

PROGRESS REPORT

February 2009

**Agronomic programs for newly released potato varieties
suited for local consumption and/or export seed markets**

ADF Project No: 20070015



**Pacific Russet - a new russet-skinned line, released by the Prairie Potato Research Program
for use by members of the Saskatchewan Seed Potato Growers Assoc.**

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Evaluation and Development of Agronomic Programs for Newly Released Potato Varieties

Abstract

The future of Saskatchewan's seed and table potato industries depends on growers planting the best available cultivars. The Prairie Regional Potato Testing Program (PRPTP) is responsible for evaluating the suitability of any releases from potato breeding programs across N. America for suitability to prairie growing conditions and market needs. **Project 20070015 will support Saskatchewan's participation in the PRPTP from 2008 through 2011.** Each year, between 40-60 breeding lines developed by breeders at Agriculture Canada and elsewhere are evaluated for vigor, earliness, yields, tuber appearance, disease and insect resistance, flavor and processing characteristics. The Saskatchewan Seed Potato Growers Association (SSPGA) has used the data generated by this project as a basis for obtaining exclusive or shared licences for several lines, including AC Ptarmigan, AC Peregrine Red and most recently AC Pacific Russet. **This project will also support the development of agronomic recommendations for the SSPGA exclusive lines, as well as several other lines of interest to Saskatchewan growers.**

Agronomic variables examined in 2008 included yield and quality responses to time of planting and harvest, nitrogen fertility levels, herbicides, irrigation, plant growth regulators and plant populations. All trials were conducted as planned and the data have or will be made available to the industry in print and web-based formats.

Executive Summary

The potato industry in Saskatchewan is, at present, too limited to justify supporting a full-scale breeding program, yet the continuing health and expansion of the industry depends on the growers planting the best available cultivars. The Prairie Regional Potato Program (PRPP) involves the collaboration between researchers and industry across the four Prairie provinces under the direction of Agriculture Canada (Lethbridge). The PRPP conducts breeding, early generation selection and pathology trials on potato breeding lines potentially suited to the Prairie environment. Each year, project co-ordinators in BC, AB, SK (University of Saskatchewan) and MB conduct regional tests (Prairie Regional Potato Testing Program or PRPTP) evaluate the performance of the best breeding lines generated by the PRPP. Promising clones from breeding programs out of the northern U.S. are evaluated, as well as the clones developed by other Canadian breeders. **This project will support Saskatchewan's participation in the PRPP and the PRPTP from 2008 through 2011.** Each year, between 40-60 breeding lines were evaluated in the PRPTP for vigor, earliness, yields, tuber appearance, disease and insect resistance, flavor and processing characteristics. Results of PRPTP trials conducted in Manitoba, Alberta, Saskatchewan and British Columbia are considered in determining which releases should be licensed, named and made available to prairie potato growers. From 1995-2007, the PRPP released 91 lines with sufficient merit to warrant field scale evaluation by the industry. The PRPP has named and released 14 varieties of potato over the past 7 years. **Over 35% of the potatoes grown on the Canadian Prairies in 2002 were varieties developed by the PRPP.** The Saskatchewan Seed Potato Growers Association (SSPGA) has used the data generated by the PRPTP as a basis for requesting exclusive or shared licences for three lines derived from the Prairie Potato Breeding Program. **AC Ptarmigan** is now considered the industry standard for extremely early table potatoes. **AC Peregrine Red** has better skin color and storage characteristics than Norland which is presently the industry standard for red skinned table potatoes. Most recently, the SSPGA have become agents for **AC Pacific Russet** - a high yielding russet-type potato with superior yields and cooking quality than the present standard Russet Norkotah.

This project also supported the development of agronomic packages specific to the newest cultivars licenced to the SSPGA, as well as other lines being considered for future licencing. Yields and quality of the various lines were evaluated in trials involving differing planting and harvest dates, soil nitrogen levels, irrigation levels, plant populations, herbicide and plant growth regulator treatments. The

performance of the new lines were compared against established cultivars and recommendations were made as to optimum management practices for these new cultivars.

All trials in 2008 were conducted as planned. The data were analysed and the results have been or will be made available to the growers in print and web-based formats, at field days and at grower presentations.

Project Background

Cultivar testing represents a highly efficient and cost effective means of maintaining and/or improving yields, quality and profitability of crop production. Industry needs may be matched with breeders' achievements, without the expense of maintaining a full breeding program. Growers are provided with the cultivars required to meet changing production practices, pest pressure and market demand.

Potato production in Saskatchewan is, at present, too limited to justify supporting a full scale breeding program, yet the continuing health and expansion of both the seed and table potato sectors depends on the growers planting the best available cultivars. The Prairie Regional Potato Testing Program (PRPTP) was initiated in 1979 at the request of the Prairie Potato Council to develop and test potato lines with characteristics required by the potato industry on the prairies. The Prairie Potato Regional Program (PPRP) administered by Agriculture Canada (Lethbridge) has provided the personnel responsible for breeding, early generation selection and pathology. The participating western provinces conduct the regional test sites and testing expertise required to run the PRPTP. Promising clones from the northern central and western U.S. are evaluated in the PRPTP, along with the clones developed by Canadian breeders. Saskatchewan has participated in the Prairie Regional Potato Trials since their inception, with funding provided through the Agriculture Development Fund and the Technology Adaptation Programs of Saskatchewan Agriculture and Food.

This project will support Saskatchewan's participation in the Prairie Regional Potato Testing Program during the 2008-2011 cropping seasons.

The Prairie Regional Potato Testing Program is conducted in accordance with a standardized protocol that is followed at all testing sites. Clones or cultivars are included in the evaluation trials based on recommendations by the Cultivar Evaluation Committee of the Prairie Potato Council. Each year, performance of the various lines are evaluated by the Breeding and Selection Committee of the PRPP, with sub-standard types dropped from the trials, outstanding performers graduated to more extensive testing and the remainder examined again in the next year. There are five levels of testing, from the *Adaptation trials* in which new entries are evaluated in small non-replicated plots, to the much larger replicated *Main Crop trials*, in which the most promising lines are evaluated against standard cultivars. Entries are evaluated for vigor, earliness, yields, tuber appearance, disease and insect resistance, flavor and processing characteristics. Results of trials conducted in Manitoba, Alberta, Saskatchewan and British Columbia are considered in determining which releases should be licensed, named and made available to prairie potato growers. While most of the trial sites are irrigated, but there are also two dryland sites (Edmonton, AB and Carmen, MB).

