

Effect of Phosphorus Placement on Canola

Paul Hendrickson and John Lukach

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 lbs., 2) 11.25 lbs., 3) 22.5 lbs., and 4) 45 lbs. of P_2O_5 /acre in 2005 and 1) 0 lbs., 2) 22.5 lbs., 3) 45 lbs., and 4) 90 lbs. 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/ft² 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.

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/ft².

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_2O_5 level and applied P_2O_5 at each site are listed in Table 1. 'Invigor 5550' was planted at each site in 14-inch rows at 14 pure live seeds 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 four weeks starting 10 to 14 days after emergence and analyzed for phosphorus concentrations.

Table 1. Soil test, yield goal and applied P₂O₅ at each site.

Site	Soil Test	Applied
	P ₂ O ₅ ppm	P ₂ O ₅ lb/ac
Low	5	17
Medium	10	9
Irrigated	9	22
Langdon	9	17

ResultsRow 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/ft² under dryland conditions. Seed yields were similar in 2008 at the irrigated site (Table 2).

Table 2. Effect of seeding rate on canola.

Seeding Rate seeds/ft ²	2005	2006	2008	
			Dryland	Irrigated
			Seed yield (lb/acre)	
7 live seeds	1,799	1,442	2,125	3,369
14 live seeds	1,952	1,673	2,601	3,567
LSD (P=.05)	99	210	286	NS

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 lbs./acre when Hyola 357 Magnum was planted in 14-inch rows (Table 3).

Table 3. Canola response to hybrid and row spacing.

Hybrid	2005		2006	
	Row Spacing			
	7-inch	14-inch	7-inch	14-inch
	Seed yield (lb/acre)			
Invigor 4870	2,010	1,958	1,614	1,681
Hyola 357 Magnum	1,934	1,601	1,651	1,284
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-inch and 14-inch 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	2,001	3,303
Hyola 357 Magnum	2,725	3,633
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	2,223	3,551
14 inches	2,504	3,385
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.

Table 6. Canola plant tissue phosphorus concentrations at Carrington.

11-52-0 starter fertilizer Placement	Low P Site				Medium P Site				Irrigated Site			
	6/5	6/11	6/19	6/24	6/5	6/11	6/19	6/24	6/5	6/11	6/19	6/24
Plant tissue sampling date												
canola plant tissue phosphorus concentration (ppm)												
14" Rows												
In-Row	5,220	4,881	3,586	4,583	5,593	4,665	4,746	4,349	6,355	4,325	4,342	4,384
Mid-Row	3,858	4,463	2,933	4,126	4,077	4,107	4,781	3,700	5,870	4,728	3,598	4,333
Jumpstart	3,901	4,453	3,763	4,207	4,964	5,027	4,879	3,227	5,985	5,322	4,156	4,281
Jumpstart + Mid-Row	3,903	4,987	5,128	3,935	4,200	4,995	4,341	4,554	5,456	5,340	3,141	4,162
In-Row + Avail	4,715	4,851	4,687	4,763	5,958	4,923	4,611	3,512	6,643	4,794	4,126	4,779
Untreated	4,633	4,333	3,525	4,423	5,020	4,318	4,226	3,172	5,320	4,920	3,821	4,011
7" Rows												
In-Row	4,826	5,331	2,821	4,423	4,551	5,028	4,636	3,619	6,027	5,721	3,832	4,746
In-Row + Avail	5,219	4,836	3,307	4,195	5,602	5,530	4,423	4,129	6,329	4,924	3,499	4,925
In-Row + Jumpstart												
Untreated	4,244	5,418	3,690	4,633	4,273	5,156	3,799	3,698	5,317	4,692	3,668	4,337
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.

11-52-0 starter fertilizer Placement	Carrington												Langdon			
	Low P Site				Medium P Site				Irrigated Site							
	1000 Seed wt.	Test Weight	Seed Oil	1000 Yield	1000 Seed wt.	Test Weight	Seed Oil	1000 Yield	1000 Seed wt.	Test Weight	Seed Oil	1000 Yield	Plant Height	1000 Seed wt.	Test Weight	Seed Yield
gram	lb/bu	%	lb/ac	gram	lb/bu	%	lb/ac	gram	lb/bu	%	lb/ac	cm	gram	lb/bu	lb/ac	
14" Rows																
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

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.



Effects of phosphorus fertility on canola.