SEED POTATO! A "Vigorous" Proposition for Saskatchewan.

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It is believed that potato seed-tubers originating in northern latitudes or higher altitudes are more vigorous and higher yielding than seed from southern latitudes or lower elevations (Wahab, 1993). In North America, seed potato production is centred around the northern states and Canada. In 1990, Idaho, North Dakota, Maine, Minnesota, Montana, Nebraska, and Wisconsin, accounted for 87% of the U.S. seed potato production (Slack, 1993). The advantage from growing seed potato in the northern climate is attributed to the reduced pressure of virus-transmitting insects (Slack, 1993) and the perceived physiological superiority of seed-tubers produced in the northern latitudes compared to seed from more southern locations (Wurr, 1978). Recently, producers from the U.S.A. have begun to purchase seed potato from Canada based on the observation that Canadian seed is more productive than domestic seed. Canada and the U.S.A. have very stringent seed certification regulations to ensure varietal purity and freedom from tuber-borne diseases. Therefore, the purported superiority of Canadian seed could likely be attributed to physiological effects rather than pathological conditions.

The effect of the environment in which seed potato is grown on the level of tuber-borne diseases and their influence on growth and productivity of the progeny is well documented. However, less known nor appreciated, is the impact of the environment on the physiological condition of the potato seed-tuber and its relationship with growth and productivity of the seed lot.

A research project initiated in 1986 (1986-l 991) and subsequent on-farm tests conducted by the Department of Horticulture Science University of Saskatchewan examined the effects of latitude of seed potato production (i.e. northern versus southern seed) on the performance of the progeny. Yield tests were conducted at Colorado, Minnesota, and several locations in Saskatchewan. This study showed that seed originating in higher latitudes (e.g. Saskatchewan) was more vigorous and higher yielding than seed grown in relatively lower latitudes (e.g. Minnesota, Nebraska, Wisconsin). Based on this findings seed potato exports from Alberta and Saskatchewan to the U.S.A has increased significantly during the recent years. Presently, seed potato production is the fastest growing horticultural industry in Saskatchewan.

With the rapid expansion of the seed potato export market, it is necessary to develop economically viable and sustainable management practices to increase yields of 'seed grade' (small) tubers compared to processing or table grade (large)

potato. This paper summarizes results from (i) the 'Northern Vigour' study conducted at the Department of Horticulture Science, University of Saskatchewan and (ii) the joint project between the Department of Horticulture and the Saskatchewan Irrigation Development Centre to develop suitable agronomic practices for seed potato production. Data from selected field trials are presented to describe the salient features of this project.

NORTHERN VIGOUR

Preliminary Test

During the summer of 1986, a preliminary test was conducted at the field plots of Department of Horticulture Science, Saskatoon, to evaluate the productivity of certified Norland and Russet Burbank seed obtained from several northern (Prince Albert, Outlook) and southern (Minnesota, Nebraska) sources.

Norland and Russet Burbank from the northern (Outlook and Prince Albert) sources produced significantly higher marketable yields than the southern (Nebraska and Wisconsin) sources during both 'early' (90 DAP) and 'mature' (120 DAP) harvests (Table 1). The Outlook and Prince Albert seed sources produced similar yields.

Multi-location Tests

Seed source effects on productivity for both Norland and Russet Burbank were carried out in multiple locations during 1988 through 1990. Test sites included locations in Saskatchewan (Outlook, Prince Albert, Saskatoon) and the U.S.A. (Colorado, Minnesota). Genetically uniform seed were utilized for these tests. This was achieved by multiplying a single source of seed in the various Saskatchewan and the U.S.A. locations. The seed lots were stored under uniform conditions in Saskatoon prior to planting during the next season.

In this multi-year/multi-location study (15 site-years), the yield trends for the various seed sources were quite consistent across yield test sites in the different years. The Saskatchewan seed sources generally outyielded the more southern U.S.A. seed sources during both 'early' and 'final' harvests. The yield differences were more pronounced for Russet Burbank than Norland. The yield advantage for Saskatchewan grown seed ranged from 5%-27% for Norland and up to 133% for Russet Burbank.