All the PRPTP trials in Saskatchewan in 2008 were conducted at the Horticulture Science Potato Plots in Saskatoon and at the Canada Saskatchewan Irrigation Diversification Centre in Outlook. The use of two sites allows for more thorough testing of the cultivars under differing conditions while also raising the profile of the trial with local grower groups. The Saskatoon site is a sandy loam (pH 7.4) while the Outlook site is a moderately saline, sandy loam (pH 7.9). Standard irrigated production practices are employed at both sites. A portion of the crop is harvested in late August to allow for evaluation of early yield potential. The remainder of the crop is harvested at the normal time in late September. The crop is stored under standard conditions and the processing and culinary quality is evaluated after 60 and 90 days of storage.

Agronomics of New Potato Varieties - ADF Project 20070015

The breakdown of trials conducted at the two sites in 2008 is as follows;

	<u>Saskatoon Site</u>	<u>Outlook Site</u>
1) Adaptation Trial		
- 30-40 most recent releases	yes	no
- 8 plants/plot		
- non-replicated		
2) Advanced Adaptation Trial		
- Level I - 40 lines	yes	no
- 8 plants/plot		
- 2 replicates		
- Level II - 50 lines	yes	no
- 12 plants/plot		
- 4 replicates		
3) Prairie Main Crop Trial		
- 20 advanced lines	yes	yes
- 20 plants/plot		
- 4 replicates		
4) Prairie Early Replicated Trial		
- 10-15 advanced lines for areas with shorter growing seasons	yes	yes
- 20 plants/plot		
- 8 replicates		
5) Prairie Region Registration Trials		
- evaluate newly registered lines	no	yes
- European and N. America breeding programs		

Data Collected: Emergence time, % stand, yield components at 85 and 110 days after planting, tuber appearance, plant and tuber disease incidence and reactions, boiling, baking, chipping, frying and storage quality. All procedures follow protocols determined by the PRPTP.

Progress to February 1, 2009

All of the 2008 PRPTP trials were conducted as planned. Yield and processing quality evaluations were completed and all data were sent to the PRPP administrators (AAFC Lethbridge) for inclusion in the prairie-wide evaluation of the new cultivars. These data will be used in determining which cultivars to release, which to drop and which to further evaluate. The 2008 data will be reviewed at the Annual Meeting of the Prairie Potato Council, held in mid-January of 2009. Yields from the Saskatoon site administered by this project were consistently amongst the highest seen in the PRPTP, indicating a high degree of commitment to the project objectives. Virus problems were noted at the site in 2008 but these problems were traced back to the seed lots received for testing.

Notable Program Achievements

From 1995-2007, the PRPP released 91 lines with sufficient merit to warrant industry evaluation. The PRPP has named and released 14 the varieties over the past 7 years. **Over 35% of the potatoes grown on the Canadian Prairies in 2002 were varieties developed by the PRPP.**

The release and introduction of new cultivars by the Prairie Regional Potato Program has resulted in increased acreage and enhanced competitiveness, while also opening potential export markets. Some notable releases from this program are;

- Niska - is a chip cultivar with excellent processing characteristics and long term storage capability. Niska has consistently rated as one of the top varieties in the cross Canada chipping trials. Exclusive European rights to Niska have been sold to a German company.
- AC Ptarmigan - is an early maturing cultivar licenced in 1993 and suited for both chipping and table use. A member of the Saskatchewan Seed Potato Growers Assoc. has the exclusive licence for Ptarmigan, with the royalties being shared between the Saskatchewan Seed Potato Growers Association and the Prairie Regional Potato Program.
- Amisk - a clonal variant of Ranger Russet, licenced in 1993, has joined Russet Burbank as the dominant french fry variety in North America. Significant acreages of Ranger and Amisk seed are being grown in Saskatchewan for export into the United States. Growers are beginning to prefer Amisk over Ranger, as it tends to be more uniform with less problems with blackspot bruising.
- AC Stampede Russet - released from the program in 1999, this early maturing russet variety has excellent early yield potential with acceptable processing characteristics. AC Stampede Russet also has potential for used as an early season russet for the fresh-pack market. Maple Leaf Foods of Alberta has been granted an exclusive licence for AC Stampede Russet.
- AC Glacier Chip - is a high yielding chipping cultivar with excellent processing characteristics. Exclusive commercialization rights for this line have been requested by Potato Growers of Alberta.
- AC Maple Gold - is a high yielding yellow fleshed potato with potential in both the fresh market and french fry sectors. Exclusive commercialization rights for this line have been requested by Maple Leaf Foods.
- FV 9649-6 A fresh market russet type. Produces a very uniform crop with very shallow eyes. Resistant to hollow heart, after cooking discoloration and sloughing. Registration trials indicate yields at maturity superior to Burbank and equivalent to Norkotah. The variety is exceptionally early but lacks processing quality. **SSPGA had the exclusive licencing agreement for this variety with AAFC. This agreement started in 1999 but was terminated in 2001 due to erratic performance of the line in grower trials.**

- AC Peregrine Red** tested as ND2937-3, this is a round/oval dark red skinned line with shallow eyes and uniform tubers. AC Peregrine Red has superior red color, particularly after storage. It also shows little after cooking discoloration. AC Peregrine Red is slower developing than the standard Norland, resulting in poor yields in short growing seasons. AC Peregrine does not perform well under late season drought stress. Scab levels are higher than Norland, but it is



AC Peregrine Red

more resistant to Fusarium dry rot. **SSPGA has the exclusive licencing agreement for this variety with AAFC and the breeders at NDSU.** Commercial growers are enthusiastic about the color and uniformity AC Peregrine Red but express concern about its lateness and apparent sensitivity to scab. Peregrine may be of greatest value in areas with a long and hotter growing season, especially as the current standard cultivar (Norland) does poorly under these conditions. **One of the main limitations of Peregrine is the fact that the breeders in North Dakota have stipulated that it cannot be licenced into the United States.** This is unfortunate, as AC Peregrine Red should perform well in the US given its greater heat tolerance and positive yield response to longer growing seasons.

AC Pacific Russet

- this recent release from the PRPP (tested as VO168-3) is a russet skinned alternate to the standard variety Russet Norkotah. AC Pacific Russet has far superior yields and culinary quality than Russet Norkotah. AC Pacific Russet is exclusively licenced to the SSPGA and Alberta Potato Growers Association. Industry uptake of this variety has been slow - reflecting; a) the limited market for table russets on the CDN Prairies and b) the dominance of the cv. Russet Norkotah in addressing this market segment.



AC Pacific Russet

Northstar

- (tested as V0123-25) is a white-skinned, white-flesh mid-season maturity potato cultivar suitable for cold storage chipping. Yields and chip color of Northstar are superior to present industry standards. Northstar showed excellent potential for chipping directly out of 6° C storage. Internal and external defects are rare.

