2012 Canola Seeding Speeds Demonstration 2011 and 2012 Reports

Stewart Brandt

ABSTRACT

Thirty field scale demonstrations were done across Northern and Central Saskatchewan to evaluate the impact of seeding speed on canola establishment. In most cases speeds varied in the 3 to 7 mph range, but at one site the highest speed was 9 mph, and 8.5 mph at another. Most sites were planted directly into standing cereal stubble, but in the NE region three sites in 2011 were planted on pre-tilled fallow (much of the area was fallowed because it could not be seeded in 2010). One site in 2012 was seeded to oat, due to very late seeding. Equipment varied in the level of soil disturbance from very low disturbance disc type openers, to paired row systems and spoon types which caused moderate soil disturbance. Equipment varied in the level of soil disturbance from low disturbance narrow knives, to paired row systems and spoon types which caused moderate soil disturbance. Seedbed moisture conditions were good to excellent at most locations. Several sites were affected by frost in 2011, but not 2012, and one site was reseeded and no furthur data taken. Out of the 30 sites, seeding speed had little or no effect on plant density at 22 sites, five showed negative response and three showed positive response to increased speed. Where trends with seeding speed were noted, both increases and decreases were noted. In one instance plant density declined by 44% as speed increased from 3.5 to 6 mph, or almost 6 plants per m^2 for each mph increase in speed. In this case densities still remained above 40 plants per m^2, the level below which we would expect yield to be adversely affected, and no affect on yield was found. At sites where yield was determined, there was no real evidence that seeding speed affected yield at any location. This project suggests that under favorable seeding conditions with good moisture producers may be able to speed up if they are pressed for time to get the crop in the ground. With increased seeding speed it is important to ensure the seeding rate and fertilizer rates are adjusted accordingly as some equipment did start to drop in rates as speeds increased. At another site there was an indication that losses of anhydrous ammoinia enceased as seeding speed increased. This may have been due to poor soil movement over the row where to fertilizer was appied, or because it was being appied so fast that it could not be effedctively absorbed onto soil particles. In either case, setting the fertilizer opener at greater depth would likely have alleviated this problem. This project suggests that under favorable seeding conditions with good moisture producers may be able to speed up if they are pressed for time to get the crop in the ground. Where large soil clods result in poor seed coverage, higher speeds may even be benficial in breaking up clods to improve coverage. With increased seeding speed it is important to ensure the seeding rate and fertilizer rates are adjusted accordingly as some equipment not be able to maintain rates as speeds increase. Where anhyrous ammonia is being applied at seeding, growers should

check to ensure that gaseous losses are not increased. Where such losses occur, growers should make adjustments to reduce losses. As with any other change to seeding practices, careful observation of how seed and fertilizer placement is affected is essential to minimize risk of poor plant stands and early vigour.

2011 Annual Report: Canola Seeding Speeds Demonstration

Report Compiled by Stewart Brandt

Project Location(s):

- Fields in NW Saskatchewan – 3 Scott, 2 Wilkie, 1 Leipzig, 1 North Battleford, 1 Goodsoil, 1 Meadow Lake
- Fields in NE Saskatchewan – 2 Tisdale, 2 Melfort, 1 Star City
- Field in NC and C Saskatchewan – Paddockwood, Rosthern, Simpson

Project contact person & contact details:

- Sherrilyn Phelps, Regional Crop Specialist, SK Ag, 446-7475. Sherrilyn.Phelps@gov.sk.ca. Mailing address: 1192-102nd Street, North Battleford, SK S9A 1E9 (ADOPT 20100282)
- Stewart Brandt, Northeast Agricultural Research Foundation, Mailing Address: Box 1240 Melfort, SK S0E 1A0 Email: brandts@xplornet.ca Phone 306 247-2138 (ADOPT 20100259)
- Shannon Urbaniak, Regional Crop Specialist, SK Ag, 953-2362. Shannon.Urbaniak@gov.sk.ca. (ADOPT 2010285)

Project objectives:

To demonstrate effect of seeding speed on canola emergence and yield over a range of equipment and field conditions.

Project Rationale:

Establishing a healthy vigorous crop stand is critical for all crops, but especially so for canola because reseeding claims for this crop are typically much higher than for cereal grains. Added to this are the high cost of seed and the substantial yield loss associated with delayed seeding when the crop is reseeded. The Canola Council of Canada recommends that growers target plant populations of 80-150 plants per m^2. Plant density studies suggest that yield declines rapidly as densities drop below 40 plants per m^2. By targeting 80-150 plants per m^2 plant populations remain adequate except in extreme situations.

With large areas to seed, a short season and often unfavourable weather farmers are tempted to speed up the seeding operation any way they can. One way is to increase seeding speed. Recent research indicates that emergence declines as seeding speed increases, although seeding depth had a much greater effect. The work was done with small plot equipment and a single type of seed opener raising questions about how this might differ under field conditions with a variety of seeding equipment.

As seeding gets delayed past the optimum time, farmers are faced with making tradeoffs between what is optimum and what reduces overall risk. An extensive knowledge of the implications of seeding speed on canola emergence would provide growers with essential tools to make such decisions in a way that minimizes risk.

Because growers use a diversity of equipment under a diverse set of soil conditions, it was important that we used a diversity of modern equipment over a range of soil conditions to ensure results were broadly applicable.

Methodology:

The project involved field scale equipment in 17 fields in Saskatchewan. Details for each site are provided in Table 1. Canola was seeded using normal practices on untilled cereal stubble, except at 3 locations in NE SK where seeding was done on pre-tilled chemical fallow (chemical fallow is uncommon in the region, but much of the area was un-seeded in 2010 due to excess moisture, and was fallowed). The producers own equipment was used to seed canola at predetermined speeds in adjacent strips with one pass for each speed. Seeding speeds ranged from 3 to 9.5 mph depending on equipment used and operators preference. Strips were a minimum of 100 metres in length and consisted of a minimum of 5 speeds. The width of each strip was determined by seeding equipment. Speeds were chosen based on normal speed used, maximum that can be safely done with equipment and then 3 other speeds depending on the separation. A minimum difference of 0.5 mph between speeds was targeted.

