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Seeding Rate Response to Various Management Factors in Canola Production

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Research Summary

Canola acreage has expanded significantly in North Dakota over the past 10-yr period. Seed size varies considerably among the numerous commercial canola cultivars that exist, but most canola producers seed canola at 5 lb/acre. The objective of this study was to determine if seeding rate adjustments are needed to reflect differences in seed size and management practices. Two canola cultivars were sow at four seeding rates in conventional- and no-till seedbeds at Dickinson in 1999 and 2000 as part of this project. Preliminary results indicate that a seeding rate between 10 and 15 seeds/ft^2 resulted in optimum economic yield, suggesting that seeding rates should be increased for optimum economic returns.

Introduction

Canola (*Brassica napus* L.) acreage has expanded rapidly in North Dakota from 15,000 acres in 1991 to 850,000 acres in 1999. North Dakota's canola production continues to increase in the traditional northern counties of the state with a substantial general shift southward to Interstate 94 and also more localized areas of increase in production approaching the South Dakota border. Grower interest in raising canola has risen from Freedom to Farm legislation, the *Fusarium* head blight epidemic, and depressed crop prices for small grains. Low

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yields with poor grain quality, caused by *Fusarium* head blight, coupled with depressed prices have resulted in many producers growing small grains for negative economic returns. Over this same time period the canola market has remained fairly attractive and yields have been stable. The typical seeding rate for canola in North Dakota is 5 pound per acre. Producers typically choose open-pollinated or hybrid cultivars for production and had access to HTC cultivars for the first time in the 1999 season. Most producers fail to account for differences in seed size between and within different canola types, thus often over seed or under seed for a targeted plant population. In addition, management factors such as seeding depth or tillage system effect on seeding rates have not been examined in the state.

Several early studies with open-pollinated canola report that seeding rate did not influence yield performance (Degenhardht and Kondra, 1981a; Christensen and Drabble, 1984). However other studies found greater yield produced as the seeding rate increased (Kondra, 1975, 1977; Degenhardht and Kondra, 1981b). Studies on later developed hybrid canola performance regarding seeding rate are limited. McVetty et al. (1988) suggested a 4 pound per acre seeding rate for hybrid canola while Deynze et al. (1992) suggested a 5.3 pound per acre seeding rate for both open-pollinated and hybrid cultivars. Current Canadian and North Dakota (Berglund and McKay, 1998) recommendations are to seed *B.napus* from 5-8 pounds per acre and *B. rapa* cultivars from 5-7 pounds per acre with a goal of obtaining a plant stand of 7-17 plants per square foot. More recent investigations by Oelke and LeGare (1998) in Minnesota looked at seeding rates based on plant density. This approach based seeding rate on seed number or plants per unit area and is more precise than seeding rates based on pounds per acre especially given the large variability in cultivar seed size. High seed costs for hybrid canola and HTC and varying seed size require producers to be efficient in determining seeding rates to achieve good crop performance.

Seeding depth can have a major influence on establishing adequate plant stands. Current recommendations are from ½ to ¾ inch in the southeastern U.S. (Thomas et al., 1994) to ¾ to 1 inch in Canada (Thomas 1984). Seeding at 2 inches compared to 1 inch can reduced yields by 9 percent (Canola Council of Canada). Planting deeper than 1 inch delays and reduces emergence and increases exposure of emerging seedlings to soil pathogens. Increased seedling vigor was observed by Hanson and Lukach (1998) for hybrid cultivars compared to open-pollinated cultivars in canola variety trials conducted at the Langdon Research Extension Center. Hybrid seed is larger than open-pollinated seed and has more stored energy for germination and emergence processes. This may enable hybrid seed to emerge from deeper planting depths than smaller seeded open pollinated cultivars. Research in this area has not been reported. No-till production of canola is increasing in areas with limited soil moisture and acreage may increase with the introduction of HTC. No-till systems require more management but can result in increased soil moisture especially in the critical seed zone at planting time. Research in the area of seeding rate interaction with tillage systems has not been reported.

This project seeks to provide valuable information from across the varying climates in North Dakota to help canola producers be more successful in canola production and to realize greater on-farm profits. The project will provide information to producers on seeding rate response to various management factors in canola production. Management factors include the use of *B. napus* conventional, open pollinated or herbicide tolerant canola (HTC) seed, seeding depth, and tillage systems. Not all management factors will be imposed at each location. These studies will be conducted across six locations in North Dakota to determine if seeding rate response is similar across environments. Economic evaluations of treatments will be applied where appropriate.

