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INVESTIGATION INTO THE EFFECTIVENESS OF RESIDUE MANAGERS AND WHEELS WITH DIRECT SEEDED FIELD CROPS

Abstract:

Direct seeding into high amounts of residue is a problem for most types of seeding equipment. Disk type openers hair pin residue and hoe type openers cause plugging or accumulations of residue. This results in decreased crop emergence and yields. Residue managers or wheels are designed to either push residue away from the opener or hold straw and chaff in place so the hoe or disc opener can better slice through it, allowing for proper seed and fertilizer placement. A study was conducted to determine the effect on emergence and yield of barley, canola, peas and wheat when using residue managers and wheels with a disk and hoe opener.

Overall the trend shows increased crop emergence with the use of residue managers and wheels. Crop emergence was higher at 14 of 18 crop sites when using residue managers and wheels. Crop yields were erratic and showed no specific trends. The study should be continued to further investigate the effect of residue managers and wheels on crop emergence and yield. Sites with higher residue levels should be used in the future.

INVESTIGATION INTO THE EFFECTIVENESS OF RESIDUE MANAGERS AND WHEELS WITH DIRECT SEEDED FIELD CROPS

Introduction:

Direct seeding into high amounts of residue is a problem for most types of seeding equipment. Disk type openers hair pin residue and hoe type openers cause plugging or accumulations of residue. This results in decreased crop emergence and yields. Residue managers or wheels are designed to either push residue away from the opener or hold straw and chaff in place so the hoe or disc opener can better slice through it, allowing for proper seed and fertilizer placement. Residue managers are commonly used in the United States to clear residue for precision planters seeding high value crops. Manufacturers recently have developed residue managers more suited to cereal and oilseed seeding equipment. The price of managers has been reduced over the years. The systems are also narrower so they can be used with narrow row spacings. Residue wheels are new and in the prototype stage. The USDA (Siemens, Wilkins and Correa) have developed a residue management wheel for hoe-type no-till drills. A study was conducted to determine the effect on emergence and yield of barley, canola, peas and wheat when using residue managers and wheels with a disk and hoe opener. The project also demonstrated the use of residue managers and wheels.

Materials and Methods:

Three sites were used for the study in 2003. Table 1 summarizes the study sites and operations. All sites were direct seeded and sprayed with glyphosate prior to seeding. Granular chemical was also used at the Lethbridge canola site prior to seeding.

Table 1: Summary of project sites and operations.

Site	Crop	Variety	Seeding Date	Plant Count Date	Harvest Date
Lethbridge	Peas	Espace	21-May-03	16-Jun-03	24-Sep-03
Lethbridge	Wheat	AC Barrie	21-May-03	16-Jun-03	15-Sep-03
Lethbridge	Canola	LG 3455	21-May-03	16-Jun-03	15-Sep-03
Lacombe	Barley	AC Lacombe	27-May-03	24-Jun-03	29-Sep-03
Lacombe	Canola	LG 3455	27-May-03	24-Jun-03	29-Sep-03
CACDI Farm	Peas	Yellow Field	20-21 May 2003	24-Jun-03	30-Sep-03

The study was divided into two parts. Each part of the study was set up as a randomized complete block design with four replications. Plots were 2.4 x 15.2 m (8 x 50 ft). A 12.2 m (40 ft) strip was used between the ends of replication blocks. Border effects were controlled through winter crops on the sides of each plot. The AgTech Centre plot seeder was used to seed the plots. Travel speed in the plots was 6.4 km/h (4 mph). The treatments in the two parts of the study are listed in Table 2.

Table 2: Treatments used in study.

Part 1	Prototype Residue Wheel from Mark Siemens with Flexi-coil Stealth opener
	Flexi-coil Stealth Opener (hoe check)

Part 2	Yetter Narrow row Single Wheel Residue Manager with Barton Double Shoot Disk Opener
	K-Hart Residue Wheel with Barton Double Shoot Disk Opener
	Barton Double Shoot Disk Opener (disk check)

Phosphate in the form of 11-52-0 was placed with the barley, canola and wheat and banded with the peas. Nitrogen in the form of urea (46-0-0) was banded with barley, canola and wheat. The rates of the various materials are listed in Table 3. Plot yields were obtained with a self-propelled plot harvester. One plant count was taken for each row of every plot.

Table 3: Material application rates.

