UNIVERSITY OF SASKATCHEWAN

VEGETABLE CULTIVAR AND CULTURAL TRIALS 2005

Agronomy of New Potato Lines

PREPARED BY:
D. WATERER
J. BANTLE
W. HRYCAN

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Department of Plant Sciences
University of Saskatchewan, 51 Campus Drive
Saskatoon, Saskatchewan, Canada, S7N 5A8
Telephone: (306) 966-5855 Fax: (306) 966-5015
E-mail: waterer@sask.usask.ca jmb127@duke.usask.ca

Saskatchwan Agriculture and Food

Agronomy of New Potato Lines

The objective of this trial was to evaluate the performance of a range of newly released potato cultivars under Saskatchewan growing conditions. Changes in yield and quality as a function of N-fertility, crop maturity, irrigation and in-row spacing were evaluated in trials conducted on the Plant Sciences Department Potato Research plots in Saskatoon. The site features a sandy loam, pH 7.8, EC < l dS, with 4% O.M. This is the first year this site has been cropped to potatoes - the previous year it was in dryland canola and prior to that it was in a long term alfalfa crop.

The 2005 growing season was cool and wet during May and June. Precipitation and temperatures were near normal in July and August. Crop establishment was slow but conditions were excellent during tuber set and bulking. 37 cm of rainfall was received over the growing season (normal = 20 cm). A total of 13 cm of supplemental irrigation was applied to the plots (Fig. 1). Yields were relatively high in both the dryland and irrigated trials. Weed control was achieved by applying metribuzin prior to planting, followed by linuron applied at ground crack. The crop was hilled twice prior to ground crack. The crop was overhead irrigated whenever soil water potentials averaged over the effective root zone (0-30 cm) fell below -50 kPa. Weather conditions delayed application of the herbicide linuron and some plants had emerged at the time of application. This resulted in some crop damage (yellowing/death of the emerged leaves) and resulted in ca. 5% mortality, particularly to the fast emerging cultivars. No significant problems with diseases or insects were observed. Unless otherwise specified, the trials were top-killed using diquat in mid-September (ca. 120 DAP) and machine harvested in early October. The crop was graded into size categories; small = < 44 mm diam., medium = 44 - 88 mm and oversize = > 88 mm diam.

