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Factors Influencing Canola Emergence

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Background

- Seed costs are one of the highest input expenses for canola growers.
- Canola seeds are relatively small and require careful management for successful germination and emergence.
- Given germination levels >90%, average canola emergence under field conditions is only approximately 50% (Harker et al. 2003).
- Deep seeding (4.5 vs. 1.5 cm) can reduce canola emergence and yield (Malhi and Gill 2004).
- Poor or patchy canola emergence and subsequently weak canola stands may necessitate additional herbicide use, delay maturity, and reduce canola yield and quality (CCC 2010).
- Economically, seeding at 150 seeds m^{-2} is more frequent, risk-efficient strategy than seeding at 100 or 200 seeds m^{-2} (Upadhyay et al. 2006).
- Seeding at relatively low rates to reduce input costs is not congruent with integrated weed management strategies and may also reduce canola yields (Harker et al. 2003).
- Canola growers are interested in management practices that will improve canola emergence.

Objective

The objective of this study was to determine the seeding and environmental factors that influence canola emergence.

Materials and Methods

- Direct-seeding experiments were conducted at Agriculture & Agri-Food Canada Research sites at Lacombe and Lethbridge, Alberta, and Scott and Indian Head, Saskatchewan from 2008 to 2010.
- In May each year hybrid ('71-45 RR' – glyphosate-resistant) or open-pollinated ('34-65 RR' – glyphosate-resistant) canola was seeded at 150 seeds m^{-2} at 4 or 7 mph at a depth of 1 or 4 cm.
- Experimental design was a 2x2x2 factorial arrangement in a randomized complete block design with four replications. Plot size was 3 x 15 m.
- Glyphosate at 450 g ae ha^{-1} was applied in-crop (twice when required for weed control).
- Crop emergence density was determined at 4 locations in each plot (4 x 0.5m x 1 row – diagonally across the plot).
- In addition to crop yield, % green crop canopy, the start and end of flowering, maturity dates, 1000 seed weights, % green seeds, and oil and protein content were also determined.

Results and Discussion

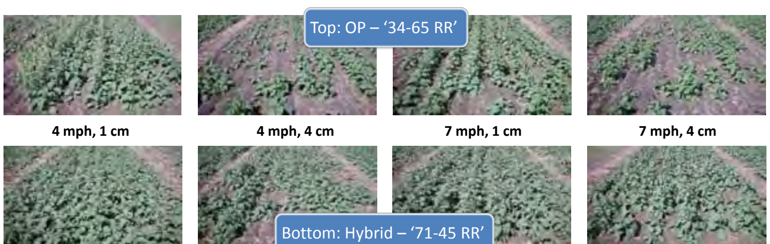

Figure 1. Lacombe plot photos – 2009 (Test 32).

Crop Emergence – Photos and Digital Analyses

- Visual inspection of emergence effects led to consistent effects across locations and years (Figures 1 and 2).
  1. Increasing seeding depth from 1 to 4 cm often dramatically reduced canola emergence (there were several exceptions when soil moisture was very limited).
  2. Increasing seeding speed from 4 to 7 mph reduced emergence under most conditions. In 7 mph plots, soil from back shanks covered some front shank rows which led to greater seeding depth.
  3. The hybrid cultivar appeared to resist seeding stress treatments (4 cm depth, 7 mph) better than the open pollinated cultivar.
  4. To compensate for poor emergence and less competitive crop canopies, canola producers will often choose to make a 2nd in-crop herbicide application after seeding too fast and/or deep.

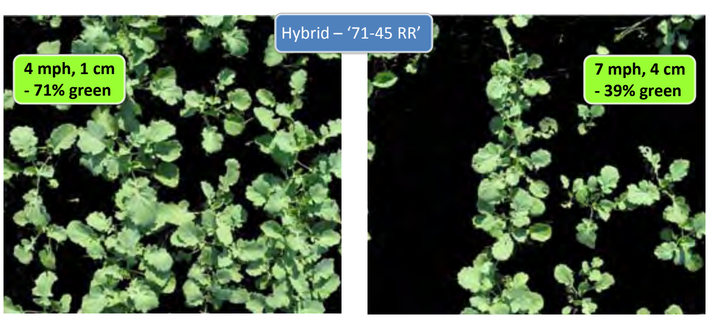

Figure 2. Digital analyses of green pixels from processed photos – June 23, 2010 – Lacombe (Test 32).

Table 1. Canola emergence (plants m^{-2}) as influenced by cultivar and seeding treatments.