Alta Crown

- (tested as CV92028-1) is a russet skin, dual French fry/table variety, with high yields and mid-season maturity. Cultivar description in Amer. J. Potato Res. (2009)

Sentinel

- (tested as FV8957-10) is a round-oval white-skinned, yellow flesh variety suited for both chipping and the table market. It has a mid-season maturity and high yields.

Glacier Fryer

- (tested as CV92056-4) is a long white-skinned, white flesh French fry variety, with mid-season maturity and high yields.

V0379-2:

- a early maturing, high yielding, oval shaped, white fleshed, white skin line, for early (out-of-the field) chipping, to be released in 2009.

CV96053-4: - a high yielding, oval shape, white fleshed, main crop potato with white skin and good storage characteristics. This chipping variety will be released in 2009.

CLONES ACCESSED BY WESTERN POTATO CONSORTIUM

In 2008, a total of 15 Lethbridge selections were under active testing by industry. Eight (8) new advanced selections (including 4 french fry, 3 fresh market, and one chipping clone) are available to industry for testing with the option to license.

BREEDING PROGRAM FUTURE DIRECTIONS

Some of the initiatives being pursued by the PRPP include:

- Emphasis on tuber defect testing (including bruising, greening) for increased acceptability by industry.
- emphasis on disease resistance testing (common scab, powdery scab, verticillium wilt, fusarium dry rot, foliar and tuber late blight).
- development of germplasm with improved nutritional composition (low glycemic index, low starch content, modified starch composition).
- Development of germplasm with improved water-use efficiency (tolerance to deficit irrigation) and improved nutrient use.

Part 2. Agronomy trials of Prairie Potato Breeding Consortium Releases

These trials are designed to determine the optimum growing practices for the new potato lines licenced to the Saskatchewan Seed Potato Growers (SSPGA), along with any new lines from other breeding programs that have been identified as being of particular interest to Saskatchewan's potato industry. Timely efforts to develop a package of appropriate management practices is key to market success of new potato varieties. The trials conducted in 2008 were designed to evaluate key performance factors such as the cultivars' responses to soil moisture availability, plant spacing, time of planting and harvest and soil N fertility levels.

Materials and Methods

Cultivars tested included in 2008 trials

AC Pacific Russet (SSPGA + PGA)
AC Peregrine Red (SSPGA)
Gem Star (McCains line with the SSPGA as local agents)
Dakota Jewel - a new red-skinned release from the NDSU breeding program.
Dakota Rose - another new red-skinned release from the NDSU breeding program

Most trials evaluated the new lines against established industry standard lines (Russet Norkotah, Russet Burbank and Norland). Cultivars will be added to the trials based on industry demand or dropped from the trials based on inferior performance and/or a lack of industry interest in further development of that cultivar.

Planting * Harvest Trials

Trials were planted in either the first week of May (early planting) or the 3rd week of May (late planting). A section of each planting date trial was harvested in late August (early harvest), with the remainder of the plot being harvested in late September. This arrangement of planting and harvest dates resulted in plants that were in the field for 80, 90, 105 and 120 days.

Plant Population Response Trial

Trials were planted in mid-May utilizing, 15, 23 or 30 cm spacings between seedpieces within a row. This trial was harvested in mid-September.

Nitrogen Response Trial

Prior to planting, sufficient 34-0-0 was applied to the plots to raise the soil N levels to 100, 150, 200 or 250 kg N/ha. This trial was planted in mid-May and harvested in mid-September.

Dryland Trial

All lines were tested under dryland conditions and yields were compared to irrigated production. This trial was planted in mid-May and harvested in mid-September.

Site Description

Unless otherwise specified, all trials were conducted on the Plant Sciences Department Potato Research plots located in Saskatoon. The site features a sandy loam, pH 7.8, EC < 1 dS, with 4% O.M. This site has only a limited history being cropped to potatoes - until 5 years ago its was in dryland alfalfa. In all trials, each treatment plot consisted of a single, 8-m long section of row. Unless otherwise specified, the row spacing was 1 m between rows with 25 cm between plants within a row. Weed control was achieved by applying EPTC + metribuzin prior to planting, followed by linuron applied at ground crack. The crop was hilled twice prior to ground crack. With repeated cropping of potatoes on this site we have begun to select for weeds that do well within the potato crop. Despite the use of several herbicides and tillage, repeated flushes of red-root pigweed were experienced in the 2008 crop. In 2008 we added a late season application of rimsulfuron to the weed control program - but it provided only limited control of the weed problem. Although it is unlikely that the weed pressure was sufficient to harm the potato crop, we will need to

develop a more effective weed control program for future trials. The crop was overhead irrigated whenever soil water potentials averaged over the effective root zone (0-30 cm) fell below -50 kPa. Populations of Colorado Potato Beetle were higher than normal in 2008. No effort was made to control the beetles as they normally cause little harm to the potato crop - however in 2008 they caused significant levels of defoliation in the dryland trial. The less vigorous red-skinned cultivars appeared particularly hard hit by the beetles. Again, we will be modifying the 2009 trials to more effectively deal with the threat of a beetle problem. No problems with diseases were observed in any of the trials. Unless otherwise specified, the trials were top-killed using diquat in early September (ca. 100 DAP) and machine harvested in early October. The crop was harvested utilizing a Grimme harvester. Tubers were cured for 10 days at 15C, graded and then cooled to 4C for longterm storage. The tubers were mechanically graded into size categories; small = < 44 mm diam., medium = 44 - 88 mm and oversize = > 88 mm diam. Seed yields consist of all potatoes <88 mm in diam, while tablestock yields consist of all potatoes >44 mm in diam. Specific gravities were determined using the weight in air/weight in water method of determination. The boiling, baking, chipping and frying quality of the various lines were evaluated using standard methodologies.

Project Results

2008 Growing Season

Temperatures in 2008 were well below normal in May and June, about normal in July and slightly above normal in August and through the harvest period in September. The frost free period (May 26 to Sept 24) was near the 30 year average. About 17 cm of rainfall was received from June 1 - Sept 1 (normal = 17 cm). Very limited precipitation throughout August resulted in exerted substantial moisture stress on the dryland crop during the crucial period of tuber set and bulking. A total of 15 cm of supplemental irrigation was applied during the 2008 growing season (Fig. 08-1).

