DRY BEAN PRODUCTION ON DRYLAND IN SASKATCHEWAN

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INTRODUCTION

Dry edible bean *(Phaseolus vulgaris)* is the world's most widely grown and most widely consumed pulse crop. It is the most important pulse crop in North America in terms of both production and consumption. The ten year average annual production area in North America is about 800,000 ha. The pinto market class represents 40 % of total North American dry bean production (USDA Bean Market News). About 75 % of the pinto production is consumed domestically. This means that the North American pinto bean market is by far the largest domestic pulse market.

The Western Canadian dry bean production area has tripled in the past five years. The largest expansion is in the production of navy bean in Manitoba and irrigated pinto bean in Alberta (Table 1).

Table 1: Area of production of dry edible beans in Western Canada, 1986-1991

Year	Alberta		Saskatchewan		Manitoba		Total	
	---------- hectares (acres) ----------							
1986	5,060	(12,500)	0	(0)	4,850	(12,000)	9,910	(24,500)
1987	8,100	(20,000)	15	(35)	8,100	(20,000)	16,215	(40,035)
1988	9,150	(22,600)	25	(60)	8,100	(20,000)	17,275	(42,660)
1989	9,150	(22,600)	80	(200)	12,150	(30,000)	21,375	(52,800)
1990	9,150	(22,600)	400	(1,000)	17,000	(42,000)	26,550	(65,600)
1991†	11,350	(28,000)	1,200	(3,000)	15,700	(39,000)	28,250	(70,000)

† estimated
Sources: Alberta Agriculture, Saskatchewan Agriculture and Food, Manitoba Agriculture

Establishment of a dry bean industry in Saskatchewan based on row crop production methods was attempted in the late 1970s in the South Saskatchewan River Irrigation District #1. A second attempt was made beginning in 1987 using a modified lentil production system based on conventional seeding methods and direct harvesting with flex headers.

The development of dryland production of pinto bean in the Dark Brown soil zone began in 1988. This effort is based on the premise that experienced lentil growers have the basic skills and machinery to successfully produce pinto bean, with some modifications. This would allow access to the major domestic pulse market. Development of a second pulse crop option would help balance the price and production swings of the lentil market.

Over the past 5 years, several demonstration and research projects involving dry bean were initiated with assistance from the Saskatchewan Agriculture Development Fund (ADF), the Saskatchewan Pulse Crop Development Board (SPCDB) and the Western Grain Research Foundation (WGRF). A summary of progress on these projects is described below.

PROGRESS TO DATE

Since 1988, over 100 dryland lentil growers have experimented with pinto bean production. A replicated strip trial consisting of 5 early maturing commercial cultivars was grown at Wiseton, Saskatchewan in 1988 and 1989. This region experienced severe drought in both years. In 1988, the trial was not harvested. In 1989, the cultivars Othello and Fiesta showed superior performance.

From 1989 to 1991, a farm scale evaluation (8 ha) of dryland (stubble) great northern bean production was conducted at Bounty, Saskatchewan. Yield potential of dry bean was slightly below that of adjacent lentil crops, but harvested yield was lower because of problems associated with cutterbar losses using the direct harvesting system (Table 2). Results in 1991, however, showed that cultivar choice and lifter arrangement can greatly affect harvest efficiency (Table 3).

Table 2: Three year summary of actual and potential dry bean yield and adjacent net yield of lentil on stubble. Bounty, Saskatchewan, 1989-1991.

Year	Harvested yield of dry bean	Potential yield of dry bean	Adjacent harvested yield of lentil
	----------lb/ac----------		
1989	200	250	300
1990†	630	1080	1100
1991‡	730	1058	1400
Mean	520	796	933

† lentil yield average of Eston, Laird and French green
‡ 1991 dry bean figures averaged over three varieties; US 1140 and Beryl great northern, and Othello pinto.
Source: Evaluation of dryland production of Great Northern bean, Final Report.

Table 3. Percent of potential yield harvested and lost for three dry bean cultivars direct combined at two lifter spacings at Bounty, Saskatchewan, 1991.

Variety	Percent yield loss at lifter spacing of 3 in.	9 in.
US 1140	32	30
Beryl	13	30
Othello	34	46

Source: Evaluation of dryland production of Great Northern bean, Final Report.

