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Row Spacing and Seeding Rate Influence on Spring Canola Performance in the Northern Great Plains

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Introduction and Objective

- Spring canola (*Brassica napus L.*) is an important economic crop in North Dakota averaging 1.04 million acres annually the last 10 years.
- The canola industry is looking for ways to expand acreage in areas where row crops such as soybean, corn, dry bean and sugarbeets are grown.
- In these areas, there is potential to use row crop equipment to seed canola in wider row spacings than the current recommended 6 to 7 inches.
- Rising seed costs are a concern in canola production and the use of lower seeding rates in wider row spacing could enhance crop revenue.

The study objective was to investigate the optimum row spacing in conjunction with varying seeding rates to determine the greatest economic return per acre in canola production.

Methods and Materials

- Field experiments were conducted at two locations during 2015 and 2016.
  - Langdon, ND (48^0 76' N, 98^0 35' W elevation 1616 feet)
  - Prosper, ND (46^0 58' N, 97^0 4' W elevation 932 feet)

- Experimental design was a RCBD with a split-plot arrangement and four replications.
  - Main plot - Three row spacings of 6, 12, and 24 inches
  - Subplots - Four seeding rates of 3, 6, 9, and 12 pure live seeds/ft^2
- Variety – Liberty Link InVigor L140P, 1000 kernel weight - 4.55 g, Germination - 97%
- Seed cost - $12.30/lb
- October market price - 2015 - $14.13/cwt, 2016 - $14.70/cwt
- Net Return $/acre = grain value/acre – seed cost/acre
- Traits reported:
  - Percent pure live seed emergence at Langdon 2015 and 2016
  - Yield and Net Return in $/acre at Langdon and Prosper 2015 and 2016
- ANOVA performed by SAS with trait means separation by *F*-protected LSD comparisons at P≤0.05.

6 inch

12 inch

24 inch

Fig. 1 Three row spacings, 6, 12, and 24 inch, at the 12 seeds/ft^2 seeding rate at flowering and post harvest stubble at Langdon, ND.

Table 1. Seeding rates, seed cost and target seeds per linear foot of row for trials at Langdon and Prosper, ND in 2015 and 2016.

Seeding Rate Seeds/ft^2	Seeding Rate lbs/acre	Seed Cost/acre	Seeds/acre	Targeted seeds per linear foot of row		
				6" row	12" row	24" row
3	1.35	16.61	131K	1.5	3.0	6.0
6	2.68	32.96	261K	3.0	6.0	12.0
9	4.05	49.82	392K	4.5	9.0	18.0
12	5.35	65.81	522K	6.0	12.0	24.0

Results

- A two inch hard rain the day following seeding resulted in reduced emergence in 2015 at Langdon (Table 2).
- Pure live seed emergence was not affected by seeding rate in 2015 or 2016.
- In 2015, when there was severe crusting, the 24 inch row spacing had significantly higher percent emergence compared to the 6 and 12 inch row spacing.

Table 2. Percent pure live seed emergence of canola averaged across row spacings and seeding rates at Langdon, ND in 2015 and 2016.

Seeding Rate Seeds/ft^2	Langdon 2015	Langdon 2016	Row Spacing Inches	Langdon 2015	Langdon 2016
3	41	94	6	40a	100a
6	57	84	12	35a	83b
9	47	92	24	71b	84b
12	49	88			
LSD 5%	NS	NS		11	14

Yield

Langdon 2015 (Fig. 1.)

- A significant seeding rate x row spacing interaction for yield is shown in Fig. 1.
- There were no significant yield differences between row spacings at the 3 seeds/ft^2 seeding rate.
- Yield generally increased as seeding rate increased at row spacings of 12 and 24 inches.

Langdon 2016 (Fig. 2.)

- The 6 and 12 inch row spacings yielded significantly more than the 24 inch row spacing.
- The 3 seeds/ft^2 seeding rate yielded less the than the 6, 9, and 12 seed/ft^2 seeding rate.

Prosper 2015 and 2016 (Table 3.)

- Yield at the 6 inch row spacing was significantly higher than both the 12 and 24 inch row spacing in both 2015 and 2016 when averaged across seeding rates.
- Yields at the 9 and 12 seeds/ft^2 seeding rate were significantly higher than the two lower seeding rates in 2015 while in 2016 the 6, 9, and 12 seeds/ft^2 were significantly higher than the lowest seeding rate when averaged across row spacings.

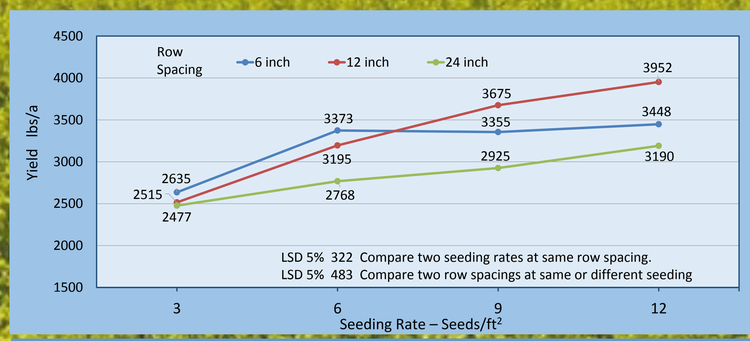

Fig. 1. Canola yield at four seeding rates and three row spacings at Langdon, 2015.