Table 1. Locations, seeding equipment, seed date, cultivar speed and moisture conditions where canola seeding speeds demonstrations were conducted in 2011.

ADOPT #	Equipment (site)	Nearest Town	Date Seeded	Variety	Seeding Speeds (mph)	Moisture condition
20100282	1. Bourgault knife	Scott	15-May	7265RR	3, 3.5, 4, 4.5, 5, 5.5	wet
20100282	2. Seed Hawk	Scott	16-May	5440	3.5, 4, 4.5, 5, 5.5	excellent
20100282	3. JD Air Disc	Wilkie	14-May	9590	4.5, 5.5, 6.5 7.5, 8.5	wet
20100282	4. Bourgault Atom Jet	Scott	16-May	5440	3-8.5 in 0.5 increments	excellent
20100282	5. Ezee-On Atom Jet	Leipzig	17-May	L150	3.5, 4, 4.5, 5, 5.5, 6	good
20100282	6.JD ConservaPak	N. Battleford	11-May	5440	3.5, 4.0, 4.6, 5.1, 5.2	good
20100282	7. Bourgault Paralink	Wilkie	17-May	Dekalb 7265	3.5, 4, 4.6, 5.1, 6, 6.5, 7	good
20100282	8. JD Air Disc	Goodsoil	19-May	L150	4, 5, 6, 7, 8	dry
20100282	9. Bourgault knife	Meadow Lake	21-May	Invigor 1145	4, 4.5, 5, 5.5, 6, 7	dry
20100285	10. Seed Hawk	Rosthern	10-May	8770	3.5, 4.5, 5.5, 6.5	good
20100285	11. Flexicoil PR	Paddockwood	24-May	L130	4, 4.5, 5, 5.5, 6, 6.5	good
20100285	12. Morris Atom Jet	Simpson	18-May	45H29	3.5, 4, 4.5, 5, 5.5, 6, 6.5	very moist
20100259	13. Bourgault paralink	Tisdale	10-May	5440	3, 4, 5, 6, 7	good
20100259	14. Seed Hawk	Tisdale	10-May	5440	3, 4, 5, 6, 7	good
20100259	15. Concorde spoon	Melfort	12-May	na	3, 4, 5, 6, 7	good
20100259	16. Bourgault knife	Melfort	16-May	9557	3, 4, 5, 6, 7	good
20100259	17. Bourgault paralink	Star City	na	na	3, 4, 5, 6, 7.1	good

Sites 5 and 12 had liquid tubes on the opener, and sites 6 and 11 had paired row openers.

At the time of seeding, a video record of each seeding speed was made for later extension use.

The most critical data collected was emergence counts at 7-10 and 21 days after seeding, since this was used to evaluate effects of seeding speed on crop establishment. Soil moving from rear rows and covering front rows thereby affecting emergence was a concern. To account for this we counted 1 m row lengths on adjacent rows equal to the number of gangs used on the seeder at that site. This ensured that front, intermediate and rear rows were equally represented in the counts at each of 5 locations per treatment. Saskatchewan Crop Insurance Corporation assisted with plant counts at NW SK locations (ADOPT 20100282).

Seeding depth was measured as the length of white hypocotyls on excavated seedlings at 21 days after seeding. This supporting data was collected to provide insight into whether seeding depth changed with increasing speed. At NE (ADOPT 20100259) sites a decision was made not to collect this data because to do so would have compromised collection of emergence data during very wet conditions in the area at that time.

Because the treatments were not replicated within sites, we felt that it was important to combine sites that had some common characteristics. By combing sites it was hoped that we could generate additional information that would assist in predicting effects of seeding speeds. It was expected that seeding equipment that caused greater soil disturbance would tend to throw more soil about as seeding speed increased. In turn we expected that this would contribute to reduced emergence as speed increased. To assess soil disturbance of machines and speeds we estimated the amount of crop residue that was lost during the seeding operation. Five digital pictures of surface residue before seeding and five pictures of each speed after seeding were taken at NW SK sites only (ADOPT 21011282). Reduction in residue from before and after photos was estimated using a line transect method. Surface residue loss differences between machines after seeding was used to group machines into zero, low medium and high disturbance groups.

Grain yields were used to measure impact of plant stand and seeding speed on yield. If there was no difference in the emergence counts then the co-operators were not required to provide yield results; therefore, not all sites were taken to grain yield. Maturity differences due to seeding speed were noted at flowering and swathing stages.

Sampling for 1000 kernel weights was planned, but since seeding speed had little effect on plant emergence and yield there was no need to evaluate seed size.

Speeds that were not an even 0.5 mph were rounded to the nearest 0.5 mph. This affected the site at North Battleford where speeds of 4.6 and 5.2 mph were rounded to 4.5 and 5.5 mph respectively as there was already a 5 mph speed. The site at Star City had speeds of 5.1 and 7.1 mph which were rounded down to 5 and 7 mph respectively. At the Site at Simpson 5.6 mph was rounded down to 5.5 mph.