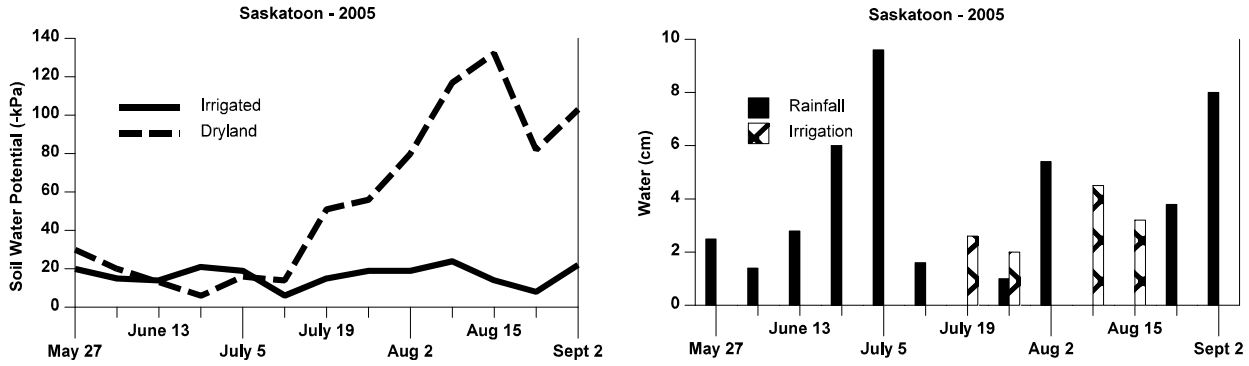


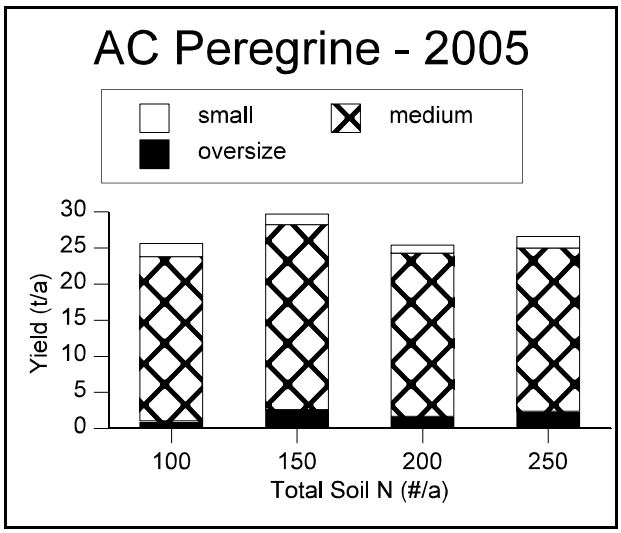
Fig.1. Soil water potentials, rainfall and irrigation events for the 2005 potato trials in Saskatoon.

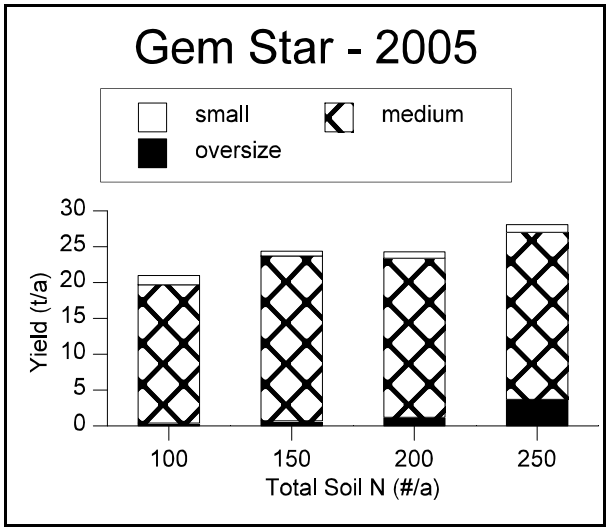
N-Fertility Trials

The objective of this trial was to determine optimum N-fertility recommendations under irrigation for a range of new cultivars. The soil-N treatments (100, 150, 200 and 250 # N/a) were achieved by pre-plant broadcasting sufficient 46-0-0 to supplement the residual soil N (ca. 100 # N/a). The N-treatments were laid out in an incremental design. Each cultivar was planted in mid-May in two 8-m long rows within each N-level. The in-row spacing was 20 cm, with 1 m between rows.

Results

The yield responses of the AC Peregrine, Gem Star and AC Pacific Russet to total soil-N levels ranging from 100-250 # N/a are presented in Fig 2. The N-response of AC Peregrine was quite flat, with the lowest level of soil-N tested (100 # N/a) resulting in total yields within 15% of the highest observed at 150 # N/a. Total yields of Gem Star increased through to the highest soil-N level tested (250# N/a).





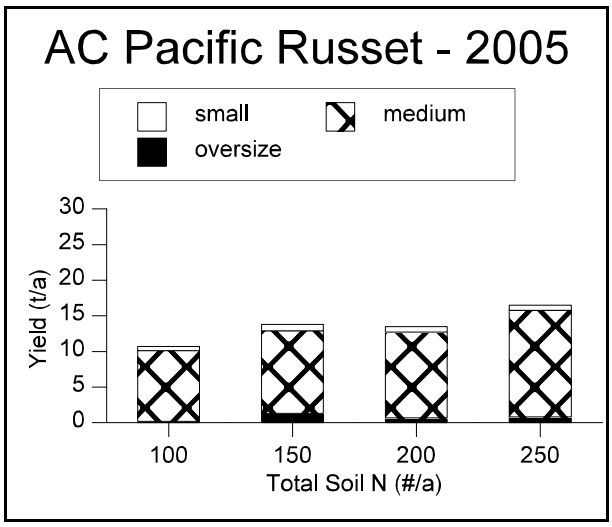


Fig 2. Yield and tuber size responses of AC Peregrine, Gem Star and AC Pacific Russet to soil nitrogen levels (2005).