Site	Crop	Seed Rate		Phosphate Rate Actual P		Nitrogen Rate Actual N	
		kg/ha	lb/ac	kg/ha	lb/ac	kg/ha	lb/ac
Lethbridge	Peas	134.0	120	34	30	0	0
Lethbridge	Wheat	101.0	90	34	30	90	80
Lethbridge	Canola	6.7	6	34	30	90	80
Lacombe	Barley	101.0	90	34	30	90	80
Lacombe	Canola	6.7	6	34	30	90	80
CACDI Farm	Peas	240.0	214	34	30	0	0

Figure 1 through 3 show the various residue managers and wheels used in the project.

Figure 1: K-Hart

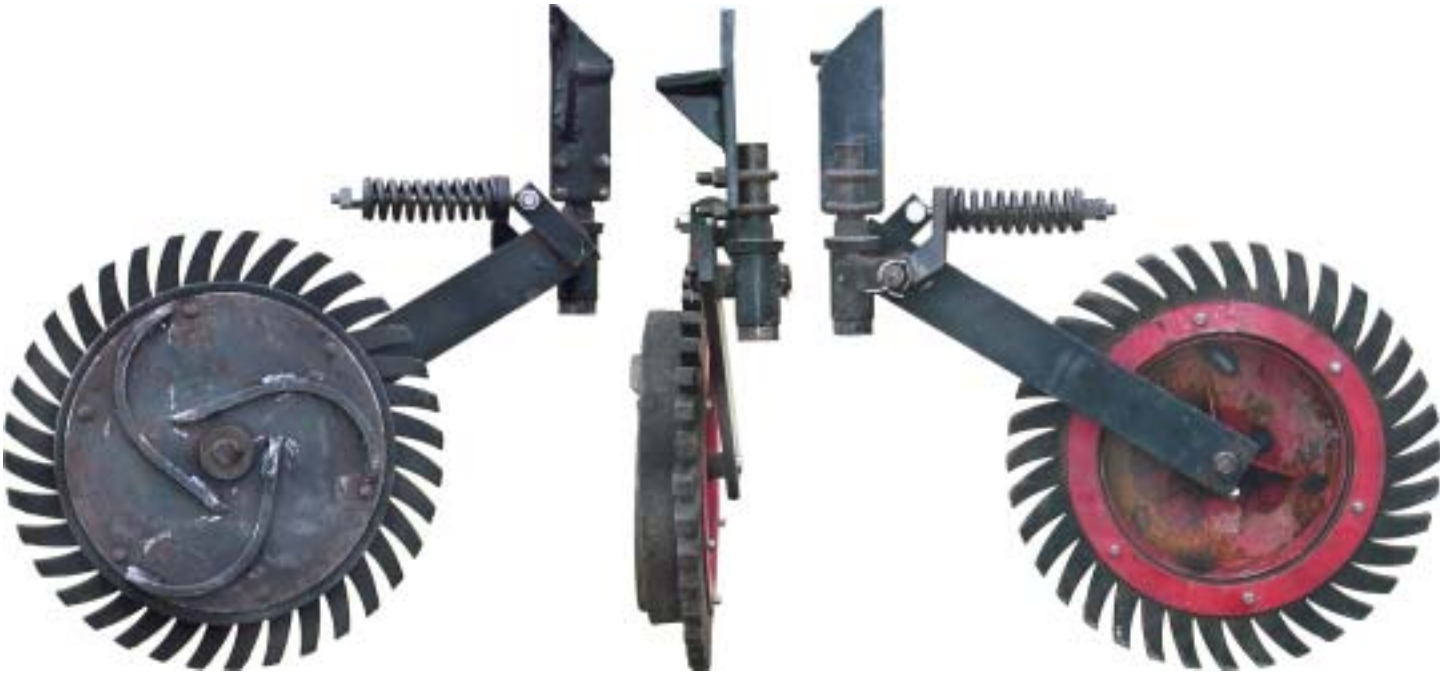

Figure 2: Siemens

Figure 3: Yetter

Results:

The residue managers and wheels assisted the flow of residue through the seeder while seeding the plots. No plugging occurred with the seeder while seeding.

An analysis of variance (ANOVA) was used to analyze the results. Crop mean plant counts for part one is presented in Table 4. Differences in crop emergence were not significantly different between the hoe check and Siemens prototype residue wheel except at the ATC canola site where the emergence of canola was significantly higher with the Siemens prototype residue wheel. Crop emergence was higher with the Siemens Prototype Residue Wheel at 5 of the 6 crop sites.