Materials and Methods

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Dryland field studies were conducted at the Hettinger, Dickinson, Carrington, and North Central (Minot) Research Extension Centers in North Dakota. The experimental design was a factorial in a RCBD with four or five replications. Seeding rates were 5, 10, 15, and 20 viable seeds per square foot. Management factors included two planting depths of approximately ½ and 1½ inches, open pollination, hybrid or HTC seed, conventional or no-till systems, depending on the location. Each location will have the following treatments:

Hettinger: Four seeding rates and open pollinated canola and HTC seed.

Carrington: Four seeding rates, open pollinated and hybrid canola seed , and two seeding depths.

Dickinson: Four seeding rates, open pollinated and hybrid canola seed, and conventional and no-till systems.

Minot: Four seeding rates, open pollinated and hybrid canola seed, and conventional and no-till systems.

Best management practices for each location regarding seeding date, fertility, insect and disease management and harvest operations were used. Plot size varied between locations with 6, 7, 8 or 12 inch row spacing and varying plot lengths and widths with sufficient border to minimize border effects on plants for character determinations. Data collected included stand establishment ratings (early emergence and final emergence counts), seedling vigor, days to 10% flower, end flower and maturity, flower duration, lodging, plant height, seeds per pound, swathing and harvest date, weed pressure and types, weed control level, seed shattering, green seed determination, percent oil, seed yield, seasonal precipitation and temperature values. Treatments were considered fixed effects with location a random effect in the combined analysis across locations. Treatments means separation were performed by *F*-protected LSD comparisons at the *P*=0.05 level of significance for each character evaluated.

Results and Discussion (emphasis on Dickinson)

Tillage: There was no significant tillage effect on any variable observed at Dickinson. There were two significant 2-way interactions involving days to flower and flower duration.

Seeding Rate: Seeding rate had a significant effect on yield. There were no significant variety x seeding rate interactions which suggests that hybrid and open pollinated varieties response similarly to seeding rates. Yields generally increased as the seeding rate increased, although the differences were not always significantly higher from the highest seeding rate. Preliminary results for the two year study indicate a large decrease in yield at the 5 seeds/ft^2 seeding rate and smaller differences between 10, 15, and 20 seeds/ft^2. Although the maximum yield occurred at 20 seeds/ft^2, economically the seeding rate for open pollinated varieties was reached at 15 seeds/ft^2 and 10 seeds/ft^2 for hybrids. This is due to the higher seed cost for hybrids.

A higher percentage of planted seeds was generally established at the lowest seeding rate compared to higher seeding rates which suggests self thinning.

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Other general trends seen as seeding rates increased were shorter number of days to flower, end flower and maturity. There were 14 interactions involving seeding rate with most of those occurring at Langdon.

Variety: Significant differences occurred between the majority of parameters measured. The hybrid had a higher yield compared to the open pollinated variety.

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Literature Cited

Berglund, D.R., and K. McKay. 1998. Canola Production. North Dakota Agric. Ext. Stn Bull A 686(revised).

Christensen, J.V. and Drabble, J.C. 1984. Effect of row spacing and seeding rate on rapeseed yield in northwest Alberta. Can. J. Plant Sci. 64:1011-1013.

Canola Council of Canada. Canola Production Center Five-Year Summary 1990-1994.

Degenhardht, D.F. and Kondra, Z.P. 1981a. The influence of seeding rate on seed yield and yield components of five genotypes of Brassica napus. Can. J. Plant Sci. 61:175-183.

Degenhardht, D.F. and Kondra, Z.P. 1981b. The influence of seeding date and seeding rate on seed yield and growth characters of five genotypes of *Brassica napus*. Can. J. Plant Sci. 61:185-190.

Deynze, A.E., McVetty, P.B.E, Scarth, R. and Rimmer S.R. 1992. Effect of varying seeding rates on hybrid and conventional summer rape performance in Manitoba. Can. J. Plant Sci. 72:635-641.

Hanson, B.K. and J.R. Lukach. 1998. 1998 Performance of row, oil and specialty crops in Northeastern North Dakota. Langdon Research Extension Center Crop Performance Report No. 73.

Kondra, Z.P. 1975. Effect of row spacing and seeding rate on rapeseed. Can. J. Plant Sci. 55:339-341.

Kondra, Z.P. 1977. Effects of planted seed size and seeding rate on rapeseed. Can. J. Plant Sci. 57:277-280.

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McVetty, P.B.E., Scarth, R. and Rimmer, S.R. 1988. Agronomic studies in hybrid spring canola rapeseed (*Brassica napus* L.). 7th International Rapeseed Congress. P. 253-258.