Results

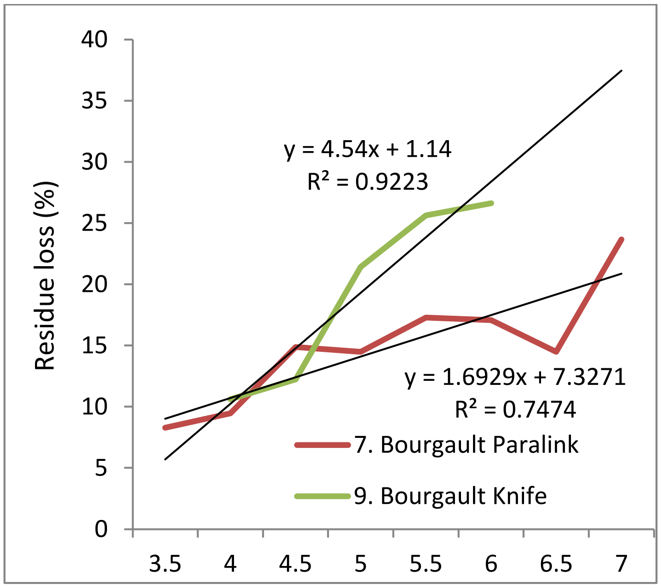
Surface Residue

The two JD disc machines at sites 3 and 8 resulted in very little loss of residue cover (Table 2). The largest residue loss was noted with the JD Conservapak (site 6) with paired rows, while one of the Bourgault knife machines (Site 1) also reduced residue cover by more than 20%. The remaining 5 machines reduced residue cover between 10 and 20%.

Table 2. Influence of equipment and seeding speed on percent residue cover loss after seeding.

	Equipment Used (site)								
Speed (mph)	1. Bourgault Knife	2. Seed Hawk	3. JD Air Disc	4. Bourgault Atom Jet	5. Ezee-On Atom Jet	6. JD Conserv apak	7. Bourgault Paralink	8. JD Air Disc	9. Bourgault Knife
3	28			24					
3.5	22	16		22	14	30	8		
4	19	14		17	14	30	9	0	11
4.5	22	12	-4	25	10	37	15		12
5	22	11		10	19	28	14	0	21
5.5	29	12	1	12	7	27	17		26
6				8	8		17	1	27
6.5			-3	15			14		
7				7			24	2	
7.5			-2	9					
8				10				-1	
8.5			2	16					
9									
9.5			-4						
Average before seeding	97	97	92	91	93	84	90	95	69
St dev	13	6	5	8	10	13	7	2	15
Avg Loss	**24**	**13**	**-2**	**15**	**12**	**30**	**15**	**0**	**19**

Seeding speed did not have a consistent effect on residue cover loss at 7 sites. However at two sites (#7 and #9) residue loss increased with speed (Figure 1). Both these sites were seeded with Bourgault machines, one with a paralink opener and the other with a knife opener. Both machines resulted in a moderate level of soil disturbance as evidenced by residue loss. The lack of any speed effect at sites 1 and 6 where soil disturbance was greatest suggests that our initial expectation that higher disturbance machines would cause even greater disturbance as speed increased was NOT substantiated. The lack of any speed effect at sites 1 and 6 could also be a result of the test speeds not going high enough to induce a response. Site 7 had a substantial increase in soil movement from 6.5 to 7.0 mph while sites 1 and 6 only went up to 5.5 mph and actual top speed at site 6 was 5.2 mph. Site 4 demonstrated a negative effect on surface residue as speed was increased. This could be the result of the openers not penetrating the soil as much as speeds increased as the seeding depth was the lowest at this site but did also have the greatest variability (Table 6).



Seeding speed (mph)

Figure 1. Reduction in surface residue as seeding speed was increased at site 7 Bourgault pararlink and site 9 Bourgault knife.

Plant Density

Initially sites were grouped according to soil disturbance (surface residue loss) in an attempt to determine if equipment with similar levels of disturbance performed similarly as seeding speed changed. This method of grouping sites did not link sites with similar responses to seeding speed.

At 7-10 days after seeding five of the sites averaged 40 or more plants per square meter and 12 sites were below 40 (Table 3). It should be noted that standard deviations for the estimates of plant density were quite high relative to the plant density values at most sites. This suggests that plant densities were quite variable at most sites, and that it was difficult to obtain a highly reliable estimate of density. It also suggests that to get a reliable picture of seeding speed effects we need to look at trends across many sites rather than place too much emphasis on individual site effects.

Site 17 (Bourgault paralink) was very badly frozen approximately 2 weeks after seeding, and plant density was so low that the field was reseeded and no further data taken. Other sites in NW SK that were damaged by frost included sites 6, 8, 9 and 10, however, only 2 of these sites (#6 and 8) had lower plant densities at 21 days after seeding than at 7-10 days (Tables 3 and 4). We initially considered dropping the frost affected sites from further analysis, but there was no evidence that frost had affected different treatments differently, so they have been included.

At 21 days after seeding, the three Bourgault knife machines produced relatively high plant densities at sites 1 and 9, but low densities at site 16. Similarly the three Seed Hawk machines provided high plant densities at sites 2 and 14, but very low densities at site 10 due to heavy frost. Similar inconsistencies were noted with these machines at 7-10 days after seeding. With other makes and models of machines there were at most 2 sites seeded with similar machines making it difficult to look at machine related trends. However where we grouped machines based on actual or estimated levels of soil disturbance no plant density trends were obvious. This would suggest that differences between sites reflected conditions at each site more than the make or model of machine used at each site or the level of soil disturbance caused by each machine.

Despite having sampled five 1 m row lengths at each of five locations within each treatment, standard deviations were quite high relative to the average value for many of the locations. This was particularly true for locations where plant densities were low, where standard deviation often exceeded the average for the site. This suggests that we needed to do more sampling to obtain an accurate measure of plant density.

Table 3. Plant density (plants/m^2) at 7-10 days after seeding at different seeding speeds at each of the17 locations.

