Title: Seeding Date and Production System (Herbicide Resistance/Hybrid) Influence on Canola Performance

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Rationale and Significance

Published manuscripts and local research reports pertaining to canola response to seeding date in the region are limited and dated, and consequently the topic was identified as a research priority in the RFP for the North Central Region Canola Research proposals for FY 2010. Previous canola seeding date studies were also all conducted under conventional tillage. The proposed research will provide information for both conventional and no-till production on seeding date response of previously not reported newer hybrid canola varieties representing glyphosate and glufosinate herbicide resistant types at major canola production regions in North Dakota.

Objective

The study objective is to i.) evaluate seeding date effect on performance of glyphosate (Roundup Ready) and glufosinate (Liberty Link) herbicide-resistant systems, with new hybrid canola varieties; ii.) compare net returns of the two herbicide-resistant systems based on grain value and seed and herbicide costs; iii.) investigate seeding date influence under previously not reported no-till production and also conventional tillage.

Materials and Methods

The field experiment will be a randomized complete-block design in a split plot arrangement with four replicates (Steele and Torrie, 1980). The study will be conducted at the Carrington, Hettinger, Langdon, and Minot (ND) Research Extension Centers during 2010, 2011, and possibly 2012. The Hettinger and Minot locations are no-till and the Carrington and Langdon locations are conventional till. The experiment is a RCBD with a split plot arrangement. Seeding date and herbicide resistance are the main and subplots, respectively. The five seeding dates are spaced at approximately 8-day intervals with the first date when canola is normally planted at that location. At most locations, this would target 1, 8, 16, and 24 May, and 5 June (see Table 1 for actual location seeding dates). An optional late April seeding date will be at the discretion of the REC agronomist. Glyphosate (DKL30-42 Roundup Ready) and glufosinate (Invigor 8440 Liberty Link) herbicide-resistant types will be evaluated. Standard agronomic practices will be applied for seeding rate, fertility, pest, and harvest management (Berglund et al., 2007). Plots will be approximately five feet wide with a row spacing of 6 to 7 inches and a length of 20 to 25 feet. Herbicide systems will be bordered on either side by a plot of their respective herbicide resistance to prevent herbicide drift from the adjacent dissimilar treatment. Traits determined are stand rating, weed pressure, weed control, first flower and end flower, plant height and lodging, maturity, seed yield, test weight, seed weight, and oil content.

Observations will also include pest incidence, seed shatter, and harvest concerns. Statistical analysis will be performed by SAS (1999) and consider seeding date, herbicide system, and hybrid fixed effects and location-year a random effect. Treatment means comparisons will be based on *F*-protected LSD comparisons at $P \leq 0.05$.

Results and Discussion

Growing season rainfall and actual seeding dates for the study locations appear in Tables 1 and 2, respectively. The Carrington and Langdon seeding dates were similar (Table 2). At Hettinger, seeding dates 1 and 2 were earlier than for Carrington and Langdon, but later dates became more similar. The earliest seeding date at Minot was delayed because of rainy weather and corresponds more with date 2 at the other locations. Further seeding dates at Minot also become shifted one day later.

Seeding date effects

Seed yield decreased after the 10 May seeding date at Carrington, Hettinger, and Minot (Table 3), which would agree with earlier research by Johnson et al. (1995) where yield decreased after mid-May seeding dates. However, yield was not influenced by seeding date at Langdon. Heavy rains (Table 1) caused soil movement and in effect increased seeding depth and also contributed to soil crusting; both of which reduced seedling emergence and plant stands for the first three seeding dates at the Langdon location. Perhaps yields would have been greater at seeding dates 1 and 2 at Langdon without this occurrence.

Seed oil content decreased as seeding date was delayed at all locations (Table 4). Oil contents decreased from 44.9% to 38.9%, 47.3 to 39.0, and 45.0% to 41.0% from seeding date 1 to date 5, at the Carrington, Hettinger, and Langdon locations, respectively. Oil content was the lowest (34.5%) from the 10 June seeding at Minot.