Table 4: Part One Crop Emergence.

Site	Hoe Check		Siemens Prototype Residue Wheel	
	Plants/m^2	Plants/ft^2	Plants/m^2	Plants/ft^2
ATC Peas	53	4.9	54	5.0
ATC Wheat	254	23.6	280	26.0
ATC Canola	**b** 43	**b** 4.0	**a** 68	**a** 6.3
CACDI Peas	92	8.6	85	7.9
Lacombe Barley	148	13.8	150	13.9
Lacombe Canola	77	7.2	83	7.7

Crop mean plant counts for part two is presented in Table 5. Differences in crop emergence were not significantly different between the disk check and the Yetter and K-Hart residue managers. Crop emergence was higher with the K-Hart residue manager at all six sites and with the Yetter residue manager at 3 of 6 sites.

Table 5: Part Two Crop Emergence.

Site	Disk Check		K-Hart		Yetter	
	Plants/m^2	Plants/ft^2	Plants/m^2	Plants/ft^2	Plants/m^2	Plants/ft^2
ATC Peas	39	3.6	40	3.7	40	3.7
ATC Wheat	222	20.6	230	21.4	199	18.5
ATC Canola	68	6.3	70	6.5	69	6.4
CACDI Peas	74	6.9	80	7.4	75	7.0
Lacombe Barley	150	13.9	155	14.4	140	13.0
Lacombe Canola	87	8.1	93	8.6	83	7.7

Crop mean yields for part one are presented in Table 6. Differences in crop yield were not significantly different between the hoe check and Siemens prototype residue wheel. Crop yield was higher with the Siemens Prototype Residue Wheel at 4 of the 6 crop sites.

Table 6: Part One Crop Yield.

Site	Hoe Check		Siemens Prototype Residue Wheel	
	tonne/ha	lb/ac	tonne/ha	lb/ac
ATC Peas	3.0	2678	2.8	2499
ATC Wheat	3.7	3302	3.8	3392
ATC Canola	1.8	1607	2.0	1785
CACDI Peas	2.0	1785	2.3	2053
Lacombe Barley	4.6	4106	4.4	3927
Lacombe Canola	1.0	893	1.1	982

Crop mean yields for part two is presented in Table 7. Differences in crop yield were not significantly different between the disk check, the Yetter and K-Hart residue managers except at the Lacombe canola site where use of the Yetter residue manager yielded significantly higher than the K-Hart residue manager and the Disk check. Crop yield was higher with the K-Hart residue manager at 2 of 6 crop sites. Crop yield was higher with the Yetter residue manager at 3 of 6 crop sites.

Table 7: Part Two Crop Yield.

Site	Disk Check		K-Hart		Yetter	
	tonne/ha	lb/ac	tonne/ha	lb/ac	tonne/ha	lb/ac
ATC Peas	2.1	1874	2.2	1964	2.3	2053
ATC Wheat	3.6	3213	3.0	2678	2.9	2588
ATC Canola	2.1	1874	1.8	1607	2.1	1874
CACDI Peas	2.0	1785	2.0	1785	2.7	2410
Lacombe Barley	4.2	3749	4.8	4284	4.6	4106
Lacombe Canola	**a** 1.3	**a** 1160	**b** 1.1	**b** 982	**a** 1.3	**a** 1160

Discussion and Conclusion:

Plant emergence was increased at 5 of the 6 crop sites with the Siemens prototype residue wheel, at 3 of 6 sites with the Yetter manager and at all six sites with the K-Hart manager. The only significant difference in crop emergence was with the Siemens prototype residue wheel seeding canola at the AgTech farm. Crop yields were erratic and showed no specific trends. Crop yields were increased at 4 of the 6 crop sites with the prototype residue wheel, at 3 of 6 sites with the Yetter manager and at 2 of 6 sites with the K-Hart manager. The only significant difference in crop yield was seeding canola at Lacombe where the yield with the K-Hart was significantly lower than the disk check and the Yetter residue manager.

Overall the trend shows increased crop emergence with the use of residue managers and wheels. The study should be continued to further investigate the effect of residue managers and wheels on crop emergence and yield. Sites with higher residue levels should be used in the future.

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