Comparing Straight Harvest with an Anti-shattering Agent to Swathed Harvest of Canola in the Evaluation of Field Scale Straight Combining Canola compared to Swathed Canola

A: Plot scale comparisons of straight (with and without an anti-shatter agent) and swathed canola harvest

[1]Burton Johnson, [2]Kent McKay, [3]Eric Eriksmoen, and [4]Greg Endres
[1]North Dakota Agricultural Experiment Station, Fargo
[2]North Central Research Extension Center, Minot
[3]Hettinger Research Extension Center, Hettinger
[4]Carrington Research Extension Center, Carrington

Report

April 2008

2007 Canola Harvest Management Study
North Dakota Agricultural Experiment Station, Fargo
Burton L. Johnson, Dept. of Plant Sci., North Dakota State Univ.

Abstract

The traditional approach to canola harvesting (*Brassica napus* L.) is swathing followed by crop drydown with combining when seed moisture approaches storage levels. Swaths are usually secured in the remaining standing canola stubble, but in the vast openness of the grassland prairie of North Dakota, strong winds can blow swaths off the fields, causing nearly total yield losses. Direct or straight harvest would eliminate swaths entirely (including cost of swathing), but producers are concerned about seed and pod shattering losses from the standing canola crop. The objective of this research was to compare swathed and direct harvest of canola in a plot-scale and a field-scale study. Both studies were a RCBD (4 replicates) with swathed and direct harvest treatments harvested at the optimum time, followed by three additional delayed harvest dates, each spaced approximately 7 d apart. The anti-shattering agent Biovital/Spodnam was applied (1 pint/acre) at two water volumes of 20 and 50 gallons per acre in the plot-scale study. There was also a non-Biovital treatment (control). Liberty Link hybrids Invigor 4870 and 5550, and Roundup Ready hybrid Hyola 357 were used in the studies. The plot-scale studies were conducted at research extension centers associated with the ND Agric. Expt. Stn., Fargo and were located at Carrington, Hettinger, and Minot. There was also a plot-scale site near Prosper, ND, also associated with the ND Agric. Expt. Stn., Fargo. Field-scale studies were conducted in grower fields near Velva, Rugby, Langdon, and Newburg, ND. Studies were conducted in the 2005, 2006, and 2007 growing seasons. Standard agronomic practices were applied for crop rotation, seeding date, seeding rate, fertility, and pest management to ensure high production. Traits evaluated included seed yield, seed oil content, green seed, seed shatter, and seed moisture. Results from the plot-scale studies indicated yield, whether swathed or direct harvested, was generally similar from the first two harvest dates, with the exception at one location-year where yield was reduced at the second harvest date for the swath and direct harvest control treatment. When yield reductions occurred, they usually began at harvest date 3. However, in two location-years at the Minot site, harvest date and harvest treatment did not affect seed yield. Seed oil content was generally not affected by the treatments; however, at a couple of location-years the harvest treatment by harvest date interaction indicated treatment ranking differences for seed oil content as harvest date was delayed. When this occurred seed oil content differences were 1 to 2%. Biovital reduced yield losses as the direct harvest treatments were delayed from harvest week 1 to 2 at Carrington in 2006, and harvest week 3 to 4 at Hettinger in 2007. At the other nine location-years Biovital did not influence seed yield. Results from the field-scale study with commercial harvesting equipment indicated in 5 of 7 location-years direct and swath harvest produced equal seed yield and seed oil content. In 1 of 7 location years, direct harvest was less than swath harvest yield because direct harvest was delayed beyond when 10% seed moisture had been reached in the field. In 1 of 7 location-years direct harvest yield was greater than swath harvest yield. Yield loss can occur in the swath or on the standing plants if harvest is not performed in a timely manner. Seed oil content was not affected by the harvest treatments, but green seed was often lower for direct compared with swath harvest. Both the plot- and field-scale studies indicate direct harvest of canola without yield losses is possible, but timely harvest is essential to avoid seed loss in the swath or from the standing plants. When direct harvesting large acreages of canola growers will need to carefully evaluate the feasibility of timeliness of harvest.

Introduction

Producers are seeking alternatives (direct harvest/straight harvest) to swathing canola for the harvesting procedure. Swaths have been reported to scatter across the fields when high winds blow over the wide-open spaces of central and western North Dakota, and this results in high or nearly total loss in seed yield. Concerns with direct harvesting are seed shatter losses if the crop isn't harvested in a timely manner. Advances in harvesting equipment, reported canola varieties better suited for direct

harvesting, and grower concerns to reduce input costs of production (eliminating the swathing operation) require evaluation to access the feasibility of direct harvest. An anti-shattering compound, Biovital, has been used in other crops with pods, to prevent pods from opening and shattering seeds onto the ground.