The increase in total yields of Gem Star with increasing soil-N was attributable to an increase in average tuber tested. Yields of AC Pacific Russet were low relative to the other cultivars. This may reflect a greater damage by the late application of linuron, as AC Pacific Russet emerges earlier than AC Peregrine or Gem Star. The AC Pacific Russet also had some seed-borne viral diseases which may have reduced its vigor and yield potential. Total yields of AC Pacific Russet increased through to the highest level of soil-N applied.

Specific gravities of the three cultivars were fairly typical of the values seen in previous trials. In each case, specific gravities declined with increasing levels of total soil-N (Fig. 3). The average tuber size of Gem Star was far larger than AC Peregrine or AC Pacifc Russet (Fig. 4) Increasing soil-N tended to increase the average tuber size of Gem Star to a greater extent than the other cultivars tested.

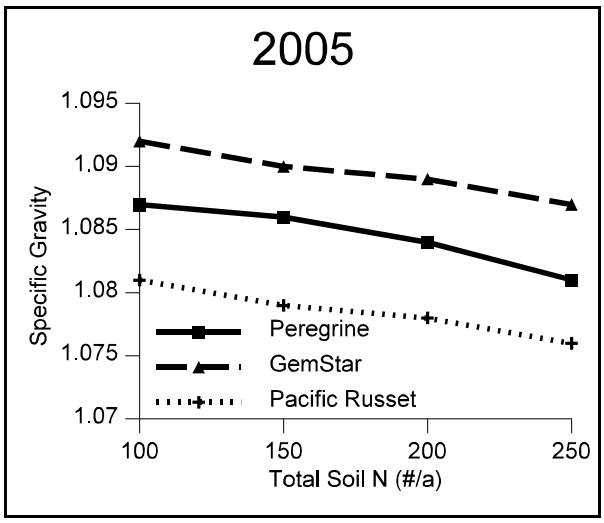


Fig. 3. Influence of soil nitrogen levels on specific gravities of AC Peregrine, Gem Star and Pacific Russet.

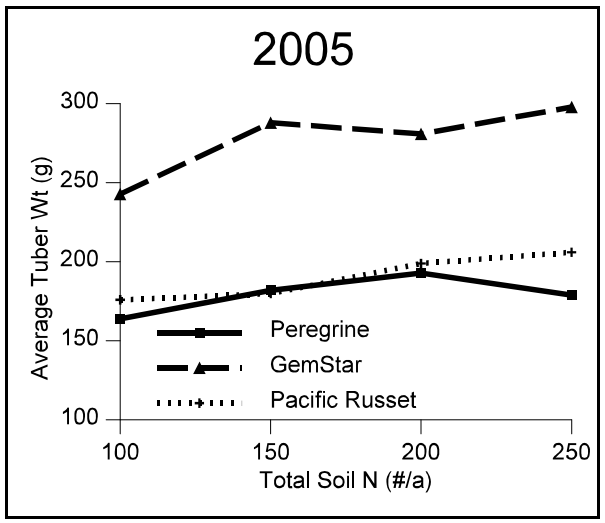


Fig. 4. Influence of soil nitrogen levels on average tuber size of AC Peregrine, Gem Star and Pacific Russet.