	Speed (mph)													
Equipment (site)	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9.5	***St Dev***
1. Bourgault knife	19	17	22	18	17	24								*15.0*
2. Seed Hawk		53	58	52	61	60								*26.1*
3. JD Air Disc				39		36		34		31		33	27	*16.9*
4. Bourgault Atom Jet	47	36	27	31	35	26	36	42	31	26	26	34		*22.8*
5. Ezee-On Atom Jet		26	33	38	31	23	42							*18.6*
6.JD ConservaPak PR		27	28	40	20	20								*14.0*
7. Bourgault Paralink		51	27	34	55	38	48	43	40					*19.7*
8. JD Air Disc			19		30		16		15		26			*19.0*
9. Bourgault knife			42	30	35	25	33		45					*21.9*
10. Seed Hawk		17		18	12	16	15							*9.8*
11. Flexicoil PR			40	39	47	42	44	46						*21.2*
12. Morris Atom Jet														
13. Bourgault paralink	6		6		9		18		15					*10.4*
14. Seed Hawk	36		49		50		38		45					*22.2*
15. Concorde spoon	24		18		22		31		28					*24.6*
16. Bourgault knife	13		12		8		9			13				*10.7*
17. Bourgault paralink		55		63	63		69		49					*28.3*

Table 4. Plant density (plants/m^2) at 21 days after seeding at different seeding speeds at each of the17 locations.

	Speed (mph)													
Equipment (site)	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9.5	***St Dev***
1. Bourgault knife	47	53	51	50	52	59								*23.0*
2. Seed Hawk		75	51	76	69	68								*25.6*
3. JD Air Disc				48		41		37		39		37	34	*18.6*
4. Bourgault Atom Jet	67	62	56	62	64	59	59	69	52	55	55	62		*30.7*
5. Ezee-On Atom Jet		52	54	63	57	39	56							*19.3*
6.JD ConservaPak PR		31	21	20	16	23								*11.0*
7. Bourgault Paralink		75	65	61	78	67	77	64	67					*20.2*
8. JD Air Disc			8		12		16		19		12			*13.0*
9. Bourgault knife			52	46	50	39	39		47					*20.4*
10. Seed Hawk		23		20	26	19	21							*11.1*
11. Flexicoil PR			62	74	63	77	63	70						*25.8*
12. Morris Atom Jet		86	84	78	72	70	64	48						*14.0*
13. Bourgault paralink	32		41		57		67		47					*36.8*
14. Seed Hawk	76		102		69		105		84					*31.2*
15. Concorde spoon	31		45		35		52		49					*24.4*
16. Bourgault knife	12		14		16		17			27				*15.9*
17. Bourgault paralink														

To generate insight into plant density trends as speeds changed we performed simple linear regression analyses on the data. Table 5 provides estimates of the change in plant density with each 1 mph increase in seeding speed, as well as the R^2 values for the regression equation. The higher the R^2 value, the stronger the trend between seeding speed and plant density is. At 14 sites, the relationship between seeding speed was relatively weak (R^2 less than 0.5) at 7-10 days after seeding. At the remaining two locations the response was positive for one and negative for the other. At site 3 there was a strong tendency (0.86 R^2)for plant density to decline by slightly over 1 plant per m^2 for each 1 mph increase in speed. While at site 13 there was a similarly strong tendency (0.79 R^2) for density to increase by 1.5 plants per m^2 for each 1 mph increase in speed.

At 21 days after seeding, 11 sites showed no consistent trend (R2 less than 0.5) for speed to affect plant density. Similar to the earlier date, site 3 showed a decline in density of 1.2 plants per m^2 as speed increased. The largest effect was at site 12 where density decreased by 5.7 plants per m^2 with each 1 mph increase in speed (0.92 R^2). It is interesting to note that even at the highest speed at site 12, densities still exceeded the 40-45 plants per M^2 minimum needed to optimize canola yield.

Countering the trends at sites 3 and 12 were sites 1, 15 and 16 where densities increased by 1.1 to 2.2 plants per m^2 for each 1 mph increase in seeding speed.

Grouping machines based on make and model, or on estimated levels of soil disturbance did not provide any consistent trends that would help to predict when seeding speed might impact plant density.

Table 5. Change in plant density (plants/m^2 increase or decrease) for each 1 mph increase in seeding speed, and R^2 value for the relationship between seeding speed and plant density with differing seeding equipment at 17 the locations at 7-10 and 21 days after seeding.

	7-10 days after seeding		21 days after seeding	
Equipment (site)	change	R^2	change	R^2
1. Bourgault knife	0.6	0.18	1.5	0.54
2. Seed Hawk	1.7	0.45	0.2	0
3. JD Air Disc	-1.1	0.86	-1.2	0.81
4. Bourgault Atom Jet	0.8	0.16	-0.5	0.14
5. Ezee-On Atom Jet	1.3	0.11	-1	0.05
6.JD ConservaPak PR	-2.2	0.17	-2.1	0.38
7. Bourgault Paralink	0.4	0.01	-0.3	0.01
8. JD Air Disc	0.1	0	0.7	0.32
9. Bourgault knife	0.7	0.04	-1.1	0.19
10. Seed Hawk	0.4	0.14	-0.3	0.05
11. Flexicoil PR	1.1	0.42	0.5	0.03
12. Morris Atom Jet	na*	na	-5.7	0.92
13. Bourgault paralink	1.5	0.79	2.8	0.41
14. Seed Hawk	0.3	0.03	1	0.04
15. Concorde spoon	1.1	0.42	2.2	0.56
16. Bourgault Knife	0	0	1.5	0.88
17. Bourgault paralink	-0.5	0.03	na	na

*na = data not available for that site**.**

Seeding Depth

We were unable to detect any significant impact of seeding speed on depth with any of the locations. Seeding depth averaged 2.39 cm over all locations and ranged from seed on the surface to a depth of 11 cm (Table 6). Differences between equipment/site combinations likely reflect how each machine was set, and how well the machine maintained that depth over the range of soil conditions encountered at that location. The coeffficient of variation (defined as the standard deviation as percent of the mean) provides an indicator of how variable seeding depth was at each equipment/site combinations. On this basis, the most consistent site was #9 seeded with a Bourgault knife, while the least consistent was #4 seeded with the Bourgault Atom Jet. However, the smallest range between shallowest and deepest depth was with the Bourgault Paralink (site 7) while the JD Conservapak Paired Row (site 6) site had the deepest seeding depth and the widest range of depths.

