

## **Irrigation and Seed Piece Spacing Effects on Potato Seed-tuber Yield**

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The seed potato industry is the most rapidly growing sector in the horticultural industry in Saskatchewan. The phenomenon of 'Northern Vigour' and the reduced levels of tuber-borne diseases and pests on the prairies make the Canadian prairies, including Saskatchewan, producers of high quality seed potato. This is reflected in the increasing exports of seed potato to the USA, Mexico, and other markets.

In Saskatchewan, seed potatoes are grown both under dryland and irrigated conditions. Small tubers are preferred as seed potato relative to processing or table stock. Cultural practices suited to produce maximum yields of seed grade tubers (30-80 mm diameter tubers) are different from producing larger table or processing potatoes (>45 mm diameter tubers). The effects of moisture stress vary among cultivars. The different growth and tuberization characteristics of potato cultivars can further complicate management considerations such as fertility practices, plant population, etc. With steadily increasing input and other production costs, it is essential to develop appropriate, cultivar(s) specific, management practices to produce high quality (physiologically vigorous and disease-free) seed potato and to maximize economic returns.

The Saskatchewan Irrigation Development Centre (SIDC) and the Department of Horticulture Science, University of Saskatchewan are jointly developing management practices to optimize yields of high quality seed potato. This project includes cultivars targeted for both domestic and export markets. Various aspects such as, land preparation, fertility requirement, seed piece spacing, irrigation scheduling, seed piece form/type, and plant population are being studied. This paper summarizes data from preliminary studies conducted during 1994 and 1995 at SIDC designed to examine irrigation and in-row seed piece spacing effects on seed grade tuber yield.

### **Materials and Methods**

Four potato cultivars were grown under three irrigation levels at 15 cm in-row spacing in 1994 and at 15 and 30 cm in-row spacings in 1995. The cultivars tested and the other treatments included during the two years are described in Table 1. In 1994, the field plots were laid out as a split-plot design (Main-plot = Irrigation, Sub-plot = Cultivar) with four replications. In 1995, the field plots were laid out as a Split-split-plot design (Main-plot = Irrigation, Sub-plot = Cultivars, Sub-sub-plot = seed piece spacing) with four replications. Approximately 50 g seed pieces were used as planting material. The various soil moisture levels were maintained through supplemental irrigation by continuously monitoring the soil moisture status using tensiometers. Fertility management and other cultural practices were adopted according to standard recommendations. The rainfall records during the growing season in both test years are presented in Figure 1. The crops were desiccated, using Reglone, two weeks prior to harvest. The harvested tubers were graded based on tuber diameter and tubers between 25 and 90 mm diameter were considered seed grade.

## Results

### 1994:

The average tuber yield, tuber number per hill, and average tuber weight for seed grade potato for the different cultivars and irrigation treatments are summarized in Table 2. The dryland treatments produced an average yield of 38.4 t/ha of seed grade tubers (Table 2). Irrigation out yielded the dryland plots by approximately 27%. The two irrigation treatments produced similar tuber yields. Irrigation did not affect tuber number but produced larger tubers than dryland.

Maintaining the available soil moisture level at 50% produced significantly larger tubers for Red Pontiac, Ranger Russet and Russet Burbank potato than dryland, and the 50% and 65% soil moisture regimes produced similar size tubers (data not presented). For Norland, irrigation at 65% soil moisture produced the largest tubers and the average tuber size between dryland and the 50% soil moisture treatments were not significantly different.

### 1995:

Norland produced the highest seed grade yield (53.1 t/ha) which was 17% higher than the lowest yielding Shepody (Table 3). Russet Burbank and Russet Norkotah produced approximately 13% higher yield than Shepody.

Statistical analysis did not show any significant response to irrigation. This could be likely due to the substantial rainfall received during the tuber bulking period in 1995 (Figure 1). However, the following trends were evident in this test: (i) dryland produced the lowest seed grade yield (43.3 t/ha). The moderate irrigation regime (50% soil moisture) and the wettest regime (65% soil moisture) produced 5% and 16% higher yield respectively than dryland, (ii) dryland and irrigation produced similar number of tubers, and (iii) irrigation produced slightly larger tubers than dryland.

The 15 cm in-row spacing increased tuber yield by 30% and tuber number by 46% while producing relatively smaller tubers (Table 3).

## Summary

1. Irrigation generally produced higher yields and larger tubers and had no effect on tuber numbers.
2. Irrigation effects were less pronounced with high late-season rainfall.
3. Higher plant populations (closer seed piece spacing) produced higher yields of smaller tubers that are preferred as planting material.