Time of Planting and Harvest Trials

This trial examined the impact on time of planting and harvest on yields and quality. Irrigated trials were planted on May 13 and June 7 and harvested August 26 or September 30. This resulted in plots harvested at 80, 90, 105 and 120 days after planting. Separate plots were grown for each planting and harvest date. In a dryland trial only a single combination of planting and harvest dates was used - the crop was planted in mid-May and harvested at 120 days after planting. In both the dryland and irrigated trials, each treatment plot consisted of a single, 8-m long section of row. Each treatment was replicated three times in a split plot design (main plot = planting date and sub-plot = planting date). The rows were spaced 1 m apart with 20 cm between plants within a row. The irrigated trials were watered whenever soil moisture potentials in the hills dropped below -50 kPa. Weed control was achieved through application of herbicides and cultivation as previously described.

The early harvested plots had the tops removed by hand a week prior to the harvest. For the 120 day harvest, the plots were sprayed twice with Reglone 10 days prior to the harvest. The crop was machine harvested and then sized and graded as previously described.

Results

Reds - In the irrigated trial, total yields for Norland where higher than for the other red-skinned lines until the final harvest (120 days) at which time AC Peregrine and CV89023-2 had higher yields (Fig. 5a). Norland has a tendency to oversize - by the final harvest over 25% of the tubers of Norland were in the oversize category (Fig. 5c). By contrast, AC Peregrine and CV89023-2 have a smaller average tuber size - this can be disadvantageous in short cool seasons or early harvested crops but can result in fewer problems with oversize tubers at later harvest dates. Peregrine has much higher tuber specific gravities than the other red varieties in this trial (Fig. 5d). In the dryland trial, yields were about 70% of the irrigated trial (Table 1). Relative yields of the four red-skinned varieties in the dryland trial were very comparable to the corresponding trial under irrigation - with AC Peregrine and CV89023-2 again out yielding Norland at 120 days after planting. Specific gravities in the dryland trial were higher than under irrigation.

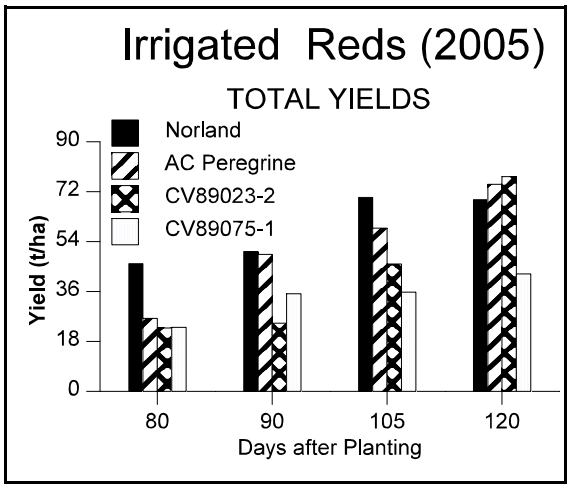
Table 1. Yield and quality components for Red and Russet potatoes under dryland conditions in 2005.

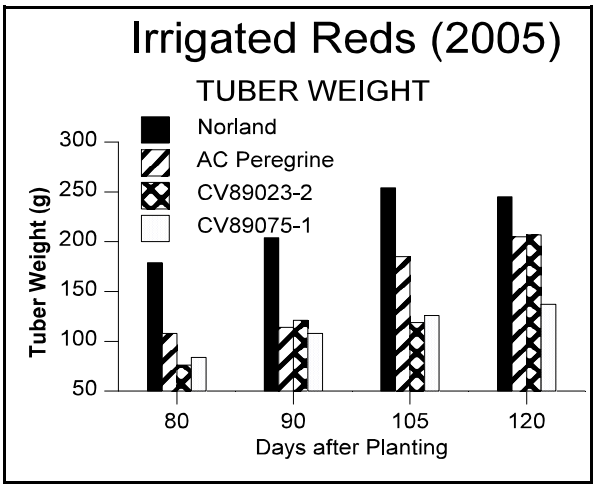
Line	Yield (t/ha)	Specific Gravity	Avg Tuber Wt. (g)
Reds			
Norland	47.2 a	1.078 b	175 a
AC Peregrine	55.8 a	1.086 a	134 b
CV 89023-2	52.4 a	1.080 ab	142 ab
CV 89075-1	31.6 b	1.084 ab	119 b
Russets			
R. Norkotah	38.2 c	1.082 b	149 b
R. Burbank	48.2 b	1.087 ab	216 a
AC Pacific Russet	35.0 c	1.082 b	160 b
Gem Star	57.4 a	1.090 a	202 a
VO865-1	37.6 c	1.093 a	167 b