The 1989 marketable yield data during 'early' and 'final' harvests for Norland and Russet Burbank potatoes are presented in Tables 2 and 3 respectively.

PRODUCTIVE CAPACITY OF DIFFERENT GENERATIONS OF SEED PRODUCED IN SASKATCHEWAN

Seed potatoes are classified into several generations based on the number of field multiplication seasons. Seed potato certification standards specify slightly increased levels of tolerance for later generations. With successive generations in the field there can be a progressive accumulation of tuber-borne diseases, mainly viruses, that can affect crop vigour and reduce yields. Northern latitudes and higher altitudes are favoured for seed potato production as these regions are relatively free from virus transmitting insects. This study is a preliminary examination of different generations of seed potato produced in Saskatchewan.

The different seed generations compared for the various cultivars and their yield potentials are presented in Table 4. The lower generation for Russet Norkotah was bin-run potato and the other classes were inspected seed categories.

There were no visible differences in the disease levels, vigour and productivity of the various generations tested for the different cultivars. For several cultivars, the seed vigour was not significantly different for Pre-Elite to E3 generations. This is a reflection of low incidence of virus transmitting vectors under Saskatchewan growing conditions that produced high quality lower generation seed potato.

Seed **Piece Form**

Whole seed-tubers are more desirable for potato production because of (i) reduced spread of diseases through cutting equipment, (ii) greater tolerance to adverse soil conditions, and (iii) uniform plant stand. Productivity of whole versus cut seed can vary depending on the sprout distribution characteristics of the seed tuber.

In this test, equivalent sized (approximately 50 g) whole tubers, half (single cut), and quarter (double cut) seed pieces of Alpha, Atlantic, Shepody, and Russet Burbank potatoes were compared for growth and productivity. This test also included 15 and 30 cm seed piece spacing treatments. The trial was grown under irrigation utilizing standard management practices.

The four cultivars tested responded similarly to seed cutting and spacing effects (absence of cultivars, seed type, and spacing interactions: Table 5). The drop and single cut seed pieces produced 17% higher seed grade yield than double cut seed (Table 5). The 15 cm seed piece spacing outyielded the 30 cm spacing by 24%. These results support the perception that whole and single cut are superior in performance to double cut seed. In this test, the extent of the seed type effect was greater than anticipated considering the favourable growing conditions and the high quality of the double cut seed.

The results emphasize the need for refining management practices, including seed piece type, seed piece spacing etc., to enhance production of seed grade tubers under Saskatchewan conditions.

WHY SASKATCHEWAN IS A GOOD SEED PRODUCTION REGION!

Saskatchewan is ideally suited for seed potato production for the following reasons: (i) benefits through 'northern vigour', (ii) extreme winters control virus transmitting vectors, (iii) limited potato production in Saskatchewan and dispersed potato fields offer sufficient isolation, and (iv) availability of irrigation enables consistency in production and supply.

Literature Cited

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Table 1. Marketable tuber yields for Norland and Russet Burbank potato from different seed sources at 90 and 120 days from planting: 1986.

Seed source	Marketable tuber yield (t/ha)[z]			
	Norland		Russet Burbank	
	90 DAP	120 DAP	90 DAP	120 DAP
Nebraska	32.4	32.6	-	-
Wisconsin	-	-	20.9	24.0
Outlook	40.6	41.3	28.5	37.3
Prince Albert	46.6	38.9	33.7	37.5
Significance	<0.01	<0.05	<0.01	<0.01
LSD (5.0%)	7.7	6.8	5.4	7.7

***Tubers between 45-90 mm in diameter.**

Table 2. Marketable tuber yields for Norland potato from different seed sources at 90 and 120 days after olantina at several locations: 1989.