In 1990 and 1991, a multi-site evaluation (4 ha per site) of the potential for dryland pinto bean production was conducted by the SPCDB with the assistance of ADF. In 1990, pinto bean was grown at Swift Current, Elrose and Kindersley. Swift Current was unaffected by drought and harvested yield of pinto bean was 700 lb/ac compared to 1750 lb/ac for Laird lentil. In 1991, six sites were selected

to assure even distribution across the lentil growing area of Saskatchewan. Mean potential yield across the six sites was 1827 lb/ac compared to 1327 lb/ac for lentil. Harvested yield was much lower (Table 4). Excessive rainfall at some sites caused yield reduction in lentil due to ascochyta blight and indeterminate growth. Conversely, the sites where late July and early August rainfall occurred produced potential dry bean yields above the normal expected yield.

In 1991, an estimated 100 or more lentil growers throughout Saskatchewan experimented with pinto bean production for the first time. Each grower used a unique production system based on lentil production. All types of seeding (discers, drills, airseeders) and harvesting systems (swathers, rigid headers, flex headers, air reels) were used. Yield estimates, based on cleanout at local seed cleaning plants, ranged from 0 to 1300 lb/ac. All growers reported difficulty with harvesting.

Overall, the results of on-farm production experiences show that dryland pinto bean production using low-cost lentil production systems can be an economically viable crop in Saskatchewan, provided that harvest efficiency is improved to 85 %. This concern is the current focus of all research and development efforts for pinto bean.

There are three basic approaches to overcoming the harvesting problem. These can be classified as agronomic, mechanical and genetic. The agronomic approaches involve variety choice and crop management. In the short term, growers have few options in choice of cultivar. Othello is recommended because of its early maturity and superior drought tolerance. In 1991, Othello had a large proportion of its pods set low in the canopy. This exaggerated the harvest loss attributable to pod cutting at harvest. There may be, however, other agronomic factors which can help increase the distance between pod tips and the ground. Adequate phosphorus and nitrogen will help ensure that early season stem elongation is maximized. Seeding into standing stubble may also help increase stem height if moisture is not limiting. Harvest losses can also be reduced by proper harvest timing. Developing a greater understanding of the interaction between pod height and crop management factors will help increase harvest efficiency.

The second approach is improving the mechanical aspects of harvesting. Modifications to floating cutterbars such as improved lifter design will help reduce losses. Adjustment of cutting angles, lifter spacing and cutting height will also lead to improved harvest efficiency. Development of air reel modifications specifically for dry bean harvest may also be possible. The mechanical approach to improving direct harvesting methods is now being investigated by the Agricultural Engineering Department at the University of Saskatchewan.

The third approach to overcoming harvesting problems is genetic. Plant breeding specifically for direct harvest conditions should help provide a long term solution to the harvest loss problem. A pinto bean breeding project was formally initiated at the Crop Development Centre in 1991 with funding from the SPCDB. For 1992 additional support from the WGRF is in place. The objectives of the breeding program, in addition to yield, are early maturity, drought tolerance, cold tolerance, marketability and, above all, harvestability using direct harvest methods. The first 500 breeding lines will be tested in 1992. All yield trials will be direct harvested with a small plot combine. This may be the only North American dry bean breeding program in which suitability for direct harvesting is determined by the use of a combine.

Successful development of a dry bean industry based on dryland production in Saskatchewan will require innovation, adaptation and trial and error. If the development of the lentil industry is used as the example to follow, success will be the result of the cooperative efforts of innovative growers and their representative organizations, pulse crop marketers, herbicide specialists, agricultural engineers, extension personnel, funding agencies and researchers.

Table 4. Yield comparison of dryland pinto bean and lentil (1991).

Site	Harvested yield	Harvest loss	Potential yield	Lentil yield
	----------lb/ac----------			
Elrose	--	1133	1133	1430
Abernethy	600	1800	2400	1600
Nokomis	600	1200	1800	1200
Fillmore A†	1146	1000	2146	600
Fillmore B‡	1640	1000	2640	600
Sw.Current A	650	833	1483	1825
Sw.Current B	650	667	1317	1825
Regina	250	1450	1700	1900
Mean:	692	1135	1827	1373

†A - 80 lb/ac seeding rate
‡B - 100 lb/ac seeding rate

Source: Dryland bean production trial, Final Report.