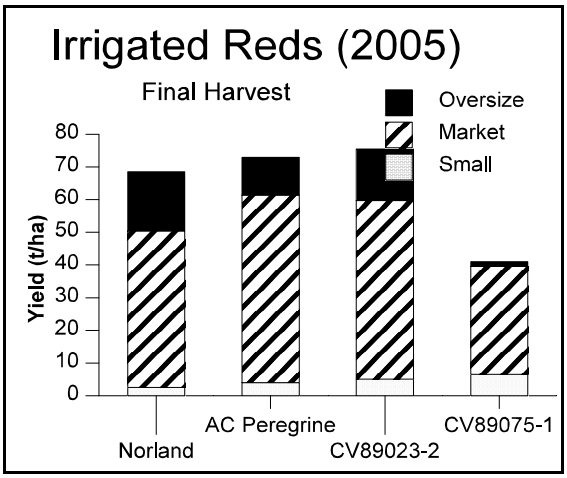
Values within columns followed by the same letter are not significantly different (p=0.05)

Russets - As noted in the other trials, the new SSPGA line Pacific Russet performed poorly in this trial. This may reflect problems with seed quality and/or herbicide damage to the emerging plants. Russet Norkotah gave the highets yields in the early harvests (80 and 90 days) but in the later harvests Gem Star and Burbank yields continued to climb while Norkotah yields appeared to plateau (Fig. 6a). Gem Star's exceptional yield potential in a longer growing season had been noted previously. Gem Star also has higher specific gravities and a larger average tuber size than Burbank - characteristics that are desirable in a processing potato (Fig. 6 b, c and d). Yields from the dryland trial of the Russets were about 80% of the irrigated trial - with Gem Star on dryland producing 90% of the yields seen under irrigation (Table 1). Relative yields of the russet varieties in the dryland trial were very comparable to the corresponding trial under irrigation - with Gem Star and Burbank again out yielding the other lines at 120 days after planting. The AAFC line (VO865-1) appeared to have limited merit in any of the categories evaluated in either the irrigated or dryland trials trial.

Figure 5 a-d. Yields (a), average tuber weights (b), tuber size profile at the final harvest (c) and specific gravities (d) for various red-skinned potatoes under irrigation.