Overall, comparisons on seeding depth have to viewed with caution as different seeding speed ranges occurred with many of the seeders. We also have limited number of data points upon which comparisons can be made. For this reason and because consistency of seeding depths between machines was not our primary objective, machine differences should be viewed with considerable caution.

Table 6. Minimum, maximum and average seeding depths in cm and the coefficient of variability (%) within each of 11 equipment by site combinations.

Equipment (site)	minimum	maximum	average	CV %
1. Bourgault knife	0.50	7.00	2.60	40
2. Seed Hawk	1.00	7.00	2.77	35
3. JD Air Drill	0.50	6.00	2.33	33
4. Bourgault Atom Jet	0.00	7.50	1.79	62
5. Ezee-On Atom Jet	1.00	7.50	2.36	41
6. JD ConservaPak PR	0.50	11.00	3.53	40
7. Bourgault paralink	1.00	4.50	1.85	30
8. JD Air Drill	0.50	5.50	2.09	38
9. Bourgault knife	0.50	6.50	2.66	27
10. Seed Hawk	0.00	5.00	2.41	32
11. Flexicoil PR	0.00	5.00	1.92	51

Grain Yield

Grain yield was measured for seven of the 17 sites had grain yield determined. Site 2 (Seed Hawk) did show reduced yield at the highest speed but the site also bordered a low area where excess water and denitrification was evident and shows in the reduced yields at that location compared to similar sites in the area. The higher speeds at this site were closer to the low spot; therefore, yield may have been impacted by the wet conditions and not by seeding speed as there was no difference in plant populations. At site 3 (JD disc) , where plant populations declined with increasing speed, yield was not determined as there was variability across the site and the producer did not feel the yield would be representative.

Site 4 seeded with the Bourgault Atom Jet did show a reduction in yield above 7 mph. However, harvest for this site was split over two days as a result of a combine break-down which may have impacted results. As there was little plant stand difference at this site we did not expect there to be grain yield differences as canola is fairly resilient as long as plant density is above 40 plants per metre square.

Plant density likely limited yield at site 10 (Seed Hawk) as densities were much below the 40 plants per m^2 minimum required due to frost. While speed did not have an effect on plant density, it appeared to result in increased yield. As little difference occurred in plant density the result of increased yields may be due to soil variation across the field.

Plant densities were adequate at all speeds at site 11 (Flexicoil PR), and yields did not show any trend related to seeding speed as expected. At site 12 (Morris Atom Jet) where densities declined most dramatically, yields were unaffected. Even at the highest speed, densities remained above 40 plants per m^2, so little differences in yield are expected with canola when densities are high enough. At sites 13 and 14, there was a slight trend for yield to increase with increased seeding speed, but without replication it is difficult to ascertain if this was significant, but it likely was not.

Overall there was no indication that seeding speed had a negative effect on yield at any of these sites.

Extension Activities:

Rosthern – Seeding Trends – June 5, presented on the project to 50 producers

Goodsoil – Summer Tour – June 29th, 30 producers in attendance. Toured the Goodsoil field and talked about the project as well as other canola production issues. Hard frost in this area in early June followed by flooding had caused a lot of problems.

Scott – Scott Field Day –July 13th, 150 producers in attendance. Toured the Scott field and talked about the project as well as other canola projects. Field was very uniform and no differences visually.

Melfort Annual Field Day July 20. The on-site demonstration was presented, and two of the collaborating farmers spoke about their sites. Attendance 120 producers.

AAFC Canola Research Update – early Dec Dr. Bob Blackshaw provided information to AAFC Canola Cluster on the project in SK. About 20 canola researchers in attendance.

Yorkton Canola Exp - Nov 2&3 – SaskCanola and WARC presented results of project to 280 attendees

Regina Master Seed Conference- Nov 3 - SaskCanola presented information from this project to approximately 300 producers.

Meadow Lake – Feb 8, 2012 – presentation at producer event (40 attendees)

Paddockwood- Feb,15, 2012 – presentation to local crop marketing club (30 attendees)

Battleford – March 8, 2012 – presentation at producer event (180 attendees)

Report will be in 2011 WARC Annual Report that will be posted to the website (www.warc.ca) in March, 2012

Report to Saskatchewan Crop Insurance to be made in April 2012 (expect 20 attendees)

These results along with some videos will be presented at the 2012 Melfort Field Day.

Videos from seeding to be incorporated into presentation and possibility of small seeding speed video to made by SK AG for posting to website (2012/2013).

In total presented to or plan to present to over 1100 producers directly, plus those that would access the website, numerous agronomists and others within the agriculture industry.

Table 7. Yield (bu/ac) of canola with varying seeding speeds at 7 equipment/site combinations.

	Seeding speed (mph)											
Equipment (site)	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5
2. Seed Hawk			19.3	18.9	24.4	14.1						
4. Bourgault Atom Jet	43.6	45.5	47.5	45.5	44.6	46.5	43.6	47.2	42.3	36.1	32.7	32.7
10. Seed Hawk		33.0		34.0	34.0	39.0	37.0					
11. Flexicoil PR		32.0	34.0	35.0	33.0	33.0	35.0					
12. Morris Atom Jet		55.5	55.7	56.2	55.8	55.8	55.8	54.3				
13 Bourgault paralink	52.2		52.2		52.2		55.1		56.9			
14 Seed Hawk	52.6		54.6		58.2		56.8		56.8			

Conclusions and Recommendations

Overall seeding speed had surprisingly little impact on canola plant density. Densities were unaffected at most sites, and where they were affected there were similar numbers of sites where density increased and decreased with increasing speed. The one site where density decreased most dramatically should caution growers that plant densities can be affected and careful consideration should be given before increasing seeding speed.

