

## **North Central Canola Region Research Report of Progress**

**Title:** Effect of Phosphorus Placement on Canola

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### ***Introduction***

Studies were conducted in 2005 and 2006 at the Carrington Research Extension Center to evaluate the effect of phosphorus (P) rate and placement and the effect of row spacing on canola yield.

### ***Phosphorus Rate and Placement***

Studies were established in 2005 and 2006 using conventional tillage practices at two locations (Q3 and Landon E) to compare the agronomic performance of different P rates and application methods. The application methods were: 1) in-row, 2) mid-row band, 3) in-row + mid-row band, and 4) broadcast. The P rates were: 1) 0 lb, 2) 11.25 lb, 3) 22.5 lb, and 4) 45 lb of  $P_2O_5$ /acre in 2005 and 1) 0 lb, 2) 22.5 lb, 3) 45 lb, and 4) 90 lb  $P_2O_5$ /acre in 2006. Soil tests indicated 10-11 ppm (Olsen) phosphate (medium site) and 3-4 ppm (low site). Canola 'Invigor 4870' was seeded at a rate of 8 pure live seeds/ft<sup>2</sup> in 14 inch rows. The in-row and mid-row band applications were applied at seeding. The broadcast application was incorporated prior to seeding.

The P rate, independent of placement, had the most impact on crop performance. At both locations and in each year, yields increased up to the recommended fertilizer rate and then leveled off (data not shown). Under the conditions of these trials, phosphate fertilizer placement had minimal effect on seed yield while the mid-row band application tended to reduce plant height and canopy density.

### ***Row Spacing by Seeding Rate***

Trials were also established in 2005 and 2006 to study the effect of row spacing and seeding rate in two canola hybrids with contrasting plant types. Materials and methods and results for the trials will be presented with the 2008 data.

### ***Justification***

This project will be evaluated at more locations and will also include plant tissue samples to help identify when and how efficiently the P is being used in each fertilizer placement method.

Since we are using tissue samples to identify P uptake, we want to evaluate the response under optimum soil moisture conditions. An irrigated site at Carrington will ensure that we have adequate soil moisture in the spring for optimum root development and phosphorus availability.

### ***Objective***

The objective of this project is to evaluate the effectiveness of mid-row banding P fertilizer.

## Materials and Methods

### *Row Spacing by Seeding Rate*

Trials were established at the Carrington Research Extension Center on a dryland site in 2005 and 2006 and irrigated and dryland sites in 2008. The canola hybrids with contrasting plant types evaluated were ‘Invigor 4870’ and ‘Hyola 357 Magnum’ (2005 and 2006) and Invigor 5550 and ‘Hyola 357 Magnum’ (2008). The hybrids were sown in 7 and 14 inch rows at a rate of 7 and 14 live seeds/ft<sup>2</sup>.

### *Phosphorus Placement*

Individual trials were conducted at three sites at the Carrington Research Extension Center; low P site medium P site, and an irrigated site, and at the Langdon Research Extension Center in 2008. The soil P<sub>2</sub>O<sub>5</sub> level and applied P<sub>2</sub>O<sub>5</sub> at each site are listed in Table 1. ‘Invigor 5550’ was planted at each site in 14-inch rows at 14 pure live seed per acre. Two plots for each treatment were planted. One plot was used to evaluate plant growth, and yield parameters while the second plot was used for destructive plant tissue samples. Plant tissue samples were collected weekly for 4 weeks starting 10 to 14 days after emergence and analyzed for phosphorus concentrations.

Table 1. Soil test, yield goal and applied P<sub>2</sub>O<sub>5</sub> at each site.

	Soil Test	Applied
Site	P <sub>2</sub> O <sub>5</sub>	P <sub>2</sub> O <sub>5</sub>
	ppm	lb/a
Low	5	17
Medium	10	9
Irrigated	9	22
Langdon	9	17

## Results

### *Row Spacing by Seeding Rate*

There was no hybrid or row spacing interaction with seeding rate. Seed yield increased as the seeding rate increased from 7 to 14 live seeds/ft<sup>2</sup> under dryland conditions. Seed yields were similar in 2008 at the irrigated site (Table 2).

A hybrid by row spacing interaction was observed for seed yield in 2005 and 2006. Seed yields were similar in each year for Invigor 4870 planted in 7 and 14 inch rows and Hyola 357 Magnum planted in 7 inch rows while seed yield was reduced by about 365 lb/acre when Hyola 357 Magnum was planted in 14 inch rows (Table 3).

Table 2. Effect of seeding rate on canola.

Seeding	2008			
rate	2005	2006	Dryland	Irrigated
seeds/ft <sup>2</sup>	Seed yield (lb/acre)			
7 live seeds	1799	1442	2125	3369
14 live seeds	1952	1673	2601	3567
LSD (P=0.05)	99	210	286	NS

Table 3. Canola response to hybrid and row spacing.

	2005		2006	
	Row spacing			
Hybrid	7-inch	14-inch	7-inch	14-inch
	Seed yield (lb/acre)			
Invigor 4870	2010	1958	1614	1681
Hyola 357 Magnum	1934	1601	1651	1284
LSD (P=.05)	140		298	

In 2008, the hybrid by row spacing interaction was not observed. Yields were greater for Hyola 357 Magnum at both the irrigated and dryland site when averaged over row spacing and seeding rate (Table 4). Seed yields were similar for both the 7 and 14 row spacing when averaged over hybrid and seeding rate (Table 5).

