Dry Bean

Canada-Saskatchewan Irrigation Diversification Centre

Optimum Seeding Rate and Row Spacing for Dry Bean Under Irrigation

Research Highlights: March 2001

Introduction

Seed yield of dry bean generally increases as plant density increases. However, high plant densities can lead to low aeration, high humidity and prolonged periods of dampness. These are ideal conditions for the development of white mold (*Sclerotinia*). The environment within a canopy of given density will be affected both by plant architecture and row spacing. As seed is a major input cost for dry bean production, optimum plant density should maximize yield while minimizing seed cost.

A target plant density of 25-30 plants/m^2 (2.3-2.8 plants/ft^2) and row spacing of 60-80 cm (24-32 in) is currently recommended for irrigated dry bean production. Preliminary results from CSIDC suggest that the optimum seeding rate for some varieties may be outside of this range. (Research is on-going to verify these results).

Field Trials

Seeding rate and row spacing trials at CSIDC included several dry bean varieties representing pinto, black, navy, great northern, and small red market classes (Table 1). Target plant population ranged from 10-40 plants/m^2 (0.9-3.7 plants/ft^2) and row spacing ranged from 20-80 cm (8-32 in). Actual seeding rate was different for each variety based on its seed weight (Seeding rate (kg/ha) = (target plant population/m^2 x grams per 1000 seeds) / % germination). Replicated treatments were arranged in strip plots and normal fertilizer, weed and disease control and irrigation practices for irrigated bean production were followed. Plant stand, yield and seed weight were evaluated.

Dry Bean Response

In general, plant stand increased as the seeding rate increased and was highest with narrow row spacing for all dry bean market classes tested (Figure 1). At wide row spacing, plants are crowded together within a row causing increased in-row competition and reduced percent emergence.

Yield response to seeding rate and row spacing was variety dependent. In general, optimum seeding rates were at the upper end of the currently recommended range (25-30 seeds/m^2; 2.3-2.8 seeds/ft^2) (Table 1). Yield generally decreased as row spacing increased. This was probably the result of reduced plant stands in response to in-row competition. Traditionally, wide row cropping is used for vine type varieties (Type III) while narrow row spacing (solid seeding) is used for upright bush varieties (Type I and upright indeterminate Type II). Because of their growth habit, the vine type varieties are better able to compensate for the reduced plant

stands by making use of the growing area between rows and producing more pods.

Narrow row spacing can impede air movement through the canopy leading to damp conditions and the development of white mold. Seasonal growing conditions and disease pressure will have an impact on the performance of plants in each cropping system. In general, dry bean in all market classes has the potential to yield higher with narrow row spacing as long as favourable conditions prevail.

Table 1. Optimum seeding rate for dry bean varieties under irrigation.

Type	Variety	Growth Habit*	Target Seeding Rate	
			(plants/m^2)	(plants/ft^2)
Pinto	Othello	T-III indeterminate sprawling vine	30-35	2.8-3.3
	CDC Camino	T-I upright determinate	30	2.8
	Agassiz	T-I determinate bush	30	2.8
Black	UI906	T-II upright determinate	30	2.8
	CDC Expresso	T-I upright determinate	30	2.8
Navy	Seafarer	T-I determinate bush	25-30	2.3-2.8
	AC Skipper	T-I upright determinate	20-40	1.9-3.7
	Mitchell	T-II indeterminate short vine	25-30	2.3-2.8
Great Northern	Beryl	T-III indeterminate short vine	30+	2.8+
	CDC Crocus	T-III indeterminate	35	3.3
Small Red	NW 63	T-II indeterminate	40	3.7

* T - 'Type'

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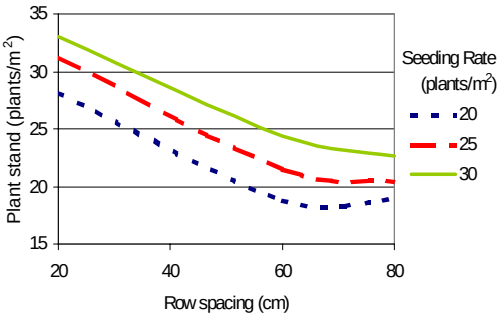

Figure 1. Pinto bean plant stand in response to seeding rate and row spacing. Based on mean of Othello and CDC Camino, 1997-2000.