Based on the data to date, it does not appear that growers would be increasing risk greatly by increasing seeding speeds in the range up to 6.0 or even 7 mph under ideal seeding conditions where moisture is good to excellent and where growers are pressed for time to get the seed in the ground. At higher speeds we have too few data points to provide good predictions. However, there is no evidence that growers should routinely increase seeding speeds above the traditional speed of 4.5 mph unless compelled to do so by time limitations. Further, if speed is increased, growers should be cautious about also using reduced seed rates, as this could increase risk of lower than desirable plant densities.

Because these results challenge what we have traditionally thought about seeding speeds for canola, it is recommended that the demonstrations are repeated in 2012. This reflects also the reaction of collaborating growers. If they are repeated, resources should be concentrated on collecting sufficient plant density data to ensure that accurate estimates are obtained, at more than one time interval. All collaborators should also be encouraged to collect yield data and provide any information they can that would explain non treatment factors that may have affected results. All growers should be encouraged to use the same speeds over a wider range, as this would aid greatly in combining data across sites.

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2012 Annual Report: Canola Seeding Speed Demonstration

Report Compiled by Stewart Brandt NARF

Project objectives:

The objective of this project was to demonstrate influence of opener type and seeding speed on canola emergence using field scale equipment. It will also demonstrate the importance of seeding depth.

Project Rationale:

Establishing a healthy vigorous crop stand is critical for all crops, but especially so for canola because reseeding claims for this crop are typically much higher than for cereal grains. Added to this are the high cost of seed and the substantial yield loss associated with delayed seeding if the crop requires reseeding. The Canola Council of Canada recommends that growers target plant populations of 80-150 plants per m^2. Plant density studies suggest that yield declines rapidly as densities drop below 40 plants per m^2. By targeting 80-150 plants per m^2 plant populations remain adequate except in extreme situations.

With large areas to seed, a short season and often unfavourable weather farmers are tempted to speed up the seeding operation any way they can. One way is to increase seeding speed. Recent research indicates that emergence declines as seeding speed increases, although seeding depth had a much greater effect. The work was done with small plot equipment and a single type of seed opener raising questions about how this might differ under field conditions with a variety of seeding equipment.

As seeding gets delayed past the optimum time, farmers are faced with making trade-offs between what is optimum and what reduces overall risk. An extensive knowledge of the implications of seeding speed on canola emergence would provide growers with essential tools to make such decisions in a way that minimizes risk.

Because growers use a diversity of equipment under a diverse set of soil conditions, it was important that we use a diversity of modern equipment over a range of soil conditions to ensure results were broadly applicable.

Methodology:

The demonstration was set up by arranging for five growers to seed strips of canola one seeder width wide and at least 100 meters long. At each location we requested that they seed at speeds as near as possible to 3, 4, 5, 6, and 7 mph. In addition they had the option of seeding at one other speeed of their chosing. On the day of seeding we flagged the plots and measured plot lengths as they were being seeded. Prior to seeding we took 5 photographs of the soil surface prior to seeding, and again following seeding. These photos were to be used as an indicator of soil disturbace related to the seeder. We also took phots of the seeding equipment and the openers on the seeder. During seeding we took a film clip showing the machine operating at each speed. Additionally we collected information about the location, soil conditions, the machine being used and seeding and fertilizer rates.
At approximately 21 days after seeding we returned to each site and collected plant density data by counting emerged crop plants in each of twenty 0.25 square meter areas in each plot. Each site was visited at least twice later in the growing season to collect notes on conditions at the site, and to note any visual treatment related differences.
By March 2012 we had arranged to have five sites participate in the demonstrations. By May 1, 2011 none of the co-operators had identified a specific field that they would use for the demonstration, reflecting their operational constraints. By the beginning of June, 3 sites were seeded, and two co-operators indicated that they were unable to participate. We were able to find a farmer who was reseeding an oat field near Tisdale. We decided that having some information on a cereal crop that was somewhat sensitive to seed depth might compliment data on canola.

A detailed description of conditions and how the treatments were applied at each site is provided in Table 1.

Table 1. Soil and Seeding Conditions at 4 Seeding Speed Sites in Northeastern SK.

	LOCATION			
	Brooksby	Melfort	Tisdale 1	Tisdale 2
Rural Municipality	Willow Creek	Star City	Connaught	Tisdale
Land Location	SW-5-47-16 W2	SW 23-45-18 W2	SE 5-46-14 W2	NE 32-45-14 W2
Soil Classification	D. Gray Kamsack	Black Blaine Lake	D. Gray / Black Tisdale/Melfort	D. Gray/Gray Tisdale/Arborfield
Soil Texture	Loam-Silt Loam	Loam-Clay loam	Clay-Clay Loam	Clay-Clay Loam
Organic matter %	5.0-5.5	7.0-7.5	7.0-7.5	6.0-6.5
pH	7.1	7.4	6.1	6.0
Seedbed Moisture	Near ideal	Wetter than ideal	Near ideal	Wetter than ideal
Crop Cultivar	Invigor 5440	7345 RR	HEAR 1997	Morgan Oat