Table 1. Potato cultivars, irrigation regimes, and seed piece spacings tested: 1994 and 1995

Treatments	1994	1995
Cultivars	Norland, Red Pontiac, Russet Burbank, Ranger Russet	Norland, Russet Burbank, Russet Norkotah, Shepody
Irrigation	Dryland, 50% available soil moisture, 65% available soil moisture	Dryland, 50% available soil moisture, 65% available soil moisture
Seed piece spacing	15 cm	15 cm, 30 cm
Row spacing	100 cm	91 cm

Table 2. Yield components for potato cultivars grown under different irrigation regimes: 1994

Treatments	Seed grade tubers (25-90 mm diameter)		
	Yield (t/ha)	No. of tubers / hill	Av. tuber weight (g)
<b>Cultivar<sup>1</sup></b>			
Norland	45.3	16.7	111
Red Pontiac	47.2	14.5	131
Ranger Russet	38.7	13.8	119
Russet Burbank	49.7	17.9	116
<b>Irrigation<sup>2</sup></b>			
Dryland	38.4	15.0	111
50% soil moisture	48.8	16.4	122
65% soil moisture	48.5	15.8	125
<i>ANOVA - Estimated probability of significance, and LSD: 5.0% (within parenthesis)</i>			
<b>Source</b>			
Cultivar	0.001 (5.6)	0.001 (1.9)	0.001 (10)
Irrigation	0.01 (6.6)	ns	0.001 (6)
Cultivar x Irrigation	ns	ns	0.01 (11)
c. v (%)	14.7	14.3	6.4

<sup>1</sup>Average of irrigation treatments.

<sup>2</sup>Average of cultivars.

Table 3. Yield components for potato cultivars grown under different irrigation regimes: 1995

Treatments	Seed grade tubers (25-90 mm diameter)		
	Yield (t/ha)	No. of tubers / m	Av. tuber weight (g)
<b>Cultivar<sup>1</sup></b>			
Norland	53.1	35.8	118
Shepody	40.2	24.1	123
Russet Norkotah	45.7	29.8	119
Russet Burbank	45.5	35.8	111
<b>Irrigation<sup>2</sup></b>			
Dryland	43.3	31.7	114
50% soil moisture	45.0	29.7	120
65% soil moisture	50.1	32.8	120
<b>Spacing<sup>3</sup></b>			
15 cm	52.1	37.3	113
30 cm	40.2	25.5	122
<i>ANOVA - Estimated probability of significance, and LSD: 5.0% (within parenthesis)</i>			
<b>Source</b>			
Cultivar	0.001 (5.1)	0.001 (2.7)	0.001 (4)
Irrigation	ns	ns	ns
Spacing	0.001 (3.1)	0.001(2.0)	0.001 (3)
Cultivar x Irrigation	ns	ns	ns
Cultivar x spacing	ns	ns	ns
Irrigation x spacing	ns	ns	ns
Cult. x Irrig. x Spac.	ns	ns	ns
c. v (%)	16.5	15.8	5.9

<sup>1</sup>Average of irrigation and spacing treatments.

<sup>2</sup>Average of cultivar and spacing treatments.

<sup>3</sup>Average of cultivar and irrigation treatments.

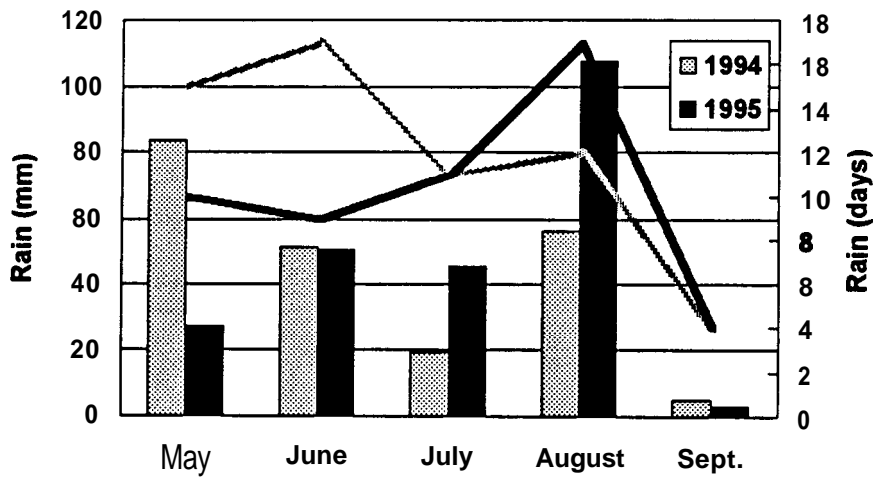


Figure. Rainfall records for the growing season during 1994 and 1995.