Pinto Bean

Yield increased up to a seeding rate of 30-35 seeds/m^2 (2.8-3.3 seeds/ft^2) for Othello and 30 seeds/m^2 (2.8 seeds/ft^2) for CDC Camino and Agassiz. The effect of row spacing on pinto bean was variable. In general, there was no effect of row spacing on Othello in four out of six years tested. Othello's vine type growth habit probably allowed the plants to compensate for the reduced plant stand associated with wider row spacing. Yield of CDC Camino, however, was significantly reduced as row spacing increased from 20 cm (8 in) to 80 cm (32 in). CDC Camino's upright determinate growth habit did not allow the plants to use the inter-row growing area as efficiently. Hot dry growing conditions resulted in very little disease pressure during the years CDC Camino was tested. Yield of Agassiz was either not affected by row spacing or was higher at wider row spacing. Agassiz was tested in years with heavy disease pressure. There was generally no effect of seeding rate or row spacing on seed weight, although, seed weight of both Othello and CDC Camino was significantly greater with wide row spacing in one year tested.

Black Bean

Yield increased up to a seeding rate of 30 seeds/m^2 (2.8 seeds/ft^2) for both CDC Expresso and UI906. Yield was significantly reduced as row spacing increased above 60 cm (24 in). Again, the upright determinate growth habit of the black bean varieties did not allow the plants to compensate for the reduced plant stand associated with wider row spacing. Hot dry growing conditions resulted in very little disease pressure during the years CDC Expresso and UI906 were tested. There was generally no effect of seeding rate or row spacing on seed weight.

Navy Bean

Yield response of navy bean to seeding rate was variable. In two years of the trials with AC Skipper, reducing the seeding rate from 30 to 20 seeds/m^2 (2.8 to 1.9 seeds/ft^2) did not affect yield indicating that a lower seeding rate may be a viable option. In another year, however, the highest yield of AC Skipper was obtained with the highest seeding rate (40 seeds/m^2; 3.7 seeds/ft^2). Highest yields for Seafarer and Mitchell were obtained at seeding rates of 25-30 seeds/m^2 (2.3-2.8 seeds/ft^2).

Yield response of navy bean to row spacing was also variable. In hot dry years, Seafarer yields were highest at narrow row spacing but in years with high disease pressure, yields were highest with wide row spacing. Yield of AC Skipper was significantly reduced as row spacing increased above 60 cm (24 in), although it was hot and dry in the years that AC Skipper was tested. Yield of Mitchell was highest with wide row spacing but disease pressure was high in the years that Mitchell was tested. Mitchell may also have done better with wide row spacing because of its vine type growth habit. There was no effect of seeding rate or row spacing on seed weight.

Great Northern Bean

Yield increased up to a seeding rate of 35 seeds/m^2 (3.3 seeds/ft^2) for CDC Crocus. Yield of Beryl also increased to the highest seeding rate tested (30 seeds/m^2; 2.8 seeds/ft^2) and may have continued to benefit from higher seeding rates. Yield of CDC Crocus was significantly reduced as row spacing increased to more than 60 cm (24 in) in the one year tested. However, excessive losses during the straight cut harvest operation may have confounded these results. Yield of Beryl was highest at wide row spacing but disease pressure was high in the years that Beryl was tested. Beryl may also have done better with wide row spacing because of its vine type growth habit. Seed weight was not affected by seeding rate but did increase with increasing row spacing.

Small Red Bean

The highest yield of NW 63 was obtained with the highest seeding rate tested (40 seeds/m^2; 3.7 seeds/ft^2) indicating that the currently recommended seeding rate may be low for this variety. Yield was significantly reduced at the 60 and 80 cm (24 and 32 in) row spacings. Seed weight was not significantly affected by seeding rate but seed weight at 80 cm (32 in) row spacing was significantly higher than at the 20 cm (8 in) row spacing.

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The Bottom Line...

The optimum dry bean seeding rate and row spacing is dependent on variety and growing conditions. Optimum seeding rates for the varieties tested were at the upper end of the currently recommended range (25-30 seeds/m^2; 2.3-2.8 plants/ft^2). Dry bean in all market classes has the potential of higher yields with narrow row spacing as long as favourable conditions prevail.

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