Seed rate lb/ac	5.0	5.0	4.8	120
Seed size g/1000	5.52	5.04	3.0	na
Seed speeds	3.2, 4.1, 5.1, 6.0, 6.7	3.0, 4.0, 5.0, 6.0, 7.0, 9.0	3.1, 4.0, 5.0, 6.0, 6.7	3.1, 4.0, 5.0, 6.0, 6.7
N-P-K-S with seed	na	12-20.6-0.30	8-12-0-8	None, reseeded
N-P-K-S other	85-0-0-0	80-0-0-0		60-16-0-0
Seeder Brand	Bourgault Paralink	Concord Air Seeder	SeedHawk Paralink	Bourgault Paralink
Opener type	Knife 0.75”	Sweep 4”	Sideband Knife 0.75”	Spoon, 2”
Row Spacing	9.8”	12”	12”	10”
Seeding Date	May 17	May 31	June 2	June 7

The site at Brooksby (SW-5-47-16 W2) was seeded May 17 using a Bourgault Paralink air hoe drill with 0.75” wide openers on a 9.8” row spacing. The cultivar Invigor 5440 (5.52 g/1000 seeds) was planted at 5 lb/ac with 85 lb/ac of fertilizer N as anhydrous ammonia midrow banded. Seeding speeds of 3,4,5,6 and 7 were targeted but actual speeds were 3.2, 4.1, 5.1 6.0 and 6.7 mph.

The site at Melfort (SW 23-45-18 W2) was seeded May 31 using a Concord Air Seeder with 4” wide sweeps on a 12” row spacing. The cultivar 7345 RR (5.04 g/1000 seeds) was planted at 5 lb/ac with 80 lb/ac of fertilizer N as anhydrous ammonia midrow banded, and N, P_2O_5, K_2O and S applied with seed at12-20.6-0-30 lb/ac respectively. Seeding speeds of 3,4,5,6 and 7 matched targeted speeds, and an additional speed of 8 mph was added.

Site 1 near Tisdale (SE 5-46-14 W2) was seeded June 2 using a SeedHawk Paralink air drill with 0.75” dual openers on a12” row spacing. The cultivar HEAR 1997 was seeded at 4.8 lb/ac with N, P_2O_5, K_2O and S side banded at 16.8-0-0-16.8 and applied with seed at 8-12-0-8 lb/ac respectively. Seeding speeds of 3,4,5,6 and 7 mph were targeted speeds, but actual speeds were 3.1, 4.0, 5.0, 6.0 and 6.7 mph.

Site 2 near Tisdale (NE 32-45-14 W2) was seeded June 7 using a Bourgault Paralink air drill with 2” spread tips on a 10” spacing. The oat cultivar Morgan was seeded at 3 bu/ac without any fertilizer because the crop was being reseeded and adequate fertilizer had been placed with the initial seeding operation. Seeding speeds of 3,4,5,6 and 7 mph were targeted speeds, but actual speeds were 3.1, 4.0, 5.0, 6.0 and 6.7 mph.

Results

<u>General Observations</u>:

At the time of seeding (May 17, 2012) at the Brooksby site, soil moisture was near ideal on the mid and upper slope positions, but was bordering on excessive in the depressions. The site was inspected May 30, and again June 7 when plant counts were made. The site was also visited June 23, after heavy rains flooded depressions across the site resulting in loss of plants and obvious damage to others. On August 30 the site had been swathed and had obvious wind damage. A decision was made not to collect yield data because valid comparisons were not possible.

The Melfort site was located on a very uniform area of the field. At seeding time (May 31, 2012) soil moisture at seeding depth (approximately 2 cm) bordered on excessive. On June 22 when plant counts were made, the site was excessively wet and plants showed obvious signs of flooding damage (yellowing, purple leaves, poor vigour). Plant counts were made in areas where there was no standing water to ensure that variable flooding did not influence results. On August 30 the site was inspected again, and a decision was made not to collect yield data because flood damage was too variable and extensive to allow for valid comparisons.

The Tisdale 1 site had near ideal soil moisture on the mid and upper slopes but depressions bordered on excessive on June 2 when it was seeded. On June 22 when plant counts were made, the depressions were full of standing water so plant counts were made on the mid and upper slope positions to provide valid comparisons. The site was inspected again August 2 and August 30 when notes were taken on uniformity and development stages of the crop. On August 30 an attempt was made to estimate the size of areas affected by flooding in each plot, but it quickly became apparent that this was not feasible. At that point a decision was made not to collect yield data.

The Tisdale 2 site seeded June 7 was wetter than ideal. On June 28 when plant counts were made, emergence was variable across plots with signs that some areas had suffered from excessive moisture. Heavy rains (> 75 mm) a few days later resulted in extensive flooding of the entire field, including the trial site. By early July Crop Insurance had written the field off, and the trial was abandoned.

Notes from all site visits indicated that no treatment differences in crop development stage or crop uniformity were evident that could be related to seeding speed. Differences between plots were all related to flooding damage, which would have confounded any yield data.

Plant Densities:

Plant densities were the primary indicator of treatment effects. At the Brooksby site there was a weak tendency for canola plant densities to be higher at 5 mph and lower at 7 mph than at other speeds (Table 2). During seeding we did note that there was a tendency for soil moved from rear rows of openers onto seed rows of the front and mid rows of openers. However there was no clear indication that this changed as seeding speed changed. As speed increased, soil did tend to be thrown farther, but that may have resulted in less soil moving onto adjacent rows.

At the Melfort site canola plant densities tended to be lowest at 3 and 4 mph and highest at 5 mph. Even where speeds of 9 mph were used at this site, plant densities did not decrease dramatically. During seeding it was noted at low speeds that large soil clods were being moved off the seed row, and there was poor flow of soil to cover the seed. Rear rows of the seeder had seed visible on the soil surface. As speed increased soil clods were shattered into smaller clods, and flow of soil over the rows was much better. At speeds of 5 mph or greater we did not see any seeds left uncovered.