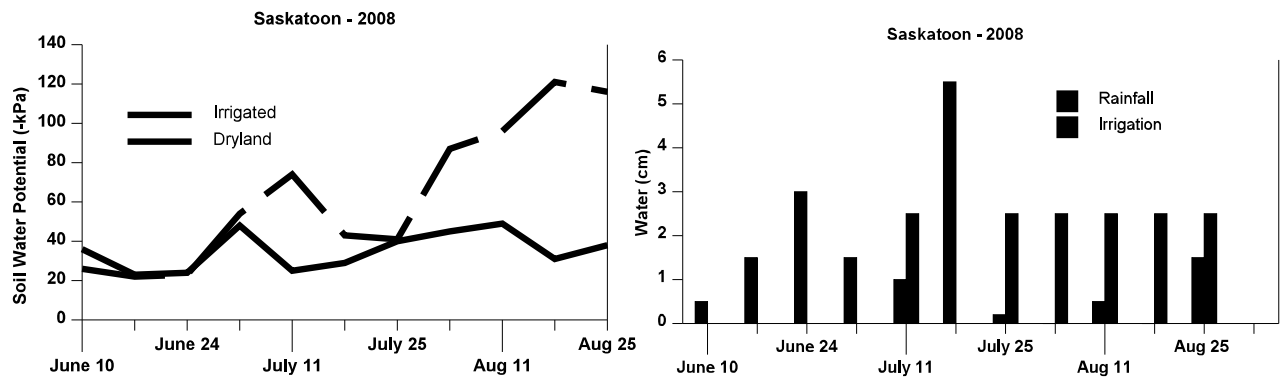


Fig. 08-1. Soil water potentials, rainfall and irrigation events for the 2008 potato trials in Saskatoon.

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 (total of 100, 150, 200 or 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 25 cm, with 1 m between rows. Each treatment was replicated twice.

Results

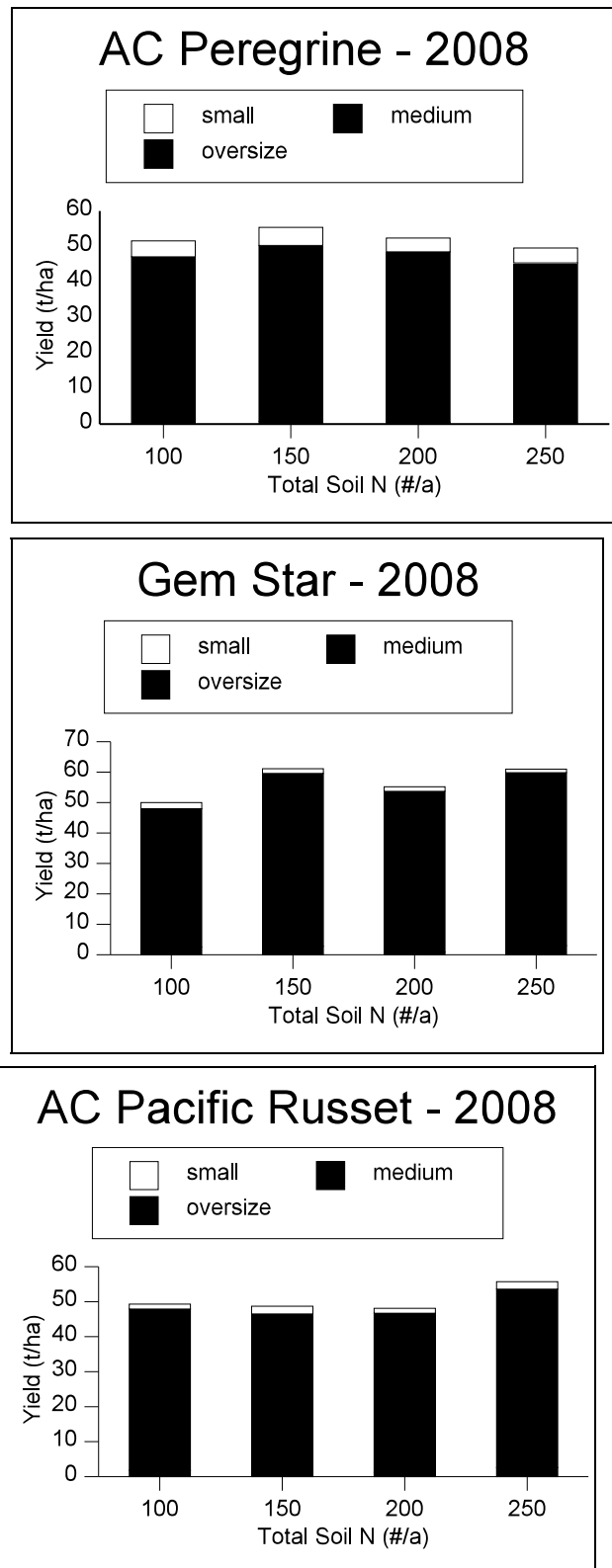
The yield responses of the AC Peregrine, Gem Star and AC Pacific Russet to total soil-N levels ranging from 100-250 # N/a are presented in Fig 08-2.

The N-response of AC Peregrine was quite flat - which corresponds to the results seen in trials conducted in 2005, 2006 and 2007. The lowest level of soil-N tested in 2008 (100 # N/a) resulting in total yields within 6% of the highest yield observed in 2008 (150 # N/a).

In 2005, yields of Gem Star increased through to the highest soil-N level tested (250 # N/a). In 2006 and 2007, the N response by GemStar was more limited, with the lowest rate of N applied (100 #/a) producing yields that were within 10% of the highest yields produced (200 #/a). In the 2008 trial, the N response of GemStar was again relatively flat, although it appeared that at least 150#/a N was required for optimum yields. A very high rate of hollow was noted in the Gem Stars in previous trials but there was no apparent relationship between the N rate applied and the incidence of hollow heart. In the 2008 trial there was little hollow heart in the GemStars, irrespective of the N-fertility levels.

In 2006 and 2007 yields of AC Pacific Russet peaked when 150 # N/a was used. In the 2008 trial, the highest yields were seen with the highest rate of N applied (250 #/a), however the actual yield difference between the highest and lowest rates of N applied were relatively small.

Fig. 08-2. Yield responses of new potato cultivars to increasing levels of soil-N.



Specific gravities of all four cultivars in 2008 were lower than in previous trials. In the trials conducted from 2005-2007, specific gravities had declined as the fertility level increased. However, in the 2008 trial there was no consistent relationship between specific gravities and N fertility levels (Fig 08-3).

Conclusion

The N fertility responses of the three new cultivars were;

- a) quite similar to one another,
- b) less consistent from year to year
- c) quite limited - in that the lowest rate of N applied (100 #/a) typically produced yields that were within 10% of the highest yielding treatments.

Supra-optimal rates of applied N seldom had any significant negative impact on yields but did tend to delay crop maturity as reflected by the lower specific gravities. Delayed crop maturity would also tend to make it more difficult to achieve vine desiccation prior to harvest.

At present, the economics of potato production dictate that growers should strive to maximize yields, even if it involves the application of very high rates of N fertilizer. As the cost of N increases and/or concerns increase regarding the environmental impact of over-application of fertilizers, it is clear that growers can cut their N applications substantially without a significant yield penalty.

