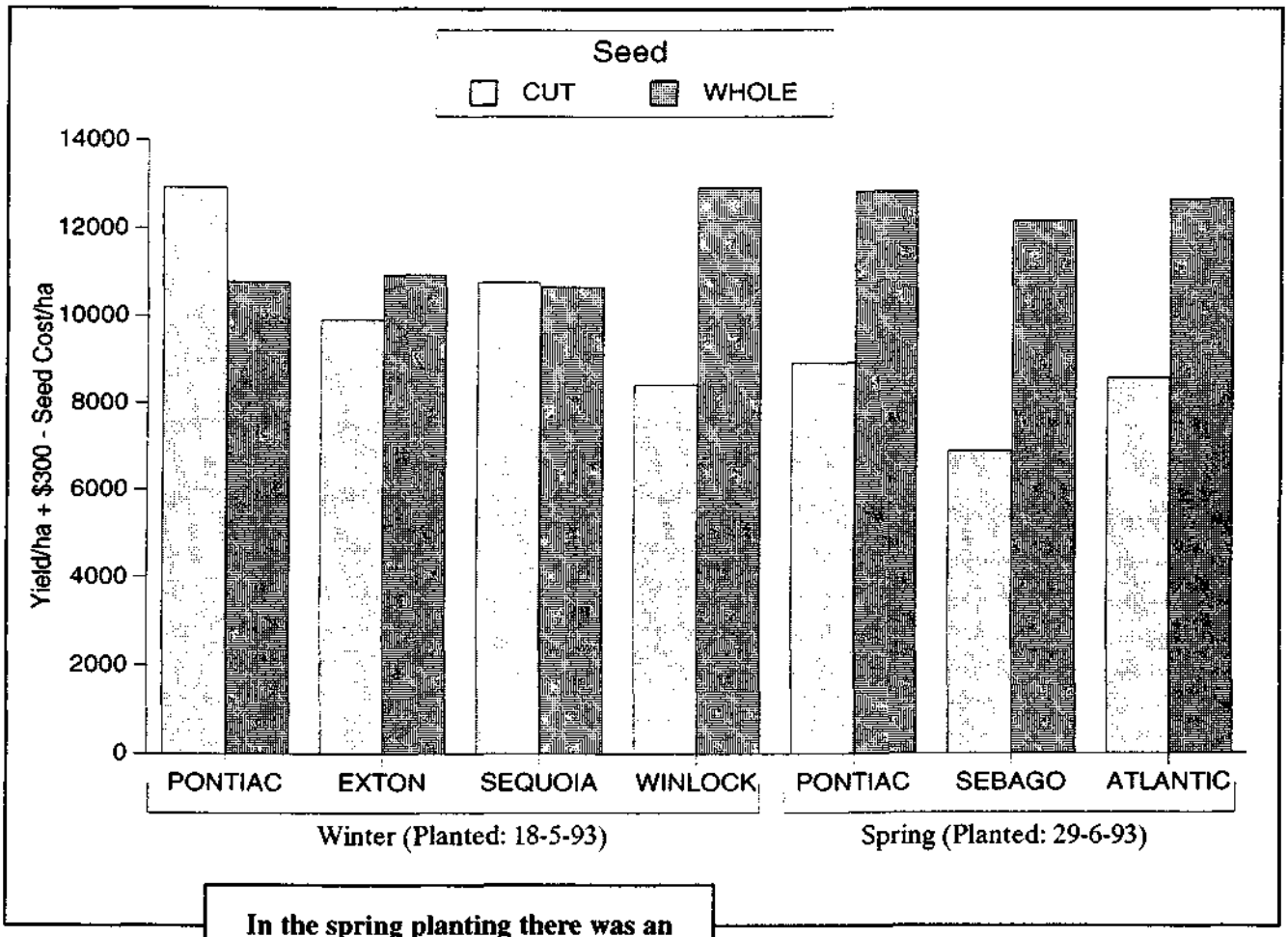

In the spring planting there was an economic advantage for planting whole seed compared to cut seed for all three varieties - Sebago, Pontiac and Atlantic

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SEED AGE - A MAJOR FACTOR DETERMINING SPACING OF ROUND SEED TO MAXIMISE NO. 1 GRADE YIELD

Presented by: John Kerr
Authors:
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Mr. Alan Duff, Experimentalist, Gatton Research Station
Mr. John Kerr, Principal District Adviser, Gatton

Introduction

Queensland potato growers producing for the fresh market have shown interest in the potential use of round seed in place of cut seed for winter and spring plantings.