The study focus was on harvest management where different treatments (swathing compared with direct/straight harvest with and without an anti-shattering agent) were evaluated to observe their influence on seed yield, oil content, and seed moisture at harvest.

Canola Liberty-Link hybrid Invigor 5550 was planted, on 15 May 2007, at the Prosper field research site associated with the ND Ag. Expt. Stn. at Fargo. Standard production practices were applied for optimum canola production regarding seeding date, stand establishment, fertility, and pest management during the season. The experimental design was a RCB with a 4x4 factorial of harvest treatment and harvest date (HD) with four replicates. Harvest treatments were swathed and direct harvested with direct harvest consisting of i.) control (no anti-shattering agent), ii.) Biovital anti-shattering agent (1 pt./A) with 20 gal. water, and iii.) Biovital anti-shattering agent with 50 gal. water). Biovital was applied according to labeled instructions regarding crop stage. Swathing was performed when pods at the top of the plant were at physiological maturity (Berglund et al., 2007). Traits evaluated included seed yield, oil content, and moisture. Analysis of variance was performed with Statistical Analysis System (SAS Institute, 1999) with trait means separation by *F*-Protected LSD comparisons at $P \leq 0.05$ (Steele and Torrie, 1980).

Analysis for seed yield indicated the harvest treatment by harvest date interaction not significant for yield (Table 1). The main effects of treatment and harvest date were significant. The direct harvest main effect yields were 1130, 1150, 1130, and 920 lb/acre for the control, Biovital + 20 gal., Biovital + 50 gal., and swathed treatments, respectively (data not shown). The direct harvest treatments were all similar for seed yield. Application of the anti-shattering agent Biovital did not reduce seed shatter yield losses compared with the control. The swathed treatment was lower for seed yield compared with the direct harvest treatments. The harvest date main effect yields indicated similar yield at HD1 and HD2. Yields at HD3 and HD4 were similar, and both lower than yields at HD1 and HD2. This indicates direct harvest within 7 days from HD1 to HD2 was not subject to yield losses. Yield losses were observed for all harvest treatments at 14 and 21 days after the first harvest date.

The main effect of harvest treatment on seed moisture was not significant, but the harvest date and harvest treatment by harvest date interaction were significant for seed moisture. Seed moisture ranking for the direct harvest treatments from high to low moisture was HD2, HD1, HD3, and HD4 (Table 1).

References

Berglund, D.R., K. McKay, and J. Knodel. 2007. Canola production. North Dakota Ext. Serv. Bull. A-686 (revised) North Dakota State Univ., Fargo.

SAS Institute Inc. 1999. SAS/STAT User's guide, Version 8, SAS Inst. Inc., Cary, ND.

Steel, R.G., and J.H. Torrie. 1980. Principles and procedures of statistics a biometrical approach. 2nd ed. McGraw-Hill Book Co. Inc. New York.

Table 1. Mean canola yield and seed moisture at harvest for 12 harvest treatments at Prosper, ND, in 2007.		
Harvest Treatment Date	Yield lb/acre	Seed moisture %
Swathed D1	960	11
Swathed D2	1110	23
Swathed D3	740	14
Swathed D4	860	9
No spodnam D1	1190	16
No spodnam D2	1250	20
No spodnam D3	1040	14
No spodnam D4	1040	8
Spodnam 20† D1	1220	17
Spodnam 20 D2	1270	21
Spodnam 20 D3	1000	14
Spodnam 20 D4	1080	8
Spodnam 50‡ D1	1250	17
Spodnam 50 D2	1230	20
Spodnam 50 D3	1000	14
Spodnam 50 D4	1010	8
LSD (0.05)	NS	2
CV%	13.2	8

† - Spodnam applied with 20 gallons water per acre at 40 psi pressure.
‡ - Spodnam applied with 50 gallons water per acre at 40 psi pressure.
Seeding date 15 May; seeding rate 6 lb/acre; harvest dates
D1 (13 August); D2 (22 August); D3 (29 August); and D4 (4 Sept.)

2007 Canola Harvest Timing Study
North Central Research Extension Center, Minot, ND
North Dakota State University

Kent McKay, Area Agronomy Specialist
Lee Novak, Research Specialist

Trial Information:
The study was planted April 25. The swath treatments were swathed July 31. The optimum harvest treatments were combined August 14. The 7 day delay harvest treatments were combined August 21. The 21 day delay harvest treatments were combined August 28. The 21 day delay harvest treatments were combined September 4.