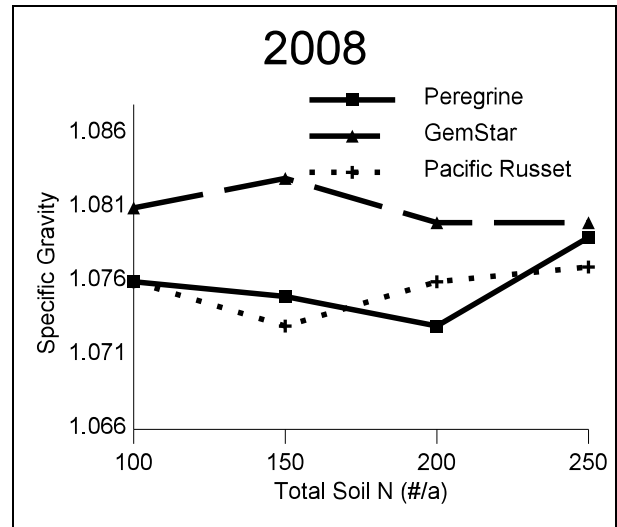


Fig. 08-3. Influence of soil-N levels on specific gravities of new potato cultivars.

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 ...and June ...and harvested August ...or October 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 25 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 and Peregrine were comparable at all four growth intervals and were consistently higher than the yields for either of the Dakota lines. (Fig. 08-4a). In previous trials, Peregrine had higher tuber specific gravities than the other red varieties tested - in the 2008 trial this difference was less pronounced (Fig. 08-4c). Norland had the largest average tuber size, while Peregrine had the greatest proportion of

the total yield falling into the small size category. Yields in the dryland trial (Table 08-1) averaged less than 40% of the irrigated trials. Norland appeared to be the most drought tolerant of the red lines tested. Specific gravities in the dryland trial were comparable to the irrigated crop.

Russets - Yields of the four russet type lines were very comparable at all four sampling dates. This is in contrast to previous years where Pacific Russet and Russet Norkotah were consistently higher yielding early in the season than the processing types (GemStar and Burbank). As in previous years, Pacific Russet and Gem Star had a larger tuber size profile than the other lines (Fig 08-5b). Specific gravities at the early harvest dates were higher than in previous years, while at the later harvests the specific gravities were similar to previous trials (Fig 08-5c). Processing quality at 80 and 90 days was uniformly poor. At the later dates, Gem Star had excellent fry and chip colors, while the poorest colors were seen in Burbank which is considered the standard in the processing sector. Yields from the dryland russet trial (Table 08-1) averaged from 28-40% of irrigated - with the processing types (GemStar and Burbank) appearing to be more sensitive to drought stress than the table types (Pacific and Norkotah). Specific gravities were comparable in the dryland and irrigated Russet trials in 2008.

Table 08-1. Yield and quality components for Red and Russet potatoes under dryland conditions in 2008.

Line	Yield (t/ha)	Yield - % of irrigated	Specific gravity
Reds			
Norland	26.0 a	42 a	1.078
AC Peregrine	24.9 a	37 b	1.077
Dakota Rose	8.1 b	34 b	1.078
Dakota Jewel	5.5 b	26 c	1.074
Russets			
R. Norkotah	22.8 a	41 a	1.083
R. Burbank	16.1 b	30 c	1.075
Pacific Russet	20.9 a	36 b	1.079
Gem Star	16.6 b	28 c	1.080

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

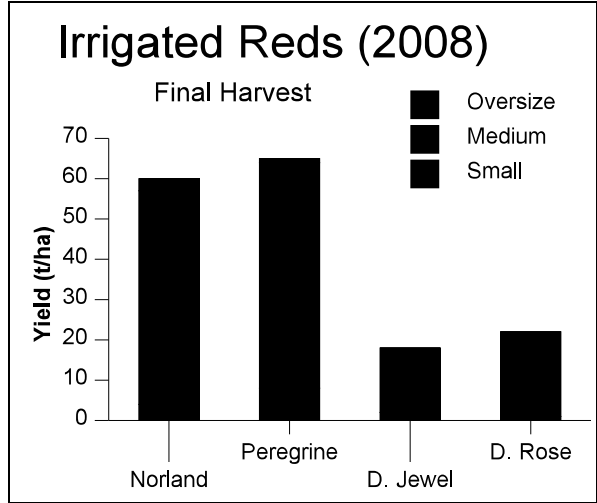
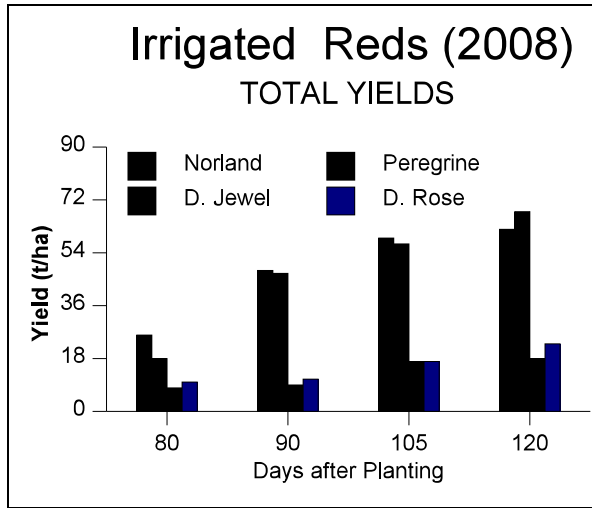
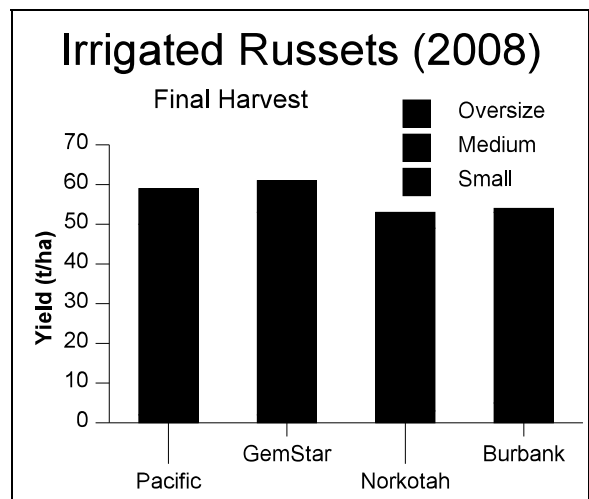
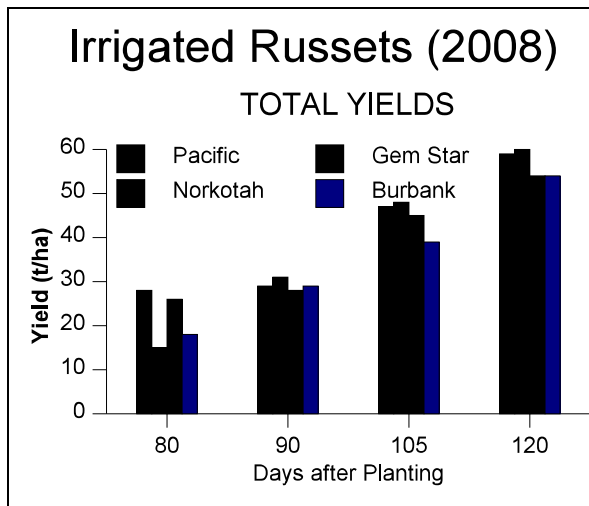
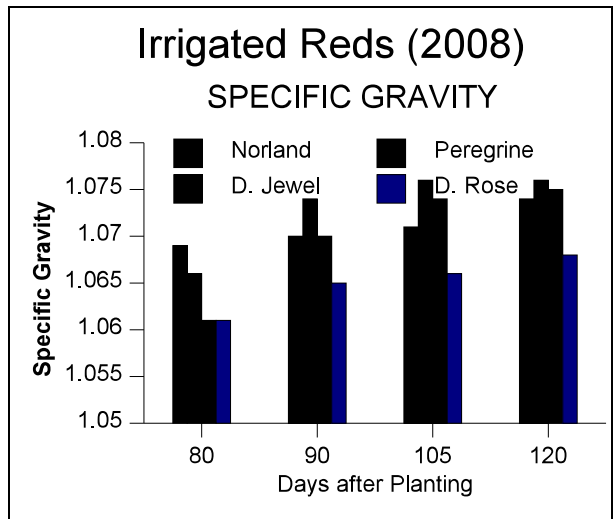


