THE POTENTIAL FOR IRRIGATED DRY BEAN PRODUCTION IN SASKATCHEWAN

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INTRODUCTION

Saskatchewan produced dry bean in the 1920s and 1930s (McGregor, 1931; CDA, 1938). Commercial production of dry bean developed in both southern Alberta (irrigation) and Manitoba (dryland) during the 1970s. During this period, the Crop Development Centre (CDC) at the University of Saskatchewan evaluated dry bean cultivars on dryland and under irrigation.

Commercial irrigated pinto bean production was attempted in the South Saskatchewan River Irrigation District No. 1 in the late 1970s. (Saskatchewan Water Corporation, 1987). One of the main obstacles to commercial development was the reluctance of growers to invest in specialized row cropping equipment used for dry bean production at that time. Some growers maintained an interest in dry bean production potential using conventional Saskatchewan crop production equipment.

In 1986, a research project was initiated with the objectives of (1) evaluating dry bean germplasm for adaptation to south-central Saskatchewan, and (2) investigating suitable agronomic practices for irrigated dry bean production under Saskatchewan conditions. This paper reports brief summaries of some results of this research in the general context of the potential for development of a dry bean industry in Saskatchewan.

GERMPLASM EVALUATIONS

Five adaptational trials have been conducted from 1986 to 1988 (Table 1). The United States Dry Bean Co-operative Nursery has been grown each year. This nursery includes varieties and experimental lines in the pinto, small white, navy, pink, great northern, red mexican and kidney market classes. The Saskatoon nursery consisted of remnant seed from previous CDC evaluations. The Prairie Dry Bean Co-op was initiated in 1988. This test includes all registered dry bean varieties commonly grown in Western Canada. Other entries include navy and coloured bean lines from breeding programs in Western Canada and the United States. The two remaining tests include observational lines from the pinto, pink, red mexican, black and great northern market classes.

Table 1. Germplasm evaluations conducted at Saskatchewan Irrigation Development Centre from 1986 - 1988

Name of nursery	Year		
	1986	1987	1988
United States Dry Bean Co-operative Nursery	+	+	+
Saskatoon Nursery	+	+	-
Prairie Dry Bean Co-operative Test	-	-	+
Pinto Observational Test	-	-	+
Coloured Bean Observational Test	-	-	

The materials and methods used in these evaluations are reported elsewhere (Vandenberg and Slinkard, 1988). Some, but not all varieties from the USDB Co-operative Nursery matured in each year. This indicates that some U.S. breeding programs are releasing germplasm suitable for production in south-central Saskatchewan. In addition, there are promising lines in the other co-operative and observational tests. The market class with the greatest number of adapted varieties is pinto. Small plot yield measurements of irrigated dry bean over a range of years and environments indicate economic potential yield. (Table 2).

Table 2. Mean yield of three check varieties of dry bean grown under irrigation at SIDC from 1986 to 1988

Market class	Variety †	Yield	Number of plots
		kg/ha	
Pinto	UI 111	2453	355
Pink	Viva	2772	374
Navy	Seaforth	2095	327

†These varieties were used in most germplasm evaluations and all agronomic experiments from 1986 to 1988. Seaforth was used in 1988 but the navy bean line D76-125 (similar maturity) was used in 1986 and 1987.

These yield levels are comparable to those achieved under irrigation by the best dry bean growers in southern Alberta.

AGRONOMIC INVESTIGATIONS

Experiments concerning date seeding, rate of seeding, row spacing, date of harvest, and method of harvest for dry bean were conducted from 1986 to 1988. The materials and methods were reported earlier (Vandenberg and Slinkard, 1988).

Date of seeding studies indicated a narrow window for seeding of dry bean. (Table 3).

Table 3. Effect of seeding date on mean yield of irrigated dry bean at Outlook from 1986 to 1988.

	Mean yield ‡			
	Year			
Seeding period†	1986	1987	1988	Mean 86-88
	kg/ha			
May 20 - May 27	2537	2558	2270	2455
May 28 - June 3	1670	1878	2504	2017
June 4 - June 10	1238	652	1971	1287

† Dates: 1986 - May 27, June 3, June 10
1987 - May 27, June 3, June 10
1988 - May 20, June 1, June 9

‡ Mean yield of three varieties with six replications per seeding date per year

The ideal target seeding date is the fourth week of May. Seeding earlier increases the risk of spring frost while delaying seeding into June increases the risk of damage by early fall frost.

Results from the seeding rate and row spacing experiment indicated that under irrigated conditions, increased seeding rates showed no yield benefit except for the bush type navy market class (Table 4). Commercial seeding rates to achieve stands of 30 plants/m^2 are adequate. Doubling this rate caused yield decreases for navy and pink bean, due to increased disease pressure from Sclerotinia (white mold). Pinto bean yield was constant across seeding rates. UI 111 was infected by Sclerotinia at all seeding rates. For viny indeterminate of pinto varieties like UI 111 grown under irrigated conditions, a lush canopy develops. This favours Sclerotinia development.

Table 4. Effect of seeding rate on mean yield of three irrigated dry bean cultivars from 1986 to 1988 at Outlook.