2007 Canola Harvest Timing Study Results, Minot, ND

Treatment	Yield lb/A	Test Weight Lb/Bu	Oil Content %	Seed Weight g/1000
Swath Optimum	1587	52.7	41.7	2.69
Swath 7 d delay	1623	52.1	41.4	2.69
Swath 14 d delay	1518	52.3	41.6	2.71
Swath 21 d delay	1577	52.5	41.7	2.75
Straight Optimum	1629	52.7	41.8	2.78
Straight 7 d delay	1549	52.3	42.0	2.75
Straight 14 d delay	1596	52.2	41.4	2.76
Straight 21 d delay	1604	51.9	41.7	2.78
LSD 5%	NS	0.4	NS	NS
Mean	1585	52.3	41.7	2.74
CV	7	0.6	0.8	2.39

Comparing straight harvest with an anti-shattering agent to swathed harvest of canola. 2007 Hettinger

InVigor 5550 was seeded on April 26, 2007. Seedling emergence was on May 7. 10% bloom was on June 22 and 90% bloom was on July 3. There was no lodging. Swathing (Swath) was done on July 27. Biovital treatments were applied on July 22 at a per acre rate of 1 pint in 20 gallons of water (Biovital 20) and 1 pint in 40 gallons of water (Biovital 40). The first harvest date (Optimum) was on August 9. This was followed by a 6 day delay (August 15), a 13 day delay (August 22), and a 20 day delay (August 29) in harvest.

Harvest Method	Harvest Timing	Oil Content	Seed Yield
		%	lbs/ac
Swath	Optimum	39.6	1438a
Straight	Optimum	39.1	1150a
Biovital 20	Optimum	39.3	1355a
Biovital 40	Optimum	38.7	1314a
Swath	6 Day Delay	38.3	931a
Straight	6 Day Delay	37.4	1150a
Biovital 20	6 Day Delay	39.5	1205a
Biovital 40	6 Day Delay	38.1	1095a
Swath	13 Day Delay	37.9	411a
Straight	13 Day Delay	38.4	821b
Biovital 20	13 Day Delay	40.4	945b
Biovital 40	13 Day Delay	38.8	780b
Swath	20 Day Delay	37.5	616a
Straight	20 Day Delay	38.2	861ab
Biovital 20	20 Day Delay	39.0	1068b
Biovital 40	20 Day Delay	38.4	986b
Trial Mean		38.7	1002
C.V. %		2.4	20.6
LSD .05		1.4	295
LSD .01		1.8	395

July was very hot and dry causing this crop to mature and dry down relatively quickly. Green seed count was 0% at all harvest intervals. As would be expected, there were no significant differences in seed yield between harvest methods when the crop was harvested at the optimal timing. There were also no significant seed yield differences when harvest was delayed by 6 days. After a 13 day delay in harvest, seed yields from the swathed treatment was significantly lower than the other harvest methods, but seed yields were not significantly different between the straight harvest and Biovital treatments. After a 20 day delay in harvest, swathed and straight harvested treatments were not significantly different in seed yield and the straight harvest seed yield was also not significantly different than the Biovital treatments. Both Biovital seed yields were however significantly higher than the swathed seed yield. Biovial does appear to assist in seed retention over a period of time, however, it does not appear to significantly enhance seed yields over straight harvesting alone. Significant differences between individual treatments for oil content were observed but no specific trend was noted.

Hettinger

There was one instance where Biovital applied with 20 gal/acre water resulted in yield at harvest date 4 being equal to yield at harvest dates 1 and 2 for this treatment, but yield for the Biovital applied with 20 gal/acre water at harvest date 3 was lower than the control. There is not a consistent pattern of reduced yield losses associated with the Biovital treatments at the Hettinger location. Swathed yields were similar to direct harvest yields at the first two harvest dates, but lower than direct harvest yields at the later two harvest dates. As harvest was delayed, yield losses became greater for swathed compared with the direct harvest treatments.

Summary

Direct canola harvest showed yield stability for the first two harvest dates at all locations. At the Prosper and Hettinger locations, yield was reduced at the later two harvest dates, compared to the earlier two harvest dates. At the Minot location yield was consistent across all four harvest dates for swathed and direct harvest treatments. There is not a consistent pattern of reduced yield losses associated with the Biovital treatments.

Yield losses were not observed as harvest date was delayed for swathed treatments at the Minot location. At this location, swathed and direct harvest yields were 1576 and 1595 lb/A, respectively, when averaged across harvest dates. At the Prosper location, the main effect of harvest date indicated swathing yields were lower than direct harvested yields. However, when swaths were harvested on a timely basis, yield was equal to direct harvest yields at this location.

All the locations showed swathed and direct harvested canola yields were similar for the first two harvest dates. At the later two harvest dates, yield reductions were greater in swaths compared with direct harvest at Hettinger. At the Minot location, harvest date did not affect swathed or direct harvest treatments, and both treatments produced essentially equal yield. The Prosper results indicate all the harvest treatments responded similarly regarding yield losses as harvest date was delayed. At this location yield, was maintained at the first two harvest dates for all harvest treatments. At the later two harvest dates yield, was lower than the first two harvest dates for all the harvest treatments.