Figure 08-4. a-c.

Yields (a), tuber size profile at the final harvest (b) and specific gravities (c) for various red-skinned potatoes under irrigation in 2008.



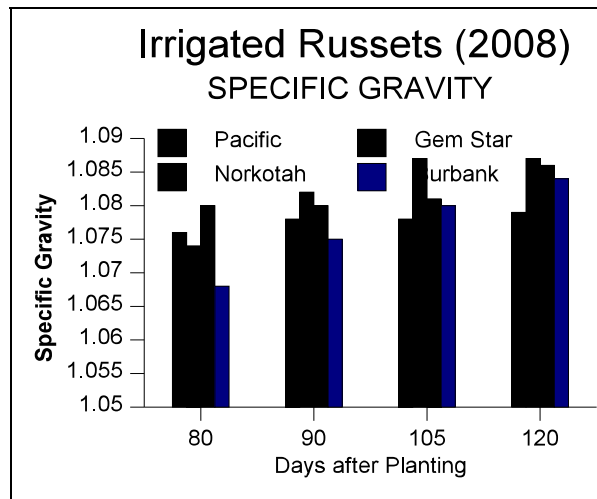


Figure 08-5. a-c.

Yields (a), tuber size profile at the final harvest (b) and specific gravities (c) for various russet-skinned potatoes under irrigation in 2008.

Summary of Time of Planting and Harvest Trial

The results of the 2008 study, as well as previous similar studies reported previously, clearly indicate the importance of maximizing the duration of the effective growing season if growers in Saskatchewan wish to maximize yields. Yields of all of the new cultivars tested increased progressively with duration in the field through to 120 days. A 120 days season represents the effective maximum available to potato growers in Saskatchewan - as earlier planting or later harvest run into excessive risk of frost damage. By contrast, some growers opt for a very short duration growing season - in the seed industry this is used to minimize the risk of virus infection, whereas in the table sector, growers may opt for an early harvest to catch a high value market opportunity or to keep the size of their tubers within the optimum range desired in the marketplace. The results clearly illustrate the magnitude of yield sacrifice associated with an early harvest. The rate of yield gain was greatest for the earlier harvests but was still significant up to 120 days in the field. The relative amount of yield loss associated with an early harvest was greater for late maturing cultivars like Gem Star and Russet Burbank than for cultivars like Pacific Russet or Norland. This suggests that growers should use caution when growing cultivars like Gem Star or Russet Burbank as a slow start to the season, an unusually cool summer or an early fall could severely depress yields. In all cases the increase in yields with time in the field was strictly a function on an increase in average tuber size, rather than any increase in tubers produced. Even at the latest harvest date (120 days) only small proportion of the tubers had exceeded optimum size for marketability. It should however be noted that these trials were based on a relatively close (25 cm or 10") in-row spacing. Growers opting for wider in-row spacings may find a relatively large proportion of the crop grading out as oversize after 120 days - especially for cultivars like Norland, Gem Star and Pacific Russet which have a larger than average tuber size profile. As expected, the dry matter content (specific gravities) increased with duration in the field - reflecting increased physiological maturity. The increase in specific gravity with maturity is of only limited importance to the seed and table growers of Saskatchewan - but this information will be of use to growers in other areas wishing to use these newly developed cultivars for processing,

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 over the 2008 cropping seasons. As similar trials were conducted in 2005 through 2007, these data are included for comparison purposes. The trial was planted in mid-May using 6, 10 or 14" (15, 25 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 fertilized, 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