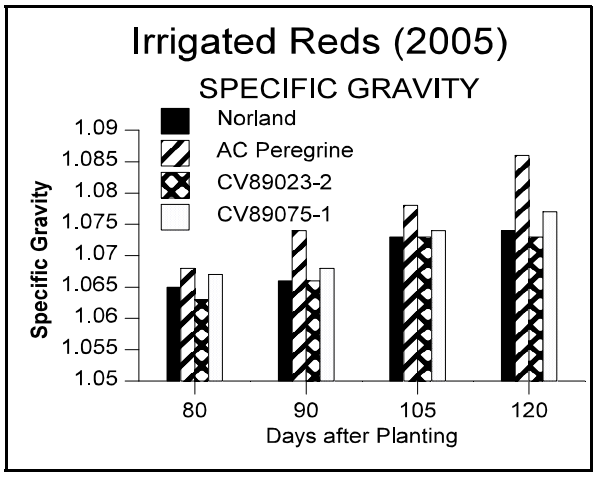
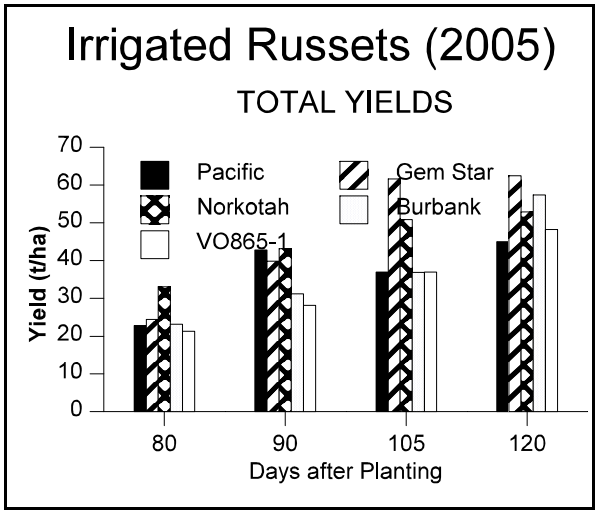
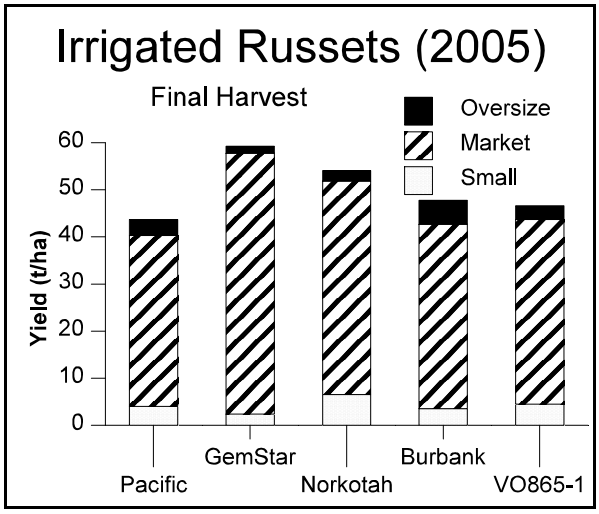
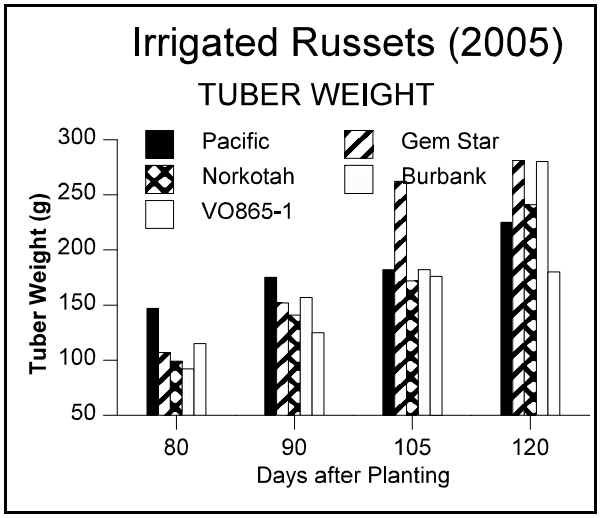
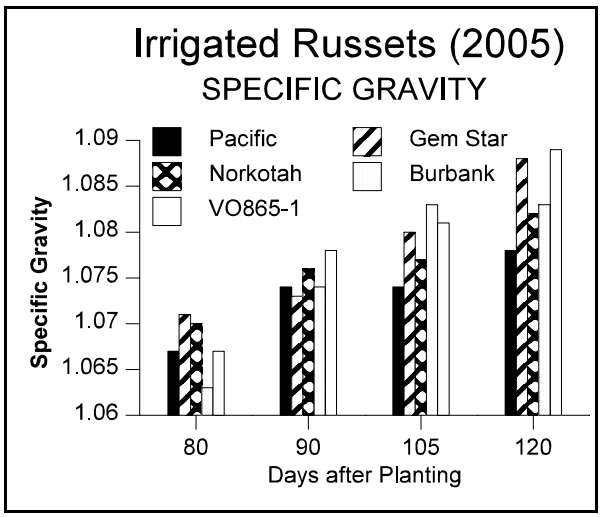