Table 4. Seed yield averaged over row spacing and seeding rate, 2008.		
Hybrid	Dryland	Irrigated
	Seed yield (lb/acre)	
Invigor 5550	2001	3303
Hyola 357 Magnum	2725	3633
LSD (P=.05)	386	290

Table 5. Seed yield averaged over hybrid and seeding rate, 2008.		
Row Spacing	Dryland	Irrigated
	Seed yield (lb/acre)	
7 inches	2223	3551
14 inches	2504	3385
LSD (P=.05)	NS	NS

### *Phosphorus Placement*

Plant tissue sample results are listed in table 2. Variability within the data set was high resulting in few significant differences. It is difficult to draw any conclusions from the plant tissue data set.

P placement had an impact on canola yield at the low P site at Carrington (Table 6). The high variability in the yield data is due to dry seedbed conditions at planting resulting in poor and uneven emergence. Canola yields were greatest when the canola was planted in 14 inch rows with an in-row starter fertilizer. The row spacing and phosphorus placement did not affect seed weight, test weight, or oil content. The row spacing and phosphorus placement did not affect any of the parameters measured at Langdon or the medium P site and irrigated site at Carrington.

### **Conclusion**

With the Invigor hybrids tested, canola can successfully be planted in wider rows with no apparent yield drag. Seed yield was reduced in two out of the four site years when 'Hyola 357 Magnum' was planted in wider rows. Seed yield also decreased when the seeding rate was reduced, regardless of row spacing.

Mid-row banding P on fields with low P levels can reduce plant growth and yield.

Table 6. Canola plant tissue phosphorus concentrations at Carrington.

	Low P Site				Medium P Site				Irrigated Site			
11-52-0 starter	Plant tissue sampling date											
fertilizer Placement	6/5	6/11	6/19	6/24	6/5	6/11	6/19	6/24	6/5	6/11	6/19	6/24
14 " Rows	canola plant tissue phosphorus concentration (ppm)											
In-Row	5220	4881	3586	4583	5593	4665	4746	4349	6355	4325	4342	4384
Mid-Row	3858	4463	2933	4126	4077	4107	4781	3700	5870	4728	3598	4333
Jumpstart	3901	4453	3763	4207	4964	5027	4879	3227	5985	5322	4156	4281
Jumpstart + Mid-Row	3903	4987	5128	3935	4200	4995	4341	4554	5456	5340	3141	4162
In-Row + Avail	4715	4851	4687	4763	5958	4923	4611	3512	6643	4794	4126	4779
Untreated	4633	4333	3525	4423	5020	4318	4226	3172	5320	4920	3821	4011
7" Rows												
In-Row	4826	5331	2821	4423	4551	5028	4636	3619	6027	5721	3832	4746
In-Row + Avail	5219	4836	3307	4195	5602	5530	4423	4129	6329	4924	3499	4925
In-Row + Jumpstart												
Untreated	4244	5418	3690	4633	4273	5156	3799	3698	5317	4692	3668	4337
LSD (P=.05)	1006	NS	1280	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	15.3	22.0	23.5	14.6	19.8	23.5	19.3	23.4	18.3	16.3	19.4	11.2
Mean	4502	4839	3716	4365	4949	4861	4493	3773	5922	4974	3798	4440

Table 7. Canola response to phosphorus placement.

	Carrington												Langdon			
	Low P Site				Medium P Site				Irrigated Site							
11-52-0 starter	1000	Test		Seed	1000	Test		Seed	1000	Test		Seed	Plant	1000	Test	Seed
fertilizer Placement	seed wt.	weight	Oil	yield	seed wt.	weight	Oil	yield	seed wt.	weight	Oil	yield	height	seed wt.	weight	yield
14 " Rows	gms	lb/bu	%	lb/ac	gms	lb/bu	%	lb/ac	gms	lb/bu	%	lb/ac	cm	gms	lb/bu	lb/ac
In-Row	2.7	52.2	44.8	1104	2.8	51.9	45.5	2414.2	3.1	52.3	46.5	3260	100.5	3.0	51.5	2120
Mid-Row	2.6	52.5	43.9	976	2.8	51.9	45.6	2488.0	3.1	52.5	46.0	3460	100.8	3.0	51.5	2116
Jumpstart	2.6	51.8	42.0	959	2.8	52.0	44.8	2127.0	3.1	52.4	46.4	3390	101.5	2.9	51.4	2060
Jumpstart + Mid-Row	2.7	52.2	43.2	880	2.7	52.0	45.2	2267.8	3.1	52.4	46.5	3367	100.3	3.0	51.9	2207
In-Row + Avail	2.8	52.3	44.3	1235	2.8	51.9	45.4	2201.3	3.1	52.3	46.7	3278	99.8	3.0	51.8	2200
Untreated	2.7	52.6	43.1	812	2.7	52.0	45.5	2147.8	3.2	52.3	44.3	3386	100.0	3.0	51.0	2042
7" Rows																
In-Row	2.7	52.1	42.8	536	2.8	51.9	45.1	1929.2	3.3	52.2	46.7	3587	101.5	3.0	51.1	2250
In-Row + Avail	2.7	52.1	43.4	697	2.7	52.0	44.7	2086.1	3.1	52.3	47.2	3534	101.3	3.0	51.3	2257
In-Row + Jumpstart													102.0	3.1	52.1	2213
Untreated	2.8	51.9	44.4	703	2.8	52.0	45.1	1935.8	3.2	52.2	47.4	3540	102.5	3.0	51.4	2024
LSD (P=.05)	NS	NS	NS	283	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	4.2	0.9	3.7	22.0	3.4	0.4	1.5	13.7	3.0	0.3	2.9	10.8	3.3	4.1	1.2	6.1
Mean	2.7	52.2	43.5	878	2.8	52.0	45.2	2177.5	3.1	52.3	46.4	3422	101.0	3.0	51.5	2149