Traditionally, these plantings are made using cut certified seed. In some cases small seed, tuber (<80 g), are graded out of the seed line and are planted as round seed. However, there is limited experience with the use of round seed for fresh market varieties in Queensland. As a result, a project was commenced in May, 1994 by the Queensland Department of Primary Industries at Gatton Research Station to determine optimum spacings for different round seed sizes for a range or varieties at different planting dates.

As part of the assessment of round seed, the effect of spacing and seed size has on the production of No. 1 grade yield is being determined. By maximising this grade, increased profitability and quality would be expected. Results to date indicate the seed age at planting is a major factor influencing spacing of round seed.

How the trails are being carried out

Winter and spring trials have been completed at Gatton Research Station in the Lockyer Valley and an autumn trial i nearing maturity. In the winter trial (planted 18 May, 1993) four varieties (Pontiac, Exton, Sequoia and Winlock) were planted at four intra-row spacings (20, 25, 32.5 and 40cm) using three whole seed sizes (30-80, 80-150 and 30-150g). The three sizes were obtained by grading the commercially available grade 30 - 150g into an additional two grade sizes. A cut seed treatment for each variety was planted at the 25 cm intra-row spacing. The spring trial (planted 29 June, 1993) included Sebago, Pontiac and the crisping variety Atlantic. The same seed sizes and spacings used in the winter trail were repeated in the spring trial. The autumn trial (planted 18 March, 1994) is a repeat of the spring trial using seed saved from this former trial.

To extend the findings, grower meetings have been addressed at the Redland Bay, Lockyer and The Atherton Tableland districts. In addition, spacing trials using cut and round seed for various varieties are being established on farm sites in these growing districts.

What we have found out

The effects of spacing and seed size across varieties for the winter and spring plantings are shown in Table 1. Yields of No. 1 grade and total yield were always highest in the closest inter-row spacing (20 cm) in both plantings. The largest seed size (80-150g) produced the highest No. 1 grade and total yields in both plantings. The proportion of No. 1 grade yield was higher in the spring planting. This proportion was not affected by spacing in the spring planting but decreased as spacing increased in the winter planting.

Table 1. Effect of intra-row spacing and seed size of round seed on No. 1 grade (80-350 g) and total yield (t/ha) of potatoes planted in winter and spring seasons in the Lockyer Valley.

	Intra-to spacing (cm)				Round seed size (g)		
Yield	20	25	32.5	40	30-80	80-150	30-150
Winter trial							
No. 1 grade	41.2	37.2	31.5	27.8	32.0	36.7	34.5
Total	55.6	52.0	48.8	45.2	46.4	54.4	50.0
% No. 1 grade	74.1	71.5	64.5	61.5	68.9	67.4	67.9
Spring trial							
No. 1 grade	47.4	42.7	40.6	38.8	39.9	44.8	42.5
Total	56.5	52.4	49.0	47.0	48.6	54.3	51.5
% No.1 grade	83.8	75.0	82.8	82.5	82.1	82.5	83.5

In general varieties in both plantings performed similarly to the main effects of spacing and seed size described in the above table. The main exceptions were that yields of Sebago, Pontiac and Seqoia from the 30-80 g and 30-150 g grade sizes were similar and that yields of Pontiac and Exton were similar at the 20 and 25 cm spacings.

Conclusions

When seed costs were taken into account for the differing amounts of seed required for the different plant spacings, profitability in terms of No. 1 grade yield was highest of No. 1 grade yield was highest in the 20 and 25 cm spacings in the winter trial. In the spring trial there was little difference in returns regardless of spacing. This costing was done only on the 30 - 150 g seed size as it is currently the only one available.

As seed for both trials was obtained at the same time, we feel the difference in returns due to spacing in the two trials is a factor of seed age. In the first trial apical dominance was still evident in the seed and this favoured the closer spacings. In the spring trial the seed had aged to the degree that secondary sprouts had formed. This reduced the advantage of the closer spacings by providing greater potential for top growth in the wider spacings resulting in higher yields relative to the yields at these spacings in the winter trial. The age of the seed as related to sprout development is therefore a major consideration in selecting plant spacing regardless of variety to optimise No. 1 grade yield.