North Central Research Extension Center–Minot
Field Scale Canola Harvest Trials–Velva and Newburg

Kent McKay, Area Agronomy Specialist
Lee Novak, Research Specialist

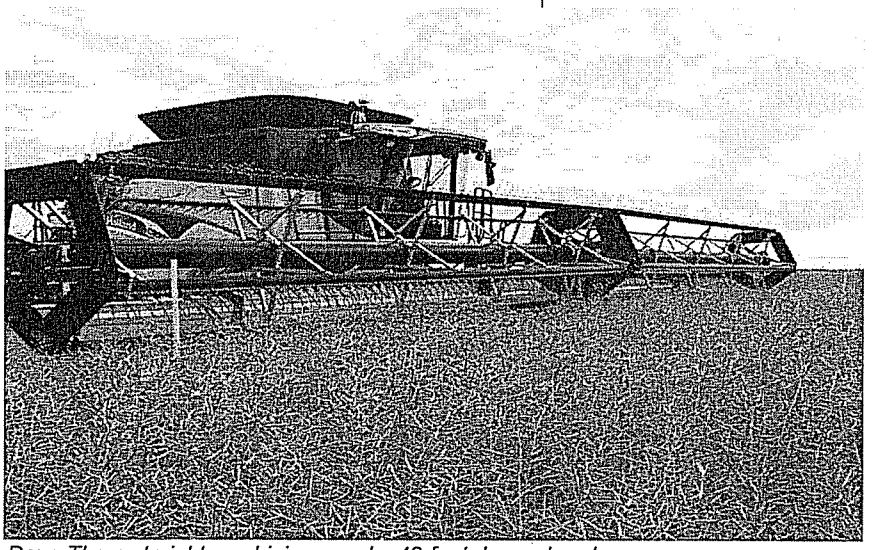
The objectives of this research were to compare field-scale straight combining canola with a rigid head, flex head, or draper head to traditional harvest methods of swathing and combining. Trials were conducted at two locations in 2007.

Trial 1 Dave Thom Farm–Velva

InVigor 5550 was seeded in late April. The trial was a randomized complete block design with three replicates. Plots were 50 feet wide by 500 feet long. The swath treatment was swathed August 2. Shatter cards were placed under the canopy in each plot to collect any seed or pod shatter prior to harvest. All plots were harvested on August 16 with a New Holland CR970 combine. The straight combine plots were harvested with a 42-foot draper head.

Results: For second consecutive year, straight combining yields were slightly higher than the swath treatments. There was no difference in oil content between harvest treatments. The draper head did not cause any significant harvest loss compared to the pick-up head.

	2007		2006			
Treatment	Yield	Oil	Yield	Oil	Moisture at Harvest	Total Seed Shatter at Harvest
	lb/A	--%--	lb/A	--%--	--%--	lb/A
Swath	1455	40.5	2212	44.3	11.4	37
Straight	1499	40.2	2356	44.3	9.3	41
Straight w/Biovital	--	--	2299	43.8	9.5	42
LSD 5%	NS	NS	NS	NS	0.2	NS



Dave Thom straight combining canola, 42-foot draper head.

North Central Research Extension Center–Minot
Field Scale Canola Harvest Trials–Velva and Newburg–Continued

Trial 2 Bob Henry Farm–Newburg

Croplan 906 RR was seeded in mid-May. The trial design was a randomized complete block with four replicates. Plots were 50 feet wide by 500 feet long. The swath treatment was swathed August 15. Shatter cards were placed under the canopy in each plot to collect any seed or pod shatter prior to harvest. All plots were harvested on August 30. All plots were combined with a Case 2388 combine. The straight combine plots were harvested with a 30-foot Mac-Don head.

Results: There were no differences in yield or oil content across harvest treatments. The Mac-Don head did not cause any significant harvest loss compared to the pick-up head.

Treatment	Yield	Oil	Moisture at Harvest
	lb/A	--%--	--%--
Swath	1331	40.3	9.3
Straight	1403	40.4	8.9
LSD 5%	NS	NS	0.2

Summary

The results of this research indicate that canola can be successfully straight combined. All combine headers; (rigid, flex, and draper) performed well with straight combining canola and did not cause any harvest loss compared to the pick-up head. When harvested at the optimum time, straight combining canola can be successful with equal to higher yield than traditional harvest methods of swathing and combining. This research was funded by a grant from the Northern Canola Growers Association. 2005/2006 research results can be found in the 2006 North Central Research Extension Center Farmers Report.

Bob Henry straight combining canola.