	Lacombe, AB				Lethbridge, AB				Indian Head, SK		Scott, SK			
	2008		2009		2008		2009		2009		2008		2009	
Treatment	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb
4 mph, 1 cm	123	101	72	52	58	45	54	52	112	112	24	37	54	52
4 mph, 4 cm	74	80	26	30	51	49	49	76	111	111	56	64	45	57
7 mph, 1 cm	85	79	49	43	60	60	50	46	98	98	19	20	36	70
7 mph, 4 cm	68	61	13	24	31	35	60	63	80	80	48	63	56	40
LSD (0.05)	24		20		12		24		26		12		28	

Table 2. Precipitation 1 week before seeding (WBS), 1 week after seeding (WAS), and 2 WAS.

	Lacombe, AB		Lethbridge, AB		I.H., SK	Scott, SK	
Date*	5	1	18	26	15	16	15
Time	**2008**	**2009**	**2008**	**2009**	**2009**	**2008**	**2009**
1 WBS	6.3	2.2	1.6	2.9	1.4	8.2	0.2
1 WAS	19.6	2.4	71.3	0	0.6	1.8	14.2
2 WAS	0	4.4	10.8	22.9	10.4	0.4	1.6
Total	25.7	9.0	83.7	23.8	12.4	10.4	16.0

* May date of seeding. ** Experiment not conducted at Lethbridge in 2010.

Table 3. Canola yield (t ha^{-1}) as influenced by cultivar and seeding treatments*.

	Lacombe, AB				Lethbridge, AB				Indian Head, SK		Scott, SK			
	2008		2009		2008		2009		2009		2008		2009	
Treatment	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb
4 mph, 1 cm	4.2	4.8	4.5	5.2	2.7	3.1	3.4	3.7	2.8	2.7	2.9	3.6	2.7	3.1
4 mph, 4 cm	4.1	4.4	3.8	4.2	2.4	2.9	3.5	3.9	3.0	2.9	2.9	4.3	2.7	3.2
7 mph, 1 cm	4.1	4.8	4.3	4.7	2.9	2.8	3.6	3.7	2.7	2.8	2.7	3.4	2.7	3.0
7 mph, 4 cm	4.1	4.7	3.4	4.8	2.2	2.9	3.4	4.0	2.6	2.8	3.0	3.8	2.6	3.0
LSD (0.05)	0.5		0.4		0.4		0.5		0.4		0.5		0.4	

* Values in green cells were not significantly lower than the highest yield within a particular site and year.

Table 4. Percent green canola seed as influenced by cultivar and seeding treatments*.

	Lacombe, AB				Lethbridge, AB				Indian Head, SK		Scott, SK			
	2008		2009		2008		2009		2009		2008		2009	
Treatment	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb	OP	Hyb
4 mph, 1 cm	1	1	2	1	8	4	1	1	3	1	2	1	5	2
4 mph, 4 cm	1	1	3	2	7	3	1	1	4	2	1	0	4	3
7 mph, 1 cm	1	0	3	1	8	3	3	1	3	3	3	1	5	3
7 mph, 4 cm	1	1	3	1	7	5	2	1	5	2	1	0	4	3

* Green seed levels ≤ 2, 6, and 20% "distinctly green" result in canola grades of #1, #2, #3, respectively. Above 20% green = "sample" grade.

Crop Emergence – Canola Density

- Canola stand density (Table 1) was similar to that observed visually and digitally (Figures 1 and 2). Under the very dry condition at Scott in 2008 (Table 2), seeding at 4 cm was usually superior to seeding at 1 cm (Table 1). Under similar dry conditions at Lacombe in 2009, crop density was almost always superior at a 1 cm versus a 4 cm seeding depth.

Crop Yield and Green Seed

- With the exception of Indian Head, canola yields were almost always greater for hybrid versus open pollinated canola (Table 3). Few consistent yield effects were apparent as a result of seeding speed and seeding depth treatments.
- When green seed differences were apparent among treatments (once at each site), they were a result of seeding too fast and/or too deep (Table 4). Higher green seed levels in the latter treatments were a result of extended flowering periods and subsequently delayed maturity as canola compensated for uneven stands (data not shown).

Conclusions

- Seeding hybrid canola will most-often maximize canola yield.
- Seeding relatively slow and shallow will maximize the chance of obtaining high grade canola (< green seed).
- Careful seeding maximizes opportunities for practising IWM; less herbicides are required in uniform crop canopies.

Literature Cited

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