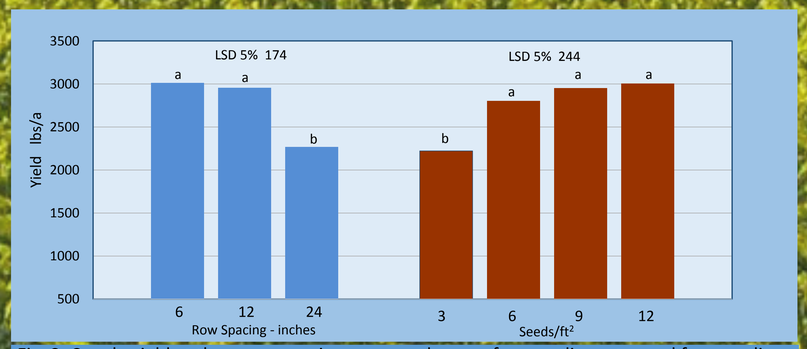

Fig. 2. Canola yield at three row spacings averaged across four seeding rates and four seeding rates averaged across three row spacings at Langdon, 2016.

Table 3. Canola yield at four seeding rates averaged across three row spacings and row spacings averaged across four seeding rates at Prosper 2015 and 2016.

Seeding Rate Seeds/ft^2	Prosper 2015	Prosper 2016	Row Width Inches	Prosper 2015	Prosper 2016
3	1720a	1513a	6	2194a	2333a
6	1985b	1999b	12	1891b	1776b
9	2165c	2131b	24	1972b	1737b
12	2206c	2152b			
LSD 5%	147	257		108	322

Net Return $/acre

Langdon 2015 (Fig. 3.)

- The 3 seeds/ft^2 seeding rate had the lowest Net Return $/acre at all row spacings.
- Net Return $/acre at the 12 inch row spacing was not significantly different at the 9 and 12 seeds/ft^2 seeding rate.
- Net Return $/acre at the 6 inch row spacing was highest at the seeding rate of 6 seeds/ft^2 but was not significantly different than the two higher seed rates.

Langdon 2016 (Fig. 4.)

- Highest Net Return $/acre was at the 6 and 12 inch row spacing when averaged across seeding rates.
- Highest Net Return $/acre for seeding rate was at 6, 9, and 12 seeds/ft^2 when averaged across row spacings.

Prosper 2015 and 2016 (Table 4.)

- Net Return $/acre at the 6 inch row spacing was significantly higher than the 12 or 24 inch row spacing in both 2015 and 2016 when averaged across seeding rates.
- Net Return $/acre was significantly lower at the 3 seeds/ft^2 compared to the 6 and 9 seeds/ft^2 seeding rates in 2015 and the 6, 9, and 12 seeds/ft^2 seeding rate in 2016 when averaged across row spacings.

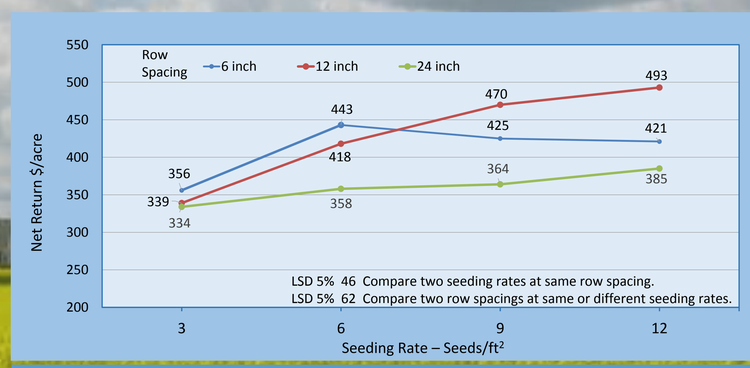

Fig. 3. Canola Net Return $/acre at four seeding rates and three row spacings at Langdon, 2015.

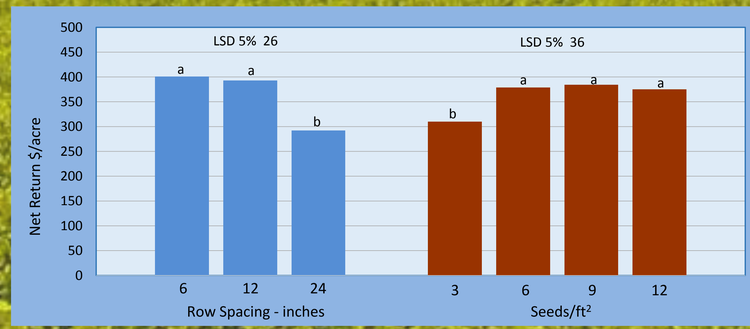

Fig. 4. Canola Net Return $/acre at three row spacings averaged across four seeding rates and four seeding rates averaged across three row spacings at Langdon, 2016.

Table 4. Canola Net Return $/acre at four seeding rates averaged across three row spacings and three row spacings averaged across four seeding rates at Prosper 2015 and 2016.

Seeding Rate Seeds/ft^2	Prosper 2015	Prosper 2016	Row Spacing Inches	Prosper 2015	Prosper 2016
3	226a	206a	6	269a	301a
6	247b	260b	12	226b	219b
9	256b	263b	24	238b	214b
12	245ab	250b			
LSD 5%	21	38		15	47

Conclusions

- Canola in crusted soils in 24 inch row spacing may have improved emergence due to neighboring plants aiding each other in breaking the crust while in non-crusted soils emergence could be reduced from self thinning due to increased plant competition.
- At Langdon, the optimum combination of row spacing and seeding rate for Net Return $/acre was seeding in a 6 or 12 inch row spacing at a seeding rate of 6 or 9 seeds/ft^2.
- At Prosper, the optimum combination row spacing and seeding rate for Net Return $/acre was seeding in a 6 inch row spacing at a seeding rate of 6 or 9 seeds/ft^2.
- Effects of row spacing and seeding rate on agronomic traits (data not shown) of flowering, maturity, plant height, kernel weight, percent oil and lodging were very small or non-significant and would have little practical value in canola production.

Acknowledgement

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