At the Tisdale 1 site canola plant densities also tended to be lowest at 3 and 4 mph and highest at 5 and 7 mph. Soil at this site was very mellow, and tended to flow well and cover the seed. The dual opener system on the seeder used here also ensured good soil flow over the seed. However, this machine placed anhydrous ammonia in a side band near the seed. As speed increased, there was increasing evidence that the anhydrous ammonia was being lost. It may have been possible to prevent this by setting the fertilizer opener to run deeper allowing more space to trap the gas.

Higher plant densities at the Tisdale 1 site were in part because seed size of the HEAR 1997 was much lower than seed used at Brooksby or Melfort sites. At this site, differences in plant density between seeding speeds were relatively small and did not show any clear trend to increase or decrease with seeding speed.

At the Tisdale 2 site where oat was grown, plant densities were lowest at 7 mph and highest at 3 mph. Relatively low and highly variable plant densities at the Tisdale 2 site (oat) likely reflected the overly wet conditions at seeding coupled with clay soils. This likely resulted in some smearing of soil above and/or around the seed creating a dense layer of soil that inhibited oxygen movement into the seed. Such smearing could also create a barrier impeding seedling growth to the soil surface.

Based on seed size and seed rate at each location, there were 101 seeds planted per square meter at Brooksby, 111 at Melfort, and 169 at the Tisdale 1 site. Thus average percent plant establishment was 46% at Brooksby, 60% at Melfort and 70% at the Tisdale 1 site. In all cases, plant densities exceeded the threshold of 40 plants per square meter generally considered the minimum density needed to avoid significant yield loss.

Overall, there was a trend for densities to be highest where seeding speed was 5 mph, and for plant densities to decline at faster or slower speeds. However, standard deviations for the estimates of plant populations at all sites and speeds were quite high despite counting plants at 2 locations in each treatment. This along with the lack of a clear trend associated with speed suggests that differences between seeding speeds were not very particularly large. This is in general agreement with observations made the previous year in a similar seeding speeds demonstration.

Table 2. Influence of Seeding Speed on Canola Plant Density at 4 Locations in NE SK in 2012.

Location	Variable	Seeding Speed (mph)					
		3	4	5	6	7	9
Brooksby	Plants per square M	46	46	54	45	42	
	Standard Deviation	41.7	38.3	29.4	37.1	37.8	
Melfort	Plants per square M	62	60	78	68	66	66
	Standard Deviation	32.1	32.7	34.5	54.3	38.4	29.0
Tisdale 1	Plants per square M	112	112	128	116	127	
	Standard Deviation	41.2	48.3	40.5	39.8	59.3	
Tisdale 2	Plants per square M	64	59	55	61	52	
	Standard Deviation	49.5	77.2	72.6	56.1	50.0	
Mean	Plants per square M [1]	71	70	79	73	72	
Mean	Plants per square M [2]	73	73	87	76	78	

[1] *Mean of all 4 sites;* [2] *Mean of the 3 canola sites.*

<u>Extension Activities 2012</u>

A poster and a verbal presentation along with a video clip were presented at the 2012 Melfort Field Day July 18, 2012 with approximately 90 farmers in attendance.

Results were also presented at the Saskatchewan Forage Seed Growers Commission Meeting on Dec 5, 2012 in Nipawin, SK.

The Poster and video will be posted on the NARF website once it is up and operational.

Results will be presented at meetings planned for Wynyard (Jan 30), Yorkton (Jan 31), Tisdale (Feb 1), Melfort March 12 and Prince Albert (Mar 21).

During 2011, results from the earlier project were presented at more than 10 events reaching over 1100 producers.

Dr. Robert Blackshaw with AAFC will be including results from this work at canola cluster meetings and extension events in Western Canada.

Copies of the poster, film clip and photos developed from this project accompany this report.

Conclusions and Recommendations

Overall seeding speed had surprisingly little impact on canola plant density, similar to what we observed in 2011. Densities did tend to be slightly higher at 5 mph than at faster or slower speeds at some sites in 2012. These differences were small enough that they could be accounted for by sampling error although with 20 quadrats per plot in 2012, sampling error was likely much lower than in 2011. The previous year density differences showed an even less consistent trend. The one site where density decreased most dramatically in 2011 should caution growers that plant densities can be affected and careful consideration should be given before increasing seeding speed.

Based on the data to date, it does not appear that growers would be increasing risk greatly by increasing seeding speeds in the range up to 6 or even 7 mph under ideal seeding conditions where moisture is good to excellent and where growers are pressed for time to get the seed in the ground. At speeds greater than 7 mph we have too few data points to provide good predictions. However, there is no evidence that growers should routinely increase seeding speeds above the traditional speed of 4 to 5 mph unless compelled to do so by time limitations. Further, if speed is increased, growers should be cautious about also using reduced seed rates, as this could increase risk of lower than desirable plant densities. Growers should bear in mind that these demonstrations were conducted under normal to wetter than normal conditions. Under dry conditions seed depth may be a more important factor in determining whether seeds will emerge. As a result, minor changes in seed depth associated with seeding speed could have a more dramatic impact on emergence under dry conditions.

Growers should also be aware that there may be other factors to consider when increasing seeding speeds. In one case we noted that seed and fertilizer application rates declined at speeds above 5 mph. In two other cases when applying anhydrous ammonia as a side band it appeared that gaseous losses increased with increasing seeding speed. This likely reflected that with side band openers operating at shallow depth while seeding canola soil flow around the opener was affected. This in turn either affected how well the fertilizer gas was trapped in the soil, or that too much as being injected with too little time for it to be effectively retained in the soil. Depending on equipment, it may be possible to set the side band opener deeper to compensate. Thus changing seeding speed may affect things other than seed placement, so such changes should be approached with caution. The seeding operation is often the most important consideration in establishing a high yield potential for canola, and most other crops as well.

Acknowledgements

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