			Seeding rate‡ (seeds/m^2)				
Market Class	Growth Habit	Cultivar†	15	30	45	60	Mean
			--------------	kg/ha	--------------		
Navy	bush	Seaforth	2235	2465	2652	2495	2462
Pink	semi-vine	Viva	3178	3166	3153	2803	3075
Pinto	vine	UI 111	2492	2359	2240	2311	2351
Mean			2635	2663	2682	2536	

† Seaforth used in 1988, D76-125 in 1986 and 1987.
‡ Mean yield of six replications and two row spacings for three years, 1986-1988.

Table 5. Effect of row width on mean yield of irrigated dry bean from 1986 to 1988 at Outlook.

	Row Width†		
Year	30 cm	60 cm	Mean
	----------------	kg/ha	----------------
1986	2590	2603	2597
1987	1721	2184	1953
1988	3428	3267	3348
Mean	2580	2685	

† Mean yield of 3 cultivars combined over 4 seeding rates, 6 replications.

Response to row spacing varied from year to year (Table 5). No effect was observed in 1986. Seeding in 30 cm rows reduced yield by more than 20% compared to 60 cm rows in 1987. Wet weather in late July and August promoted Sclerotinia development which severely infected the indeterminate pinto UI 111. In 1988, relatively little Sclerotinia infection occurred because the weather was hot and dry. Under this environment mean yield was 5% higher in 30 cm rows compared to 60 cm rows. Experience over the past three years indicates that Sclerotinia is the major concern for the overhead irrigation crop production systems used in south-central Saskatchewan. In this environment, Sclerotinia infection is a threat every year. The wider row spacing, therefore, reduces the risk of yield loss largely due to reduced risk of Sclerotinia, particularly for indeterminate cultivars.

The harvest date experiment from 1986 to 1988 showed that mean losses due to shattering did not exceed 10% for up to one month beyond physiological maturity (Table 6).

Table 6. Effect of harvest date on yield of irrigated dry bean at Outlook from 1986 to 1988

Date †	Yield ‡	Percent of date 1
	kg/ha	
1	2362	100
2	2248	95
3	2314	98
4	2222	94
5	2155	91

† Mean of 3 cultivars over 6 replications in each of 1986 and 1987 (4 in 1988).
‡ Date 1 represents physiological maturity; subsequent dates are weekly intervals thereafter.

Experiments comparing hand harvest to direct cutting with a small plot combine, at two row spacings, showed that combine losses averaged 13.7% over all cultivars and row spacings over the three year period (Table 7). At 30 cm row spacing, mean direct combining losses were slightly greater than at 60 cm row spacing because narrower rows promote Sclerotinia development. Severe stem infections cause collapse of the canopy. At harvest, pods are closer to the ground resulting in greater harvest loss. These results parallel the findings in the seeding rate and row spacing study. Combine losses averaged 7.3% for upright (Midnight) and bush (Seaforth) plant types compared to an average loss of 18.2% for semi-vine (Viva) and vine (UI 111) types. This again is due to the effect of Sclerotinia which is a greater problem for more indeterminate plant types.

Table 7. Effects of harvest method and row spacing on yield of 4 dry bean cultivars from 1986 to 1988 at Outlook.

		Harvest method ‡				
		Combine		Hand		
Cultivar†	Growth habit	30 cm rows	60 cm rows	30 cm rows	60 cm rows	Mean
		-----------------	-----kg/ha-----	-----------------		
Midnight	upright	2157	2008	2251	2321	2184
Seaforth	bush	1753	1736	1901	1813	1801
Viva	semi-vine	2378	2710	3049	3123	2815
UI 111	vine	2378	2231	2623	2674	2400
Mean		2090	2171	2456	2483	

† Seaforth used in 1988, D76-125 in 1986 and 1987.
‡ Yield values are 3 year means of 6 replications.

CONCLUSIONS

Research on irrigated dry bean for the past three years shows that production is possible in the warmer long season areas of Saskatchewan around Lake Diefenbaker. Although the choice of adapted varieties may be limited compared to other areas of the continent, more are available each year. There is a risk of frost during the growing season, but the probability of occurrence is likely no higher than the probability of crop loss due to wet weather at harvest or drought in other dryland bean production regions of the continent.

Dry bean should be seeded at conventional seeding rates (30 plants/m^2) in the fourth week of May. Wide row spacing (45 - 60 cm) is advantageous under irrigated conditions for dry bean types with indeterminate viny growth habit. Sclerotinia is the major concern in production of these types of dry bean. Fungicide application will likely be necessary every year with the overhead sprinkler irrigation systems used in Saskatchewan. Direct combining of dry bean is possible using lentil harvest technology. With good Sclerotinia control and timely harvest at the recommended moisture content, field harvest losses of less than 10% should be possible under commercial production.

Irrigated dry bean production has potential in Saskatchewan. Growers with good crop management skills should be able to profitably produce dry bean under irrigation without additional investment in farm equipment. Over the next decade, there is good potential for development of an irrigation dry bean industry in the Lake Diefenbaker region.

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