Hybrid effects

The Invigor hybrid (3350 lb/A) yielded greater than the Roundup Ready hybrid (3000 lb/A) at Langdon when averaged across seeding dates and for each seeding date, with a markedly greater yield at seeding date 2 (Table 3) (data not shown). At the Carrington location the Roundup Ready hybrid (2039 lb/A) yielded more than the Invigor hybrid (1735 lb/A), and there was not a seeding date by hybrid interaction (data not shown). The Roundup Ready hybrid yielded 240 lb/A more than the Invigor hybrid at Hettinger (data not shown). The hybrids yielded the same at the Minot location. Seed oil content tended to be about 2% greater for the Roundup Ready hybrid compared with Invigor hybrid among locations (data not shown).

The seeding date by hybrid interaction was significant for seed yield at Langdon and Hettinger. At Langdon, hybrid yield ranking differences were noted as seeding date advanced from date 1 to 5 (data not shown). Yield tended to increase from date 1 to date 3 for both hybrids and plateaued for the Roundup Ready hybrid for dates 3, 4, and 5, but decreased after date 3 for the Invigor hybrid (data not shown). At Minot, both hybrids showed decreasing yield as seeding date advanced with the Invigor hybrid indicating a 940 lb/A yield decrease from date 1 to date 2

whereas the Roundup Ready hybrid yield reduction was 380 lb/A. Yield reduction tended to be greater for the Invigor (1810 lb/A) than Roundup Ready hybrid (1650) when comparing date 1 and date 5.

Summary/Conclusions

Seed yield decreased as seeding date became later at three of four locations. At the other location (Langdon), heavy rains caused reduced stands that may have limited yield, and consequently there was not a yield decrease, as seeding date was delayed at this location. The hybrids responded differently to seeding date at two of the four locations indicating choice of hybrid with seeding date could be important for maximizing yield. Seed oil content decreased as seeding date was delayed at all four locations. Further replication of the study in 2011 is recommended to verify seed yield, oil content, and other trait responses to seeding date and hybrid.

Table 1. Monthly rainfall (inches) at North Dakota study locations in 2010.

Month	Carrington	Hettinger	Langdon	Minot
April	1.43	2.03	1.55	1.58
May	2.60	3.66	4.98	3.67
June	3.22	2.90	3.60	4.84
July	1.95	3.66	2.57	2.29
August	1.64	1.98	2.98	2.70

Source: http://ndawn.ndsu.nodak.edu

Table 2. Canola seeding dates at four North Dakota locations in 2010.

Seeding date	Carrington	Hettinger	Langdon	Minot
Date 1	28 April	21 April	29 April	10 May
Date 2	12 May	3 May	10 May	20 May
Date 3	21 May	17 May	21 May	3 June
Date 4	28 May	26 May	1 June	10 June
Date 5	9 June	8 June	9 June	23 June

Table 3. Canola seed yield (lb/A) at five seeding dates and four North Dakota locations in 2010.				
Seeding date	Carrington	Hettinger	Langdon	Minot
Date 1	2540	2770	2970	N/A
Date 2	2380	2100	3110	2454
Date 3	1780	1950	3560	1870
Date 4	1560	1860	3080	880
Date 5	1180	1030	3160	900
LSD (0.05)	300	180	NS	450

Table 4. Canola seed oil content (%) at five seeding dates and four North Dakota locations in 2010.				
Seeding date	Carrington	Hettinger	Langdon	Minot
Date 1	44.9	47.3	45.0	N/A
Date 2	43.7	46.7	43.5	43.0
Date 3	41.5	45.6	43.5	42.8
Date 4	40.6	41.2	43.2	38.7
Date 5	38.9	39.0	41.0	34.5
LSD (0.05)	1.6	1.2	1.4	2.7

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