Seed source	Test site					
	Becker	Greeley	Outlook	S'toon	p.Albert	Mean
	Marketable yield (t/ha)[z]					
	90 DAP					
Becker	40.7	61.0	19.9	32.3	16.0	34.0
Outlook	58.5	61.5	33.3	55.1	32.2	48.1
Saskatoon	56.7	72.4	35.2	55.2	28.3	49.6
P.Albert	47.7	66.4	35.8	47.7	28.8	45.3
Significance	***	NS	**	*	**	***
LSD (5.0%)	5.5	9.5	7.9	17.0	8.4	5.8
	120 DAP					
Becker	48.6	53.1	33.8	60.2	17.0	42.5
Outlook	67.7	60.3	49.8	67.4	27.8	54.6
Saskatoon	64.5	56.9	49.8	68.3	30.4	54.0
P.Albert	59.7	61.9	51.2	64.1	31.7	53.7
Significance	*	NS	**	NS	*	***
LSD (5.0%)	13.7	7.2	8.6	11.4	9.5	4.5

[z]Tubers larger than 45 mm in diameter.
* ** *** and NS indicate significance at P<0.05, 0.01 0.001 levels of significance and not significant, respective&.

Table 3. Marketable tuber yields for Russet Burbank potato from different seed sources at 90 and 120 days after planting at several locations: 1989.

Seed source	Test site					
	Becker	Greeley	Outlook	S'toon	P.Albert	Mean
	Marketable yield (t/ha)[z]					
	90 DAP					
Becker	21.1	23.0	0.1	14.0	6.4	12.9
Outlook	30.6	46.8	9.1	23.3	30.5	28.1
Saskatoon	27.0	47.0	12.4	24.0	15.4	25.2
P.Albert	29.9	47.0	6.4	29.4	16.9	25.9
Significance	NS	***	***	NS	**	***
LSD (5.0%)	9.4	6.6	3.2	14.1	12.5	6.7
	120 DAP					
Becker	58.4	31.7	3.8	7.2	14.3	23.1
Outlook	64.4	37.0	41.9	46.7	25.7	43.1
Saskatoon	61.7	43.2	38.9	35.6	23.2	40.5
P.Albert	69.4	46.5	37.3	45.3	27.5	45.2
Significance	NS	**	***	***	NS	**
LSD (5.0%)	15.3	8.8	9.1	11.1	14.0	10.7

[z]Tubers larger than 4.5 mm in diameter.
** *** and NS indicate significance at P<0.01 0.001 levels of significance and not significant, respectively.

Table 4. Marketable yield potential for high and low generation seed potato of selected cultivars

Cultivar	Marketable yield (t/ha)z		
	High aeneration	Low aeneration	Mean
Alpha	24.7 (EI)	33.0 (E3)	28.9
Norland	47.5 (PE)	46.9 (EI)	47.2
Ranger Russet	38.7 (EI)	38.0 (E2)	38.3
Russet Burbank	41.4 (PE)	42.8 (E3)	42.1
Russet Norkotah	36.6 (PE)	29.6 (--)	33.1
Shepody	46.5 (PE)	44.8 (E3)	45.6
Mean	39.2	39.2	
ANOVA	Significance	LSD (5.0%)	
Cultivar	• **	8.4	
Generation	NS		
Cult. x Gener.	NS		

'Tubers larger than 45 mm in diameter.
• ** and NS indicate significance at P <0.001 levels of significance and not significant, respectively.

Table 5. Seed piece type and spacing effects on yield components of seed grade tubers for selected cultivars

Treatment	Seedersz			
	Yield (t/ha)		Av. tuber weight (g)	
*Cultivar*y				
Alpha	38.9		116	
Atlantic	48.8		118	
Shepody	44.6		117	
Russet Burbank	47.4		115	
Seed piece type"				
Drop seed	47.3		120	
Half	47.2		113	
Quarter	40.4		117	
*Spacing*w				
15cm	49.8		123	
30 cm	40.1		111	
ANOVA	Signi	LSD (5.0%)	Signif.	LSD (5.0%)
Cultivar (C)	• **	4.9	NS	
Seed type (T)	• *	4.3	NS	
Spacing (S)	• **	3.5	NS	
C x T	NS		N S	
c x s	NS		NS	
T x S	NS		NS	
C x T x S	NS		NS	

zTubers between 25-90 mm diameter.
** *** and NS indicate at P 0.01 levels of significance and not significant, respectively.