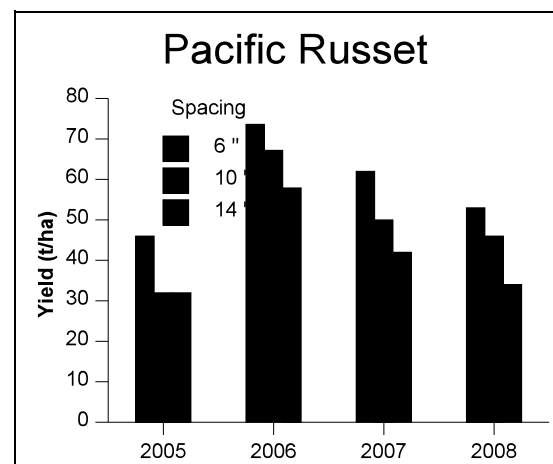
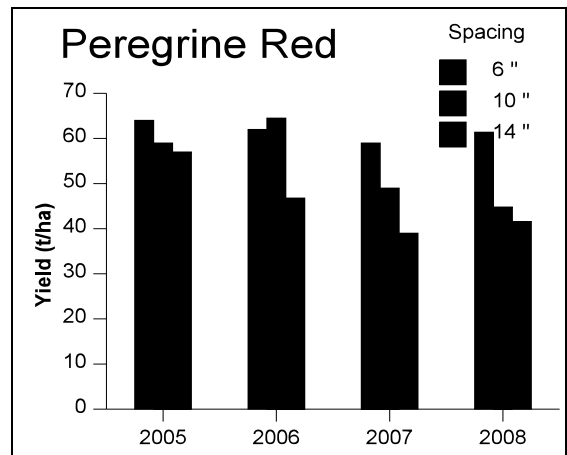
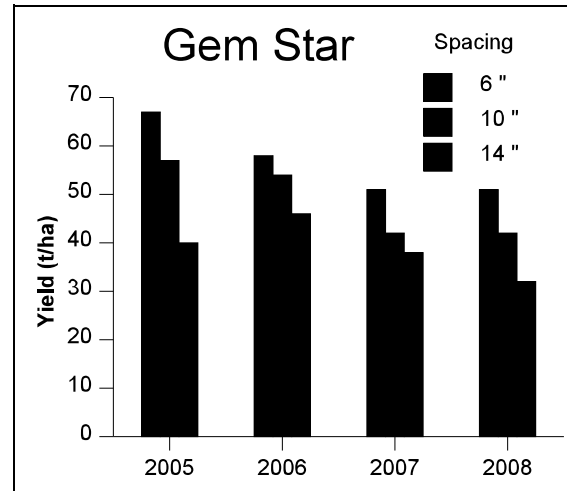
In 2008, as in previous years, yields of all three cultivars increased as the in-row spacing decreased (Fig. 08-6a). The magnitude of this yield increase was easily sufficient to offset the additional cost of seed required for the closer in-row spacing. As expected, the average tuber size increased as the distance between plants increased (Fig. 08-6b). The average tuber size of Peregrine Red was much smaller than the other varieties. The larger average tuber size of Gem Stars is well suited for the production of french fries. Tuber specific gravities showed a small but consistent tendency to increase as the in-row spacing decreased (Fig 08-6c).

Fig 08-6. Influence of in-row spacing on (a) yields, (b) average tuber weights and (c) specific gravities of Pacific Russet, Gem Star and Peregrine Red.

Conclusion

The results from this trial clearly illustrate the responsiveness of potato to manipulation of plant populations. If the objective is to maximize yields, a close in row spacing is clearly desirable as long as tuber size is not a significant issue. A close in-row spacing would obviously be desirable in seed production where high yields combined with a small average tuber size distribution would be ideal. The table and processing sectors are looking for a larger size profile - and therefore a slightly wider in-row spacing might be desirable - as long as it does not represent an excessive compromise in yield potential or processing quality. The small but consistent decline in tuber specific gravity with increasing in-row spacing may be a concern for the processing sector.

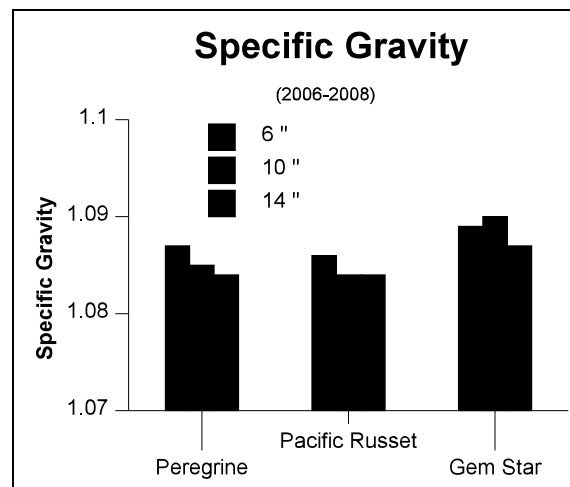
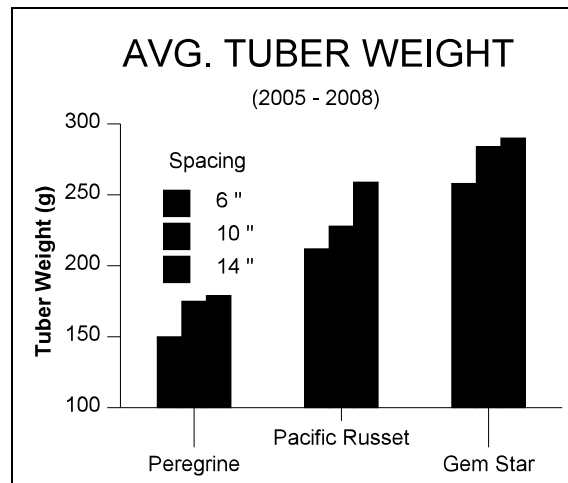
It is noteworthy that yields were increasing with plant population through to the closest spacing used ie; 6" This raises two questions;



a) would the trend continue for an even closer spacing ?
 We suspect that the yield profile would tend to plateau - with the cost benefit ratio depending on the relative cost of seed versus the harvested crop. For cultivars like Peregrine, the yield profile at 6" was already quite small. There is a substantial price penalty in table markets if the tuber size falls below "A" size (1 3/4" or 55 mm diam). If however, the tuber size falls all the way to a "Creamer" size (1" or 25 mm) these tubers command a price premium as "Baby" potatoes.

b) would a commercial grower expect to see the same responses ?

The yields obtained in this trial were well in excess of those obtained in typical commercial fields in SK.. This may reflect efforts to manage all inputs so as to minimize crop stress or competition for resources. These management practices would have allowed the crop to express its full yield potential - even when there were very large numbers of plant competing for resources. However, the cost and cost efficiency of this type of management regime was not considered. If a grower cannot or does not provide the same stress-free production environment, this will lead to competition between plants within the row - with a corresponding drop in yield potential. This loss of yields will be greatest in situations where a high plant population tends to exacerbate competition effects. Growers will need to tailor their plant populations to match their ability to manage the crop while also factoring in costs of production and anticipated yields and economic returns. .



POTATO VARIETY TRIALS

This trial evaluates the yield and quality of standard potato varieties relative to some recently introduced varieties under Saskatchewan growing conditions. Trials are conducted on irrigated land in Saskatoon. Varieties are planted side-by-side in 20 m long rows with an in-row spacing of 25 cm and 1 m between rows. Nitrogen is applied preplant and just prior to row closure (150 #/acre total). Phosphorus is band-applied at seeding (120 #/acre total). Standard pest control measures are employed. The trial is planted in mid-May and harvested 90 (early) and 120 (final) days later. Crop vigour and disease reactions are monitored throughout the season. The crop is graded and rated for yields, appearance, disease reactions and specific gravities.

Long term average data is based on at least 6 site years of tests conducted from 1991 onwards.

The growing conditions during May and June of 2008 were cooler than normal while conditions for the remainder of the season were more favorable. Yields at the 90 day harvest were about normal in 2008, while yields at 120 days were above normal.

Performance of SSPGA varieties

Pacific Russet - this new release from the Prairie Potato Breeding Consortium is targeted at the fresh market. Although Pacific Russet normally out yields Norkotah at both 90 and 120 days, it did not perform up to expectations in the 2008 trial. .