Oelke, E.A. and D.G. LeGare. 1998. Summary of canola research on Minnesota on planting rate and date. Preliminary Report.

Thomas, D.L., Raymer, P.L., and Breve, M.A. 1994. Seeding depth and packing wheel pressure effects on oilseed rape emergence. J. Prod. Agric., Vol. 7, no. 1.

Thomas, Phil. 1984. Canola grower manual. Published by: Canola Council of Canada. 400 - 167 Lombard Ave. Winnipeg, MB R3B OT6.

HTC canola response to tillage system, plant type (hybrid vs open-pollinated variety) and seeding rate.

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Source of Variation	Stand	Emerg JD	Plant Est.-JD	Days to Flower	Flower Dur.	Weed Control	Plant Ht	Seed Size	% Oil	Yield	Test Wt
Tillage	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Variety	NS	**	**	**	**	**	**	**	**	**	**
Seeding Rate	**	NS	NS	**	NS	**	NS	**	NS	**	**
T*V	NS	NS	NS	**	**	NS	NS	NS	NS	NS	NS
T*R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
V*R	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	**
T*V*R	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Tillage System = T
Variety = Type = V
Seeding Rate = R
* and ** denote significant differences at P<0.05 and P<0.01, respectively.
NS-non-significant

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Tillage effects on various agronomic traits of canola averaged over seeding rates and varieties.

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	Emerg	Plant	Stand	Days to	Flower	Plant	% Weed
Tillage	JD	Est. JD	plants/ft^2	flower	Duration	Height(in)	Control
No-till	116.6	119.4	7.6	58.5	19.3	32.1	90.3
Conventional	116.2	118.5	8.9	58.2	19.2	32.0	94.6
LSD 5%	NS	NS	NS	NS	NS	NS	NS

	TW	Oil	Seeds/	Yield
Tillage	lbs/bu	%	pound	lb/a
No-till	50.2	47.2	117,935	1279
Conventional	50.1	46.8	117,660	1403
LSD 5%	NS	NS	NS	NS

Seeding rate effect on various agronomic traits of canola averaged over tillage and varieties.

Seeding Rate	Emerg	Plant	Stand	Days to	Flower	Plant	% Weed
Seeds/ft^2	JD	Est. JD	plants/ft^2	flower	Duration	Height(in)	Control
5	116.7	119.6	3.5	58.8	19.7	32.6	86.9
10	116.4	118.9	6.4	58.4	19.1	32.4	93.9
15	116.3	118.9	10.5	58.0	19.1	31.3	94.4
20	116.1	118.6	12.6	58.0	19.1	31.9	95.5
LSD 5%	NS	NS	1.7	0.4	NS	NS	2.4

Seeding Rate	TW	Oil	Seeds/	Yield
Seeds/ft^2	lbs/bu	%	pound	lb/a
50	49.6	46.7	113,110	1211

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10	50.3	47.0	118,003	1327
15	50.4	47.1	120,425	1369
20	50.4	47.1	119,653	1456
LSD 5%	0.3	NS	4195	126

Variety effect on various agronomic traits of canola averaged over tillage and seeding rates.

	Emerg	Plant	Stand	Days to	Flower	Plant	% Weed
Tillage	JD	Est. JD	plants/ft^2	flower	Duration	Height(in)	Control
Hyola 357	116.7	119.7	8.6	56.7	17.8	30.1	93.9
LG3295	116.0	118.3	7.9	59.8	20.8	34.0	90.9
LSD 5%	0.4	0.6	NS	0.3	0.5	1.0	1.7

	TW	Oil	Seeds/	Yield
Tillage	lbs/bu	%	pound	lb/a
Hyola 357	49.6	47.9	115,673	1480
LG3295	50.8	46.0	119,922	1202
LSD 5%	0.2	0.01	2966	89.4

Significant Interactions

VxR

	Seeding Rate (seeds/ft^2)			
	Test Weight (lbs/bu)			
Variety	5	10	15	20
Hyola 357	49.5	49.3	49.7	49.7
LG3295	49.7	51.3	51.1	51.1
LSD 5%	0.25			

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	Seeding Rate (seeds/ft^2)			
	Seeds/lb			
Variety	5	10	15	20
Hyola 357	111,469	112,468	118,343	120,411
LG3295	114,749	123,537	122,506	118,893
LSD 5%	2967			

TxV

	Tillage			
	Days to Flower		Flower Duration - Days	
Variety	Conventional	No-Till	Conventional	No-Till
Hyola 357	57.1	56.4	17.5	18.0
LG3295	59.8	59.8	21.2	20.4
LSD 5%	0.37		0.64	

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