Figure 6 a-d. **Yields (a), average tuber weights (b), tuber size profile at the final harvest (c) and specific gravities (d) for various russet-skinned potatoes under irrigation.**









Spacing trial

This trial evaluated the impact of in-row spacing on yields and tuber size distribution of AC Peregrine, Pacific Russet and Gem Star. The trial was planted on May 16 using 6, 10 or 14" (15, 23 or 35 cm) in-row spacings. Each treatment row was 8 m long with 1 m between rows. Each treatment was replicated four times in a randomized complete block design. The trial was irrigated and weeds were managed as previously described. The crop was top killed in the 2nd week of September and harvested in early October (120 days after planting). The crop was graded as previously described.

Results

Yields of all three cultivars increased as the in-row spacing decreased (Fig. 7a). This yield response to spacing was more pronounced for Gem Star than for AC Peregrine or Pacific Russet - likely reflecting the low tuber set characteristic of Gem Star. Average tuber size increased as the distance between plants increased, with the greatest response observed as the spacing changed from 10 to 14" between seed pieces (Fig. 7b). The average tuber size for Gem Star was much larger than for Pacific Russet, with AC Peregrine having the smallest average tuber-size.

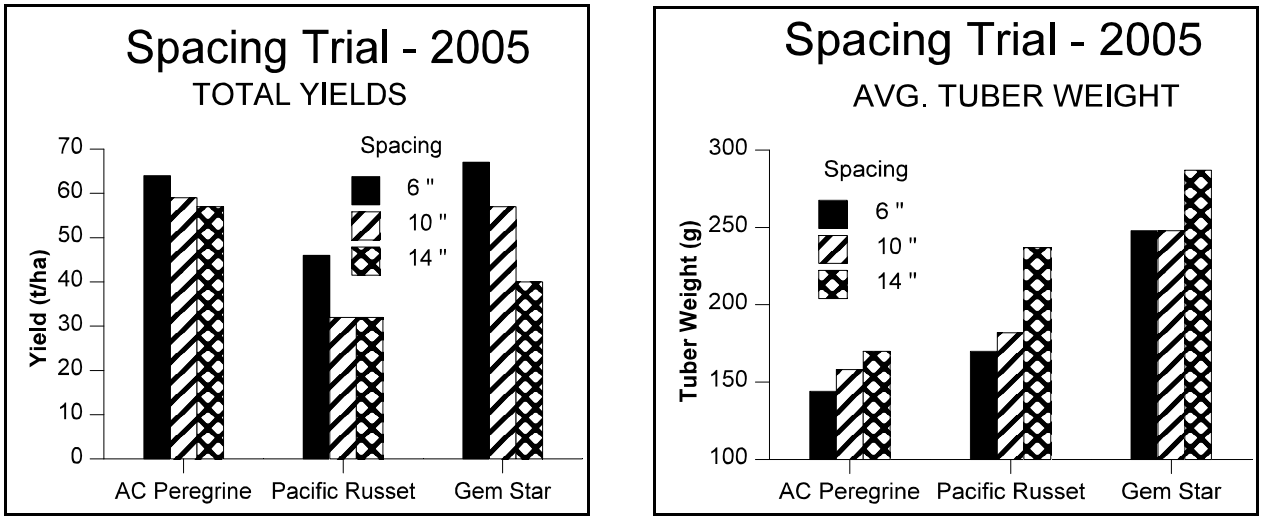


Fig 7. Influence of in-row spacing on yields (a) and average tuber weights (b) of AC Peregrine, Pacific Russet and Gem Star.