Peregrine Red - this SSPGA exclusive line continues to show exceptional yield potential at both 90 and 120days. Peregrine has a very dark red skin color, small uniform tubers and superior storage characteristics.

Agronomics of New Potato Varieties - ADF Project 20070015

	LONG-TERM AVERAGE		2008 RESULTS				LONG-TERM AVERAGE				
	Marketable Yield (t/a)	Specific Gravity	Marketable Yield (t/a)		Specific Gravity		Uniformity	Eye Depth	Skin Colour	Flesh Colour	Scab %
			Early	Final	Early	Final					
RUSSETS											
Pacific Russet	18.7	1.083	13.7	15.8	1.080	1.084	Good	S	R	W	trace
Amisk / Ranger	18.0	1.092	16.5	22.4	1.095	1.096	Good	S	R	W/Y	10
Russet Burbank	16.9	1.086	10.9	16.9	1.079	1.084	Medium	M	R	W/Y	5
Gemstar	20.0	1.091	11.2	20.0	1.086	1.090	Good	S	R	W	trace
Goldrush	18.9	1.083	15.8	19.3	1.080	1.092	Good	S	R	W	trace
Norkotah	18.4	1.081	15.8	17.3	1.071	1.075	Very Good	M	R	W/Y	8
Shepody	18.3	1.082	12.9	17.2	1.078	1.078	Good	S	L R	W/Y	21
Umatilla	19.9	1.090	13.1	16.9	1.081	1.086	Good	S	R	W/Y	trace
REDS											
Peregrine Red	22.9	1.083	20.2	23.2	1.075	1.081	Good	S	D Red	W	25
Cherry Red	19.7	1.088	16.2	17.4	1.088	1.091	Medium	S	D Red	W	18
Chieftain	21.8	1.079	11.7	23.1	1.062	1.076	Good	M	Red	W	14
Norland	20.7	1.072	18.8	22.6	1.063	1.075	Medium	M	Red	W	12
DR Norland	20.3	1.074	18.7	19.5	1.071	1.073	Medium	M	D Red	W/Y	8
Pontiac	24.1	1.075	-	-	1.078	1.078	Medium	D	Red	W/Y	32
Sangre	21.5	1.076	12.1	17.5	1.070	1.078	Good	M	D Red	W	15
Viking	21.2	1.074	8.8	23.3	1.074	1.078	Medium	S	Red	W	14
CHIPPERS											
Atlantic	21.0	1.095	-	-	-	-	Good	S	L R	W/Y	20
Snowden	19.3	1.095	-	-	-	-	Medium	M	L R	W/Y	14
OTHER											
AC Ptarmigan	22.7	1.073	12.9	26.3	1.065	1.069	Good	S	L R	W/Y	15
Alpha	17.5	1.098	5.5	16.3	1.095	1.103	Medium	S	L R	Y	14
Bintje	20.2	1.088	17.0	19.1	1.075	1.091	Good	M	W	Y	12
Yukon Gold	20.8	1.093	15.9	23.3	-	1.094	Good	M	W	Y	12

Early and Late = 90 and 120 days respectively.

Eye Depth : S=Shallow, M=Medium, D=Deep

Colour: D Red=Dark red, R=Russet, W=White, Y=Yellow, L=Light

Marketable Yield/Specific Gravity: Early=90 days after planting, Late=120 days after planting

Scab % = % of surface area of tuber affected on average

Agronomics of New Potato Varieties - ADF Project 20070015

Appendix. 08-1. Analysis of variance and treatment means for the influence of planting and harvest dates on yield and quality parameters for Red-skinned potatoes under irrigation (2008).

	80 Days		90 Days		105 Days		120 Days	
	Yield	SPGR	Yield	SPGR	Yield	SPGR	Yield	SPGR
Cultivar	**	**	**	**	**	**	**	**
CV(%)	17%	-	16%	-	14%	-	9%	-
	(t/ha)		(t/ha)		(t/ha)		(t/ha)	
Peregrine	17.8 b	1.066 b	46.7 a	1.071 a	56.9 a	1.074 a	67.5 a	1.076 a
Norland	25.8 a	1.070 a	47.6 a	1.070 b	58.5 a	1.074 a	64.4 a	1.074 a
D. Jewel	8.5 c	1.061 c	8.7 b	1.065 c	17.2 b	1.071 b	18.9 b	1.066 b
D. Rose	10.2 c	1.061 c	11.2 b	1.070 b	17.3 b	1.074 a	23.3 b	1.074 a

Values within columns followed by the same letter are not significantly different ($p=0.05$), ns = no significant difference.

Agronomics of New Potato Varieties - ADF Project 20070015

Appendix. 08-2. Analysis of variance and treatment means for the influence of planting and harvest dates on yield and quality parameters for Russet-skinned potatoes under irrigation (2008).

	80 Days				90 Days				105 Days				120 Days			
	Yield	SPGR	Chip ^Z Color	Fry Color	Yield	SPGR	Chip Color	Fry color	Yield	SPGR	Chip Color	Fry color	Yield	SPGR	Chip Color	Fry color
Cultivar	**	**			Ns	**			**	*			*	ns		
CV(%)	11%	-			16%	-			15%	-			14%	-		
	(t/ha)				(t/ha)				(t/ha)							
Pacific Russet	28.4 a	1.076b			29.5	1.078b			47.4a	1.078b			59.4 a	1.079b		
R. Norkotah	26.2 a	1.080a			27.5	1.081a			45.2a	1.084a			54.7 b	1.086a		
Gem Star	15.2 b	1.074b			30.6	1.082a			47.6a	1.087a			60.3 a	1.087a		
R. Burbank	17.8 b	1.068c			28.6	1.075c			39.2b	1.084a			53.9 b	1.086a		

Values within columns followed by the same letter are not significantly different ($p=0.05$). ns = non-significant.

^Z Chip color scores > 50 are considered acceptable, Fry color scores < 2 are considered acceptable.

Agronomics of New Potato Varieties - ADF Project 20070015

Appendix. 08-3

Analysis of variance and treatment means for the influence of in-row spacing yields and tuber size for several newly released potatoes (2008).

	Gem Star		Pacific Russet		Peregrine	
	Yield	Avg. Tuber Wt	Yield	Avg. Tuber Wt.	Yield	Avg. Tuber Wt.
Spacing	***	***	*	0.61	***	**
CV(%)	8%	11%	19%	12%	13%	11%
	(t/ha)	(g)	(t/ha)	(g)	(t/ha)	
6"	51.1 a	243 b	53.1 a	250	61.4 a	145 b
10"	42.4 b	290 a	46.2 ab	240	44.8 b	187 a
14"	32.4 c	270 ab	36.4 b	263	41.6 b	168 ab

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

